CLIMATE CHANGE CONSIDERATIONS IN PORTFOLIO MANAGEMENT

NOT JUST AN ETHICAL CHECKBOX, BUT A FUNDAMENTAL DRIVER OF RETURNS

SEDCO CAPITAL
سدكو كابيتال

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EXECUTIVE SUMMARY

The importance of climate risk has grown and it has been gradually evolving into a secular theme from an investment perspective. Both climate related physical and transition risk levels are expected to increase in the near future and those risks are expected to impact regions and sectors differently. For example, high carbon emitting investments and exposed locations are expected to have lower return expectations. This means that investors must proactively consider these risks in their investment processes. This paper discusses the integration of climate considerations in asset allocation – in terms of investment theses, geographies and industries – for the asset classes managed by SEDCO Capital. The objective of this paper is to enhance the integration of climate considerations into investment decision-making and risk management processes. It is to demonstrate that, for SEDCO Capital, climate risk mitigation is a fundamental investment proposition rather than solely an ethical obligation. Furthermore, the paper identifies future trends and technologies that could benefit from future climate engagement, which may represent strategic opportunities for investors.

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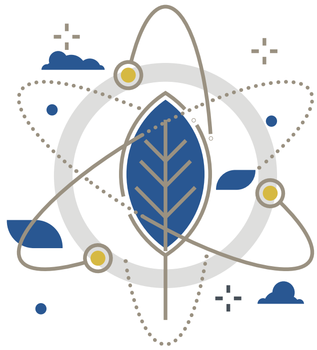
CONTENTS

1 INTRODUCTION

The objective of this paper is to enhance the integration of climate considerations into investment decision-making and risk management processes. Climate change analysis requires a strategic, long-term view, complementing and deepening SEDCO Capital's existing responsible investment approach, known as Prudent Ethical Investment (PEI).

1 INTRODUCTION

The importance of climate risk as a topic has grown substantially, gradually evolving into a secular theme, at least since the Paris Agreement (Paris Climate Accord) in December 2015, and paving the way for a more coordinated approach in addressing greenhouse-gas-emissions mitigation, adaptation, and finance, starting in the year 2020. The agreement's key goals are:



1

Limiting the increase in the global average temperature to well below 2°C above pre-industrial levels. Pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change;

2

Increasing the ability to adapt to the adverse impacts of climate change and foster climate resilience and low greenhouse gas emissions development, in a manner that does not threaten food production;

3

Making finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development.

Being a thought leader in responsible investing and a pioneering Saudi and Shariah-compliant asset manager signatory to the UN-supported Principles for Responsible Investment (UNPRI) network, SEDCO Capital is committed to playing its part in mitigating the negative externalities of climate change.

This paper demonstrates that climate risk mitigation can serve as a fundamental investment proposition rather than solely an ethical obligation. Section 2 highlights the importance of the Climate Risk and Investment process by summarizing research results and forecasts, most notably by the UN Intergovernmental Panel on Climate Change (IPCC). Section 3 summarizes the consensus on how the global economy must change to mitigate climate risks. Section 4 categorizes climate risk factors that are applicable to SEDCO Capital's investment and risk process. Section 5 addresses climate scenario analysis and section 6 covers climate analysis in SEDCO Capital's investment process. Section 7 highlights potential investment opportunities that may benefit from a transition to carbon reduction.

2

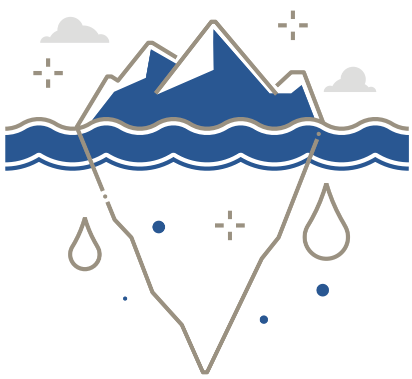
HOW IS CLIMATE CHANGE AND GLOBAL WARMING CAUSED?

Of the total solar energy reaching the atmosphere, one third is reflected back into space by the atmosphere itself and the earth's surface. The rest is absorbed, mostly by the earth, especially the oceans. Greenhouse gases, including water vapor, methane (CH_4), and carbon dioxide (CO_2), trap some of the reradiated heat. This process heats up the earth.

2 HOW IS CLIMATE CHANGE AND GLOBAL WARMING CAUSED?

Since the Industrial Revolution 250 years ago, CO_2 levels have increased from 280 parts per million (ppm) to 400ppm now and are rising by 2 ppm per year. Earth is heading to CO_2 levels far above 600 ppm this century, based on the current emissions trajectory. Limiting total warming below 2°C roughly equates to an atmospheric concentration of CO_2 of 450 ppm. In fact, most of the CO_2 increase occurred in the last four decades – in 1970, carbon dioxide was still about 325 ppm.

2.1 Human Contribution to Global Warming



The United Nations Intergovernmental Panel on Climate Change (IPCC) concluded in its 5th Assessment Report (2013) that humans have caused essentially all the warming the earth has experienced since 1950.

One reason the world's top scientists have confidence that humans are responsible for so much of the warming is that most of the naturally occurring drivers that affect global temperature should have cooled the Earth. That means, in the absence of human activity and the warming that results from it, the planet would likely have cooled in recent decades. As examples, the sun's level of activity tends to be cyclical and has reached a minimum since almost a century and volcanic activity in recent decades should have lowered temperatures slightly.

When scientists measured the type of carbon building up in the atmosphere (the particular ratio of carbon isotopes), the result was that most of it was the type that is known to originate from combustion of fossil fuels.

Satellite measurements tell us that increasingly less heat is escaping the earth's atmosphere, thus illustrating direct evidence of the greenhouse effect. Heat not leaving the atmosphere goes back to the earth's surface. Surface measurements confirm this, observing more downward infrared radiation.

IPCC concluded that deforestation was responsible for 17% of all greenhouse gas emissions, with most of those emissions coming from the destruction of tropical forests in places such as Brazil and Indonesia.

Climate is not inherently stable. In the past, climate changes occurred due to external factors such as the intensity of the sun's radiation, volcanic eruptions (which generally cause short-term cooling), rapid releases of green-house gases, and changes in the earth's orbit. However, temperature changes and CO_2 levels over the last 800k years have been highly correlated.

Human contribution to climate change becomes even more evident when reviewing data around the financial damage of natural catastrophes. There has been a steep increase in the number of weather-related events while only a slight increase in geophysical events (earthquake, volcano, tsunami, etc.).

[2] See Romm (2016).

2.2 Consequence of Global Warming

As the planet warms, the extent of both sea ice and land-based ice (glaciers) shrinks. Thus, white ice, which is very reflective, is replaced by the blue sea or dark land, each of which absorb much more solar radiation. This results in more ice melting. This feedback loop causes a significant drop in the earth's reflectivity – the so-called 'albedo effect'.

This feedback loop has caused the Arctic region to warm at twice the rate of the planet as a whole. It is a central reason Arctic summer ice volume has experienced an almost 80% drop since 1979 and a more than five-fold increase in the Greenland ice sheet melt rate in the past two decades. As the planet heats up, evaporation increases, which puts more water vapor into the air. Water vapor accelerates the greenhouse effect.

Approximately one quarter of the CO_2 humans emit into the air gets absorbed by the oceans, subsequently dissolving in the seawater to form carbonic acid, which acidifies the ocean. As a result, the oceans are more acidic today than they have been over the last 300 million years. Furthermore, if the rate of ocean acidification becomes high enough, it could cause the mass extinction of marine species.

More than 90% of global warming goes into the oceans, whereas only 1% goes into the atmosphere. Consequently, measurements of ocean warming are expected to be the most reliable indicator of global warming.

As climate scientists had predicted, the Arctic is warming much faster than the rest of the globe. This is often called polar amplification. Arctic amplification accelerates the loss of land-based ice in the northern hemisphere, including the Greenland ice sheet, which accelerates sea-level rise and worsens storm surges. A number of recent studies further suggest that polar amplification is weakening the Northern Hemisphere's jet stream, which in turn causes certain weather patterns - such heat waves, droughts, and floods - to get "stuck".

2.3

How Climate Change contributes to Extreme Weather and Natural Catastrophes

Climate change may not directly cause extreme weather and natural catastrophes, but it indirectly accelerates a variety of the most extreme weather events more frequently and acutely. Heat waves, droughts, and flooding events tend to get compounded from the extra energy in the atmosphere due to global warming.

2.3.1 Effect on Storms and Hurricanes

Warming also extends the range of sea surface temperatures, which can subsequently help sustain the strength of hurricanes as they move towards land. As the average sea-level rises, storm surges on average will also rise leading to greater potential damage on land. Studies suggest that global warming tends to increase the most destructive superstorms.

2.3.2 Effect on Droughts

Human-induced climate change has long been predicted to shift rainfall patterns and expand the dry regions of the world to encompass semi-arid regions. The driest regions, including the major deserts, are found in the subtropics, two belts just outside the tropics (north and south of the equator). Climate science predicted these subtropical belts could expand, and there is supporting evidence of their actual expansion. As a result, semi-arid regions become more prone to drought.

Global warming causes greater evaporation and, once the ground is dried out, the sun's energy goes into baking the soil, leading to a further increase in air temperature.

2.3.3 Cause of Wildfires

Global warming increases the likelihood of wildfires and makes them more destructive. The rationale here is that global warming leads to more intense droughts, hotter weather, and earlier snowmelt (hence less water available for late summer and early autumn). Consequently, wildfires are a dangerous amplifying feedback, whereby global warming causes more wildfires, which release carbon dioxide, thereby accelerating global warming.

Milder winters and warmer springs have resulted in more severe infestations of insects such as bark beetle, which have devasted large forests in North America and Europe, thereby contributing significantly to the increase in wildfires.

2.3.4 Cause of Flooding and severe Rainfall

Global warming makes floods more intense. Higher sea surface temperatures mean additional water vapor in the atmosphere, which produces 5 to 10% more rainfall, which in turn raises the risk of flooding.

Warmer air can contain more water vapor than cooler air. Global analyses show that the amount of water vapor in the atmosphere has in fact increased due to human-induced warming. This extra moisture is absorbed into storm systems, resulting in heavier rainfalls. Climate change also alters characteristics of the atmosphere that affect weather patterns and storms.

Aside from more intense rainstorms, the higher water vapor in the atmosphere from warming can also cause more severe snowstorms. While this may appear counterintuitive, the warming to-date is not close to that needed to end below-freezing temperatures over large parts of the globe. Thus, more intense snowstorms should be expected in cold regions of the earth.

Winters may be perceived as more severe due to the occurrence of snowstorms. However, warmer-than-normal winters favor snowstorms. Very low temperatures tend to hinder snowfall. Climate science projects that snowstorms are going to become more extreme due to the higher water vapor in the atmosphere.

3 REQUIRED ACTION TO LIMIT GLOBAL WARMING

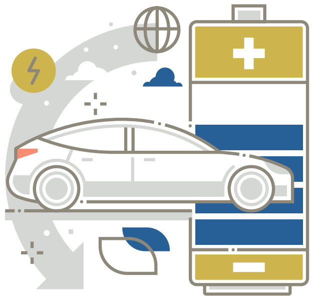
In model pathways with no, or limited, overshoot beyond 1.5°C, global net human-caused CO_2 annual emissions decline by about 45% from 2010 levels by 2030, reaching net zero around 2050. For limiting global warming to below 2°C, CO_2 emissions are projected to decline by about 25% by 2030 in most pathways and reach net zero around 2070.

Carbon reduction requires comprehensive actions on lowering the carbon impact of the energy mix, the resource efficiency of all industrial sectors as well as the reduction of current carbon levels (Figure 1).

Pathways to limiting global warming to below 2°C would require rapid and far-reaching transitions in energy, land, urban and infrastructure (including transport and buildings), and industrial systems. These system transitions are unprecedented in terms of scale and imply deep emissions reductions in all sectors, a wide portfolio of mitigation options and a significant upscaling of investments in those options.

3 REQUIRED ACTION TO LIMIT GLOBAL WARMING

Climate-Related Opportunities | **Potential Financial Impacts**



Resource Efficiency

Climate-Related Opportunities

- Use of more efficient modes of transport
- Use of more efficient production and distribution processes
- Use of recycling
- Move to more efficient buildings
- Reduced water usage and consumption

Potential Financial Impacts

- Reduced operating costs (e.g., through efficiency gains and cost reductions)
- Increased production capacity, resulting in increased revenues
- Increased value of fixed assets (e.g., highly rated energy efficient buildings)
- Benefits to workforce management and planning (e.g., improved health and safety, employee satisfaction) resulting in lower costs

Energy Sources

Climate-Related Opportunities

- Use of lower-emission sources of energy
- Use of supportive policy incentives
- Use of new technologies
- Participation in carbon market
- Shift toward decentralized energy generation

Potential Financial Impacts

- Reduced operational costs (e.g., through use of lowest cost abatement)
- Reduced exposure to future fossil fuel price increases
- Reduced exposure to GHG emissions and therefore less sensitivity to changes in cost of carbon
- Returns on investment in low-emission technology
- Increased capital availability (e.g., as more investors favor lower-emissions producers)
- Reputational benefits resulting in increased demand for goods/ services

Products and Services

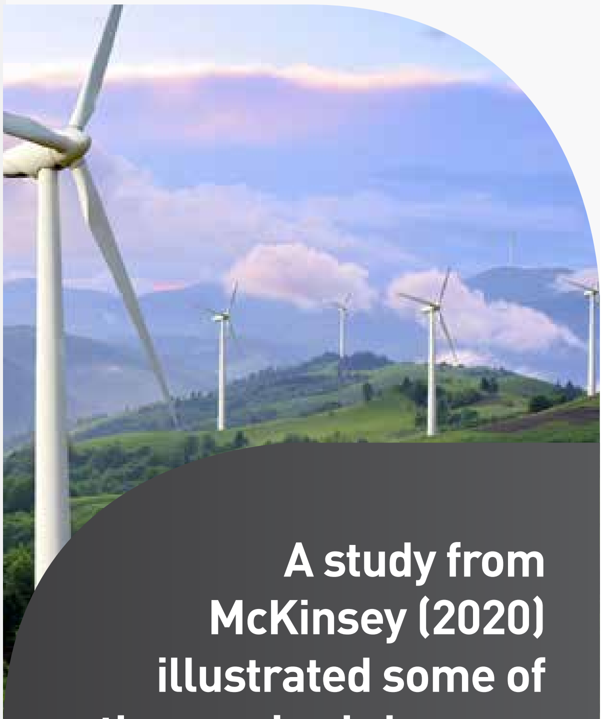
Climate-Related Opportunities

- Development and/or expansion of low emission goods and services
- Development of climate adaptation and insurance risk solutions
- Development of new products or services through R&D and innovation
- Ability to diversify business activities
- Shift in consumer preferences

Potential Financial Impacts

- Increased revenue through demand for lower emissions products and services
- Increased revenue through new solutions to adaptation needs (e.g., insurance risk transfer products and services)
- Better competitive position to reflect shifting consumer preferences, resulting in increased revenues

Figure 1: Examples of climate-related opportunities and financial impacts. Source: Task Force on Climate-related Financial Disclosures (2018)



A study from McKinsey (2020) illustrated some of the required changes, which generally follow measures highlighted in the IPCC documents.[3]

Reforestation at scale:

Over the next decade, a massive, global mobilization to reforest the earth would be required to achieve a 1.5°C pathway. It is impossible to achieve a 1.5-degree pathway that does not remove carbon dioxide to offset ongoing emissions. By 2050, on top of nearly avoiding deforestation and replacing any forested areas lost to fire, the world would need to have reforested more than 300 million hectares (741 million acres)—an area nearly one-third the size of the contiguous United States.

Renewables:

Replacing thermal assets with renewable energy would require a dramatic ramp-up in manufacturing capacity of wind turbines and solar panels. By 2030, yearly build-outs of solar and wind capacity would need to be eight and five times larger, respectively, than today's levels. In a scenario where coal and gas generate power for longer, their respective reduction would need to be about two-thirds by 2030. In a more progressive scenario, coal-powered electricity generation would need to decrease by nearly 80 percent by 2030.

3 See McKinsey Global Institute (2020).

Bioenergy:

This can be used an important interim energy source. Its most pressing mandate would be substituting for oil-based fuels in aviation and marine transport in the interim, until sustainably sourced synthetic fuels would account for a larger share in the long term.

Carbon capture and storage (CCS):

This technology would prevent emissions from entering the atmosphere by compressing, transporting, and either storing the carbon dioxide underground or using it as an input for products. Carbon-dioxide removal involves capturing and permanently sequestering CO_2 that has already been emitted, through either nature-based solutions or approaches that rely on technology. However, the technology is still in an early state. Carbon capture has shown as expensive, difficult and has not yet emerged from its nascent stage. Thus, it may not be not viable unless carbon dioxide emission costs substantially increase. Moreover, any leakage of carbon storage has the risk of contaminating water and being fatal for people.

Green Hydrogen:

Hydrogen produced from renewable energy—so-called green hydrogen—would play a huge part in any 1.5-degree pathway. "Blue hydrogen", which is created using natural gas with the resulting CO_2 emissions stored via CCS, would also play a role. This is because about 30 percent of the energy-related CO_2 emitted across sectors is hard to abate with electricity only.

Electrification of road transport:

The road-transportation sector (passenger cars and trucks, buses, motorbikes) accounts for 15 percent of the carbon dioxide emitted each year. Nearly all of the fuel used in the sector today is oil based. To decarbonize, this sector would need to shift rapidly to a cleaner source of energy and leverage either batteries with sustainably produced electricity or fuel cells with sustainably produced hydrogen to power an electric engine.

Electrification of buildings:

Electrification would also help decarbonize buildings, for which CO_2 emissions represent about 7 percent of the global total emissions. Space and water heating, which typically rely on fossil fuels, are the primary emission contributors. By 2050, electrifying these two processes in residences and commercial buildings would abate their 2016 heating emissions by 20 percent (if the electricity were to come from clean sources). By expanding the use of district heating and blending hydrogen or biogas into gas grids for cooking and heating, the buildings sector could potentially reduce nearly an additional 40 percent of emissions.

Upgrading industrial operations:

Industrial operations must be upgraded by improving energy efficiencies, by enhancing more electrification (using renewable sources) and by tackling emissions such as fugitive methane (natural gas that is released through the activities of oil and gas companies, as well as from coal-mining companies).

Recycling and substitution could enhance industrial carbon efficiency:

- Replacing an additional 20% of inputs to the steel-production process with scrap steel could lower emissions from iron ore use.
- Recycling could cover about 60% of plastics demand by 2050.
- Cement – among the biggest CO_2 emitters – could be substituted with alternative building materials such as cross-laminated timber. Cement manufacturers would need to abate their current CO_2 emissions, which accounted for 6 percent of global CO_2 emissions in 2016, by more than 7 percent by 2030.

Consumption and behavioral changes:

- Remote communication and modal shifts in transportation could reduce emissions in the aviation sector by up to 10% over the next decade. The Covid-19 pandemic has disrupted travel by remote communication. However, it is unknown to what degree these changes will remain in a post-Covid-19 world.
- The biggest source of agricultural emissions – almost 70 percent – is from the production of ruminant meat. Animal protein from beef and lamb is the most GHG-intensive food, with production-related emissions more than ten times those of poultry or fish and 30 times those of legumes. Delivering the emissions reduction needed to reach a 1.5-degree pathway would imply a notable dietary shift: Reducing the share of ruminant animal protein in the global protein-consumption mix by half, from about 9 percent in current projections for 2050 to about 4 percent by 2050.

4 CLIMATE-RELATED RISKS

Climate risks can be classified into transition risks and physical risks. Transition risk is the requirement to respond and adapt to a potentially rapidly changing regulatory, technological, market, and social backdrop. Physical risks comprise the costs and damage resulting from climate change (such as extreme weather events). There is a trade-off between transition and physical risks driven by the speed of policy change.

4 CLIMATE-RELATED RISKS

4.1 Transition Risks

Transitioning to a lower-carbon economy may entail extensive policy, legal, technology, and market changes to address mitigation and adaptation requirements related to climate change (**Figure 2**). Depending on the nature, speed, and focus of these changes, transition risks may pose varying levels of financial and reputational risk to organizations (**Figure 3**).

4.1.1 Policy and Legal Risks

Policy actions around climate change continue to evolve. Their objectives generally fall into two categories—policy actions to constrain the adverse effects of climate change or policy actions to promote adaptation to climate change.

Some examples include implementing carbon-pricing mechanisms to reduce GHG emissions, shifting energy use toward lower emission sources, adopting energy-efficiency solutions, encouraging greater water efficiency measures and promoting more sustainable land-use practices. The risks and financial impact of policy changes depend on the nature and timing of the policy change. Another important risk is litigation or legal risk. Recent years have seen an increase in climate related litigation claims being brought before the courts by property owners, municipalities, states, insurers, shareholders, and public interest organizations. Reasons for such litigation include the failure of organizations to mitigate impacts of climate change, failure to adapt to climate change, and the insufficiency of disclosure around material financial risks. As the value of loss and damage arising from climate change grows, litigation risk is also likely to increase.

4.1.2 Technology Risk

Technological improvements or innovations that support the transition to a lower-carbon, energy efficient economic system can have a significant impact on organizations. For example, the development and use of emerging technologies such as renewable energy, battery storage, energy efficiency, and carbon capture and storage will affect the competitiveness of certain organizations, their production and distribution costs, and ultimately the demand for their products and services from end users. To the extent that new technology displaces old systems and disrupts some parts of the existing economic system, winners and losers will emerge from this "creative destruction" process. The timing of technology development and deployment, however, is a key uncertainty in assessing technology risk.

4.1.3 Market Risk

Whilst the ways in which markets could be affected by climate change are varied and complex, one of the major factors is the supply and demand for certain commodities, products, and services as climate-related risks and opportunities are increasingly considered. Systemic financial impacts can occur for a repricing of risk premiums if market expectations of the climate impact on economic output change.

4.1.4 Reputation Risk

Climate change has been identified as a potential source of reputational risk tied to changing customer or community perceptions of an organization's contribution to or detraction from the transition to a lower-carbon economy.

4.1.5 Stranded Asset Risk

Stranded asset risk refers to the notion that certain resources (like fossil fuels) could become unusable due to climate policies, regulations, legal rulings, and technological displacement. In turn, unusable resources would deteriorate the investment returns. Excluding investments in strategies tied to assets at risk from stranding can be a long-term economic decision to mitigate climate risk.

Climate-Related Risks

Potential Financial Impacts

Climate-related risks:
- Increased pricing of GHG emissions
- Enhanced emissions-reporting obligations
- Mandates on and regulation of existing products and services
- Exposure to litigation

Policy and Legal

Potential financial impacts:
- Increased operating costs (e.g., higher compliance costs, increased insurance premiums)
- Write-offs, asset impairment, and early retirement of existing assets due to policy changes
- Increased costs and/or reduced demand for products and services resulting from fines and judgments

Climate-related risks:
- Substitution of existing products and services with lower emission options
- Unsuccessful investment in new technologies
- Costs to transition to lower emissions technology

Technology

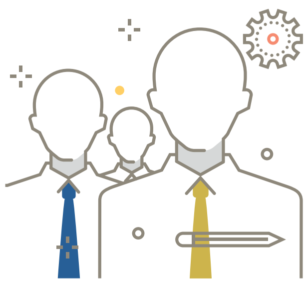
Potential financial impacts:
- Write-offs and early retirement of existing assets
- Reduced demand for products and services
- Research and development (R&D) expenditures in new and alternative technologies
- Capital investments in technology development
- Costs to adopt/deploy new practices and processes

Climate-related risks:
- Changing customer behavior
- Uncertainty in market signals
- Increased cost of raw materials

Market

Potential financial impacts:
- Reduced demand for goods and services due to shift in consumer preferences
- Increased production costs due to changing input prices (e.g., energy, water) and output requirements (e.g., waste treatment)
- Abrupt and unexpected shifts in energy costs
- Change in revenue mix and sources, resulting in decreased revenues
- Re-pricing of assets (e.g., fossil fuel reserves, land valuations, securities valuations)

Climate-related risks:
- Shifts in consumer preferences
- Stigmatization of sector
- Increased stakeholder concern or negative stakeholder feedback



Reputation

Potential financial impacts:
- Reduced revenue from decreased demand for goods/services
- Reduced revenue from decreased production capacity (e.g., delayed planning approvals, supply chain interruptions)
- Reduced revenue from negative impacts on workforce management and planning (e.g., employee attraction and retention)
- Reduction in capital availability

Figure 2: Examples of transition risks and financial impacts. Source: Task Force on Climate-related Financial Disclosures (2018)

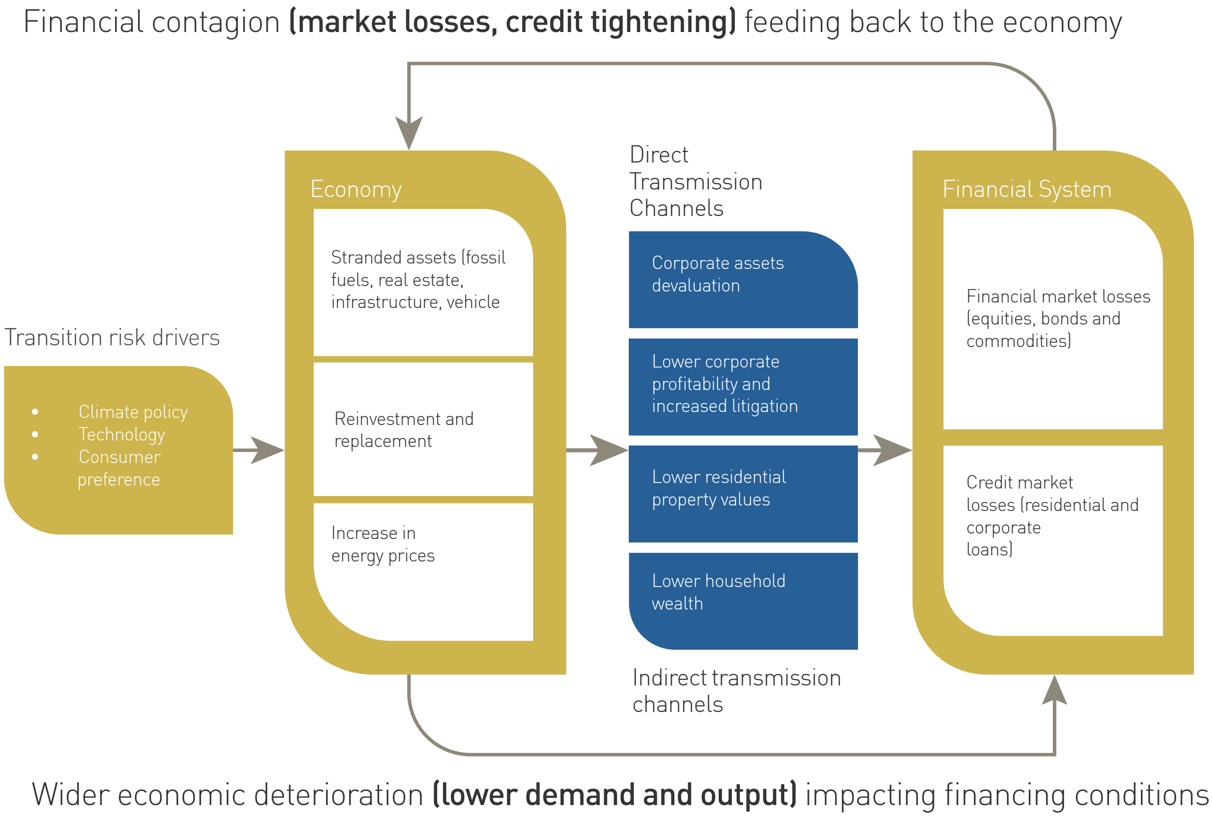


Figure 3: Transmission of transition risk to financial system stability. Source: NGFS (2019)

4.2 Physical risks

Physical risks resulting from climate change can be event driven (acute) or represent longer-term shifts (chronic) in climate patterns **(Figure 4)**. Physical risks may have financial implications for organizations, such as direct damage to assets and indirect impacts from supply chain disruption. Organizations' financial performance may also be affected by changes in water availability, sourcing, and quality; food security; and extreme temperature changes affecting organizations' premises, operations, supply chain, transport needs, and employee safety **(Figure 5)**.

4.2.1 Acute Risk

Acute physical risks refer to those that are event-driven, including increased severity of extreme weather events, such as cyclones, hurricanes, or floods.

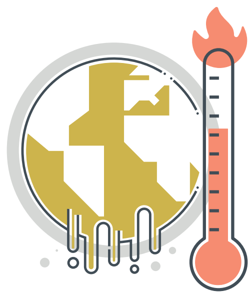
Direct physical impact can be caused by extreme or shifting weather events leading to the destruction of real property, or interruption of economic activity. According to data from Swiss Re Sigma Insurance Research, climate-related losses have increased in each decade (both insured and total, including uncovered losses) from 1974 to 2013. According to projections by Rhodium Group in the Risky Business study in 2014, between $66 billion to $106 billion worth of existing coastal property in the United States will likely be below sea level nationwide by 2050, assuming the world stays on its current emissions path. That range increases to $238 billion to $507 billion by 2100.

4.2.2 Chronic Risk

Chronic physical risks refer to longer-term shifts in climate patterns (e.g., sustained higher temperatures) that may cause rises in sea levels or chronic heat waves.
As an example, extreme weather events can impact supply chains. 2011 flooding in Thailand, a supply chain manufacturing hub for many multinational corporations, caused $15 billion to $20 billion in losses and impacted the profitability of these firms. A 2013 Oxford University study estimated that as much as $11.2 trillion in agricultural assets, including processing facilities, transportation networks, and distribution assets could become unviable annually because of environmental risk factors such as climate change and water scarcity.

Climate-Related Risks

- Increased severity of extreme weather events such as cyclones and floods



Acute

- Changes in precipitation patterns and extreme variability in weather patterns
- Rising mean temperatures
- Rising sea levels

Chronic

Potential Financial Impacts

- Reduced revenue from decreased production capacity (e.g., transport difficulties, supply chain interruptions)
- Reduced revenue and higher costs from negative impacts on workforce (e.g., health, safety, absenteeism)
- Write-offs and early retirement of existing assets (e.g., damage to property and assets in "high-risk" locations)
- Increased operating costs (e.g., inadequate water supply for hydroelectric plants or to cool nuclear and fossil fuel plants)
- Increased capital costs (e.g., damage to facilities)
- Reduced revenues from lower sales/output
- Increased insurance premiums and potential for reduced availability of insurance on assets in "high-risk" locations

Figure 4: Examples of physical risks and financial impacts. Source: Task Force on Climate-related Financial Disclosures (2018)

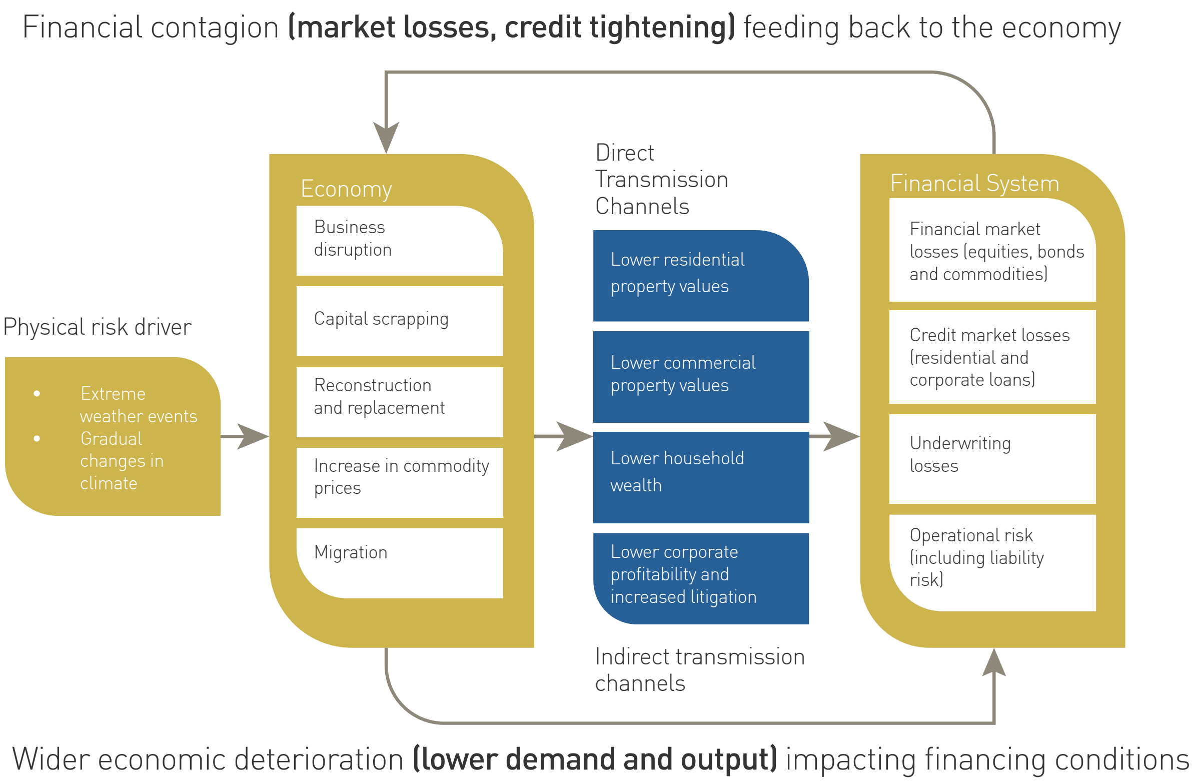


Figure 5: Transmission of physical risk to the financial system. Source: NGFS (2019)

5

POSSIBLE RESPONSE SCENARIOS FOR CLIMATE CHANGE

Scenarios should be plausible, distinctive (differentiated in construction and outcome), consistent, relevant and challenging. There are two opposing scenarios. Firstly, the 'Business-as-usual' or 'No response' scenario (Figure 6), which involves no or minimal policy interference, thus no transition risks but maximum physical risks. This scenario is represented by IPCC's scenario Representative Concentration Pathway 8.5 or RCP8.5. Secondly, the other end of the spectrum is high in transition risk and low in physical.

risks due to the 'early and gradual policy response' and 'aggressive mitigation' as per Paris Agreement. This outcome is modelled in IPCC's aggressive mitigation scenario RCP2.6.

While the exact policy choice and thus the applicable scenario is uncertain, there is a high degree of certainty that financial risks from some combination of physical and transition factors will occur. The time horizons over which financial risks may be realized are uncertain and their full impact may crystallize outside of many current investment and business time horizons. In contrast to market risks, climate risks cannot really be modeled from historical market data. The financial risks from physical and transition risk factors are relevant to all lines of business, sectors and geographies, but of course sensitivities vary.

The Choices we face now

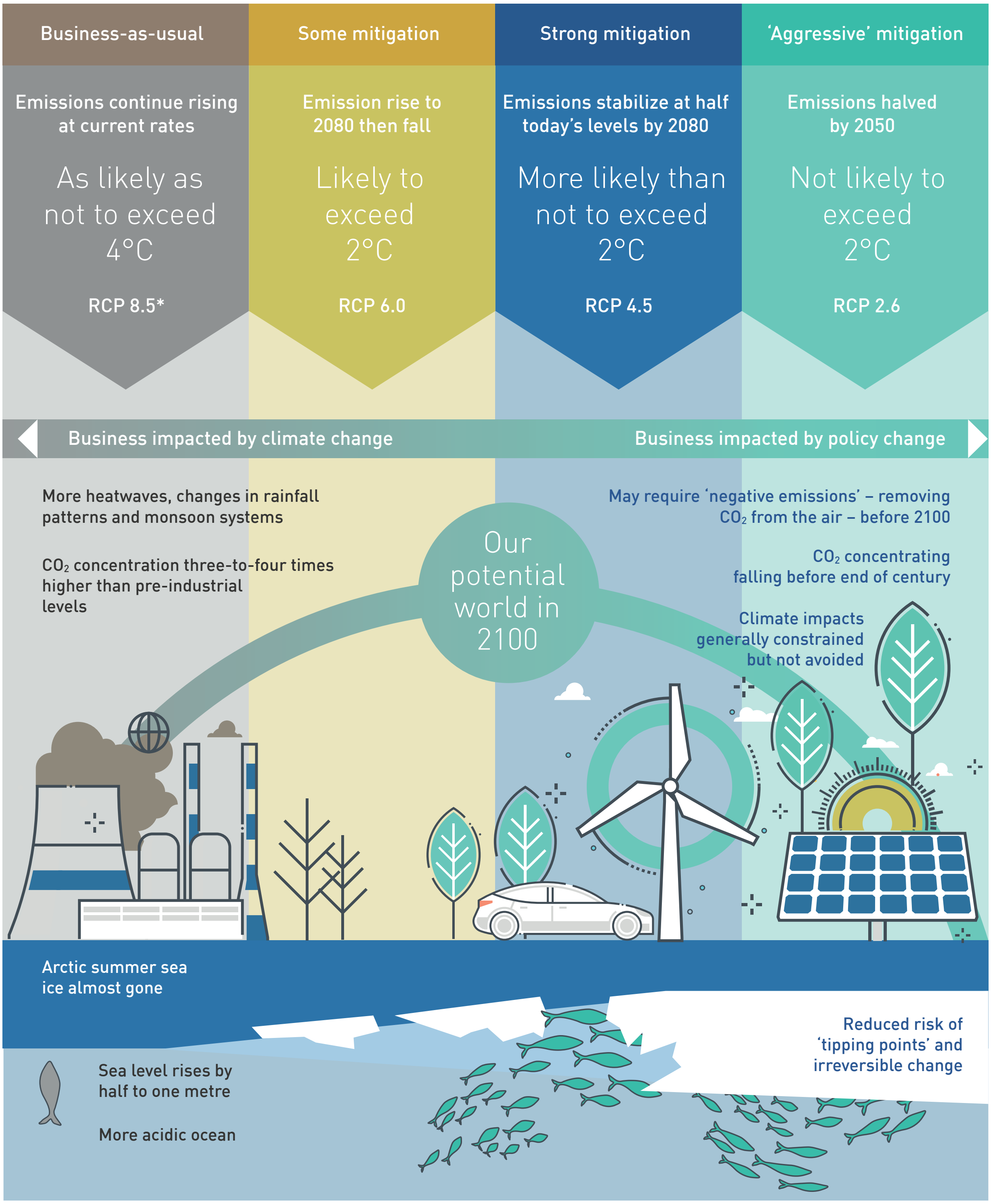


Figure 6: Carbon crossroads – the choices between physical and transition impacts presents important choices. Source: IPCC (2013), Fifth Assessment Report (AR5), (RCP – Representative Concentration Pathway)

5.1

Business-as-usual: High Physical Risk and Low Transition Risk

Under this scenario, governments fail to introduce policies to address climate change other than those already announced. Companies and consumers do not change their behavior to reduce emissions compared to current trends. There is also limited technological transition. As a result, the climate target is not met and the global average temperature increases substantially by 2080. This scenario tests financial firms' resilience to both chronic changes in weather (e.g. rising sea levels), as well as more frequent and extreme weather events (e.g. flash floods). Therefore, under this scenario, there are limited transition risks, but physical risks are significant.

The IPCC has modelled the climate change for a business-as-usual scenario called RCP8.5. RCP8.5 is the high-emissions scenario, consistent with no future policy changes to reduce emissions and characterized by increasing GHG emissions that lead to high atmospheric GHG concentrations. In this scenario, CO_2 (equivalent) concentration will increase to >1000ppm from the current level of 400ppm. This would translate into an expected temperature increase of 4°C relative to pre-industrial levels (1850 to 1900).

IPCC's scenario analysis projects world maps of climate impacts for the two extreme carbon concentration scenarios (RCP2.6 and RCP8.5, see **Figure 9**). In RCP8.5, the Artic region will experience temperature increases far above the average 4-degree increase in range of >9 degrees. Precipitation patterns will change and subtropical zones are projected to become more arid. Estimated sea level rise of 0.8m means that some regions will be particularly impacted, especially in the southern hemisphere [4]. According to a report from Economist Intelligence Unit (2015), the mean expected loss due to climate impact through the year 2100, in discounted present value terms, amounts to USD 4.2 trillion. At more severe climate scenarios, for example a 5°C warming, mean expected loss rises to USD 7 trillion.

5.2

Regulatory Response: Low Physical Risks and High Transition Risks

In this scenario, there is early and decisive action to reduce global emissions in a gradual way, with clearly signposted government policies implemented relatively smoothly. Companies and consumers align their behavior with a carbon neutral economy gradually over the scenario. Financial markets price in the transition in an orderly fashion and take advantage of the opportunities that the transition provides. In this scenario, there is a structural reallocation without any macroeconomic shock. The climate policies are sufficient to limit global average temperature increases to below 2°C. But even this moderate increase in global temperatures leads to higher physical risks relative to the current situation.

IPCC refers to this scenario in its RCP2.6, which is equivalent to carbon (equivalent) concentrations of 450ppm. There are a few publicly available scenario specifications for the 2°C outcome that focus on the transition costs. It is worth evaluating publicly available scenarios that are (1) used, referenced, and issued by an independent body; (2) wherever possible, supported by publicly available data sets and (3) updated on a regular basis.

[4] See World Resources Institute (2016).

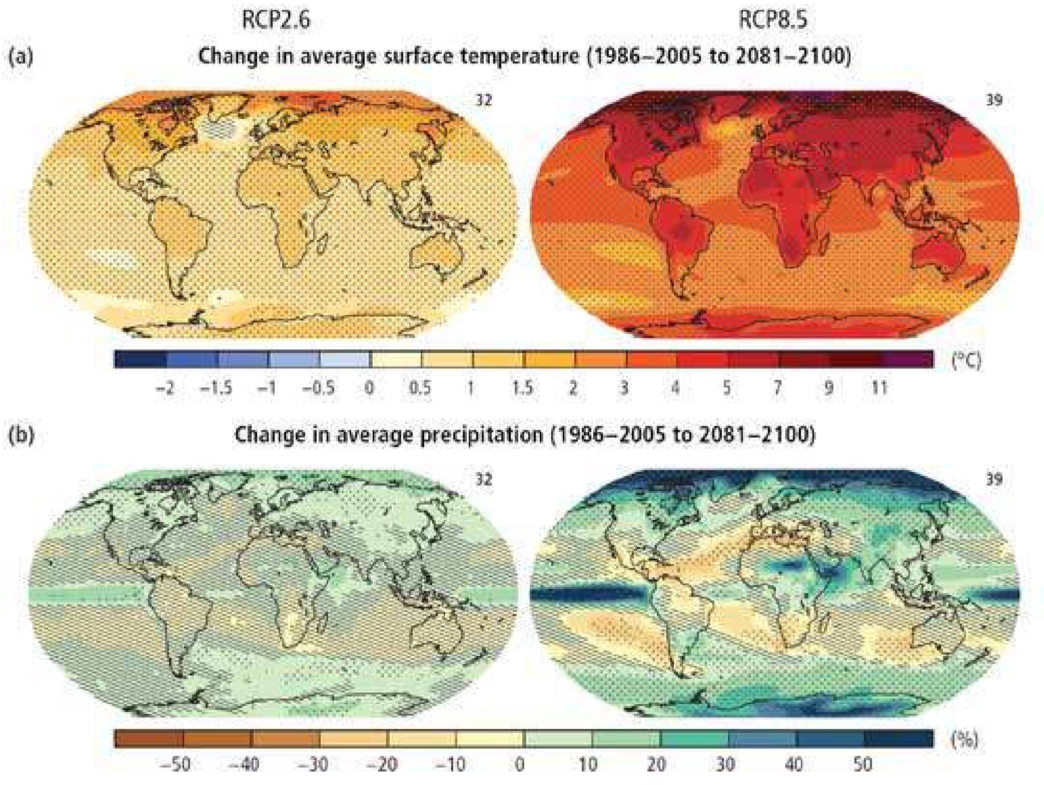


Figure 7: Change in average surface temperature (a) and change in average precipitation (b) based on multi-model mean projections for 2081–2100 relative to 1986–2005 under the RCP2.6 (left) and RCP8.5 (right) scenarios. Source: IPCC (2014)

These publicly available scenarios can help inform development of an organization's own scenarios or they can be used directly as a framework for strategic planning discussions. Examples of 2°C scenarios that presently meet the criteria 1-3 include: International Energy Agency (IEA) 450, Deep Decarbonization Pathways Project (DDPP), and International Renewable Energy Agency (IRENA) and ETP 2DS Scenario (Energy Technology Perspectives).

The models make parameter assumptions such as energy savings from efficiency increases, carbon emissions pricing (such as IEA assuming CO_2 prices in most OECD markets reach $140/ton in 2040, up from ~$20/ton in 2020), global energy demand growth and emerging technologies such as larger photovoltaic, electric vehicle and CCS deployment as well as increases in renewables and nuclear in the energy mix [5] .

There are more parameter alterations in other public climate models for 2°C scenarios. For example, Bank of England suggests scenarios that differ by speed of transition, in which late policy responses will cause more disruptions. This is modelled by an initial slow implementation that is followed by a more accelerated and aggressive policy execution.

[5] See TCFD (2020), pages 21-23

6

CLIMATE INVESTMENT AND RISK ANALYSIS

6.1

Integration into Existing Investment Process

SEDCO Capital takes a forward-looking perspective on how climate risk will impact its investment activities. This requires proactive decisions before markets price climate risk premia, regulators impose restrictions and costs (i.e., transition risks) or physical risks will render certain activities unprofitable. The integration does not necessarily mean new exclusions, but the climate analysis should result in a gradual rebalancing towards climate neutral and positive exposures.

SEDCO Capital's asset allocation should lower climate risks, all other factors being equal. Thus, climate analysis for investment opportunities as well as portfolio reviews of climate sensitive exposures and risks will be integrated into the existing investment process. **Figure 18** provides a matrix for the assessment of new and existing investment opportunities.

6.2

Investor Philosophy, Beliefs and Restrictions

Historically, asset owners have excluded certain investments for ethical reasons, as well as specific ESG-related reasons such as breaches of international norms and standards, the UN Global Compact being an example. Environmental and climate-related exclusions have become more prominent over the last several years. Exclusions include fossil fuel and high emission sectors and activities. As an example, Norges Bank Investment Management ceased investing in companies involved in the "production of coal or coal-based energy" or those that result in "severe environmental damage"[6].

SEDCO Capital has integrated climate risk considerations into its responsible investment policy. The importance of climate risk has grown and it has been gradually evolving into a secular theme from an investment perspective. Both climate related physical and transition risk levels are expected to increase in the near future and those risks are expected to impact regions and sectors differently. Thus, SEDCO Capital aims to integrate climate considerations in its asset allocation subject to overriding constraints and the duty of protecting the interests of its clients. Geographic regions, countries down to micro locations will differ in their sensitivities to climate physical and transition risks. Industrial sectors and businesses differ in their sustainability profile and emissions.

[6] See NBIM exclusion list under https://www.nbim.no/en/the-fund/responsible-investment/exclusion-of-companies/ as per 1st Dec 2020.

6.3

Geographic Asset Allocation

Geographic asset allocation needs to consider sensitivities to climate risk at a macro level (regional and country exposures) and micro level (locations with extreme weather risks).

Climate risks are analyzed in the context of a given investment opportunity. In regions sensitive to climate risks, physical risks will likely pose bigger challenges. However, transition risks may embody opportunities if there is a supportive backdrop for addressing climate change in the respective economy.

Firstly, there are risk-based, negative screening approaches to mitigating physical climate risks. As weather patterns become more extreme, zones of moderate climate tend to have advantages relative to tropical and subtropical regions. Global reinsurance firms have dedicated resources for climate risk research and have built substantial databases. This means that investments in real estate and infrastructure have to be analyzed for the physical risks of their respective locations as well as the forward-looking insurability. Global climate change hotspots are assessed and identified according to their sensitivity to snow/ice losses (resulting in risks to water supply, river runoffs, snowmelt-related risks and flood risks), semi-arid areas (risks to rainfall variability and temperature rise thus creating drought, flood, water supply, wildfire and land degradation) as well as river deltas (sea-level rise, land movement, water and sediment flows due to storms, floods, erosion and water quality deterioration).

Secondly, a positive screening approach to climate asset allocation assesses countries' achievements of climate change mitigation, i.e. addressing transition risks. The Climate Change Performance Index[7] (CCPI) rates countries according to evaluation criteria consisting of 14 indicators across the categories of GHG Emissions, Renewable Energy, Energy Use and Climate Policy. It also compares country performances in meeting their Nationally Determined Contributions to the targets outlined by the Paris Climate Accord.

For SEDCO Capital's investment process, avoiding physical risk in geographic allocation will be key, in addition to a regulatory transition process without excessive costs, business disruption and impact. Data sources such as CCPI can be used at a macro level. Geographic micro locations require research into physical risk exposures such as prior event data as well as transition risks like regulatory climate-related restrictions.

[7] See 2020 report under https://www.climate-change-performance-index.org/sites/default/files/documents/ccpi-2020-results-the_climate_change_performance_index.pdf.

6.4

Industrial Sector Climate Sensitivities

High carbon emission sectors tend to be most sensitive to transition risks if there are carbon efficient substitutes. Transition risk sensitivity has the greatest negative transition sensitivity for the energy sector, particularly coal. Gas is still perceived as a transition resource that is more difficult to substitute due to its flexibility in the electricity grid **(Figure 14)**. The transition sensitivity is greatest in a below 2-degrees scenario. Renewables have the most positive transition sensitivity, even in a less extreme scenario. While transition risk sensitivity is most negative for utilities and energy, some sensitivity is relatively widespread across sectors, including industrials, telecoms, financials, consumer staples and consumer discretionary. This is due to certain factors such as the location or climate exposure of invested capital. Within each sector, there will be "winners" and "losers" at a stock level, including those sectors where overall sensitivity is expected to be neutral.

Expected annual return impacts remain most visible at an industry-sector level, with significant variations by scenario, particularly for energy, utilities, consumer staples and telecoms. Asset class returns can also vary significantly by scenario, with infrastructure, property and equities being the most notable. Variations in results between asset classes and across regions, cumulative impacts and the emphasis on sustainable opportunities provide multiple portfolio construction possibilities for investors. According to a study by Mercer[8], coal will be most negatively exposed with expected annualized incremental return of -7.1% through to 2030, followed by oil and gas (-4.5%) and electric utilities (-4.1%). In contrast, the study predicts incremental annualized positive returns for renewables (6.2%), followed by sustainability-themed infrastructure (3.0%), infrastructure (2.0%) and sustainability-themed global equities of (1.6%) by 2030.

Climate sensitivities will be a driver of future returns and thus asset allocation may at least incrementally underweight less carbon efficient sectors.

[8] Mercer (2019), p. 10 following.

6.5

Public and Private Equity

Investment opportunities should ideally have favorable climate risk sensitivities. Companies have to be analyzed for their climate, particularly carbon-equivalent, efficiency. In developed markets, companies are disclosing granular environmental data. For emerging markets and smaller companies, environmental disclosure is often unavailable, but can be obtained through third party research providers. Relative to peers, a company should be well positioned on transition and physical risks under different scenarios by, for example, demonstrating carbon efficiency.

Besides the direct emissions from the business itself, the supply and value chains should be analyzed for carbon emissions depending on the degree of vertical integration. There are reporting standards for emissions data from organizations such as World Business Council for Sustainable Development and World Resources Institute (2004). **(Figure 8)** summarizes key selection criteria for company analysis in public and private equity as well as the investment manager selection.

6.6

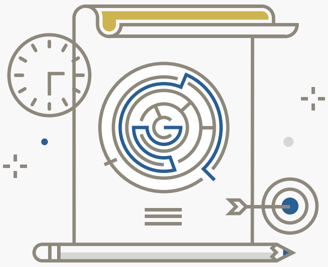
Income investment strategies

For income securities, the selection criteria discussed under 6.5 are applicable to corporate issuers while asset allocation criteria in section 6.2 such as Climate Change Performance Index pertain to sovereign issuers. A special case relates to green bonds which may be special financing vehicles for environmental impact investments.

6.7

Real Estate and Infrastructure

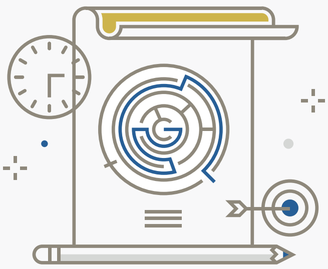
Real estate and infrastructure have the greatest negative sensitivity to the impact of physical damages and resource availability. The sensitivity to the climate change risk factors will vary by underlying sector **(Figure 10)**. More-stringent climate change policy (and investment in technology) is likely to reduce the value of some assets that are less-advanced or unable to adapt, whereas others will benefit strongly.

	Climate Risk Impact	**Considerations in Due Diligence and Monitoring**	**Potential Challenges**
Direct Management	• Direct physical impact • Transition risks, particularly regulatory impact • Supply chain risks	• Consider carbon and emission pricing as well as increased regulatory compliance costs. • Build internal carbon price assumptions and scenarios. • Engage best-in-class data providers to measure emissions exposure. • Apply long-term scenario analysis beyond the target exit date since markets may start pricing long-term climate risks.	• Favor businesses that have diversified their supply chain. • Favor advanced technologies (such as wastewater recycling or water efficiency) to manage resource risks.
Manager Selection	• Exposure of investment strategy to climate risks	• Assess data sources and reporting such as CO_2 emissions of the portfolio vs. benchmark. • Engage with active managers to increase disclosure from portfolio companies on climate risks and resource usage, risks to production, manufacturing and supply chains. • Review the managers' underwriting assumptions about downside risks from supply chain disruptions in high-sensitivity sectors (e.g., food, agriculture). In some cases, higher input costs are passed on to end consumers, but investors and investment managers should test the sensitivity and long-term viability of these passthrough effects. • Assess the manager's approach and existing exposures to climate liable sectors (e.g. transportation, basic materials and energy) and geographies as well as to benefit from the secular opportunities resulting from climate change. • Managers should stress test portfolio using incrementally higher carbon price scenarios.	• Finding managers that have developed strong climate risk-disclosure policies, monitoring and reporting.

Figure 8: High-level criteria for private and public equity assessments as well as manager assessment. [9]

[9] See Cambridge Associates (2015).


Climate Risk Impact	Considerations in Due Diligence and Monitoring	Potential Challenges
• Direct physical impact • Longer-term indirect risks (on fiscal stability)	• With sovereign or other long-term exposures, managers should integrate climate modeling and scenario analysis • Understand the impact of severe droughts on water revenues. • For sovereign credits with high exposure to coastal regions, inquire about longer term budgetary risks from climate adaptation and extreme weather disaster costs. • For leasing, avoid equipment with substantial energy footprint (all other factors equal). Otherwise, consider re-pricing of climate risks in exit assumptions.	• Apply caution with strategies that do not have the flexibility to diversify geographically. • Aim to gauge stranded asset risk.

Figure 9: High-level criteria for income securities.

Climate Risk Impact	Considerations in Due Diligence and Monitoring	Potential Challenges
• Direct physical impact • Transition risks, particularly regulatory impact	• Expect energy efficiency rating requirements to be introduced or to become tougher and consider upgrades in business plans. • Insurance coverage related to extreme weather events (and credit quality of those insurers). • Geographic exposure and mitigation of extreme weather exposures. • Stress test future cash flow and exit value assumptions, especially in coastal regions with more sensitivity to extreme climate events. • Evaluate the reliance of the (tenant's or property's) business model on a particular set of climate conditions. • Apply long-term scenario analysis beyond the target exit date since markets may start pricing long-term climate risks.	• In manager selection, evaluate region-specific and sector-specific mandates that do not have the flexibility to diversify. • Stay ahead of stricter building efficiency and disaster resiliency standards.

Figure 10: Assessment criteria for real estate and infrastructure.

7 INVESTMENT OPPORTUNITIES IN CARBON REDUCTION

The novelty and challenging nature of the climate problem offers investment opportunities for proactive investors. Climate change has become a secular investment theme that has gained importance in recent years.

Countries have committed to the Paris Climate Accord targeting carbon reduction to limit temperature increase to less than two degrees. That means that structural changes in the energy mix, energy efficiency standards and other regulations will be required. Investment themes related to carbon reduction should particularly benefit while activities with high emission should incrementally dwindle.

Some of these climate investment themes and opportunities are more sensitive to policy and regulatory actions guiding the economy toward a lower-carbon future, but many are more market-driven solutions, with their success reliant on factors such as unit economics, technological differentiation, business model innovation and operational execution.

7 INVESTMENT OPPORTUNITIES IN CARBON REDUCTION

Rapid technological advancements, declining cost structures, business and financing model innovations, policy and regulatory evolution and improving management quality will open up new areas of investment opportunity in the future.

Carbon reduction relies on emerging or new technologies which have inherently higher risks. Regulation is evolving and well-intentioned legislation may do more harm than good. As an example, the European Union's market mechanism for carbon pricing and offsetting has not achieved the envisaged reduction. Clean technology has a somewhat mixed track record with failed businesses and projects due to overinvestment and overcapacity, variable cost and scale (such as European solar panel manufacturers losing the market to China) as well as a general reliance on state funding and subsidies. Thus, the transition means navigating uncharted territory in dealing with new technologies and evolving regulation.

Furthermore, clean and efficient technologies have a sensitivity to conventional energy prices due to substitution effects. Renewable energy may be less economically viable if fossil fuels prices are particularly low.

7.1 Selection of managers and investment opportunities

Besides climate opportunities, a more defensive approach is the incremental climate risk performance of investment opportunities discussed in section 6 assessing the sensitivities to transition and physical risks as well as the disadvantages of regions and sectors (see example in **Figure 11**). This defensive approach translated into the underweighting of investments with high emissions, efficiency issues and physical climate risks. Of course, the investment rationale must be strong, independent of the climate considerations.

The improved integration of climate change aspects in existing ESG analysis, whether through manager selection or direct opportunities, is a basic and defensive strategy for SEDCO Capital. This has resulted in sustainability and climate-themed investments, such as SC Global Sustainability Equity Fund or Wave Equity Partners, which we expect to benefit from carbon reduction policies.

Climate change is an important theme, which will likely grow in importance as physical and transition risks gain prominence. Thus, a proactive climate-centric investment approach should see continued growth beyond the current sustainability-themed investments.

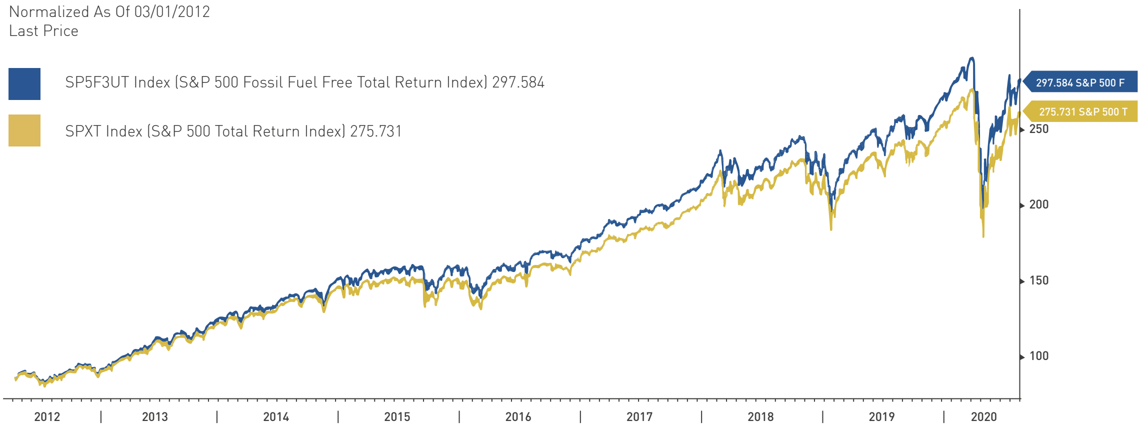


Figure 11: Outperformance of S&P 500 Fossil Fuel Free TR Index vs S&P 500 TR Index since index inception in March 2012. Annualized outperformance is about 1%-point p.a. to July 2020. Source: Bloomberg

7.2 Renewable and Clean Energy

Renewable energy is projected to account for most of the additional global capacity installed by 2050, with photovoltaic and onshore wind to account for most growth (see **Figure 13** and **Figure 14**) according to projections from BloombergNEF.

Through 2020, the cost to install residential photovoltaic has declined by 80-90% since 2007, due primarily to manufacturing scale-up and technological advancements. Booming Chinese production has been a significant contributor to cost reductions **(Figure 12)**. The price declines have led to greater adoption of photovoltaic being a tailwind for the development of renewable projects and thus becoming a growing part of countries' energy mix.

The combination of policy and regulatory pressure toward cleaner power generation, net metering incentives and consumer behavioral changes is further driving demand growth. Renewable infrastructure is one theme for investors, who want to mitigate the risk of aggressive policy and regulatory responses against climate change. If policies and regulations continue to evolve and favor investment in lower carbon energy sources, renewables should gain competitiveness and market share over time against traditional high carbon sources.

Apart from energy generation, the efficient usage and management of energy resources is a growing theme - so-called "smart energy" and smart grids. In this area, software, hardware, and energy management intersect to form opportunities for investment.

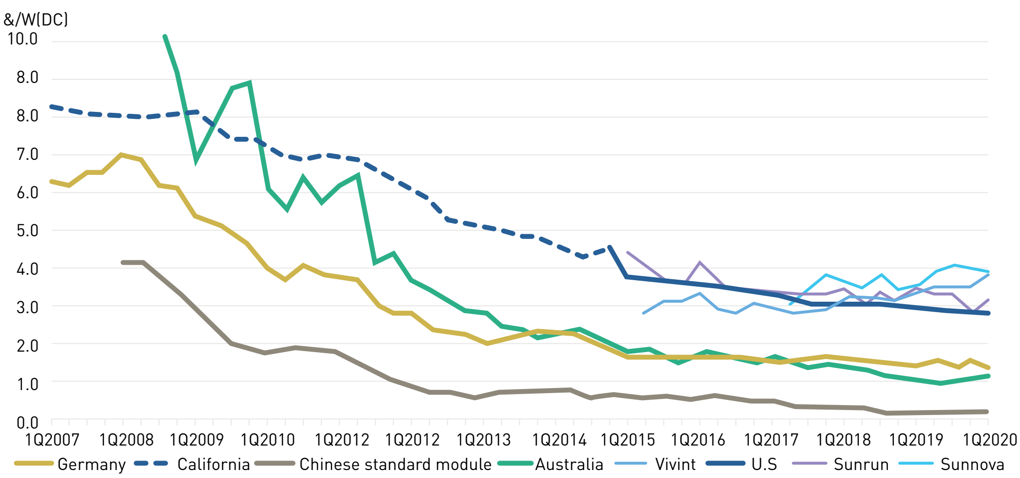


Figure 12: Cost of residential solar panels. Source: Bloomberg NEF.

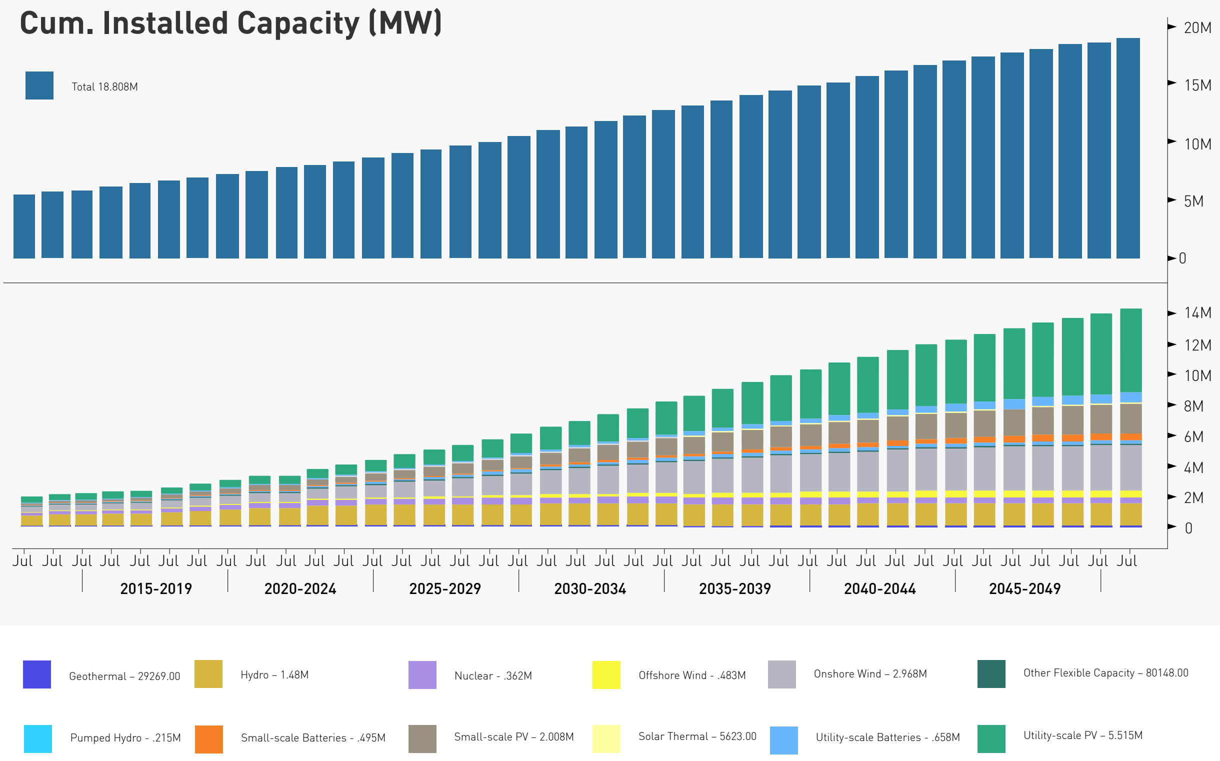


Figure 13: Projected share of global renewable energy capacity relative to global total installed capacity. Share of renewable capacity is projected to increase to more than 75%. Particularly, photovoltaic and onshore wind are projected substantial growth. Source: Bloomberg

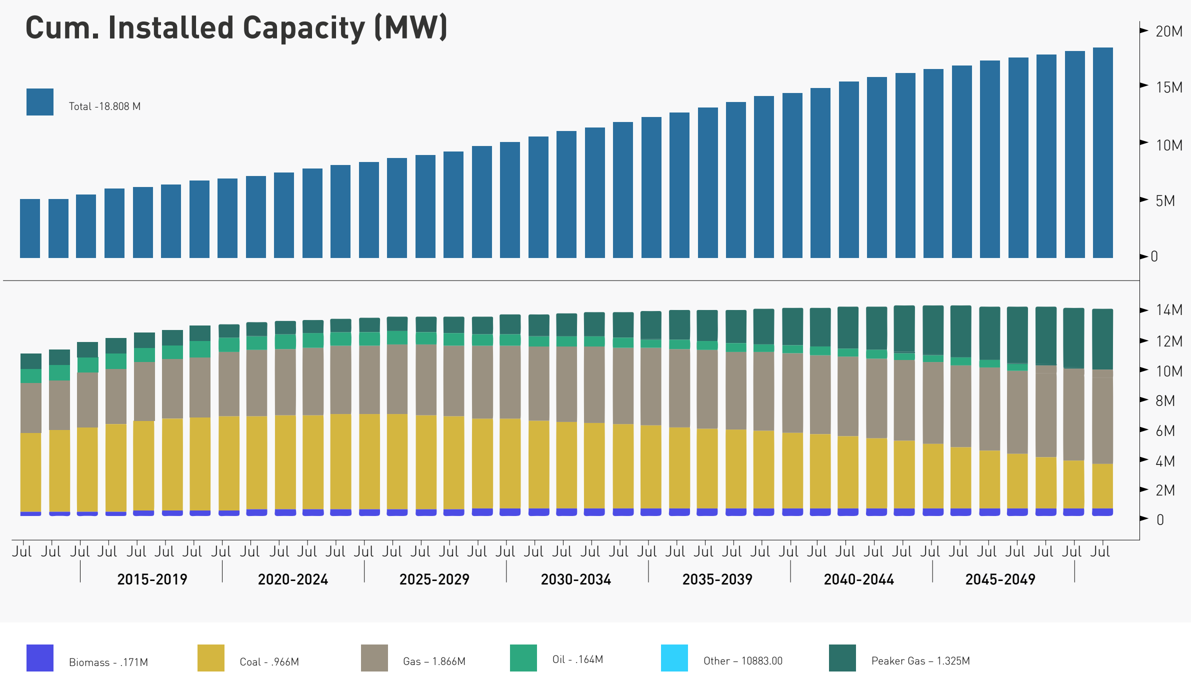
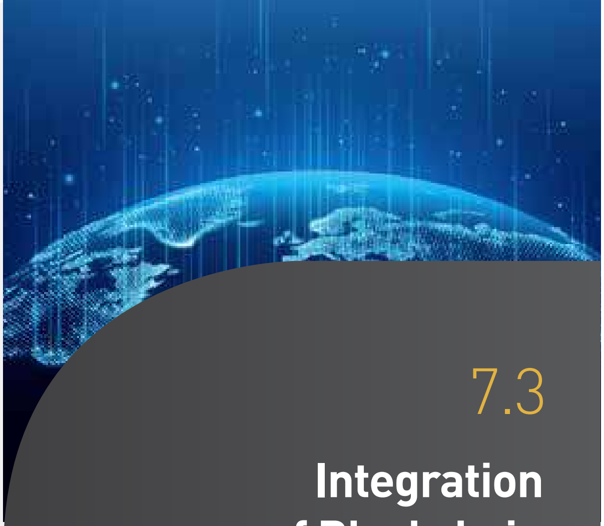


Figure 14: The projected share of global installed capacity of carbon emitting fuels is projected to decline by 2050 with stagnating total capacity. Particularly the relative share and absolute capacity of coal will likely decline while gas will gain importance among remaining fossil fuels. Source: Bloomberg



7.3 Integration of Blockchain Technology

There are business and investment opportunities originating from blockchain technology used in clean resources and energy technology. As a distributed ledger technology, blockchain provides a platform for the management and transaction of data. The use of blockchain technology allows all participants access and transparency. The key feature of blockchain is the decentralization element, which makes the technology resilient to attacks or abuse, in contrast to centralized traditional databases. The decentralized approach of blockchain can bring together all stakeholder groups, including companies, government and individuals. There is an abundance of potential blockchain applications. The usage in carbon emissions tracking and smart grid are examples:

The calculation, tracking and reporting of reductions in greenhouse gas emissions along the entire supply chain (including manufactures, suppliers, distributors and consumers) could be enabled with blockchain technologies. Transparency is an important element in the tracking and reporting of emissions reductions thus avoiding measurement and attribution issues among different participants along the supply chains. Hence, blockchain technology could facilitate the measurement of the Nationally Determined Contributions (NDCs) under the Paris Agreement.

Peer-to-Peer (P2P) trading. P2P is the "talk" of the sector—the prospects for blockchain technology to make transactive energy a reality, to upend the framework of the grid and the energy sector as we currently know it. Smart contracts allow a blockchain to be programmed with a set of conditions that when met, automatically prompt transactions, enabling producers, consumers and prosumers all to participate into a sale process based on price, time, location and the type of energy source. With the right business model and the right regulatory framework, blockchain's ability to make transactions faster, simpler and cheaper can allow for wider participation into the energy market, down to individual households.

In smart grids, blockchain technology facilitates a move towards peer-to-peer energy trading, which would encourage micro-power generation and make the economics of many renewable power projects look more attractive. Peer-to-peer transactions would be facilitated with the help to smart contracts. These could allow a blockchain to be programmed with a set of conditions that when met, automatically prompt transactions, enabling producers and consumers to participate into a sale process based on price, time, location and the type of energy source. With the right business model and the right regulatory framework, blockchain's ability to make transactions faster, simpler and cheaper can allow for wider participation into the energy market, down to individual households [10].

[10] See Zafar (2019) and European Commission (2019).

7.4
Energy Efficiency of Buildings

Businesses and technologies that contribute to energy efficiency measures in residential, commercial, and industrial buildings make up an emerging and growing opportunity for investors. Residential excluding electricity and heating is the fourth largest CO_2 emitting sector **(Figure 17)**.

Energy efficiency measures have focused on areas such as lighting and HVAC (heat, ventilation, and air conditioning). Thus, intelligent lighting technology solutions and heat insulation could experience growth in carbon mitigation strategies. Construction materials such as steel and cement are among the top global CO_2 emitters. Alternative materials can contribute to carbon mitigation. There may be more demand for professional services to deploy efficiency solutions such as institutionalization of scalable processes in project documentation, and measurement and verification. The smart grid theme mentioned in section 7.3 may lead to decentralized power generation such as installed solar panels in residential and commercial buildings.

From an investment perspective, opportunities along the value chain of property energy efficiency may be most interesting such as energy service companies that provide a broad range of energy solutions including the design and implementation of energy-saving projects. Furthermore, energy efficiency themes may emerge such as the integration of energy efficiency upgrades to property business plans or even entire energy efficient real estate projects.

7.5 Clean Transportation

Transportation is the second largest sector by CO_2 emissions **(Figure 17)**. This includes air travel, freight, shipping and road traffic.

Similar to power generation, the transportation industry is subject to policy, regulatory, and technological factors that can create opportunities for investors while also protecting against risks from policy and regulatory responses. In the longer term, the clean transportation theme can also be an avenue to reduce sensitivity to geopolitical risks in oil-producing regions, many of which are also sensitive to climate factors.

The regulation of fuel efficiency and emission standards will be serve as a tailwind for electric vehicles (EVs) to increase their market share in the years ahead. Regulators may increase taxes on fossil fuels and thus push for better fuel economy standards of car producers. To achieve fuel efficiency goals, the clean transportation industry will need to make up a larger share of vehicle sales. The global market share of EVs was about 2.5% in 2019, and the transition from 2020-2023 is expected to be modest, with 2024 seen as a tipping point if battery prices fall below $100/kWh, as predicted by BloombergNEF **(Figure 17)**. The predicted growth in EVs means that lithium-ion battery demand for EVs should increase by factor 8 from 2020 to 2030.

Although charging stations and refueling infrastructure have grown notably, the number of plug-in EV charging ports still seems to be a bottleneck in major markets.

It seems unlikely that EVs are going to substitute internal combustion engine (ICE) vehicles at an equal ratio, especially for heavy utility and heavy-duty vehicles such as trucks or agricultural machines. Thus, research on the efficiency of combustion engines and cleaner fuels will continue in the future, not only as transition technologies.[11].

An acceleration of a trend against individual car ownership that has become evident for millennials seems more likely: The combination of EVs, autonomous driving and automated ride-sharing technologies may lead to an evolution in passenger car usage in the next decade. As most personal vehicles stand idle more than 90% of the time, ride sharing with autonomous vehicles will lead to better capex utilization causing a substantial decrease in individual car ownership and overall car demand.

A similar cost decline experienced in solar **(Figure 12)** can be seen for battery storage capacity. As lithium-ion batteries become more operational, this opens new areas of use for commercial vehicles – at least as plug-in hybrid vehicles. Nevertheless, the share of EVs in commercial applications is predicted to be small **(Figure 17)**.

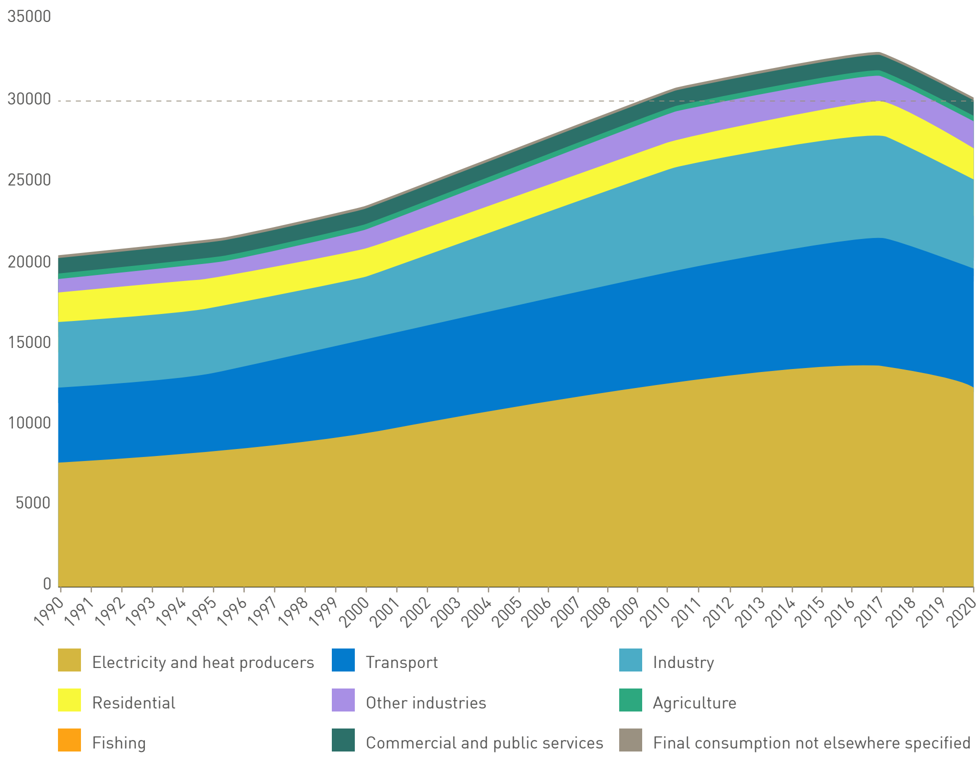


Figure 15: 2020 Global CO_2 Emissions by sector, Source: Bloomberg, IEA.

[11] See Clean Combustion Research Center at KAUST, https://ccrc.kaust.edu.sa/Pages/New-Combustion-Technologies.aspx as per 2 December 2020.

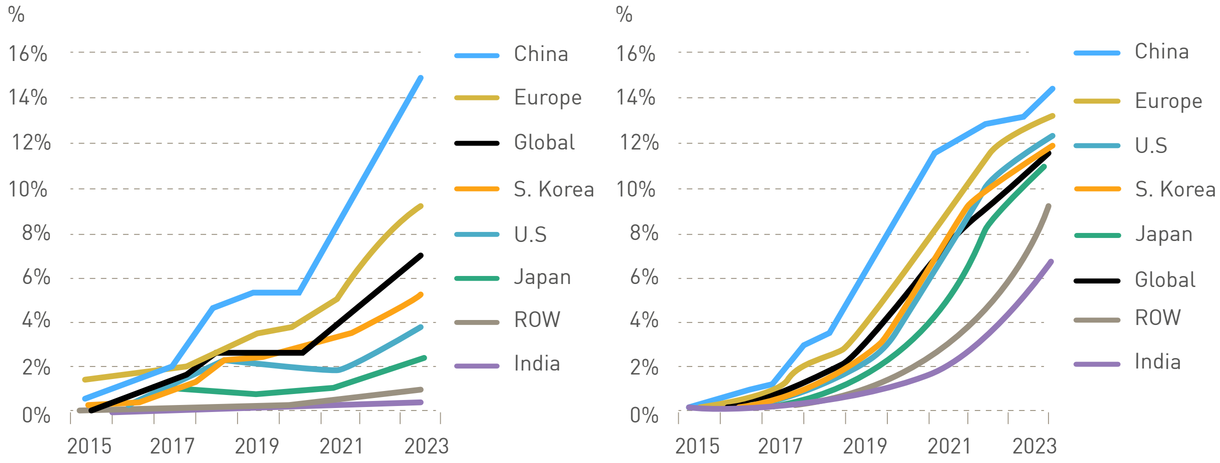


Figure 16: Global EV Sales Forecast Per Region, Source: BloombergNEF.

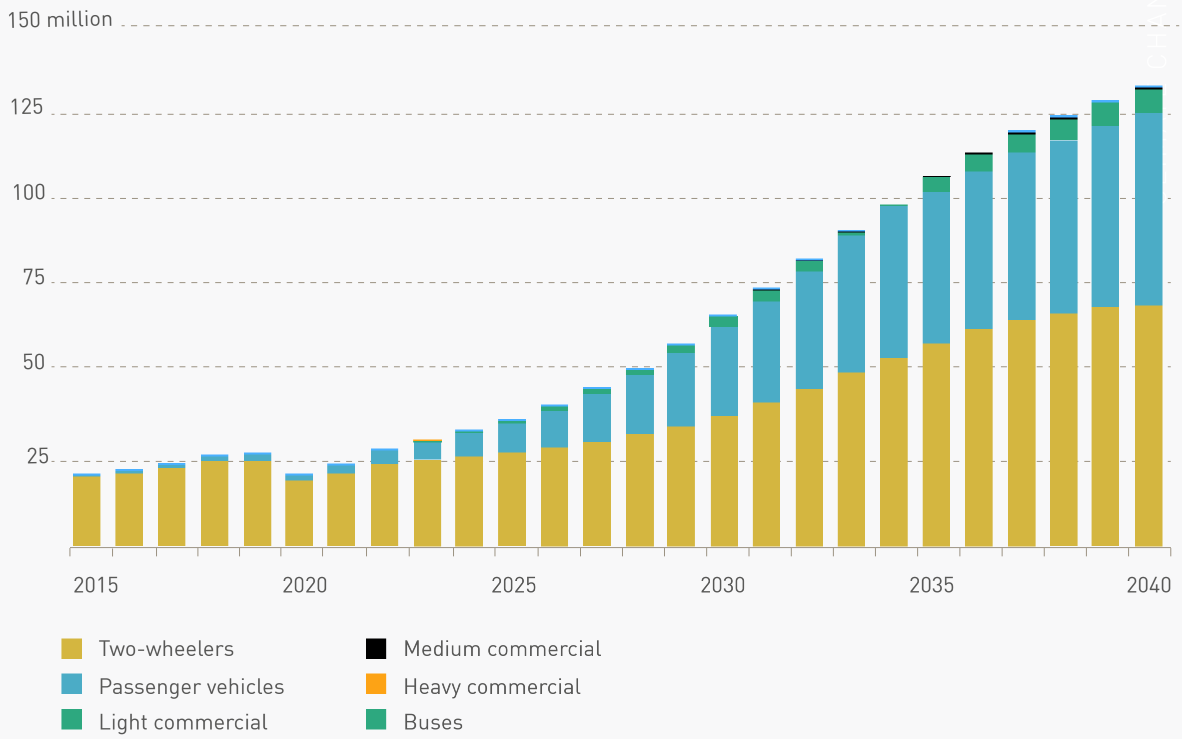


Figure 17: Actual and expected growth in annual global electric vehicle sales by segment, Source: BloombergNEF.

Investment opportunities may arise in the area of battery technology and smart software management as well as sustainable mobility solutions. A driver will be the continued storage technology advancement and cost declines and use of battery technology for commercial vehicle applications. Of course, battery technology will be important beyond the transportation sector such as smart grid and storage of solar or wind-generation. Other important trends for investments will be the required build-out of vehicle charging infrastructure networks.

7.6 Carbon Reduction Investments

Carbon sequestration, also known as carbon capture and storage (CCS), is a technology that is being pursued, which might allow the continued use of fossil fuels, especially coal and gas. Unfortunately, CCS has developed more slowly than expected, and the technology is unlikely to make a major contribution to reducing carbon pollution until after the 2020s. To ensure fossil fuel combustion does not release carbon pollution into the atmosphere, the carbon dioxide from a coal-fired power plant (or potentially a gas-fired one) must be captured and stored somewhere forever.

Carbon dioxide could be removed before combustion or after combustion. Doing so before burning the fossil fuel is much simpler and cheaper because after combustion, the carbon dioxide begins to diffuse in the exhaust (flue) gas and then the atmosphere. The more diffused the carbon dioxide, the more difficult and costlier it is to extract from the air. In 2009, Harvard's Belfer Center for Science and International Affairs published a major study, "Realistic Costs of Carbon Capture" [12]. The Harvard analysis concluded that first-of-a-kind CCS plants will have a cost of carbon abatement of some "$150 per ton of carbon dioxide" avoided, not counting transport and storage costs. This yields a "cost of electricity on a 2008 basis [that] is approximately 10 cents/kWh higher with capture than for conventional plants." That price would effectively double the cost of power from a new coal plant [13]. Only a substantial increase in carbon dioxide emission cost could make CCS viable. Furthermore, the challenge and cost of CO_2 storage will be significant (see section 3). As a conclusion, CCS seems expensive, has potential viability issues and may not yet be proven as a technology.

Halting deforestation will be key to lower carbon emissions. Deforestation—quite often linked to agricultural practices – is one of the largest carbon-dioxide emitters, accounting for about 17 percent of global CO_2 emissions.

Deforestation's outsize impact stems from the fact that removing a tree both adds emissions to the atmosphere (most deforestation today involves clearing and burning) and removes that tree's potential as a carbon sink. Even after accounting for ongoing reforestation efforts, deforestation today claims an area close to the size of Greece every year. Achieving a below 2-degree pathway requires to dramatically slow deforestation.

Reforestation will gain importance as carbon reduction mechanism. Besides carbon reduction, additional benefit can be the protection of biodiversity and ecosystems. Over the next decade, a significant global mobilization to reforest the earth would be required to achieve a below 2-degree pathway. Reforestation represents the key lever to compensate for the hardest-to-abate sectors, particularly for pre-2030 emissions [14].

By 2050, on top of nearly avoiding deforestation and replacing any forested areas lost to fire, the world would need to have reforested more than 300 million hectares (741 million acres) – an area nearly one-third the size of the United States. The pace of reforestation would need to be faster still should either the transport or power-generation sectors decarbonize more slowly.

The question of feasibility will not be capped by available land. Mass reforestation has taken place in China, admittedly at a much smaller scale. And carbon-offset markets could help catalyze reforestation (and innovation). That said, it is difficult to imagine reforestation taking place on the required scale absent of coordinated government action.

Reforestation seems to be at a nascent stage from an investment perspective. Reforestation projects may be positioned as carbon offsetting projects thus generating carbon emission credits. That means that their economic viability will be sensitive to the price of emission rights.

7.7 Water and agricultural efficiency

Precision farming, i.e. the enhanced use of technology, will continue to gain importance. Farmers are increasingly investing in data-driven technologies that save water and increase crop productivity.

Companies that provide technologies or services that increase data visibility on resource utilization, and/or provide the solutions to actually increase water efficiency and crop productivity should benefit. Agricultural and water assets that are operated in a resource-efficient manner should also benefit from long-term competitive advantages.

[12] See Al-Juaied/Whitemore (2009).
[13] See Romm (2016), pages 208-214.
[14] McKinsey (2020).

8 CONCLUSION

Man-made carbon emissions are a driver of climate change. There is no alternative to the integration of climate considerations into the investment process. Even if regulators do not impose more stringent climate regulation, the impact on investment returns will be through the manifestation of physical climate risks. Postponing the application of climate considerations is not a viable alternative since a belated but accelerated policy response may be disruptive to existing investments.

8 CONCLUSION

The integration of climate considerations in risk and investment processes is straightforward for SEDCO Capital. Existing ESG analysis needs to reflect climate risks and carbon reduction at the macro level, which will translate into reduction requirements at the corporate level. Furthermore, the incremental adjustments to geographic and sector asset allocation will be important to mitigate carbon exposure. Avoiding physical risks, such as high carbon emission activities, will be important. This includes the analysis of extreme weather risk heat maps across regions, companies' business and operations mix as well as companies' coverage of green opportunities and efficient technologies.

While the analysis of climate risks supplements the investment process, certain sectors and activities may particularly benefit from future climate policies. While being cognizant of risks, such as regulation and new technologies, there will be green investment opportunities to benefit from this secular theme.

APPENDIX

1 Governance of Climate Risk and Investment Process:

- What is the status quo of climate integration such as climate risk reporting, carbon efficiency measurement and similar?
- How is scenario analysis integrated in strategic planning and/or enterprise risk management?
- How is climate risk and investment process managed and overseen?
- What internal and external stakeholders are involved?

2 Asset Allocation:

- What are the macro and micro geographic exposures to physical and transition risks for the target investment?
- Has the industrial sector high climate sensitivity?
- Are geographic and sector sensitivity to climate risk favorable for investment selection?

3 Scenario - Physical Risks

- Assess "business-as-usual scenario" with emissions continue rising at current rates and 4-degree pathway (such as RCP8.5)
- How will the business be impacted by physical risks?
- Assess geographic and sector sensitivities to physical risks
- Expected and extreme costs such as higher insurance, physical damage, potential
- What actions are taken to mitigate physical risks and costs?

4 Scenario - Transition Risks

- Assess "aggressive carbon mitigation scenario" in line with below 2-degree pathway (such as RCP2.6 scenario)
- Impact of scenario assumptions on business such as carbon emission costs
- Assess sensitivity to Policy and Legal changes, market and technology shifts
- Assess corporate reputation
- Geographic and sector sensitivities to transition risks
- What actions are required for the investment to transition to a "below 2-degrees backdrop"? What is the time required for implementation?
- Expected cost for the required adjustments to business model

5 Opportunities to Benefit from Carbon Reduction

- Evaluate business impact and competitive position from moderate transition and potentially more disruptive regulatory transition?
- Planned changes to the business model, portfolio mix, capabilities, technologies
- How is the investment opportunity's climate performance against peers?
- Planned adjustments to strategic and financial plans
- Address potential changes to competitive advantages

6 Documentation, Disclosure and Reporting:

- Document the processes: relevant stakeholders, inputs, disclosures, analytical methods
- What periodic reporting will be provided? What are the delivery dates?

Figure 18: SEDCO Capital Climate Assessment Matrix for new investment opportunities.

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