CLIMATE CHANGE IN THE ANTHROPOCENE

A STATISTA DOSSIERPLUS ON THE MAN-MADE CLIMATE CRISIS AND POSSIBLE SOLUTIONS

statista

Table of contents

We must now agree on a binding review mechanism under international law, so that this century can credibly be called a century of decarbonisation

-

Angela Merkel

German Chancellor

Climate change - do we need to intervene now?

Executive summary

The influence of humans on fate of the planet Earth has reached unprecedented heights today. The Holocene era – i.e., the present as we know it – has witnessed significant changes in the biophysical process caused by human activity, hence it is also aptly termed the "Anthropocene". The Anthropocene marks global impacts of greater magnitude than previous epoch transitions, and more often than not, they are happening simultaneously. Especially implications from changes happening during the mid-20th century are accumulating. The processes and systems that regulate the stability and resilience of various Earth systems that guarantee our survival are at stake now – first and foremost a noticeable change in climate.

As evident in previous mass extinctions, sudden changes in climate can be profoundly devastating for all living creatures. A slight change in temperature – or global warming, as it was known previously – can change whole ecosystems beyond recovery. An increase in 1°C in just over 200 years has brought about destruction to essential ecosystems that have ensured our survival and now struggle to survive themselves.

However, the effects of climate change are not just an increase in temperatures globally. It also has its impact on our daily activities – be it energy, transportation, food habits, or the health of ecosystems and biodiversity. Approaching climate change begins with recognizing the societal implications, being aware, and identifying sustainable transformation opportunities.

Due to the growing concerns of climate change, the Intergovernmental Panel on Climate Change (IPCC) was established in 1988 by the United Nation Environment Program (UNEP) and World Meteorological Organization (WMO). It equips policymakers with a holistic understanding of the risks and implications of climate change from regular scientific assessments along with adaptation and mitigation options.

One of the foremost actions identified was to decrease our dependence on fossil fuels to reduce the detrimental emissions of carbon dioxide (CO_2), mainly from combustion. While the COVID-19 lockdown halted many industrial processes, cities were free of pollution and a congested lifestyle – the right time to ponder the necessities and prioritize global environmental action to equip humanity for future disasters.

This DossierPlus explores climate change impacts and provides insights into technological and market solutions to better deal with a climate crisis.

01 Understanding climate change

- Man-made climate change
- Socio-economic trends
- Bioprocess trends

statista

Understanding climate change and our role in this global problem

Are humans causing global warming?

Climate change describes a change in the typical climatic conditions felt on a local or global scale. Burning fossil fuels such as coal, oil, and gas that emit CO_2 as a by-product of combustion is considered the single largest contributor to the rising global temperatures. The natural sources of carbon dioxide are offset by land and ocean, respectively. Processes such as photosynthesis, ocean absorption, and creation of carbon compounds during the "carbon cycle" over the past eons have helped in the absorption of CO_2. However, the rapid build-up of additional carbon dioxide in the atmosphere by human activities occurs faster than its removal, leading to an imbalance.

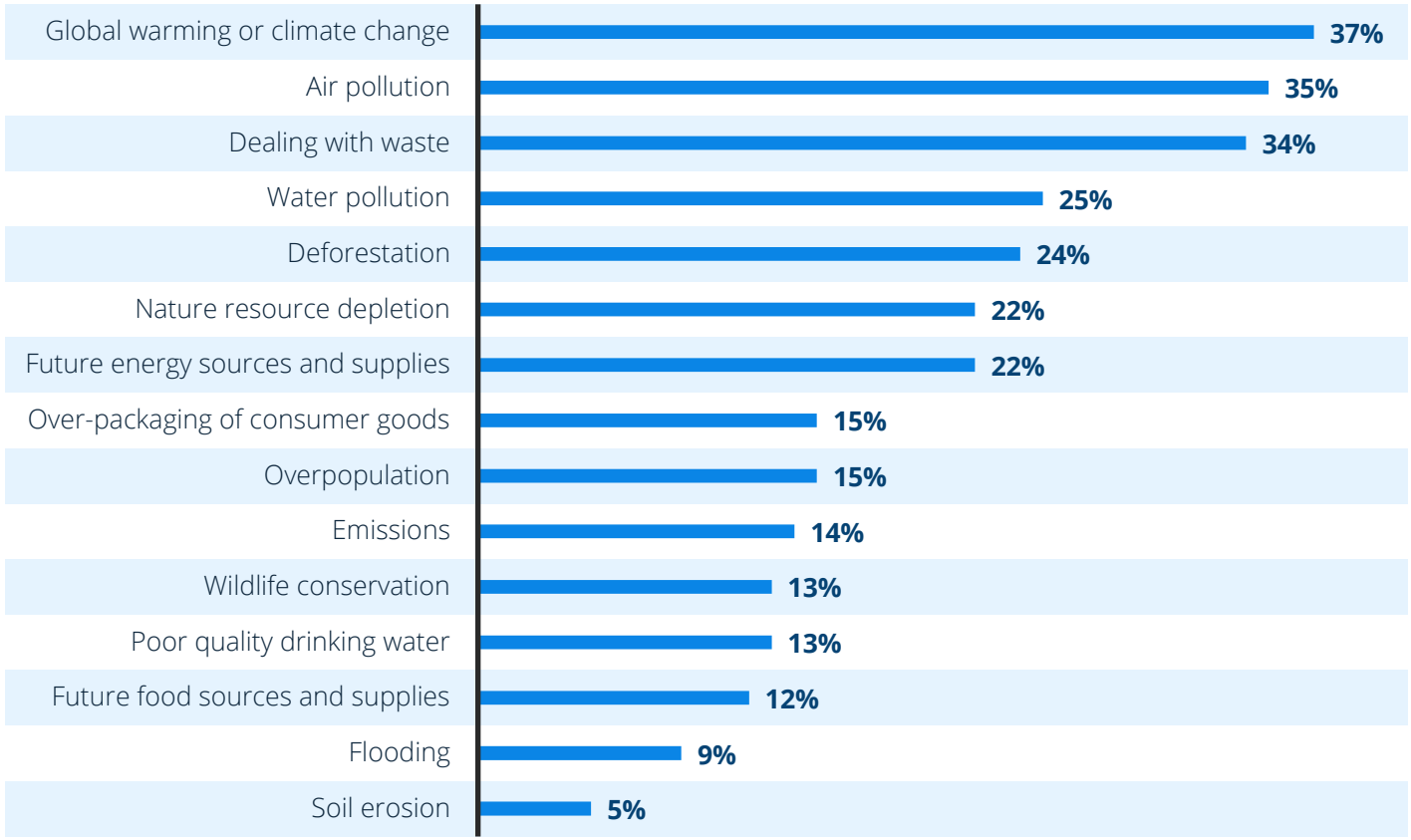
Man-made CO_2 has increased by almost a third since the pre-industrial era, which has posed several survival challenges for all living things on the planet and has also brought about several geological changes: Melting glaciers, thawing permafrost, warming oceans, intense droughts, storms, and heatwaves, are more intense and frequent than in the past. This has affected the cropping patterns and phenological mismatch in most species. According to meteorological data, many of the warmest years on record have occurred in the past 20 years – a problem that requires immediate action.

While there are sections of society who believe human-made CO_2 emissions are minuscule compared to natural processes, there is enough scientific evidence to conclude that human-caused CO_2 is the leading cause of atmospheric CO_2 after the Industrial Revolution. The increase in global mean surface temperature (GMST) has reached 0.9°C today relative to the previous century. According to the IPCC, human-induced global warming has already caused multiple observed changes in the climate system, and an increase in GMST of 1.5°C or more could devastating. Risks to natural and human systems are expected to be lower at 1.5°C than at 2°C of global warming. Hence, the long-term goal of the Paris Agreement from 2015 is to reduce global warming "to well below 2°C above pre-industrial levels and pursue efforts to limit the increase to 1.5°C".

Besides, the United Nations' Sustainable Development goals share a global vision to provide sustainable solutions to the current global challenges. While progress is being made, overall action needs to be accelerated to achieve the set goals by 2030, demanding global, local, and social action.

The warming planet is of utmost concern for many

Global concerns about key environmental issues 2019



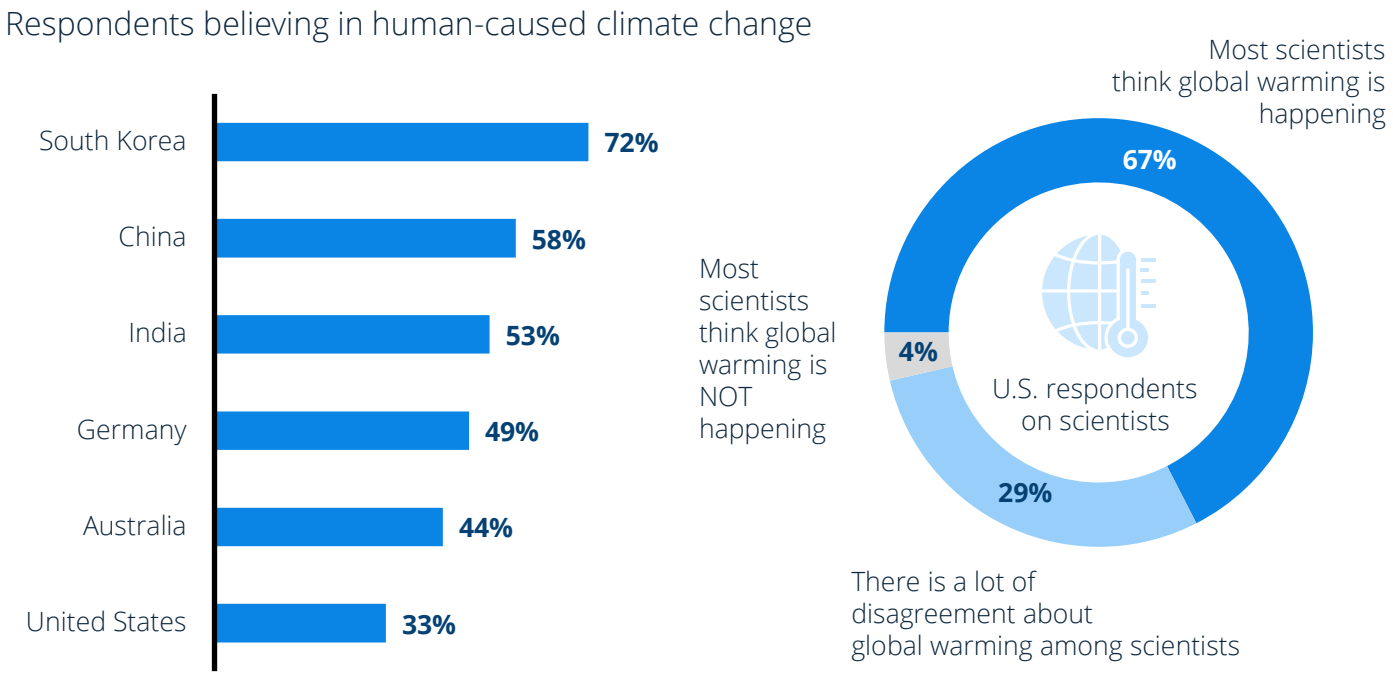
In general, the share of people expressing their concern about the environment and the threat of climate change has grown. With climate news raising awareness every day, it is difficult to step away from images of raging wildfires, devastating storms, and starving polar bears.

All significant environmental concerns are directly or indirectly induced by climate change. However, climate change is a difficult challenge to tackle due to its magnanimity and its intertwining with socio-economics. Recently, the climate crisis has brought about collective consciousness. The growing awareness of the environment has been reckoned a success when governments declared a "climate emergency" and promised to make climate change policy a priority.

Note: Worldwide; February 22 to March 8, 2019; 16-74 years; 19,519 respondents; 28 countries
Source(s): Ipsos; ID 895943

However, people seem not yet fully convinced of humans causing climate change

Global opinions on climate change cause by select country 2018, and U.S. respondents on scientists April 2020



While there is compelling scientific evidence of humans causing climate change, there exist uncertainties in understanding a system as complex as the global climate by the public. Doubts about climate change's reality and accuracy of climate models have been present for decades, mainly related to the costs involved and not the science itself. But lately, the advancement of technology, data availability, and the frequent occurrence of extreme weather events have significantly contributed to understanding the causal effects. With increased awareness about humans accelerating global temperature rise, there has been a public opinion shift. Increased media coverage and government initiatives show renewed optimism in tackling the climate crisis.

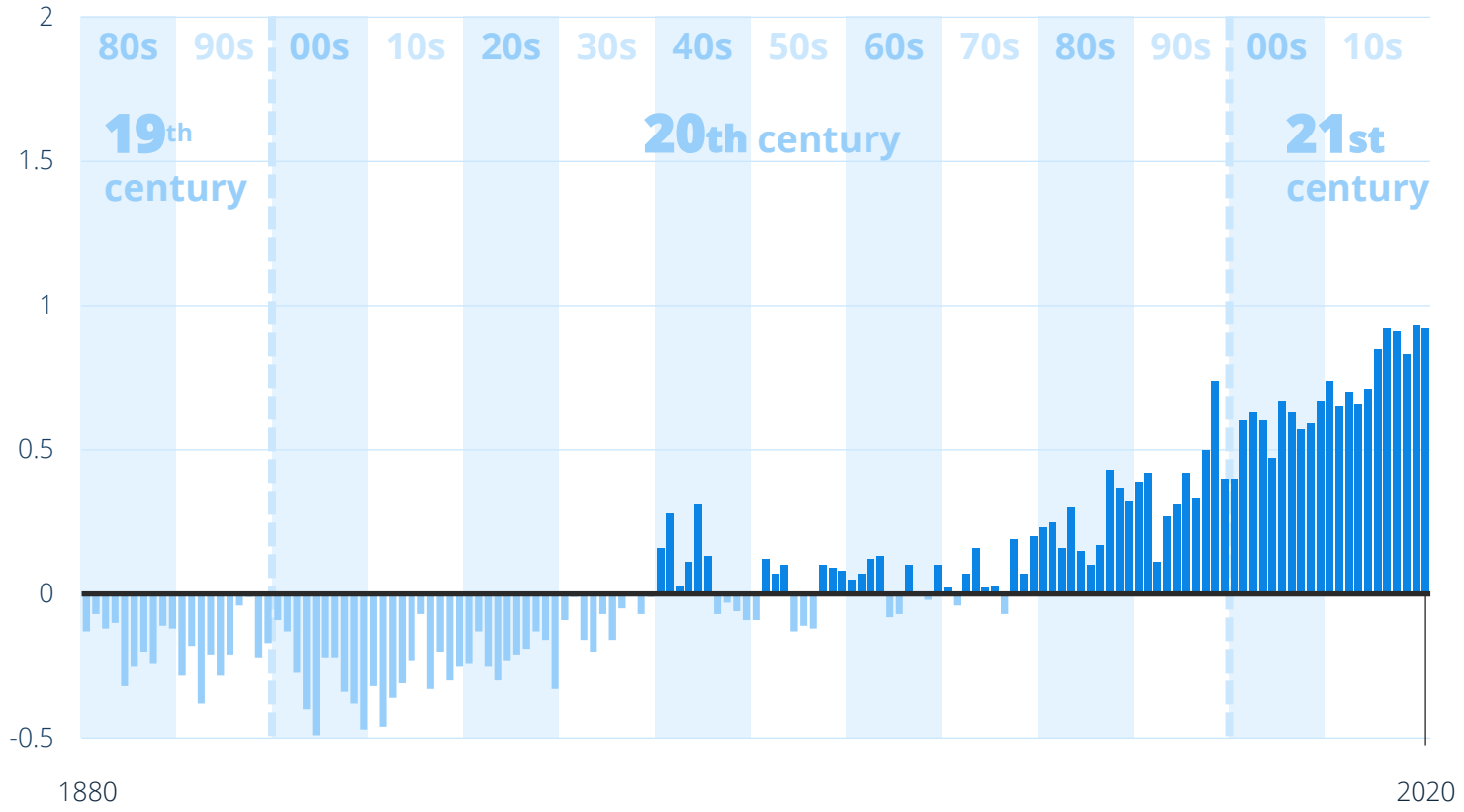
While 72 percent of South Korea respondents believe in human-caused climate change, only 33 percent of U.S. respondents agree. However, most Americans believe in the scientific claim of global warming happening.

(1) Note: United States; April 7 to 17, 2020; 18 years and older; 1,029 respondents
Source(s): Center For Climate Change Communication; Yale Program on Climate Change Communication; ID 623608

(2) Note: Worldwide; 2018
Source(s): Visual Capitalist; Raconteur; Ipsos; World Bank; ID 895700

Annual surface temperature anomalies are soaring

Global land and ocean temperature anomalies in °C, from 1880-2019

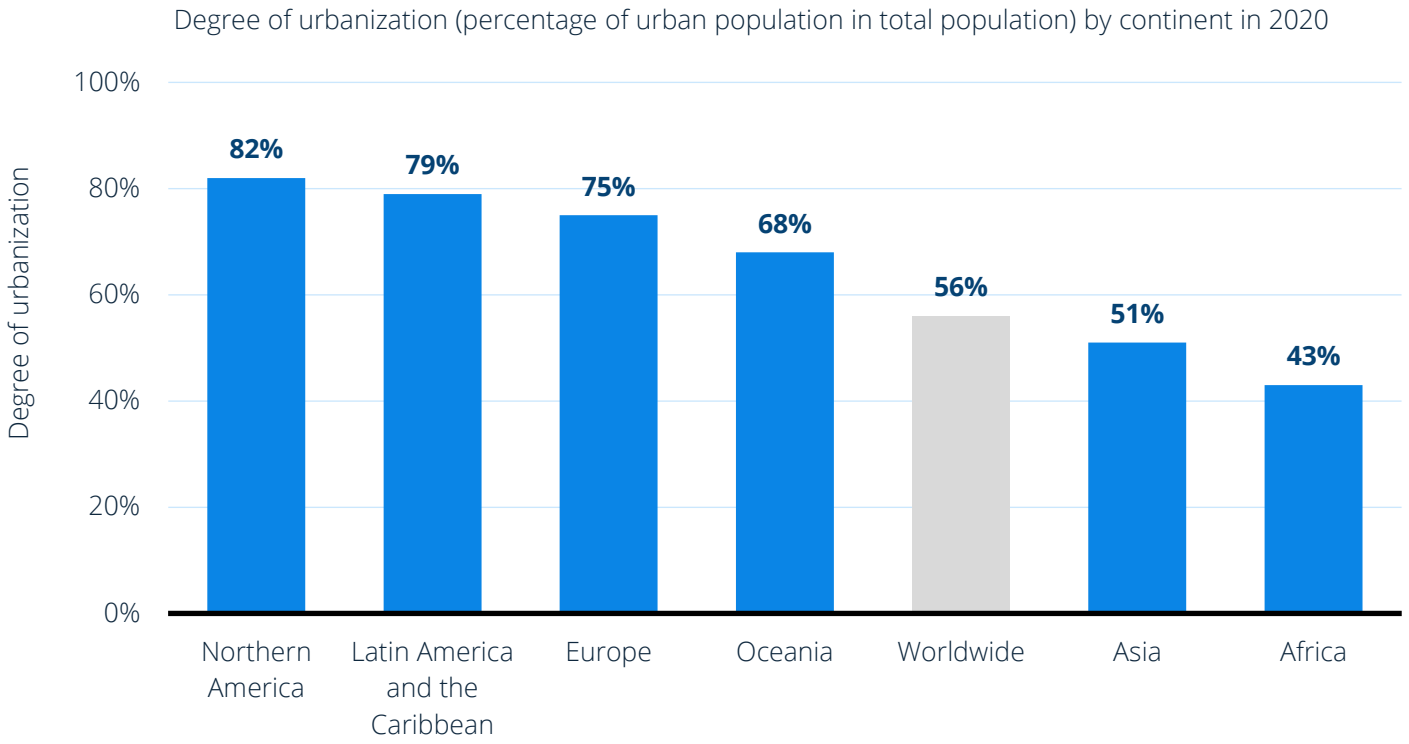


A temperature anomaly is a difference from an average or baseline temperature. The baseline temperature is typically computed by averaging years of temperature data. In this case, the base period was the 20th century. A positive anomaly indicates the observed temperature was warmer than the baseline, while a negative anomaly indicates the observed temperature was colder than the baseline.

As the estimated anthropogenic global warming is currently increasing at 0.2°C per decade, it is critical to minimize the overshoot of temperatures to 1.5°C to limit regional climatic fluctuations. Lower rates of change also enhance the ability of natural and human systems to adapt better.

Note: Worldwide
Source(s): NOAA; ID 224893

Rapid population growth and urbanization are stressing developing nations



With the global population estimated to reach eight billion in 2024, there is a vast disparity among the number of rural and urban residents. A historic milestone was achieved in 2008, when over half of the world's population lived in cities or urban areas.

Based on the current trajectories, an unprecedented population explosion that has been growing since the Industrial Revolution will peak by 2030. along with it, resource consumption has also been increasing.

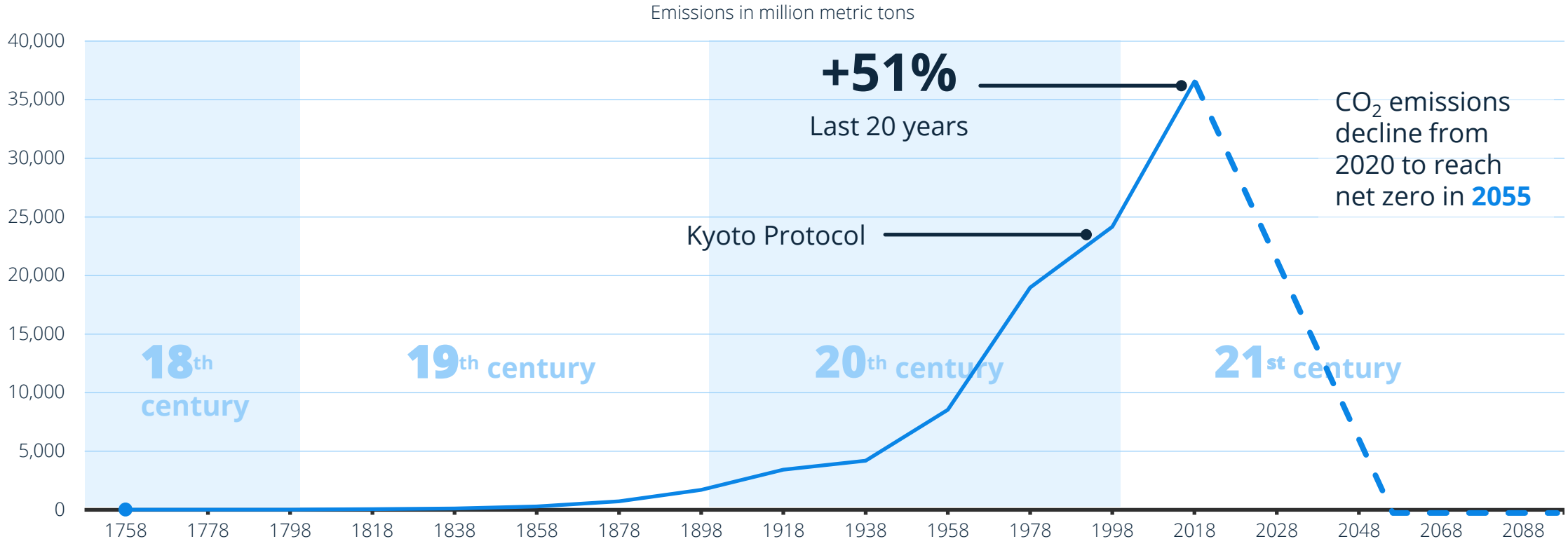
Socio-economic trends show that developing countries are highly vulnerable to climate risk. As the world's population continues to increase, energy demand is expected to increase significantly in these economies. Much of the growth in demand is expected to come from Asian nations.

Note: Worldwide; mid-2020
Source(s): Population Reference Bureau; ID 270860

The task: reduce CO_2 emissions to “net zero” by 2055

Global historical CO_2 emissions 1758-2018

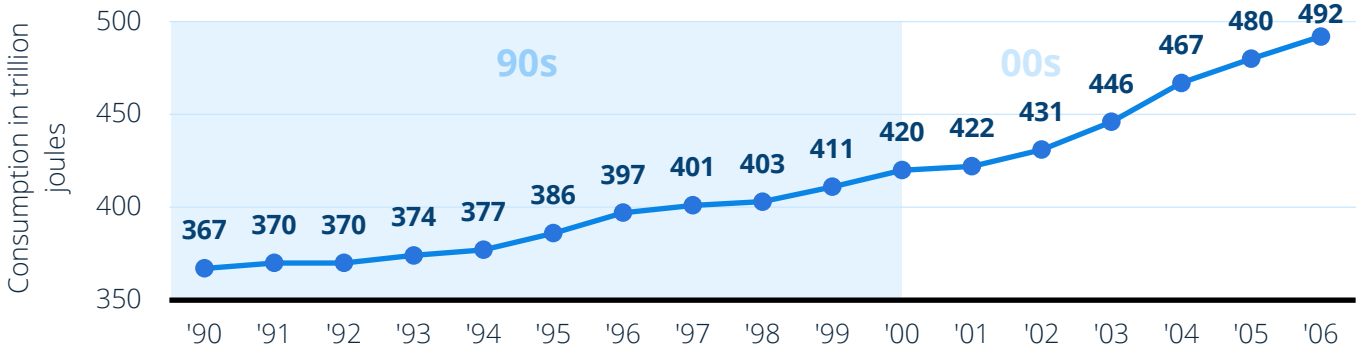
To avoid the worst climate impacts, global greenhouse gas (GHG) emissions will not only need to drop by half by 2030 – net zero has to be achieved by mid-century.



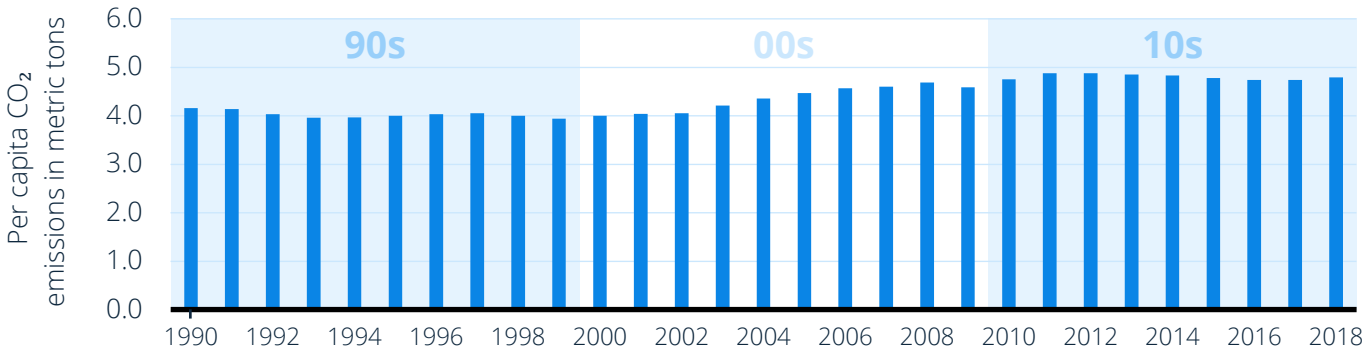
Note: Worldwide
Source(s): Global Carbon Project; Expert(s) (Gilfillan, et al.); ID 264699

The challenge: growing energy consumption & emission

Global primary energy consumption from 1990 to 2006 (in trillion joules)



Carbon dioxide emissions per capita globally from 1990 to 2018 (in metric tons)



As of today, the Earth is one degree warmer than pre-industrial times. Fossil fuels have been the backbone of economic progress, but also the main cause for this. While it eased many lives, this energy supply altered many pristine environments and polluted the environment, surpassing the permissible limits by far.

The concentrations of CO_2 in the atmosphere have increased by nearly 40 percent since the 1700s. Methane and nitrous oxide are more potent than CO_2 from fossil fuels, agriculture, and livestock production.

Continuously rising temperatures cause discomfort and health problems to many, leading to increased cooling costs. In many regions, temporary migration is also used as an adaptive response to climate stress, and the numbers of people leaving their homes are only expected to increase in the coming years. In the long run, rising temperatures will affect crop production and premature budding, and threaten coastal cities' existence.

(1) Note: Worldwide
Source(s): IEA; ID 267135

(2) Note: Worldwide
Source(s): Global Carbon Project (Global Carbon Atlas); ID 268753

02 Effects of COVID-19 on the environment

- Effect on the economy
- Effect on CO_2 emissions and pollution
- People's support for a green recovery

statista

Effects of COVID-19 on the environment

Emission reductions in tandem with major global events

The latest available data from 2017 showed that in that year, over three million people died in only nine countries, with the highest mortality rates due to fine particle pollution. That is nearly twice as many people as have died so far from COVID-19 (1.4m as of November 2020).

COVID-19 is a very present challenge for all societies around the globe. Communities have to agree on which actions to take and how to enforce them; changes to our behavioral patterns also affect our impact on nature and the environment. People are more aware of the importance of access to local green and blue spaces, and access to shared public spaces has become a privilege.

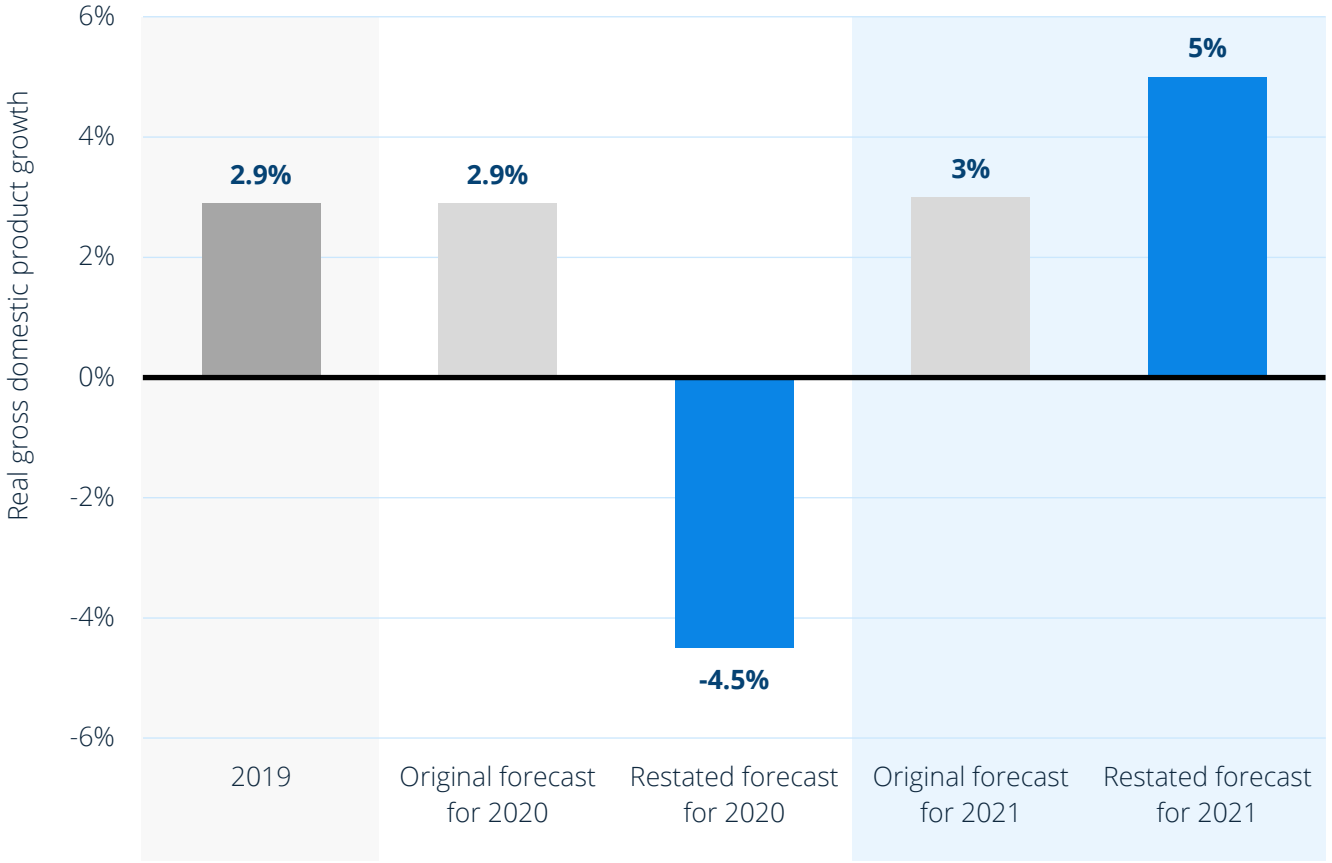
The latest surveys on people's attitudes towards environmental protection show that, especially in countries that experienced "clear air" during the COVID-19 lockdown, people strongly agree to prioritize environmental protection measures. Besides the reduction of CO_2 emissions, there was another positive climate effect that made a big difference to people living in megacities around the globe: Many people in those cities suffer from fine particles in the air of less than 2.5 micrometers in size. Less traffic, less energy, and less industrial production have helped selected cities to reduce the PM2.5 concentration by up to 50 percent.

Already, the signs are visible in many cities with cleaner air and a healthier atmosphere. Apart from clear skies, the absence of the usual crowd in cities has rendered nature to heal and reclaim many common spaces. Due to cleaner waters and pollution-free streets, wildlife has been observed venturing into urban landscapes.

The pandemic has reduced the stress on fossil fuel consumption, which can be a starting point for the projected increase in CO_2 emissions from fossil fuels over the coming decades to be slowed down. To limit global warming to below 1.5 °C, coal-fired electricity generation needs an 80 percent reduction below 2010 levels by 2030. Now, that seems achievable with implementing measures on a global scale.

Forecast global real gross domestic product (GDP) growth due to the coronavirus (COVID-19), from 2019 to 2021

Forecast global real GDP growth due to COVID-19, 2019-2021



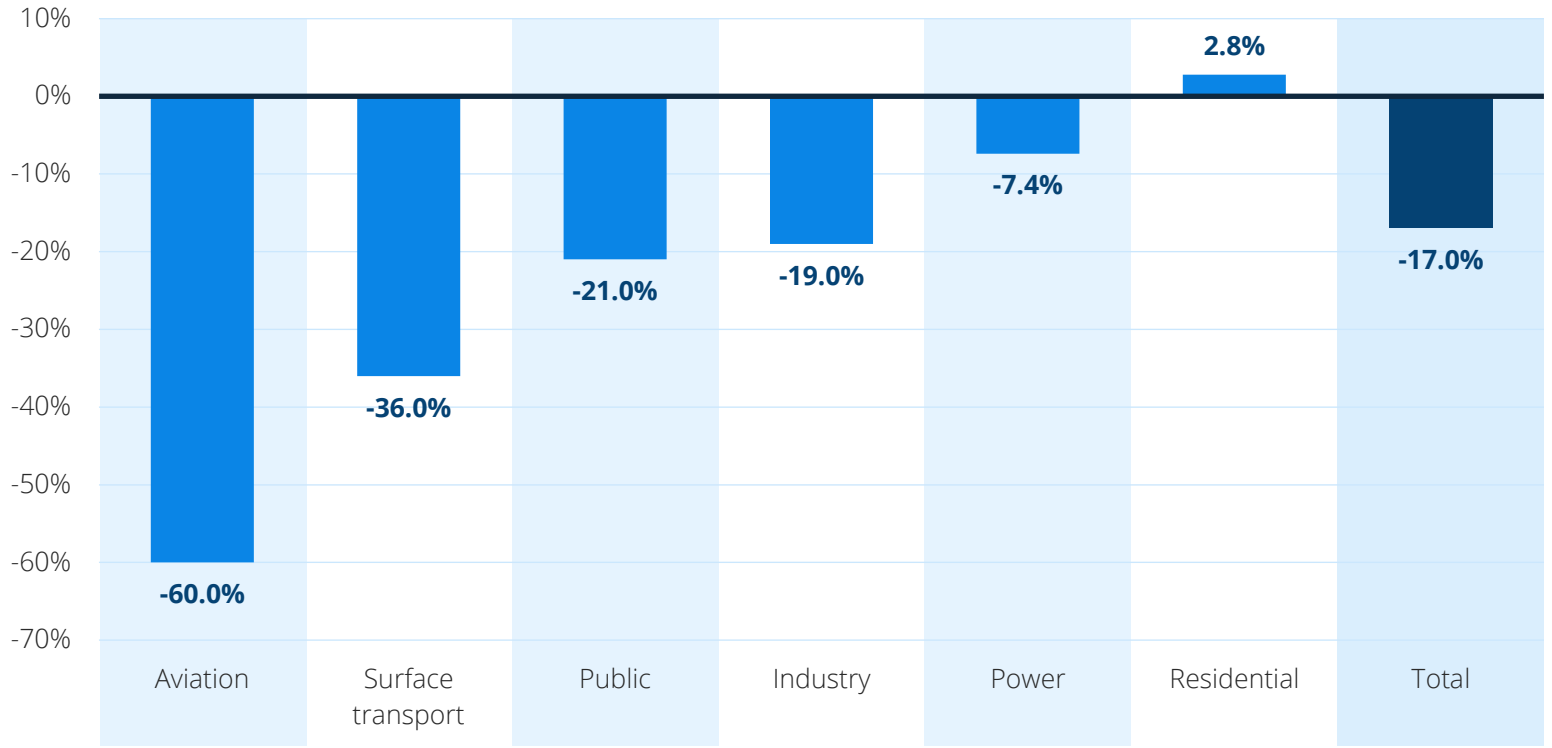
While population growth has been increasing predominantly in developing and poorer countries, it is indisputable that wealthy nations dominate the global economy's growth. The producers are not the same as the consumers; the trends show a stark difference. The onset of the COVID-19 pandemic has affected all countries and has been predicted to impact the global economy significantly.

The global real gross domestic product (GDP) grew by 2.9 percent in 2019; it is forecast that COVID-19 will cause the global real GDP growth to decrease by 4.5 percent in 2020.

Note: Worldwide; as of September 2020
Source(s): OECD; ID 1102889

Economic downturns lead to significant reduction of CO_2 emissions in many sectors

Year-on-year change in sector CO_2 emissions, as of early April 2020



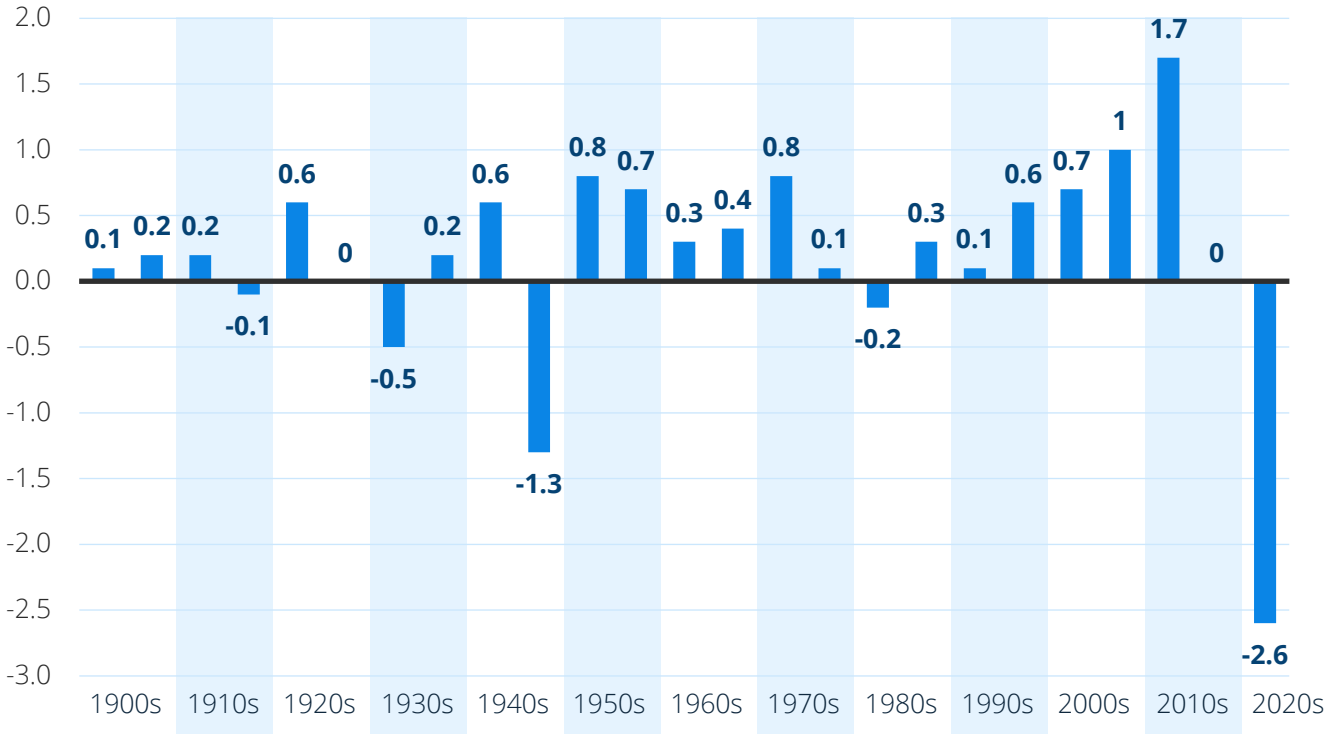
The economic downturn and the global lockdown led to a reduction of CO_2 emissions by 17 percent, with the aviation industry experiencing the largest reduction due to travel restrictions and closed borders.

On the other hand, residential emissions grew by nearly three percent as more people stayed at home and worked from home. Still, decreasing commuter numbers had positive effects on passenger emissions, which can contribute to pursuing international as well as national climate goals.

Note: Worldwide
Source(s): Nature; Expert(s) (Le Quéré, C, et al); ID 1120798

The COVID-related reduction of CO_2 emissions equals the required reduction in the future – every year

Annual change in energy-related carbon dioxide emissions worldwide in Gt



In recent decades, global CO_2 emissions have shown significant decreases as a result of major global events: The global recession of 1983 represented a fall of around one billion metric tons of carbon dioxide globally over four years. Accordingly, the COVID-19 crisis is forecast to cause a record decrease of global CO_2 emissions by nearly 2.5 billion metric tons, mainly due to the implemented restrictions worldwide on traveling, work, and industrial activities.

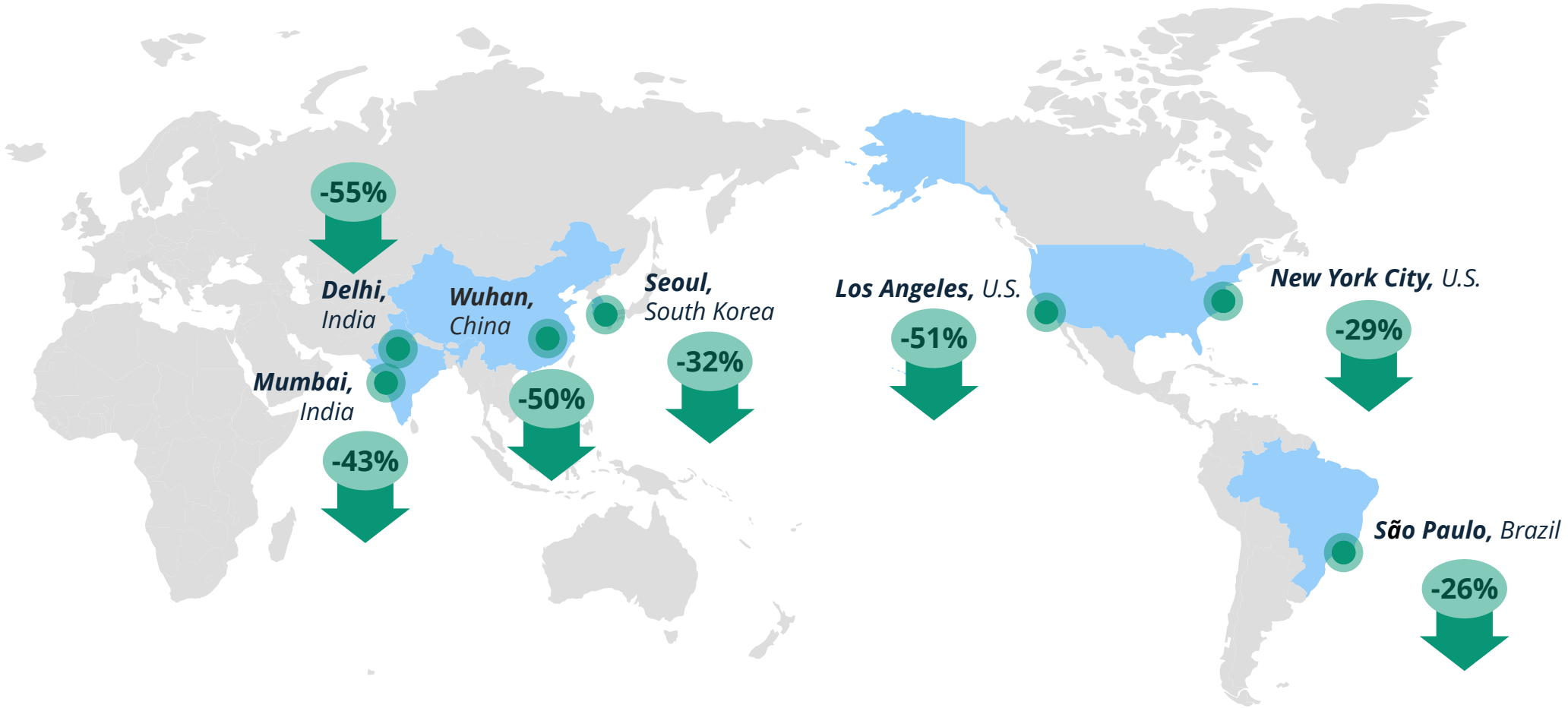
The COVID-19-related economic downturn will lead to an unprecedented reduction in CO_2 of up to 2.6 Gt in 2020, the largest decline observed so far. This would equal a decline of up to eight percent compared to last year.

To put this decline into perspective: to reach the climate targets, we need to achieve the equivalent of this year's reduction each year over the next decade.

Note: Worldwide; 1990 to 2019
Source(s): IEA; ID 1114755

One positive side effect of COVID-19 on climate: Clear skies appear above the world's most polluted cities

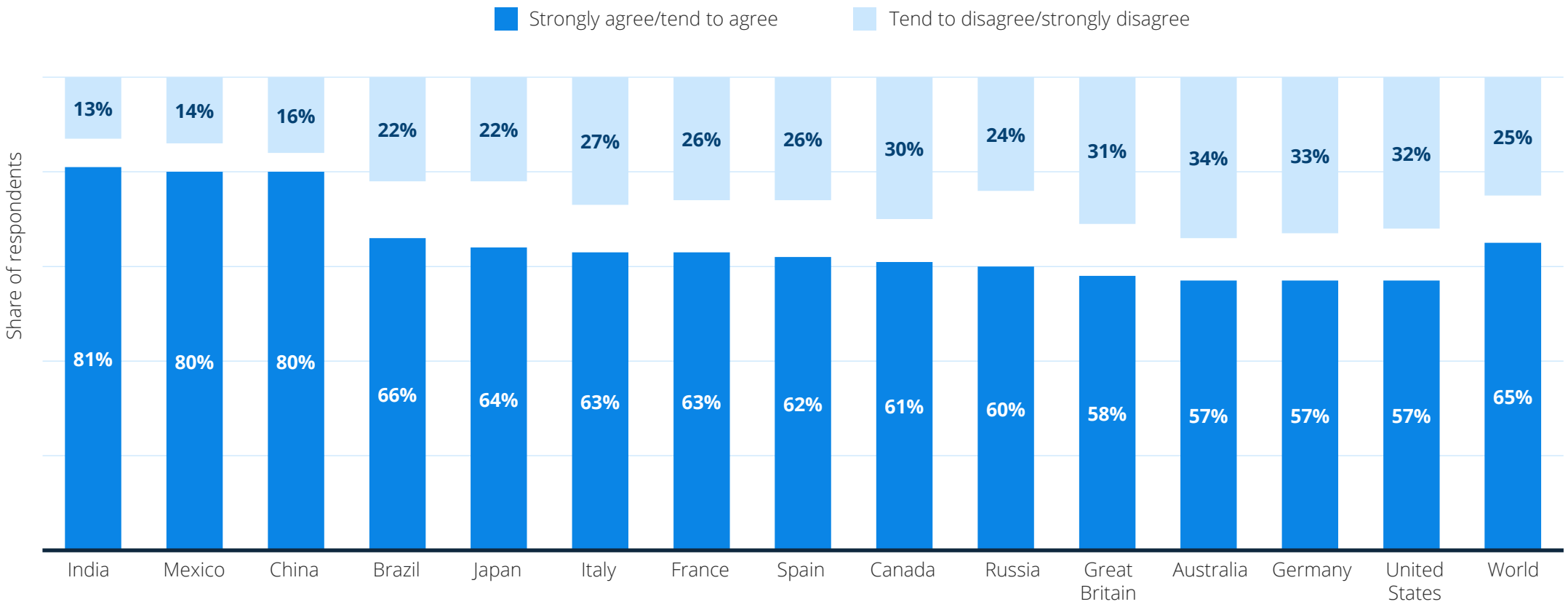
PM2.5 reductions in select cities during COVID-19 lockdowns



Note: Worldwide; 2020
Source(s): IQAir; ID 1119855

COVID-19 experience drives people towards green recovery

Support for prioritizing environmental protection in post-COVID recovery



Note: Worldwide; 16 to 19 April, 2020; 16-74 years; 28,029 respondents; the source does not provide specific information on missing percentage points to 100 percent.
Source(s): Ipsos; ID 1131853

03 Coping with the climate crisis

- Risks
- Mitigation
- Adaptation

statista

Coping with climate change

The necessary actions for ensuring survival of mankind

One of the recent global efforts to handle climate change is the Paris Agreement on climate change in 2015, in which 196 nations agreed to keep global warming below 2°C. In November 2020, one of the largest contributors to CO 2 emissions, the United States, decided to withdraw from this pact – a devastating decision that has shaken the climate agenda. With the new administration taking office in 2021, the world eagerly awaits the U.S. government's promise to re-join the Paris Agreement, which is really just the minimum of what needs to be done to stop climate change. The catastrophic events in the past years, namely droughts, forest fires, floods, or pest attacks have brought attention to the magnitude of the problem and demand far more aggressive actions in addition to the Paris Agreement.

The foremost mitigation measure is to reduce greenhouse gas (GHG) emissions, followed by the cautious use of resources and sustainable economic growth. Natural systems are resilient, but with the accelerated rate of emissions, it is impossible to rely on nature alone to do its job.

The primary strategy for adaptation is to be prepared to face the consequences of climate change and cope with them successfully. Solving climate-related problems on a local scale has been established in many cities, and future development plans have accounted for climate vulnerabilities. Therefore, mitigation strategies tackle the causes and minimize the impacts, while adaptation measures reduce the adverse effects.

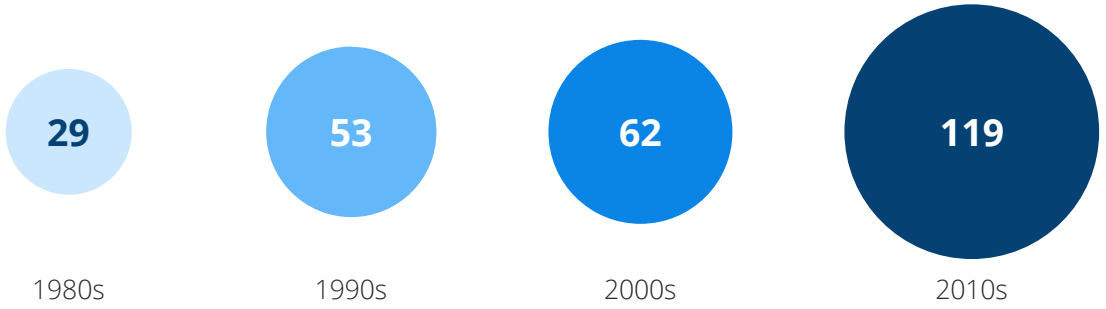
The main focus for GHG reduction is the reduction of energy-related CO_2 emissions. There has been a global energy transition in terms of energy conservation, and many countries are increasing renewable energy installations. With cheaper costs of power generation, the renewables energy sector could phase out our dependence on fossil fuel.

Scenarios predict various possible futures based on the action or inaction against the present-day effects of climate change. The most challenging decisions lie with the governments that need to understand the implication of conducting business as usual or recognizing the need to slow down.

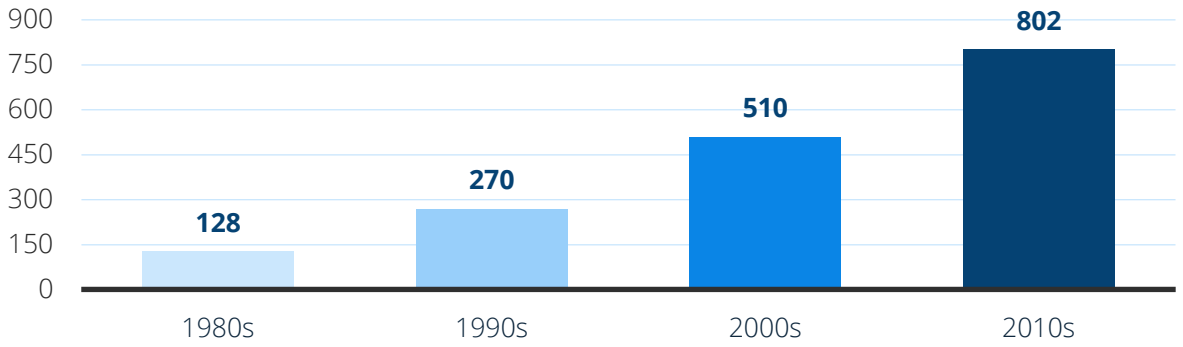
Economic costs of weather and climate disaster events have soared in the last decade

Weather- and climate-related events in the United States and related costs from 1980-2019, by decade

Number of U.S. climate disaster events by decade 1980-2019



Cost of major U.S. climate disasters by decade 1980-2019, in billion U.S. dollars



With the adverse effects of climate change becoming more evident, the economic costs of devastating natural disasters have soared high over the last decade. These climate hazards are projected to increase stress levels to food and water resources and infrastructure. While there is only a small portion of damages due to disasters caused by climate change that are covered by insurance, most are dependent on state funds.

For instance, the cost of American disaster events from 2010 to 2019 was around 800 billion U.S. dollars. With the highest average event cost, tropical cyclones dominated the losses since the 1980s. Based on the number of deaths, tropical cyclones were followed by drought/heatwave events and severe storms.

Local and national efforts to adapt to damage exacerbated by climate change will need to use up more of the taxpayers' dollars in the future to help victims to recover through financial assistance or recovery programs.

(1) Note: United States
Source(s): NOAA; ID 1101726

(2) Note: United States
Source(s): NOAA; ID 1101796

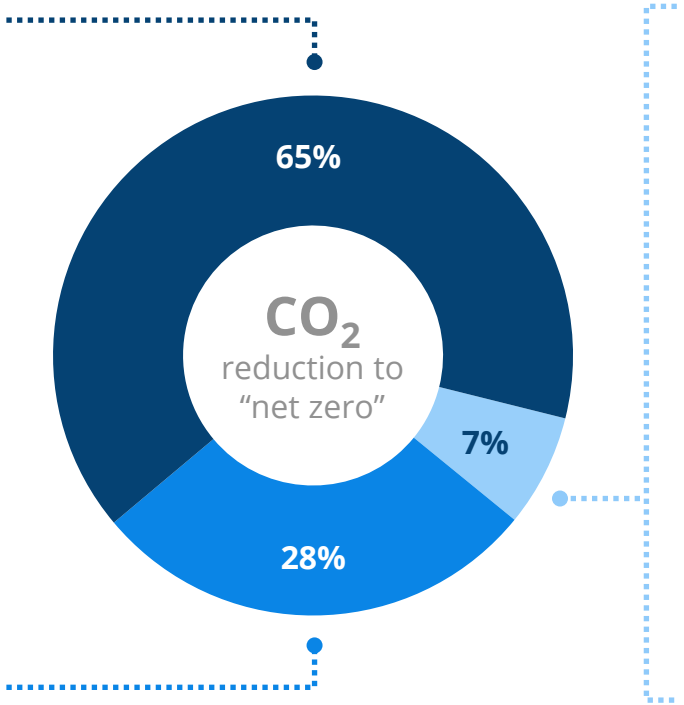
Decarbonization is most crucial to reach net-zero CO_2 emissions

Key focus areas for decarbonization and offsetting

Focus areas for decarbonization

Renewable energy, including
- direct uses of renewable energy (biofuels, solar, geothermal)
- renewable power for both direct (e.g., EVs, heat pumps) and indirect electrification (e.g., green hydrogen, synthetic fuels)

Energy efficiency, including
- structural changes (e.g., circular economy, modal shifts)
- behavioral changes (e.g., flying less, using mass transit systems)



Focus areas for offsetting

Reforestation

Afforestation

Direct air capture

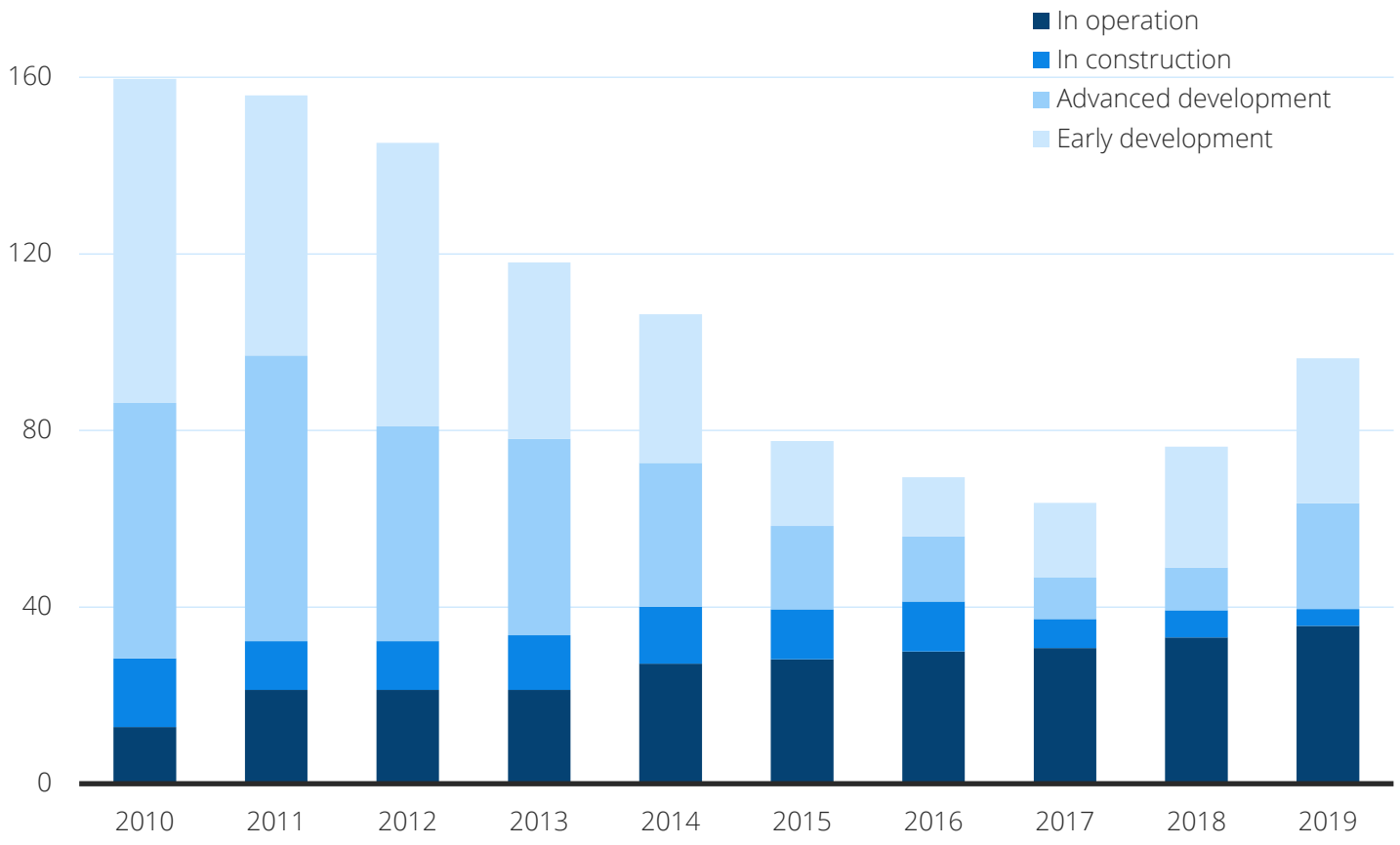
Enhanced weathering

Carbon capture, (usage) & storage
(CC(U)S)

Source(s): IRENA

Despite relevant CCS advancements in climate modeling, no substantial progress has been made in large-scale facilities

CO_2 capture and storage (CCS) capacity in large-scale facilities per year, 2010-2019 (in Mt)



Until 2017, there was a continuous drop in the carbon capture and storage (CCS) capacity, and many planned facilities have been given up – mostly because an economic operation would not have been possible. The operative capacity has increased over the years and is currently at 40 Mt p.a. – compared to current CO_2 emissions that are 1,000 times bigger than that.

With the recent tax and policy initiatives, mainly in the U.S. and Europe, experts expect a shift in direction regarding carbon capture and utilization (CCU) investments. This technology promotes connections between industrial sectors, offering economic opportunity and environmental impact reduction. Last year, Microsoft announced a one-billion-dollar investment program in CCU technology as part of their initiative to become CO_2 negative. And BCG expects total investments in CCU over the next decade to surpass 90 billion U.S. dollars.

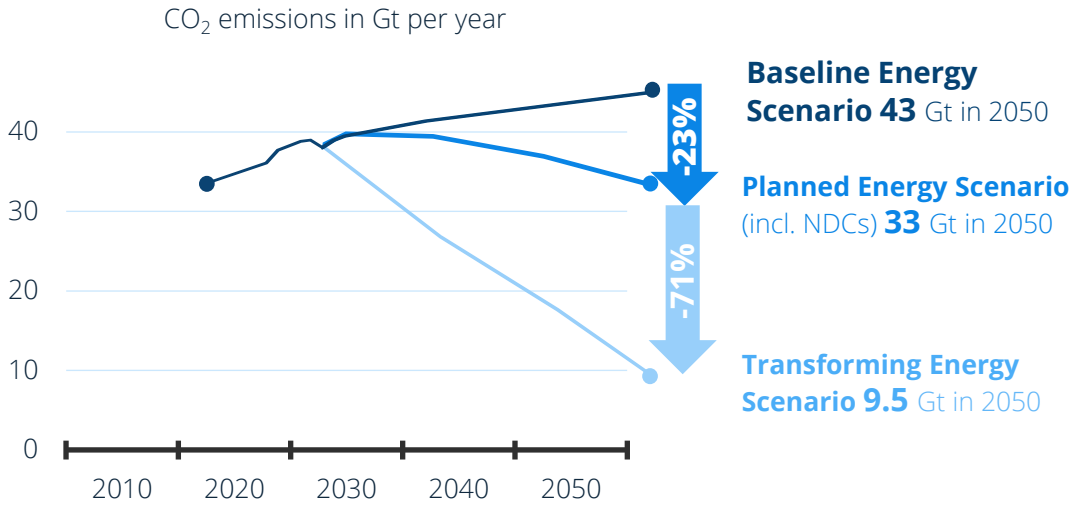
Source(s): Global CCS Institute; Microsoft; BCG

Based on our current trajectory, can global warming be halted?

Required investment and technologies to reach the lowest global warming scenario

With the increasing amounts of CO_2 emissions, various climate scenarios predict varying intensities of climate impacts. The world will still experience climate impacts under every scenario, however, they grow exponentially with higher emission levels.

The rate at which humans cut down on GHG emissions will determine the fate of future generations. Climate models are built based on the physical principles governing our climate system and empirical understanding and represent the complex, interacting processes needed to simulate climate and climate change, both past and future. Predicting socio-economic developments is more complicated than predicting the evolution of a physical system.



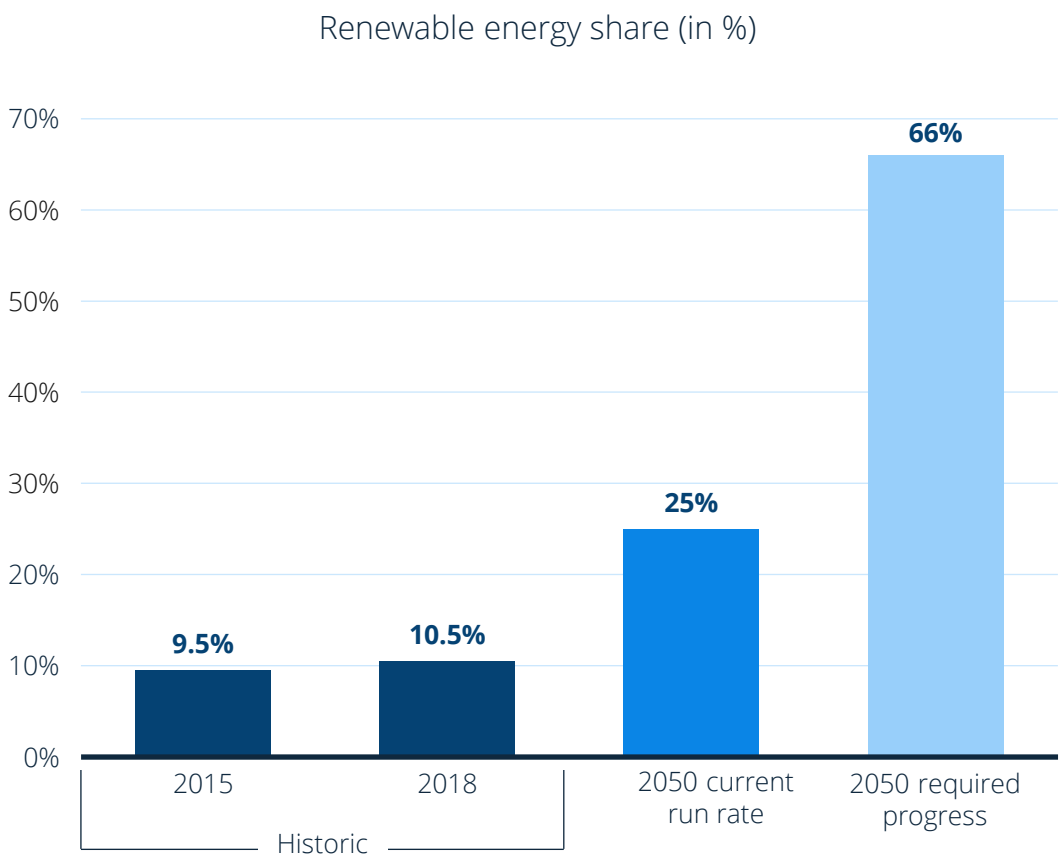
The global response to the COVID-19 pandemic has led to a sudden reduction of both GHG emissions and air pollutants. Moreover, some regions are recovering pretty quickly from the COVID-19-related economic downturn, like China, where the monthly coal-related CO_2 emissions already see a five percent year-on-year growth again as of May 2020. Though there was reduction in CO_2 emission and air pollutants for a short period, emission levels higher than before could be reached to make up for the economic losses.

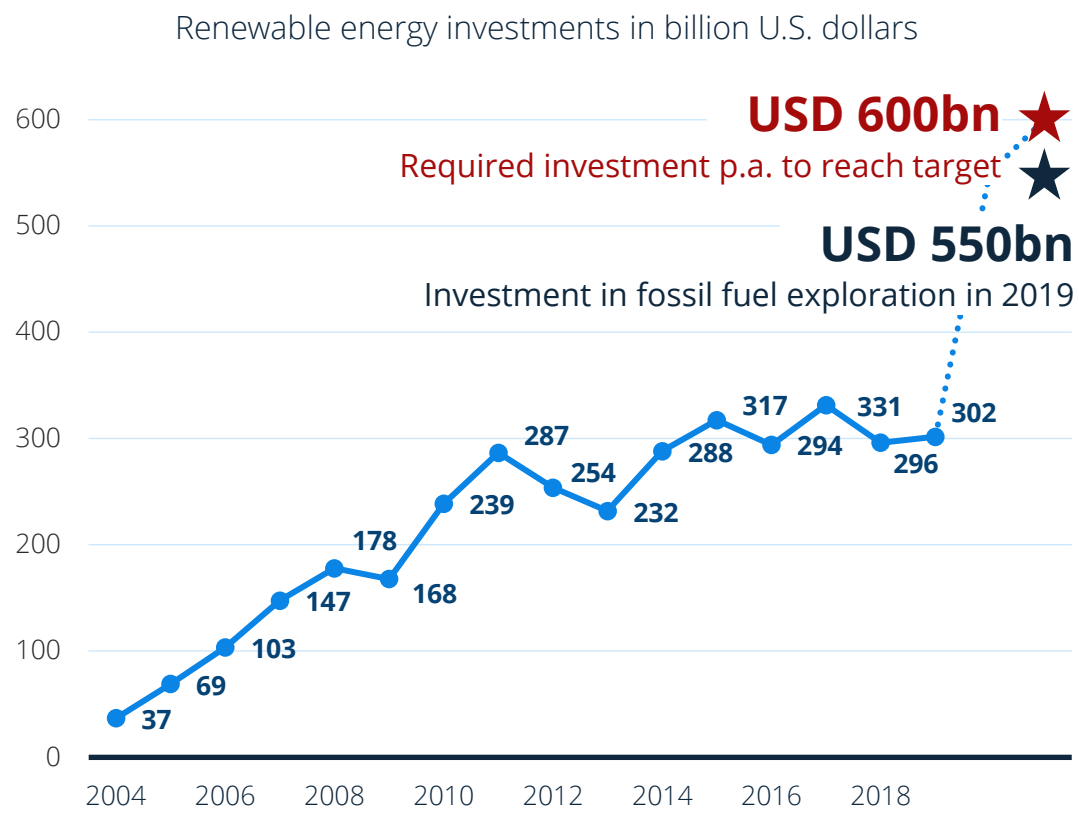
Underlying assumption	Global warming (2050)
Will happen if we keep going "as is"	**+3.0°C (up to)**
What could be achieved if committed plans (Paris Agreement) will be implemented	**+2.5°C**
What needs to be achieved to reach Paris Agreement temperature goals	**+1.5°C (towards)**

Note: NDC = Nationally Determined Contributions (communicated efforts by each country to reduce GHG emissions)
Source(s): Global Carbon Project; Expert(s) (Gilfillan, et al.), IRENA

Current investments in renewable energy are stagnating at only half of what is required

Renewable energy share by scenario and worldwide investments in renewable energy, 2004–2019



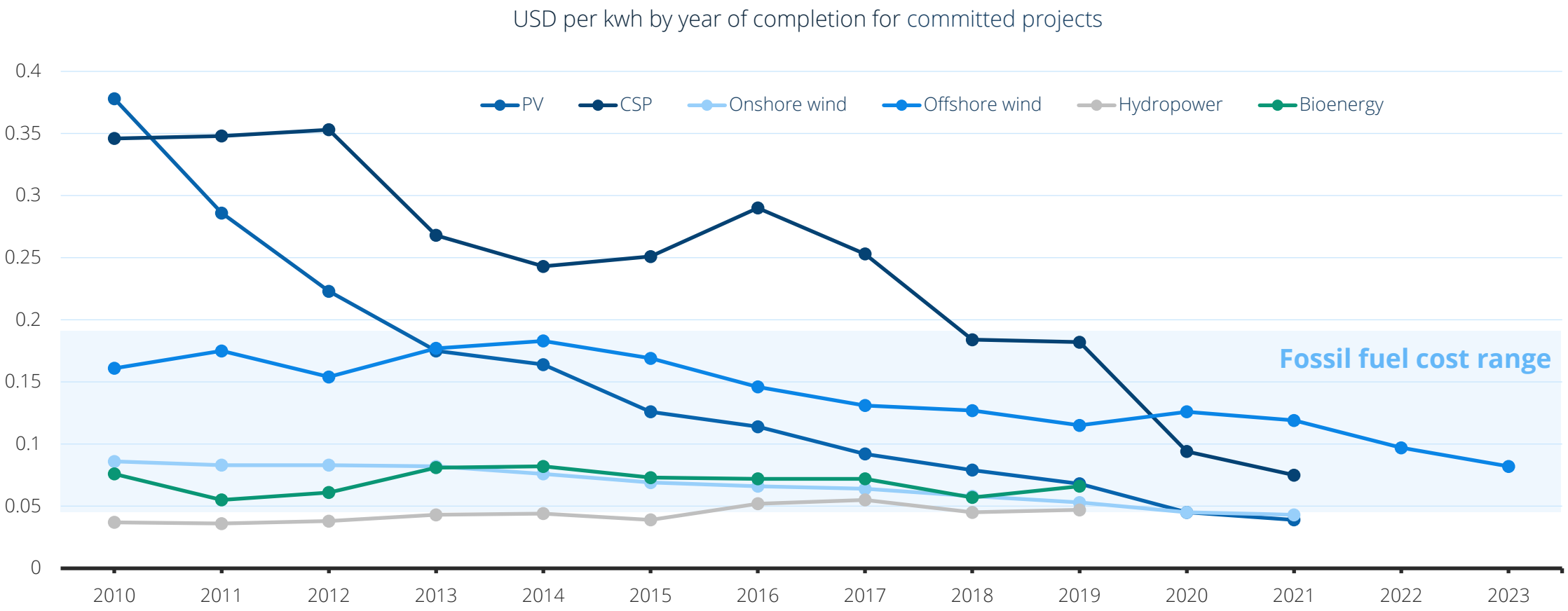


Note: Worldwide; 2004 to 2019

Source(s): IRENA; Bloomberg New Energy Finance; UNEP; IEA; FS-UNEP Collaborating Centre; ID 186807

The good news: renewable energies start producing energy cheaper than fossil fuels

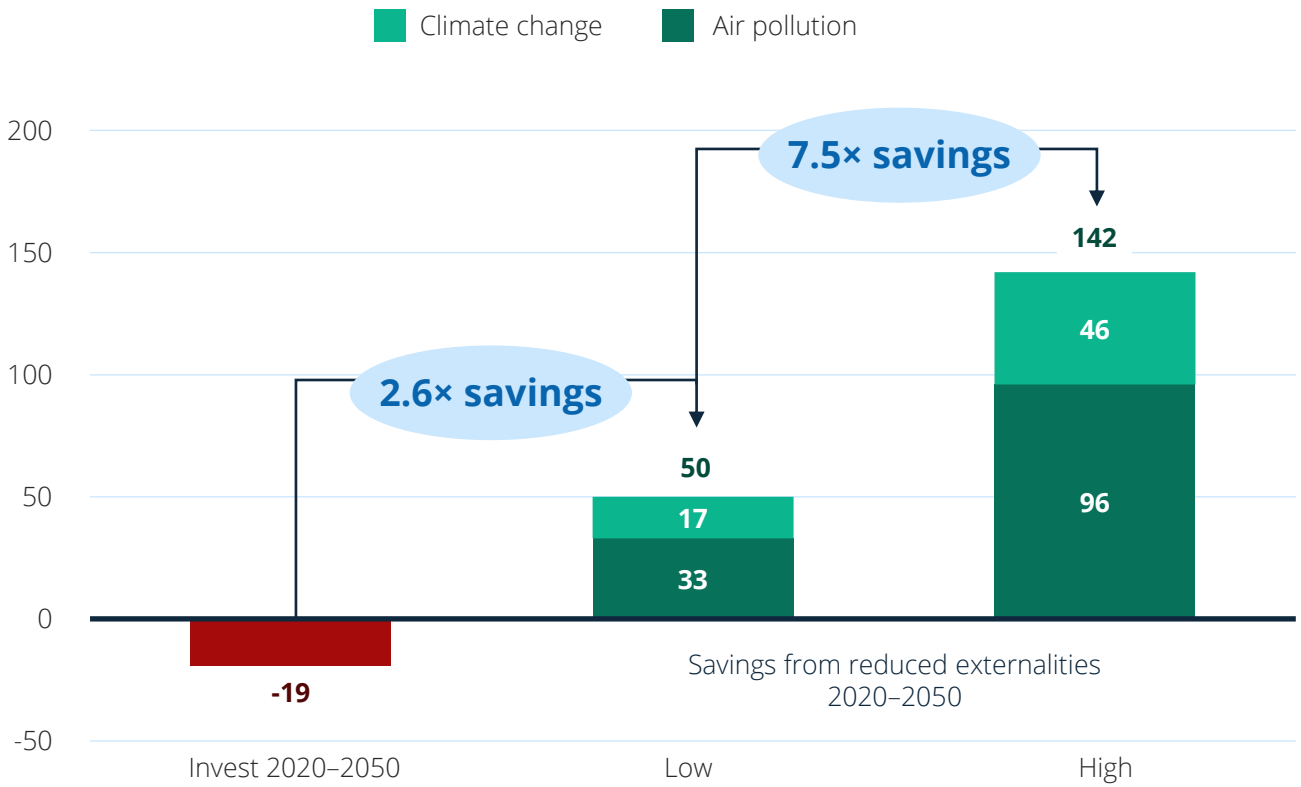
Cost of power generation by technology and year of completion (in U.S. dollars)



Note: PV = Solar Photovoltaics; CSP = Concentrating Solar Power
Source(s): IRENA

Required add-on investment of 19 trillion U.S. dollars until 2050 can produce up to 8x payback through savings of externalities

Add-on investment cost and related externality savings from IRENA “Transforming Energy Scenario”



Based on IRENA's extensive financial models, investments of 19 trillion U.S. dollars until 2050 are needed to reach the +1.5°C scenario compared to the planned scenario that will likely result in global warming of +2.7°C. Investing that amount could be a very rational decision, as the payback could be between three and eight times in actual savings of externalities caused by global warming.

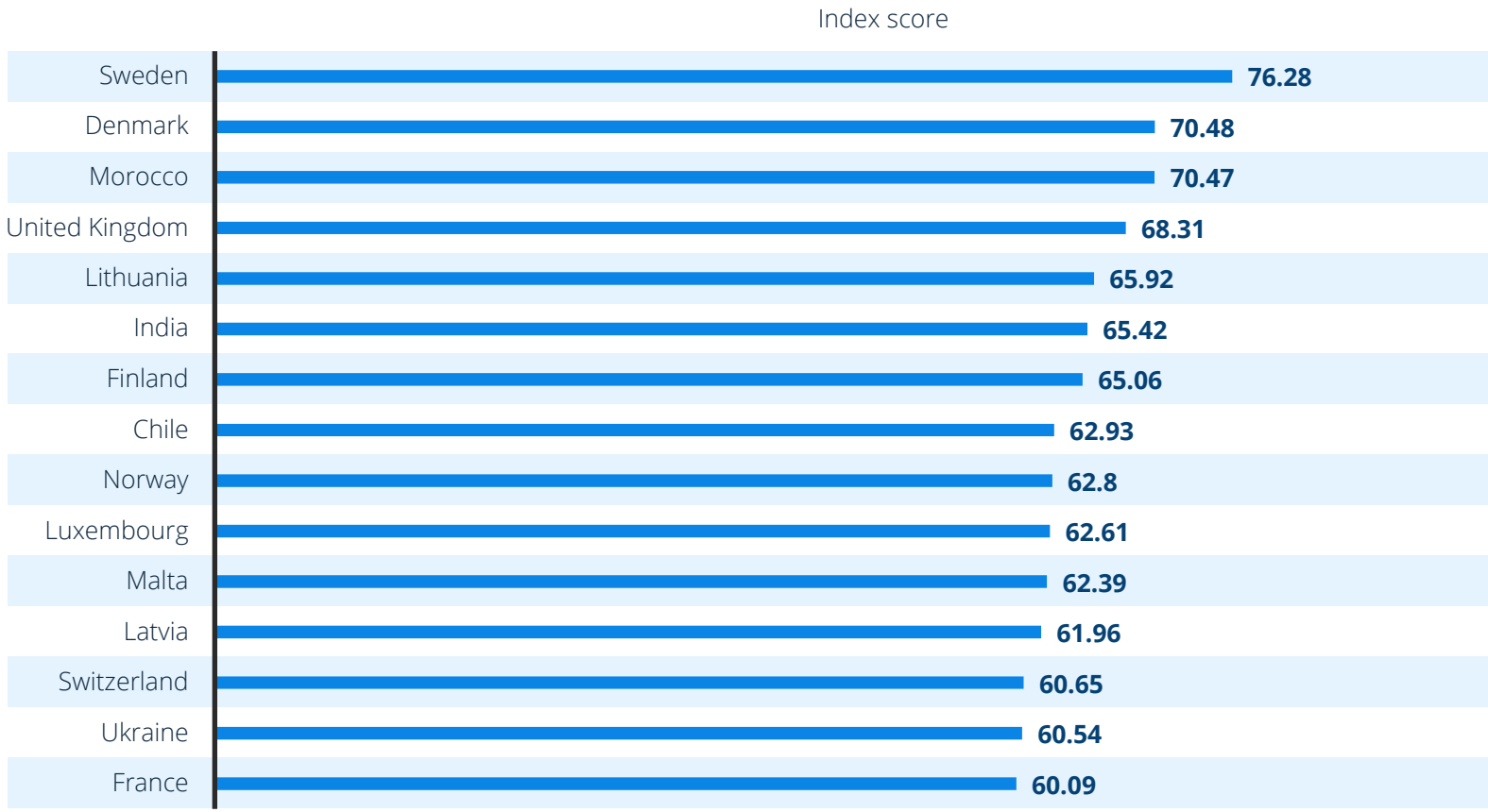
The mitigation cost per ton of CO_2 that needs to be saved until 2050 is around 34 U.S.dollars. That is already close to the cost per ton on the European Emissions Trading System – and over ten times the current price at the voluntary carbon offset market, for example, if you buy a certificate on your private airline ticket.

A lot of money will be invested, and tremendous business opportunities will open up for those investing in respective products and services.

Source(s): IRENA

2020 Climate Change Performance Index: countries with the highest achievements in climate protection

Climate Change Performance Index: achievements by country 2020



Sweden is a forerunner in achieving climate protection, performing well in GHG emissions, renewable energy and climate policy – only with a low performance in its energy use.

On the lower end of the scale, industrial powerhouse and one of the largest economies, France, still needs to work on its emission levels.

Note: Worldwide; 2018
Source(s): Germanwatch; ID 266138

Conclusion

Tackling climate change is an enormous task that involves the proactive participation of several stakeholders. While its effects seem local, the cause is global; it needs all communities and nations to act. New and innovative adaptations in markets is a necessity. As part of preparedness, adaptation strategies can reduce the risk of harm to vulnerable communities and economies. One such example is reinforcing adaptive constructions in coastal areas to withstand frequent flooding and water damage.

Even with aggressive efforts to reduce emission, the consequences of climate change are feared to be severe in the future. Nations investing in adaptation strategies are mainly concerned with the interests of its citizens, in tandem with long-term economic progress. This has enabled the development of new technologies and market-based solutions for a sustainable future.

Awareness has been growing in the past decades, people are more perceptive towards the effects of climate change as we experience frequent environmental disasters. It leads to lifestyle changes and industries taking up initiatives to make businesses sustainable in every process possible. This has also led to awareness over biodiversity losses, especially in fast-moving consumer goods (FMCG), with adverse effects directly due to human activity and indirectly due to climate change. COVID-19, with its negative impacts on society, also changed people's perception towards a cleaner environment and its benefits to health and well-being. We are moving towards a more conscious society and a greener consumer market.

To be victorious in this global war against climate change, climate resilience engaging various dimensions – social, economic, technological, and political – is the key to success. The ultimate global climate goal would be the successful transformation from net zero to zero emissions. Despite already existing mitigation measures, the current commitments fall short of steering the world towards keeping global warming to 1.5°C. This goal requires higher ambition or targets and quicker action – with no time to waste. With impacts of delayed climate action increasingly unfolding, political decision-makers need the courage to address the climate crisis, build upon positive dynamics, and push ahead with substantial change in a new wave of political momentum.

Key takeaways

The **gap between aspiration and reality in addressing climate change** is as big as ever before:

- The internationally accepted target is to keep **global warming "well below +2.0°C and towards 1.5°C" (Paris Agreement) .**
- Following current governments' energy plans under the Paris Agreement will lead to **missing the CO_2 targets by over 70 percent by 2050** and potentially to a **global warming of up to 2.5°C.**

A substantial **reduction of energy and industry related CO_2 emissions** is most crucial through a massive shift towards renewable energy and increased energy efficiency – with carbon offsetting only playing a supporting role.

- However, current investment activities are insufficient in basically all areas of focus.
- **Total investment required to achieve the Paris target could amount to 19 trillion U.S. dollars** (2016-2050) with a positive business case achieving savings of between close to 3x and even 8x in externalities.

Glossary

Anomaly
The deviation of a variable from its value averaged over a reference period.

Anthropogenic
Resulting from or produced by human activities.

Afforestation
Planting or adding of trees in an area where there was never a forest or plantation.

Baseline Energy Scenario (BES)
It reflects policies that were in place around the time of the Paris Agreement in 2015, adding a recent historical view on energy developments where needed.

Biodiversity
Variability among living organisms.

CO_2
Carbon dioxide is one of the most important greenhouse gases.

Carbon dioxide capture and storage (CCS)
A process in which a relatively pure stream of carbon dioxide (CO_2) from industrial and energy-related sources is separated (captured), conditioned, compressed, and transported to a storage location for long-term isolation from the atmosphere.

Carbon dioxide capture and utilisation (CCU)
A process in which CO_2 is captured and then used to produce a new product.

Greenhouse gas (GHG)
Gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and emit radiation at specific wavelengths within the spectrum of terrestrial radiation emitted by the Earth's surface, the atmosphere itself and by clouds.

Fossil fuels
Carbon-based fuels from fossil hydrocarbon deposits, including coal, oil, and natural gas.

Net zero emissions
When anthropogenic emissions of greenhouse gases to the atmosphere are balanced by anthropogenic removals over a specified period.

Planned Energy Scenario (PES)
The primary reference case providing a perspective on energy system developments based on governments' current energy plans and other planned targets and policies (as of 2019), including Nationally Determined Contributions under the Paris Agreement unless the country has more recent climate and energy targets or plans.

Reforestation
Replanting of trees in an area where there was once a forest which was destroyed or damaged.

Transforming Energy Scenario (TES)
An ambitious, yet realistic, energy transformation pathway based largely on renewable energy sources and steadily improved energy efficiency (though not limited exclusively to these technologies). This would set the energy system on the path needed to keep the rise in global temperatures to well below 2°C and towards 1.5°C during this century.

Sources

Bloomberg New Energy Finance

Center For Climate Change Communication

Expert(s) (Gilfillan, et al.)

Expert(s) (Le Quéré, C, et al.)

FS-UNEP Collaborating Centre

Germanwatch

Global Carbon Project

Global Carbon Project (Global Carbon Atlas)

History Database of the Global Environment

IEA

Ipsos

IQAir

IRENA

Microsoft

Nature

NOAA

OECD

Population Reference Bureau

Raconteur

The Boston Consulting Group

UNEP

Visual Capitalist

World Bank

Yale Program on Climate Change Communication

Recommendations

DossierPlus

Environmental commitments of Europe's largest banks

COVID-19: Economic downturn and recovery

Environmental effects of COVID-19

Extreme weather in the U.S.

Dossiers

Global climate change

Fossil fuel consumption in the U.S.

Emissions in the UK

Climate change and emissions in China

Clean technology investments globally

Global renewable energy industry

Green tourism

Catastrophe losses of the insurance industry

AUTHOR

DR. MADHUMITHA JAGANMOHAN

Research expert energy & environment

Madhumitha Jaganmohan is a researcher on energy and environmental topics. Since joining Statista, she has been focusing on renewable energy and sustainability, as well as on climate change-related issues.

E-MAIL madhumitha.jaganmohan@statista.com

W W W . S T A T I S T A . C O M