Climate Transparency

CLIMATE TRANSPARENCY REPORT

G20 RESPONSE TO THE ENERGY CRISIS: CRITICAL FOR 1.5°C

2022

A G20 STOCKTAKE

Climate Transparency

Climate Transparency is a global partnership with a shared mission to stimulate a “race to the top” in climate action in G20 members through enhanced transparency.

This Summary Report is part of the Climate Transparency Report 2022.
Find the G20 member profiles at **www.climate-transparency.org**

Published 20 October 2022

Data Partners

Climate Action Tracker

Enerdata intelligence + consulting

I4CE INSTITUTE FOR CLIMATE ECONOMICS

Partners

CENTRO CLIMA CENTER FOR INTEGRATED STUDIES ON CLIMATE CHANGE AND THE ENVIRONMENT - COPPE / UFRJ

CLIMATE ANALYTICS

FARN FUNDACIÓN AMBIENTE Y RECURSOS NATURALES

GERMANWATCH

BERLIN GOVERNANCE PLATFORM

icm INICIATIVA CLIMÁTICA DE MÉXICO

IDDRI

IESR

IGES Institute for Global Environmental Strategies

İPM İSTANBUL POLİTİKALAR MERKEZİ SABANCI ÜNİVERSİTESİ STIFTUNG MERCATOR GİRİŞİMİ

NEW CLIMATE INSTITUTE

ODI

SFOC Solutions for Our Climate

teri

Funders

European Climate Foundation

Supported by:

Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

based on a decision of the German Bundestag

CONTENTS

FOREWORD
Too little, but not too late for 1.5°C

We are in the midst of a crisis that threatens the very foundations of our societies. Climate change impacts are increasing across the world. Heatwaves, droughts, floods, and wildfires are causing devastation: every day, people are dying, others are losing their homes and their livelihoods, and ecosystems are being destroyed.

Energy prices have skyrocketed in many places of the world. Energy supply is not secure and, on top of that, food prices are steeply increasing, with climate change impacts contributing to the crisis. Some governments are advocating for a pause in climate action, and others are using the energy crisis as an excuse for reducing mitigation efforts and delaying the shift from fossil fuels.

The COVID-19 pandemic could have been a point of transformation but, instead, we have returned to business-as-usual in the way we generate and use energy. After a short dip in 2020, the G20's emissions have rebounded in 2021 to nearly the level experienced in 2019: not enough renewable energy added; no speeding up the coal phase-out; no reduction in deforestation; and no acceleration of the exit from fossil-fuel-based transport.

There are enormous inequalities linked to greenhouse gas (GHG) emissions. The top 1% of individual emitters are responsible for 17% of the global emissions; the poorest half are responsible for only 12%. This difference between the rich and the poor's contribution to this global problem applies in most countries. For example, the per capita emissions in sub-Saharan Africa are 1.6 tCO_2/yr; in North America they are 21 tCO_2/yr.[1]

Since the beginning of the Industrial Revolution, humanity has emitted 2,500 billion tonnes of CO_2. If we want to keep global temperature increase to 1.5˚C, less than 500 billion tonnes can be released into the atmosphere. Under present trends, we will have used up the remaining carbon budget in less than 10 years. Future generations will be left with little choice but to deal with the disastrous results of our inaction.

It is difficult to agree on what would be a just solution to the climate crisis, but not at all difficult to agree that the present situation is unjust. It is only a question of fairness that those who make the biggest contribution to climate change – countries, companies, and individuals – must drastically reduce their emissions, and must carry a bigger share of the costs associated with those reductions. And that means a big increase in climate finance. Yet the contributions to climate finance from the world's richest countries are still dwarfed by the money they pour into subsidising the very product that is causing climate change: fossil fuels, a sum that appears to increase every year.

Reducing energy demand is central to reducing emissions. Yes, millions of people need cleaner and more reliable energy for a better life. And they need the best available technology for that. But equally, there are millions who can – and should – change their lifestyle. Addressing unsustainable consumption trends requires increased and strengthened demand-side policies.

Present political tensions do not bode well for the upcoming climate negotiations, neither at the G20 Summit in Indonesia nor at the UNFCCC's COP27 in Egypt. We need global cooperation, despite the economic and political differences.

New crises, such as pandemics and wars, will come and go; but unless we act, the climate crisis will remain an ever-worsening constant. It will be with us for decades to come, and it will get more intense every day unless we decarbonise our economies by the middle of this century.

The 21st century – indeed the next decade – will be judged by whether we will solve the climate crisis by acting decisively now.

Co-Chairs Climate Transparency:
Alvaro Umaña, Peter Eigen

ENERGY CRISIS

A catalyst to tackle the climate crisis

FRANCE, 2022: *Construction of the first offshore wind farm launched in Saint-Nazaire, an important site where 80 wind turbines will soon be built. © Philippe Petit/Paris Match via Getty Images*

KEY ACTIONS

- **Increase the deployment of renewable energy** and create sustainable jobs.
- Ensure that “stop-gap” measures are reversible and **do not undermine climate action.**
- Stop domestic and international investments in fossil fuel infrastructure to **avoid carbon lock-in and stranded assets.**
- **Use targeted support for poorer households** instead of expanding subsidies for all.
- **Incentivise and promote energy conservation** and make energy efficiency measures mandatory.
- Maintain and extend **carbon pricing mechanisms.**
- **Expand climate finance** for zero-carbon investments both domestically and through international cooperation.

THE ENERGY CRISIS OVERSHADOWS THE CLIMATE CRISIS

This past year has seen massive impacts from climate change: heatwaves and wildfires in India, Europe and the USA; floods in Pakistan, China and Australia; droughts in Europe, East Africa, and North America; intense tropical storms in the central Pacific and North Atlantic.[2,3] Meanwhile, global emissions are growing again after a short-term drop in 2020 caused by the COVID-19 pandemic.[4]

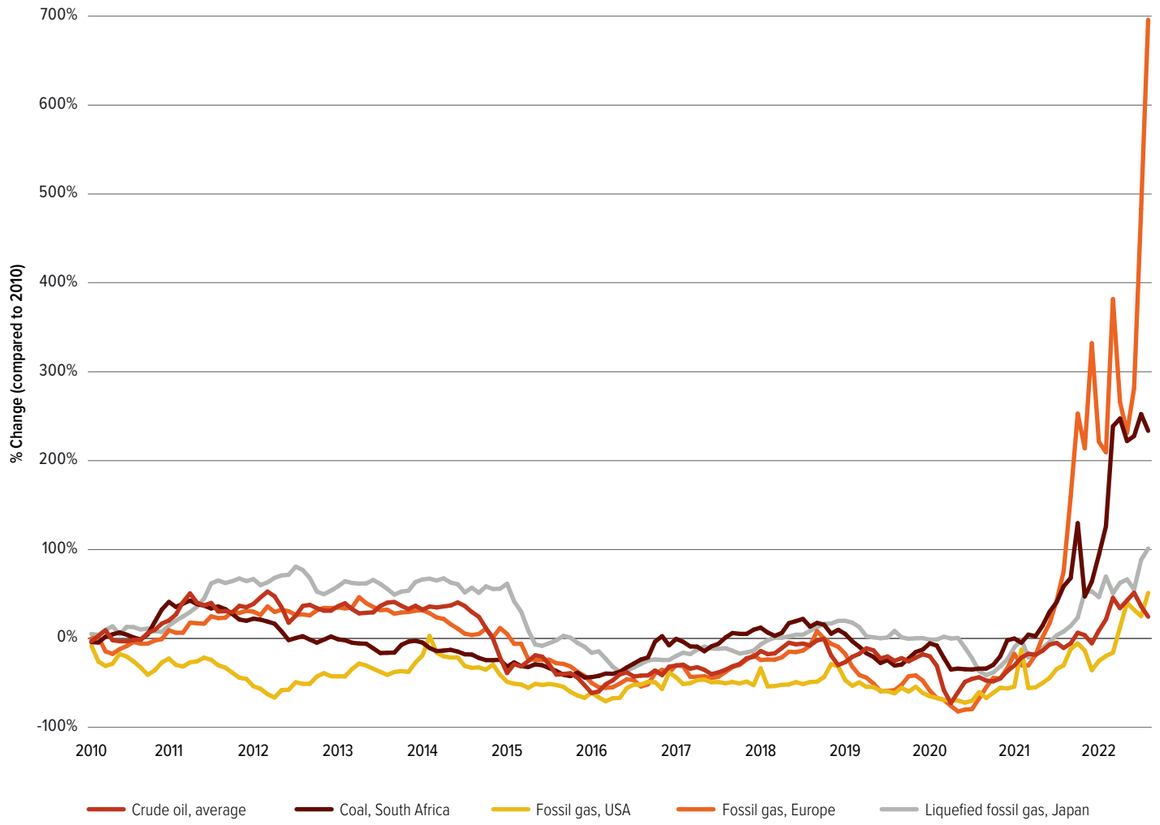
At the same time, however, the repercussions of the war in Ukraine have given rise to a massive energy crisis with global implications. Energy prices have soared in many countries. The availability of oil and gas has been affected through sanctions by western countries on Russia. Meanwhile, Russia has reduced supply to the European Union (EU) and intensified new energy partnerships with China, India, and other countries. Overall, these shifts have led to a high level of volatility in the global energy market.[5]

Energy prices had already begun to increase in the second half of 2021, as the global economy started to recover from its downturn at the height of the pandemic. The war in Ukraine escalated this trend. The price increases have varied for different fossil fuels and regions, but have been felt worldwide.[6]

Due to extreme weather events coinciding with higher energy costs and the reduced availability of wheat and fertilisers from Russia and Ukraine, food prices also increased significantly. Prices started to stabilise recently, albeit at much higher levels than before. As a result, many governments are now confronted with a cost-of-living crisis that shifts public attention away from the climate crisis.

FOSSIL FUEL PRICES BEGAN RISING STEEPLY IN THE SECOND HALF OF 2021

Development of fossil fuel prices between 2010 and 2022



World Bank, 2022a[7]

SUSTAINABLE SOLUTIONS ADDRESS CLIMATE AND ENERGY TOGETHER

There is no lack of challenges for governments: high prices and shortages in the supply of energy, food, and goods; the continuing COVID-19 crisis; and a looming global recession[8] are endangering plans to decarbonise economies. Yet, now is the time for the G20 to define the paths for the future of their energy systems if the climate catastrophe is to be averted.[9]

Many G20 governments have recently adopted short-term, “stop-gap” measures that are designed to soften the effect of high energy prices and to ensure energy security for populations and domestic industries. These measures include fiscal and economic policies as well as direct payments to subsidise high fuel and electricity costs. These measures often delay or subvert effective climate policies.

Some solutions to address the energy crisis have highly negative long-term consequences for the climate and are hard to reverse once they are in place. Fossil fuel infrastructure decisions especially have high investment costs and long lifespans that work against the energy transition to a fossil-free future.

We are already seeing increased investments in the exploration and expansion of fossil fuel infrastructure. Fossil gas has recently seen a massive boost, including in Canada, the EU and its member states, among others.[10] Fracking in the UK,[11] and tar sands exploration in Canada[12] are being discussed as ways to address fuel shortages. Coal use is not only up in Germany and Italy, but also in Brazil, and possibly China.[13]

To keep the goals of the Paris Agreement within reach, the energy crisis must be used as a stepping-stone for the G20 to rise to the challenge of the climate crisis, to continue and deepen climate action, and to reverse the currently rebounding trend of GHG emissions.

Targeted measures, expanding investments into renewable energy, and pricing mechanisms to support the shift away from fossil fuels towards renewables will help to resolve the energy crisis at hand and at the same time work against the climate crisis.

Some governments are taking steps in this direction. China’s national Emissions Trading System came online last year, covering about 2,100 power stations in the country.[14] The EU, UK, Germany, South Africa, and the USA have strengthened their policies to ramp up deployment of renewable energy.

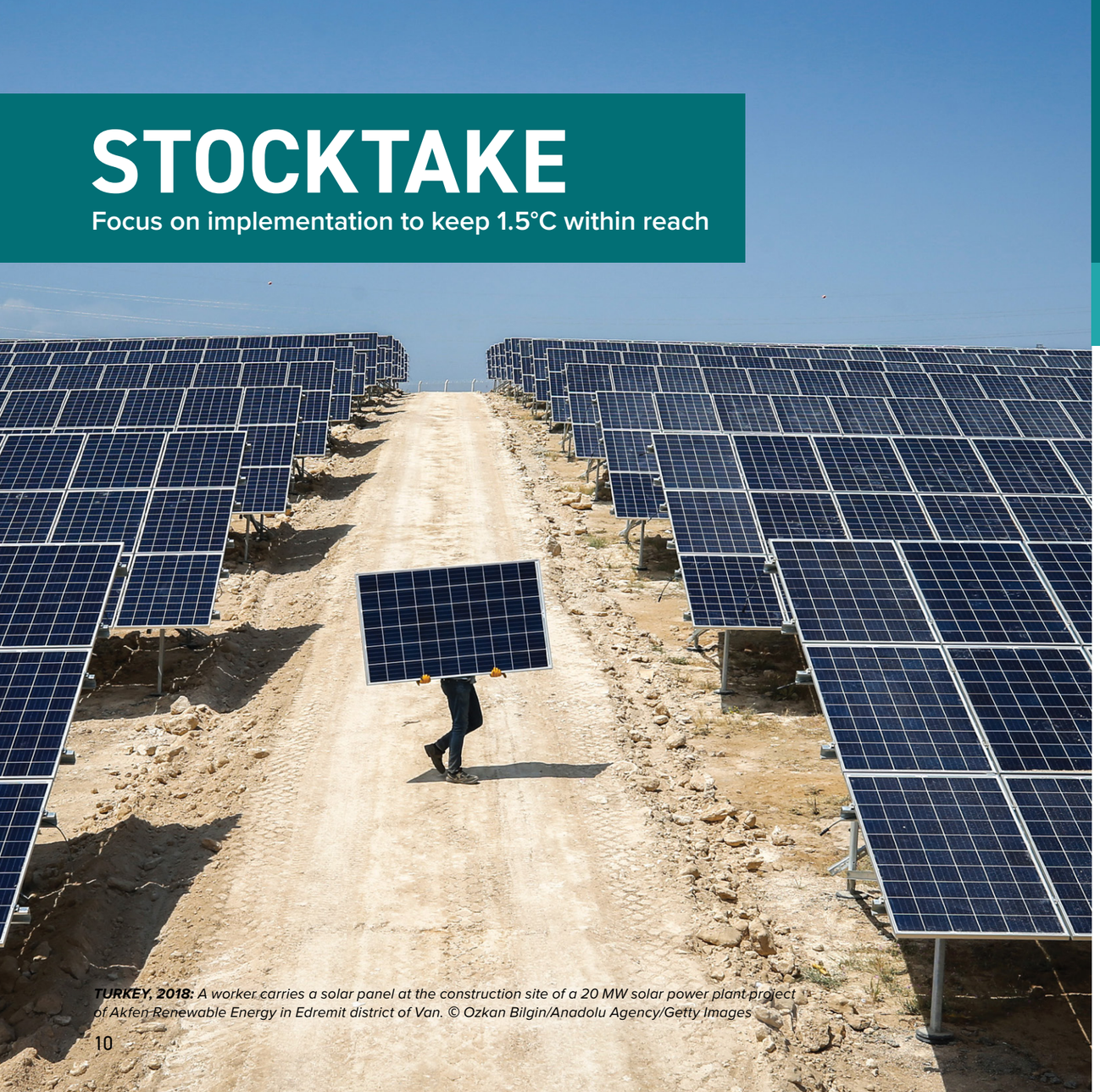
More members of the G20 need to join them in a decisive push towards renewable energy as cheaper and more flexible alternatives to fossil energy that will enhance their domestic energy security and lower emission levels.

To do this effectively, bilateral and multilateral collaboration among the G20 and between developed and developing countries is indispensable. As part of this, the wealthier countries need to demonstrate their commitment to shared responsibility by strongly increasing climate finance.

The energy crisis will pass, but the climate crisis will be much harder to overcome if the two are not addressed together. The path the G20 take will determine the success of the Paris Agreement.

STOCKTAKE

Focus on implementation to keep 1.5°C within reach



TURKEY, 2018: *A worker carries a solar panel at the construction site of a 20 MW solar power plant project of Akfen Renewable Energy in Edremit district of Van. © Ozkan Bilgin/Anadolu Agency/Getty Images*

Paris Agreement: Hold the increase in the global average temperature to well below 2°C above pre-industrial levels and pursue efforts to limit to 1.5°C, recognising that this would significantly reduce the risks and impacts of climate change.

KEY ACTIONS

2030 targets: All G20 members need to further enhance their NDCs to be 1.5°C compatible (including sectoral targets) and quickly ramp up implementation. The current energy crisis must not be used as a reason to delay action, but rather as a driver towards faster, more ambitious implementation.

Defining mid-century net zero targets: Mexico needs to commit to net zero targets. Argentina, Australia, Brazil, China, India, Indonesia, Saudi Arabia, South Africa, Turkey and the USA need to enshrine their net zero targets into law.

Implementation is the key: All G20 members need to ramp up implementation to keep 1.5°C within reach.

REBOUNDING EMISSIONS

The pandemic has not turned the trend

The average global temperature in 2021 was about 1.1°C above pre-industrial levels, and it was the seventh consecutive year in which global temperature had been over 1°C above these levels.[15]

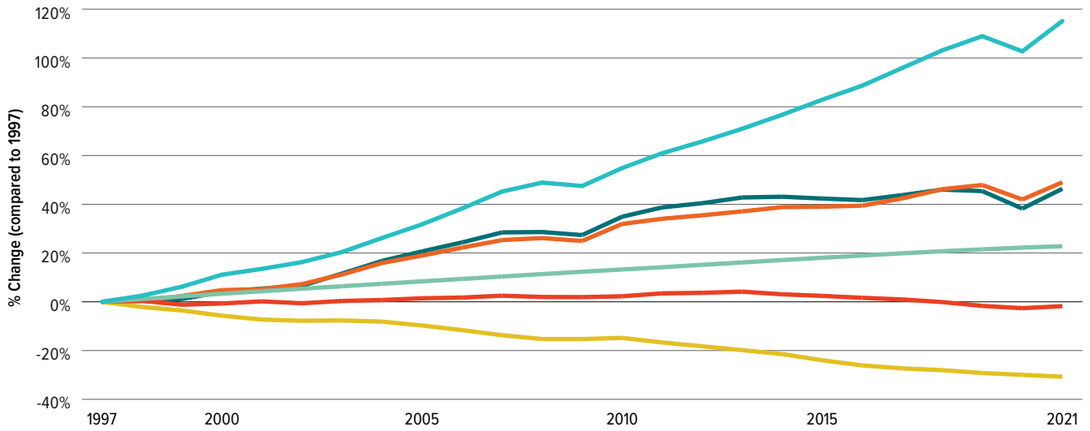
According to the IPCC, to limit global warming to 1.5°C, the remaining carbon budget is less than 500 Gt CO_2.[16] This means that we have eight years left to keep warming to 1.5°C.[17]

Globally, total net anthropogenic GHG emissions have continued to rise during the period 2010–2019. The growth rate from 2010–2019, however, was lower than that from 2000–2009 (over 2%/yr).[18]

Emissions trends among the G20 members, accounting for 75% of global emissions, are following this pattern. While the energy intensity of G20 economies is falling, carbon intensity has not changed significantly over time because the energy sector is not sufficiently decarbonised. GHG emissions increased by 268% between 1990 and 2019. Decoupling emissions from growth has not happened to the extent needed.

Unfortunately, COVID-19 did not break the rising trend in emissions. In the first year of the pandemic (2020), energy-related CO_2 emissions decreased by 4.9% – a direct result of reduced economic activities. GDP fell by 3% in the same year. However, 2021 shows a strong rebound effect. GDP increased by 6.1%, energy-related CO_2 emissions by 5.9%, and total primary energy supply (TPES) by 5%.

ENERGY-RELATED CO_2 EMISSIONS REBOUNDED IN 2021; INSUFFICIENT DECOUPLING OF EMISSIONS FROM GDP GROWTH



GDP	2021	2020	2010–2019*
	+6.1%	-3%	+3.5%

Energy-related CO_2 emissions	2021	2020	2010–2019*
	+5.9%	-4.9%	+1.1%

Total primary energy supply (TPES)	2021	2020	2010–2019*
	+5%	-4%	+1.5%

Population	2021	2020	2010–2019*
	+0.4%	+0.6%	+0.8%

Carbon intensity of the energy sector	2021	2020	2010–2019*
	-0.9%	+0.9%	-0.3%

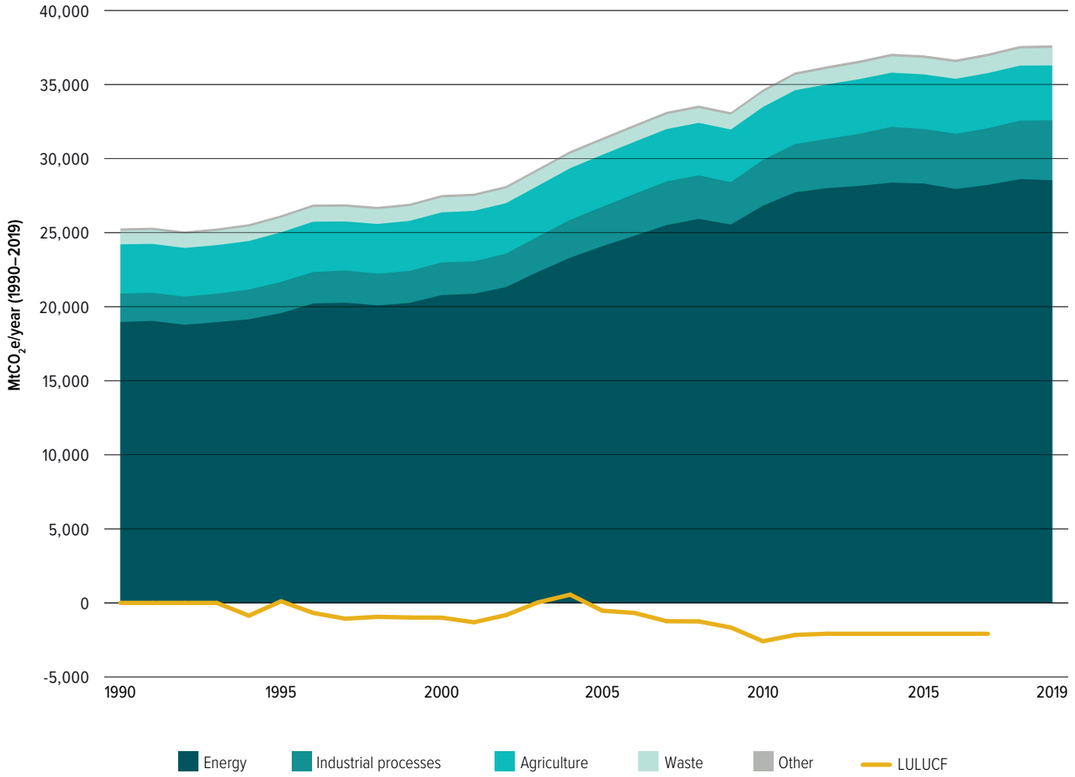
Energy intensity of the economy	2021	2020	2010–2019*
	-1.1%	-1.1%	-1.6%

*Average percentage change 2010–2019

Enerdata, 2021[19]

BEFORE THE PANDEMIC TOTAL ANNUAL GHG EMISSIONS PLATEAUED IN THE G20

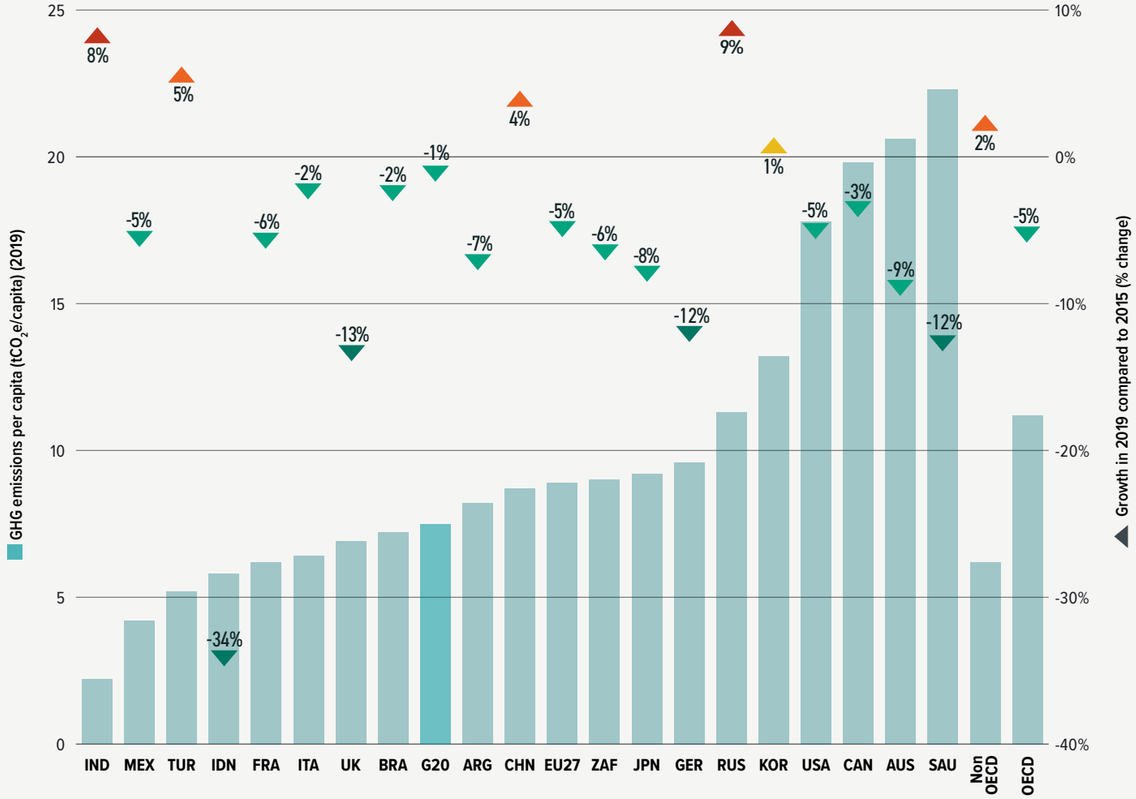
G20 total GHG emissions across sectors



Gütschow, J. et al., 2021;[20] Climate Action Tracker, 2022b[21]

G20 PER CAPITA EMISSIONS DECREASED ON AVERAGE BY 1% FROM 2015–2019, BUT INCREASED IN 5 COUNTRIES

G20 per capita GHG emissions (incl. LULUCF)



Enerdata, 2022[22]

METHANE EMISSIONS
Actions need to follow pledges

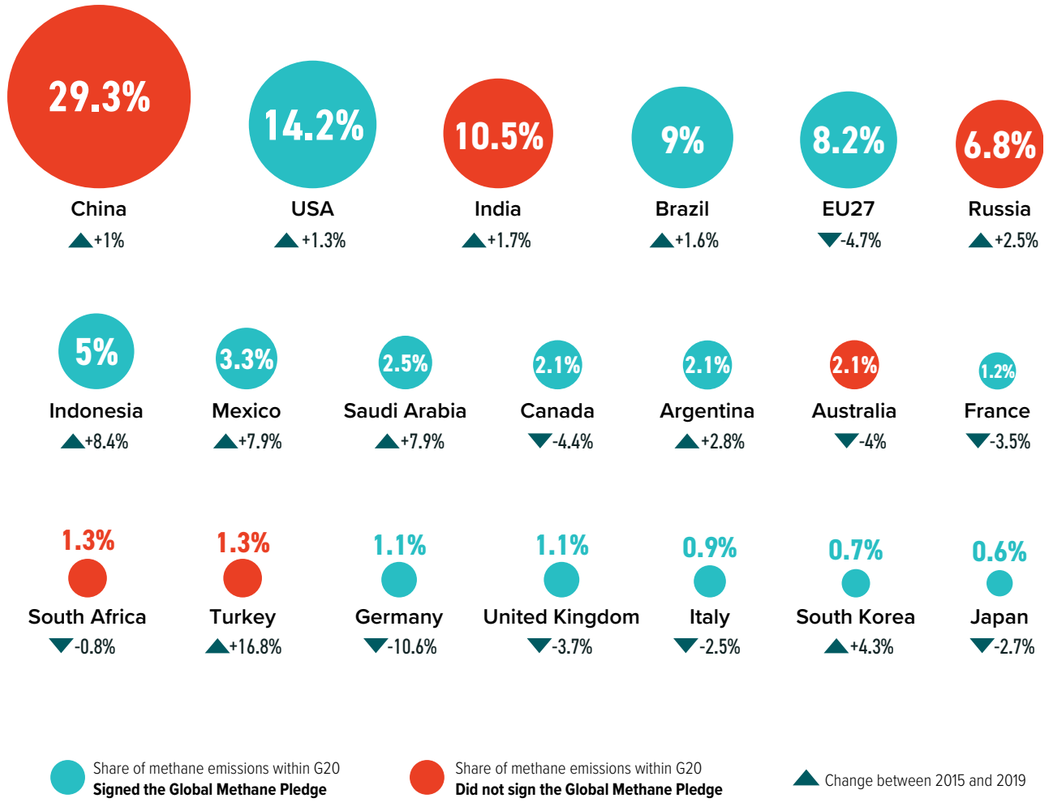
Methane is the second most important GHG emission after CO_2. Its global warming potential is at least 27 times higher than CO_2 on a 100-year timescale. Since 1750, about 30% of global warming can be attributed to methane.[23] Sources of methane emissions include oil and fossil gas operations, fracking, agricultural activities, coal mining, combustion, wastewater treatment, and certain industrial processes.

Methane emissions accounted for 16% of all GHG emissions in 2019. While they rose slower than CO_2 emissions but still increased by 11% between 1990 and 2019. In 2019, the major share of methane emissions came from agriculture (46%), followed by 32% from energy and 20% from waste.

Methane emissions are, therefore, highly relevant for keeping the long term temperature goal of the Paris Agreement within reach. According to the United Nations Environment Programme (UNEP), reducing human-caused methane emissions is one of the most cost-effective strategies to rapidly reduce the rate of warming and contribute significantly to global efforts to limit warming to 1.5°C.[24] Measures include reducing food waste and loss, improving livestock management, adopting healthy diets (vegetarian or with a lower meat and dairy content), gas leak detection and repair, recovery and utilisation of vented gas, and the treatment and disposal of solid waste.[25]

During COP26 in Glasgow, the Global Methane Pledge was launched. Signatories have agreed to take actions to reduce global methane emissions by at least 30% from 2020 levels by 2030. With methane emissions in the G20 having increased by 1.4% between 2015 and 2019, signatories must not only scale-up activities to keep this goal within reach, but also those high emitters – such as Australia, China, India, and Russia – need to join.

METHANE EMISSIONS STILL RISING; SIX G20 MEMBERS DID NOT SIGN THE GLOBAL METHANE PLEDGE



Climate and Clean Air Coalition, 2021;[26] Gütschow et al., 2021[27]

2030 TARGETS AND IMPLEMENTATION

G20 members are not on track

G20 members account for around 85% of global GDP, 75% of international trade and two-thirds of the world's population, and are responsible for around three-quarters of global emissions.[28] The USA is estimated to be responsible for 25% of global emissions, followed by the EU (22%), China (12.7%), Russia (6%), Japan (4%), and India (3%).[29]

To limit warming to 1.5°C, the G20, therefore, carries high responsibility. For developed countries, this includes providing climate finance to assist developing countries' mitigation and adaptation actions.

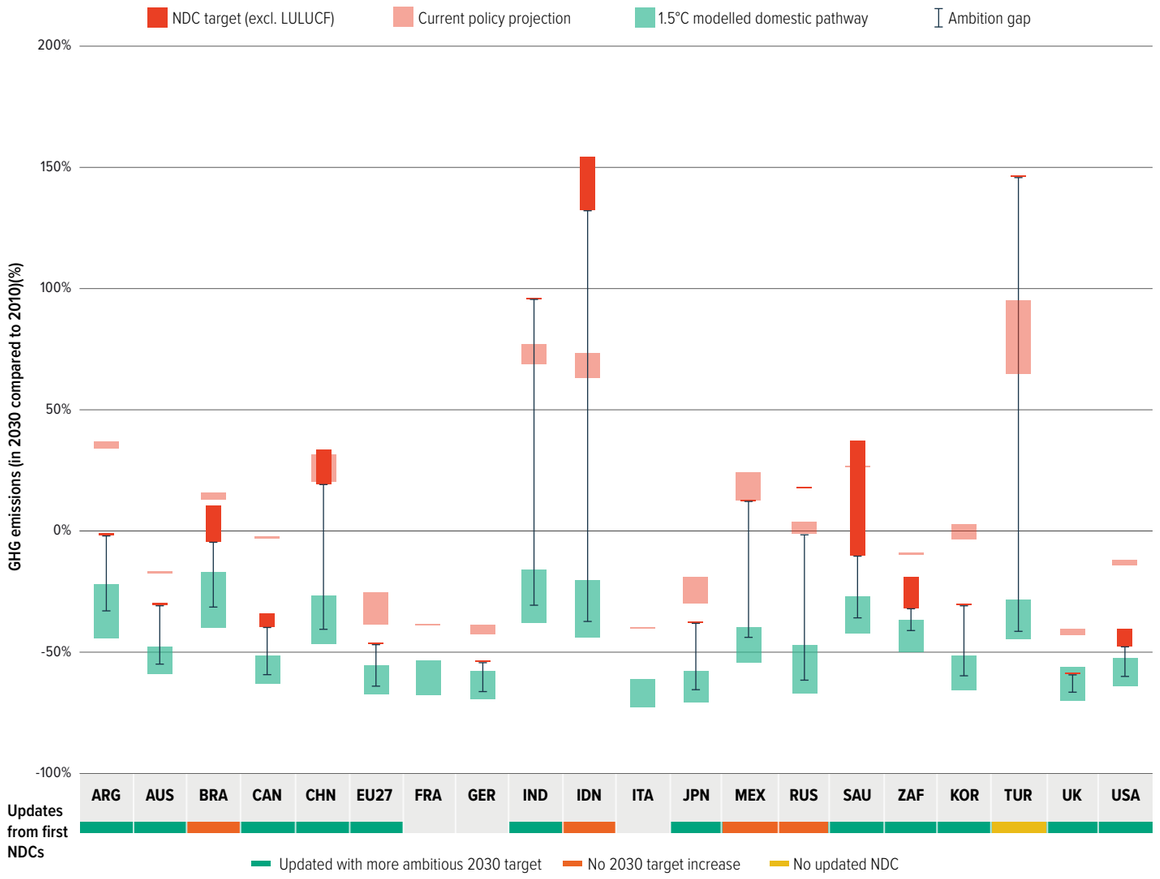
However, G20 members are still not taking the necessary level of accountability of action. Although most countries have submitted stronger NDC targets over time (except for Brazil, India, Indonesia, Mexico, and Russia), their overall level of ambition and action is still insufficient to meet 1.5°C, according to the Climate Action Tracker. The UK is the only country with an overall rating of "almost sufficient". Nonetheless, it is promising that some of the highest emitters (China, the EU, and the USA) submitted the greatest increase in their updated NDCs.

The combined mitigation effect of all 2030 targets assessed is projected to lead to warming of 2.4°C, with current policies leading to a 2.7°C world by 2100.[30] This underlines the urgent need for G20 members to strengthen current climate policies, intensify implementation, and submit more ambitious 2030 targets that align with mid-century net zero targets.

Overall rating of G20 member efforts by the Climate Action Tracker

For more information, please see www.climateactiontracker.org

NEITHER NDC 2030 TARGETS NOR POLICY PROJECTIONS ARE 1.5°C ALIGNED



Climate Action Tracker, 2022a,[31] 2022b,[32] Climate Analytics, 2021[33]

NET ZERO COMMITMENTS
Implementation needs to follow

A positive development in the last two years has been that governments are increasingly adopting net zero targets. By September 2022, within the G20, only Mexico had not announced a net zero target.

Overall, the G20 net zero targets vary in terms of timeframe, coverage of GHGs and economic sectors, use of carbon offsets and reductions outside a country's border, and legal status, all of which have important implications for the strength of those targets.

Increasingly, countries are enshrining net zero targets in law. Canada, the EU (including France and Germany), Japan, Russia, South Korea, the UK, and the USA – together accounting for 37.5% of global GHGs in 2019 – have done so.

However, most of the G20 net zero targets that go beyond just announcements at least partially rely on reductions or removals outside the country's borders, creating a high risk of double counting. Additionally, most targets rely on measures – such as carbon capture and storage (CCS) – that are still under development and not commercially viable.

Importantly, without both setting and implementing short-term targets that at least halve global emissions by 2030, the net zero targets will be out of reach. For their mid-century targets to have any credibility, the G20 members must ramp up both the ambition and implementation of their 2030 targets towards 1.5°C compatibility. To realise these net zero plans requires significant investment and a lot more progress on implementation.

MORE COUNTRIES ANNOUNCE NET ZERO TARGETS

	Target year	All emissions covered	Only reductions / removals domestically	Enshrined in law	Legally binding review process	Comprehensive planning
Argentina	Net zero target announced (2050)					
Australia	2050	Yes	No	Not yet / in policy document	Non-binding / in process	No
Brazil	Net zero target announced (2050)					
Canada	2050	Yes	Yes	Yes	Yes	Limited details
China	Before 2060	No	No	Not yet / in policy document	Non-binding / in process	Limited details
France	2050	Yes	Yes	Yes	Yes	Yes
EU	2050	Yes	Yes	Yes	Yes	Yes
Germany	2045	Yes	No	Yes	Yes	Limited details
India	Net zero target announced (2070)					
Indonesia	Net zero target announced (2060)					
Italy	2050	Yes	Yes	Not yet / in policy document	Yes	No
Japan	2050	Yes	No	Yes	Non-binding / in process*	Limited details
Mexico	No target announced					
Russia	2060	Yes	No	Yes	Non-binding / in process	Limited details
Saudi Arabia	Net zero target announced (2060)					
South Africa	Net zero target announced (2050)					
South Korea	2050	Yes**	Yes	Yes	Non-binding / in process	Limited details
Turkey	Net zero target announced (2053)					
UK	2050	Yes	No	Yes	Yes	Yes
USA	2050	Yes	No	Not yet / in policy document	Non-binding / in process	Limited details

Climate Action Tracker, 2022b:[34] France: IDDRI, 2022;[35] Italy: ECCO (www.eccoclimate.org)

***Adapted from Climate Action Tracker, 2022c[36], with input from IGES*

***SFOC assessment based on the Framework Act on Carbon Neutrality and Green Growth; according to CAT, not all emissions are covered as they are not specified*

ADAPTATION

Increase finance and actions to cope with the inevitable

CHINA, 2020: *Afforestation workers plant trees on the mountain, Handan City, Hebei Province.*
© Costfoto/Future Publishing via Getty Images

Paris Agreement: Increase the ability to adapt to the adverse effects of climate change and foster climate resilience and low-GHG development.

KEY ACTIONS

- **Adaptation strategies:** Establish adaptation strategies across key systems – including food, water, health, and infrastructure.
- **Monitoring & Evaluation (M&E):** Strengthen M&E mechanisms to guarantee adaptation implementation.
- **Adaptation finance:** Increase finance for adaptation to avoid damages and loss of life, and put additional focus on, and funding for loss and damage, to build back better if disaster strikes.

EXTREME WEATHER EVENTS

The new normal in the G20

While there has been some progress in the G20 governments' stated ambition to achieve net zero emissions by mid-century, the effects of climate change are already hitting hard.

In 2022, Australia matched the hottest temperature it had ever recorded (50.7°C). Extremely high temperatures recorded in the UK (40.3°C) led to wildfires breaking out in London and across the country.[37] A heatwave in India also saw record heat, which greatly affected workers, labour migrants, low-income households and the homeless, and reduced the yields of wheat crops, which would have been useful to address supply shortages caused by the war in Ukraine.[38] Exposure to higher temperatures and the resulting reduction of working hours has led to substantial income losses in services, manufacturing, agriculture, and construction. For India, this income loss has been estimated at 5.4% of GDP, for Indonesia at 1.6% of GDP.[39]

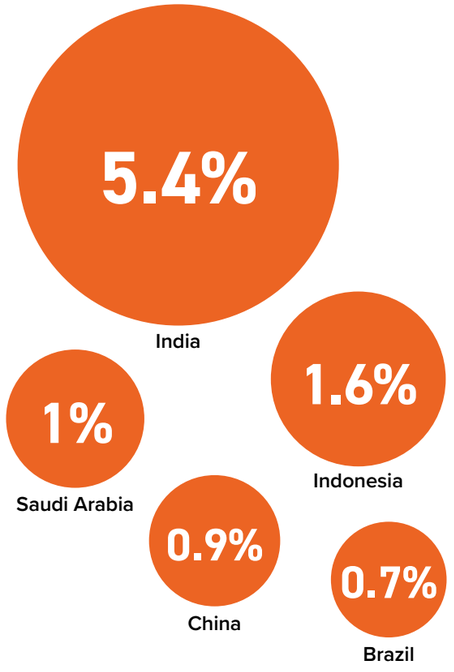
The IPCC notes that there will be unavoidable and severe damages to nature and people even if global warming can be limited to 1.5°C.[40] Water security and food production have been negatively affected;[41] serious health outcomes and economic damages have been the result.[42] The extreme climatic and weather-related events have brought about high economic and human costs.

There is no doubt that we will see more, and more severe, weather events in the near future. A multi-agency report produced by the World Meteorological Organization found that there is a one-in-two chance that the world will break the 1.5°C barrier at least once within the next five years, and that regional tipping points with cascading effects on the climate may already have occurred.[43] The need to adapt to climate change is more urgent than ever.

THE CLIMATE EMERGENCY HAS ECONOMIC AND HEALTH IMPACTS ON ALL PEOPLE

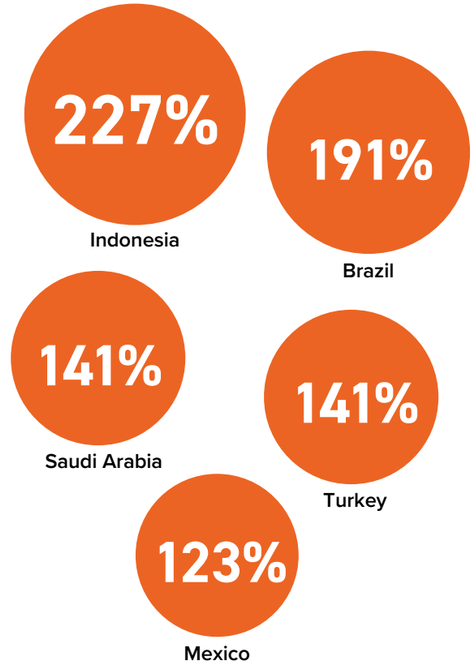
Highest losses of earnings from heat-related labour capacity reduction in the G20

in 2021 (% share of GDP across four sectors)



Highest percent change in heat-related deaths in people over 65

in 2017–2021 compared to 2000–2004



Romanello, M. et al., 2022[44]

CLIMATE IMPACTS

Strong increases with higher average temperatures

The adverse effects of climate change grow with temperature increases, in some cases dramatically so. Even fractions of a degree can have serious economic, social, and environmental costs. At 1.5°C, most G20 members can expect water scarcity and prolonged periods of drought; more frequent and extreme heatwaves; and less favourable agricultural conditions. This gives cause for concern because, even if governments were to implement their current NDCs, the average temperature rise is already projected to be 2.4°C.[45]

The number of people exposed each year to climate-induced hazards is expected to rise as the temperature increases. In India alone, 142 million people, roughly 10% of the population, may be exposed to summer heatwaves at 1.5°C. Wildfires also pose a growing threat: in Indonesia an additional 70,000 people more than those exposed annually during the reference period of 1986–2006, are projected to be exposed to wildfires each year at 1.5°C of warming. At 3°C of warming, that increase in people exposed to wildfires is projected to be multiplied almost 3 times, with a corresponding rise in dangers to individual health and the overall economy.

With increasingly unpredictable wet cycles, and incidences of extreme weather events, farmers are likely to experience increasing crop failures. Good harvests depend on precipitation, favourable temperatures, and the right soil moisture which, in many countries, will be severely diminished as the temperature rises. Using maize as an example, crop yields will diminish with increasing temperature, which will very likely exacerbate the already existing global hunger crisis.

Increased river flooding is also connected to change. Floods can have devastating effects. At least 1,100 people lost their lives, for example, when the Indus River in Pakistan flooded tens of thousands of square kilometres in August 2022.[46] G20 members will likely have to deal with a higher number of, and more severe, river floods as the temperature increases. The floods in western Europe in July 2021 bear witness to this.[47]

EXTREME HEAT AND FOOD SCARCITY WILL AFFECT MANY MEMBERS OF THE G20

Exposure to future impacts at 1.5°C warming and higher

Using the projected impacts at 1.5°C of warming compared to the reference period of 1986–2006, the table compares probable impacts at higher levels of warming. Country population figures in 2021 provided for reference.

Australia
(ca. 26 million)

	1.5°C	2°C	2.5°C	3°C
People affected by heatwaves (ca.)	1m	1.7m	2.4m	2.9m
Change of soil moisture content	-2.75%	x1.1	x1.3	x1.7
Change in maize yield (%)	-2.69%	x1.4	x1.8	x2.9

Brazil
(ca. 212 million)

	1.5°C	2°C	2.5°C	3°C
People affected by heatwaves (ca.)	20m	30m	36m	44m
Change of soil moisture content	-1.63%	x1.4	x1.4	x1.6
Change in maize yield (%)	-1.2%	x2.7	x2.3	x7.0

India
(ca. 1,392 million)

	1.5°C	2°C	2.5°C	3°C
People affected by heatwaves (ca.)	142m	227m	337m	398m
Change of soil moisture content	0.69%	x1.1	x2.5	x2.6
Change in maize yield (%)	-2.84%	x2.4	x1.5	x2.5

Indonesia
(ca. 272 million)

	1.5°C	2°C	2.5°C	3°C
People affected by heatwaves (ca.)	20m	34m	58m	94m
Change of soil moisture content	-0.27	x0.8	x0.5	x0.4
Change in maize yield (%)	-6.23	x1.3	x1.5	x2.4

Turkey
(ca. 85 million)

	1.5°C	2°C	2.5°C	3°C
People affected by heatwaves (ca.)	0.25m	0.5m	0.9m	1.2m
Change of soil moisture content	-2.77%	x1.9	x2.4	x2.5
Change in maize yield (%)	-0.3%	x9.9	x13.2	x7.1

USA
(ca. 332 million)

	1.5°C	2°C	2.5°C	3°C
People affected by heatwaves (ca.)	9.5m	17.1m	22.8m	29.5m
Change of soil moisture content	-0.71%	x1.8	x2.8	x3.3
Change in maize yield (%)	-4.43%	x1.3	x2.8	x3.8

Climate Analytics, 2021;[48] Statista, 2022[49]

ADAPTATION MEASURES

Finance must be ramped up

Enhancing adaptive capacity, strengthening resilience, and reducing vulnerability to climate change in a country are indispensable to minimise damages from an already changing climate, protect people's lives, and prevent economic losses.

G20 members are increasingly embedding adaptation planning and policies in their overall climate politics. Only Saudi Arabia has not yet developed a national adaptation strategy. Brazil, France, Japan, and the UK assess the progress of their adaptation measures in regular cycles.

However, in many other countries, such as India, Mexico, and Turkey, the implementation of measures to adapt to climate change, as well as monitoring and evaluation systems, are not yet sufficiently robust.[50] This is frequently attributed to a lack of financial, human, and technical resources, particularly in vulnerable, developing countries where adaptation is most needed and damage costs continue to rise.

The annual needs for adaptation finance for developing countries are estimated at USD 140–300bn by 2030.[51] The sectors identified as adaptation priorities in the NDCs include agriculture, water and health, representing three-quarters of the quantified adaptation needs.[52]

Estimated global private and public climate flows of USD 632bn/yr for 2019–2020 only include 7% (USD 46bn) in adaptation finance. Most of that originates from public actors, and about 80% of adaptation finance is channeled through multilateral public organisations, such as development banks and multilateral funds.[53]

While the level of adaptation funding has increased in recent years, it is still clearly insufficient. At the current rate of a changing climate, adaptation finance will need to be raised by a factor of 5–10[54] to meet the needs. This considerable amount, however, is dwarfed by the projected need by 2050 if the climate crisis keeps escalating: USD 280–500bn/yr.[55]

MOST NATIONAL ADAPTATION STRATEGIES INCLUDE REGULAR REVIEWS

	Year	Fields of action (sectors)													Monitoring and evaluation
		Agriculture	Biodiversity	Coastal areas and fishing	Education and research	Energy and industry	Finance and insurance	Forestry	Health	Infrastructure	Tourism	Transport	Urbanism	Water	
ARG	2020	✓	✓	✓	✓	✓		✓	✓		✓	✓	✓	✓	✓
AUS	2022	✓	✓	✓		✓	✓	✓	✓	✓			✓	✓	✓
BRA	2016	✓	✓	✓		✓		✓	✓	✓		✓	✓	✓	✓
CAN	2020			✓	✓				✓	✓					✓
CHN	2022	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓	
EU	2021	Actions by member states													
FRA	2018	✓	✓	✓	✓		✓	✓	✓		✓			✓	✓
GER	2008	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
IND	2008	✓	✓	✓	✓	✓		✓	✓	✓		✓		✓	
IDN	2019	✓		✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓
ITA	2017	✓	✓	✓						✓	✓		✓	✓	✓
JPN	2018	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
MEX	2021	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓
RUS	2020	No information on status													
SAU		No dedicated Adaptation Strategy													
ZAF	2020	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	
KOR	2020	✓	✓	✓	✓	✓		✓	✓	✓				✓	✓
TUR	2012	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	
UK	2018	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓
USA	2021	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓

Own Evaluation

MITIGATION

Break rebounding emissions and stop deforestation

INDONESIA, 2019: *Residents farming next to wind turbines in South Sulawesi. Indonesia already has two wind power plants with the largest total capacity in Southeast Asia. © Hariandi Hafid/SOPA Images/LightRocket via Getty Images*

Paris Agreement: Hold the increase in the global average temperature to well below 2°C above pre-industrial levels and pursue efforts to limit to 1.5°C, recognising that this would significantly reduce the risks and impacts of climate change.

KEY ACTIONS

- **Power:** Further stimulate and scale-up growth in renewables whilst rapidly phasing out fossil fuels, accelerating energy efficiency, improving grid digitalisation and energy savings.
- **Transport:** Introduce policies and measures aimed at switching fuels to zero-carbon fuels, mass electrification and modal shifting. Sales of internal combustion engine vehicles must be banned globally by 2035 at the latest.[56]
- **Industry:** Increase energy and material efficiency (switching to zero-carbon sources such as renewables-based electrification and green hydrogen) as well as material recycling.
- **Buildings:** Focus on the retrofitting and electrification of existing buildings to reduce energy demand. Require all new buildings to meet high energy-efficiency standards and be equipped with heating and cooling technologies that either are, or can be, zero emission.
- **Land use:** Strengthen policies to reduce deforestation and implement protected area networks, deforestation-free supply chains, and forest-friendly infrastructure.
- **Agriculture:** Improve productivity to feed a growing population and also preserve biodiversity, shift high-meat diets towards plant-based diets, and slow the demand for agricultural land by reducing food loss and waste.

REDUCE ENERGY EMISSIONS
through renewables and energy conservation

Energy-related emissions accounted for 76% of all GHG emissions in the G20 in 2019 (primarily CO_2, including land use change and forestry). In 2021, 40% of the energy-related CO_2 emissions came from the power sector, followed by industry (23%) and transport (19%). In the first year of the COVID-19 pandemic (2020), energy-related CO_2 emissions decreased by 5% – a direct result of reduced economic activities. GDP fell by 3% in the same year, and total primary energy supply (TPES) by 4%. However, 2021 showed a strong rebound: GDP increased by 6%; energy-related CO_2 emissions by 5%, and TPES rose by 5%.

To break this connection between GDP growth and emissions, increased energy efficiency, energy conservation (including lifestyle and consumption changes[57]), fuel switching, and electrification with renewables can bring the necessary reductions. The decarbonisation of the energy sector through renewables is critical in reducing emissions from the power, transport, industry, and buildings sectors. Indonesia, UK, and Turkey increased their share of renewables in the energy mix between 2017 and 2021 by more than 3 percentage points. In the G20, the share of renewables increased to 10.5%, up from 9.1% in 2017.

Costs and energy security arguments favour renewable sources. From 2010–2021, the competitiveness of renewables has constantly improved. The cost of electricity of newly commissioned utility-scale solar PV declined by 88%, whilst that of onshore wind fell by 68%, concentrated solar power by 68% and offshore wind by 60%.[58] Almost two-thirds of newly added renewables in the G20 had lower costs than even the cheapest coal-fired plant.[59]

As a reaction to the current energy crisis, governments are taking steps to further enhance the development of renewables sources. In May 2022 in the EU, for example, Belgium, Denmark, Germany, and the Netherlands pledged to increase wind capacity in the North Sea by at least 150 GW.[60] In the USA, USD 425m[61] will be spent to expand state clean energy programmes, and the government has added further programmes to extend the capacity of renewable energy. While the development of renewables is likely to accelerate, it is not clear whether it will be fast enough.

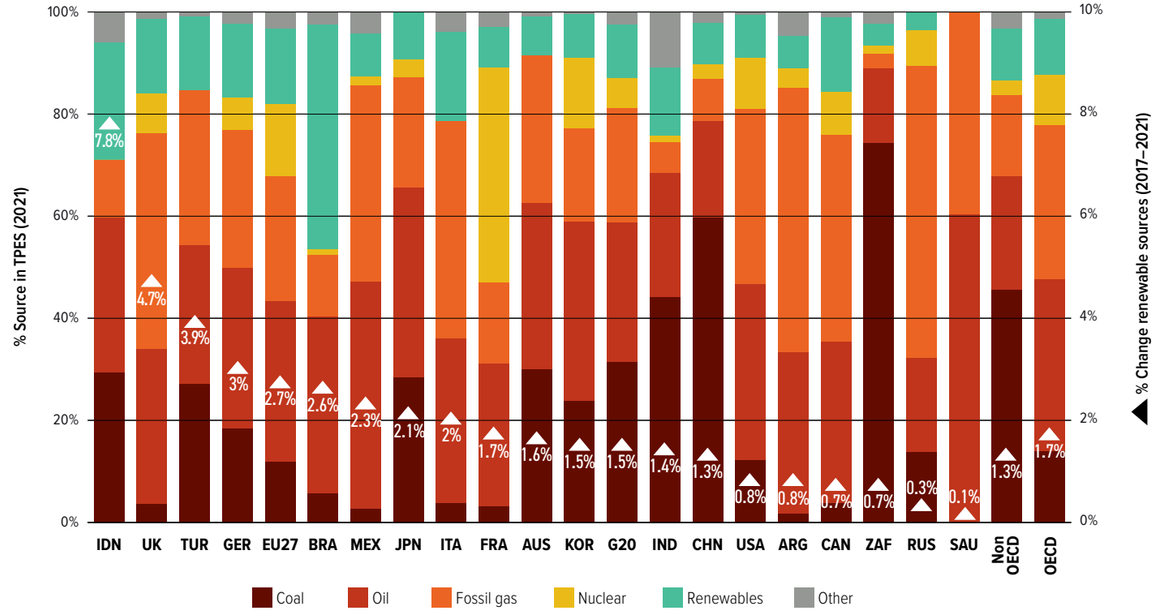
ALL G20 MEMBERS INCREASED THEIR SHARE OF RENEWABLES – THIS TREND MUST URGENTLY ACCELERATE

Direct energy-related CO_2 emissions by sector (2021)

Enerdata, 2022[62]

**Includes energy-related CO_2 emissions from extracting and processing fossil fuels.*

Energy mix in G20 members



Enerdata, 2022[63]

POWER

Prioritise renewables and phase out fossil fuels

Between 2030 and 2040, the entire world needs to phase out coal-fired power generation. By 2040, the share of renewable energy in electricity generation needs to be increased to at least 75%, and the share of unabated coal reduced to zero.[64,65]

Emissions from the power sector come from energy used to generate electricity and heat. It accounts for 40% of the energy-related CO_2 emissions. These emissions are mainly from the use of coal, which accounts for almost 40% of the G20's electricity generation mix, with fossil gas at 19%.

While the average G20 emissions intensity decreased by 8% between 2017 and 2021, overall energy-related CO_2 emissions are still growing in line with more demand for electricity. After a decrease in 2020 of 2.8% when economic activity slowed down, emissions rebounded by 7.1% in 2021.

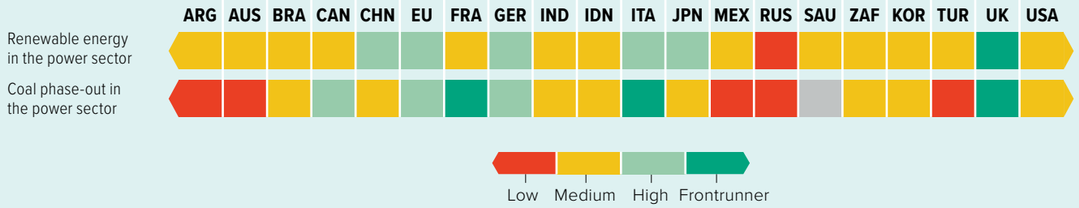
G20 ENERGY-RELATED CO_2 EMISSIONS IN 2021

40% Direct

Reduction in 2020:	Rebound in 2021:	2015–2019:
-2.8%	**+7.1%**	**+3.2%** (+0.8% p.a.)

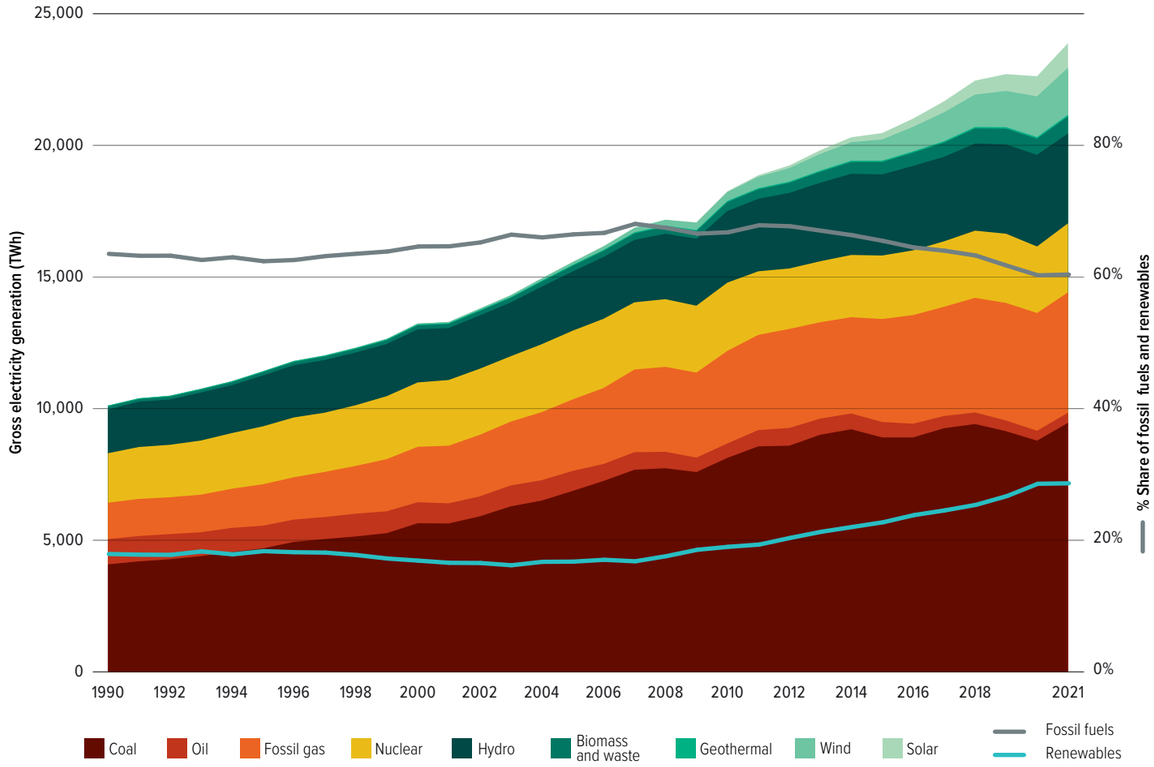
Even though the share of renewables in the power mix did not change between 2020 and 2021 (only by 0.1%) after an increase between 2019 and 2020 (1.8%), it has seen strong growth over the last decade. Renewable energy accounted for almost 29% of gross power generation in 2021, compared to 22% in 2014 and 19% in 2010. This growth in the share of renewables has primarily been driven by wind and solar installations. The decarbonisation of other sectors – such as transport, industry, and buildings – is highly contingent on a decarbonised power sector. To fully decarbonise the power sector by 2050, G20 members need to phase out coal and avoid relying on fossil gas.[66] Instead, they need to prioritise the development of renewable sources.

Policy assessment



INCREASED SHARE OF RENEWABLES DRIVEN BY WIND AND SOLAR; HOWEVER, REBOUND IN 2021 MAINLY CARRIED BY FOSSIL FUELS

Electricity generation mix



Enerdata, 2022[67]

TRANSPORT

Electrify and switch to public transport

The share of low-carbon fuels in the transport fuel mix globally must increase to between 40% and 60% by 2040, and between 70% to 95% by 2050.[68]

The transport sector is responsible for a fifth of the G20's energy-related CO_2 emissions. This is driven by the consumption of oil – with road travel accounting for two-thirds of these emissions. In this sector, there is a large difference between OECD and non-OECD countries of the G20 members, resulting from different levels of motorisation and use of transport modes.

G20 ENERGY-RELATED CO_2 EMISSIONS IN 2021

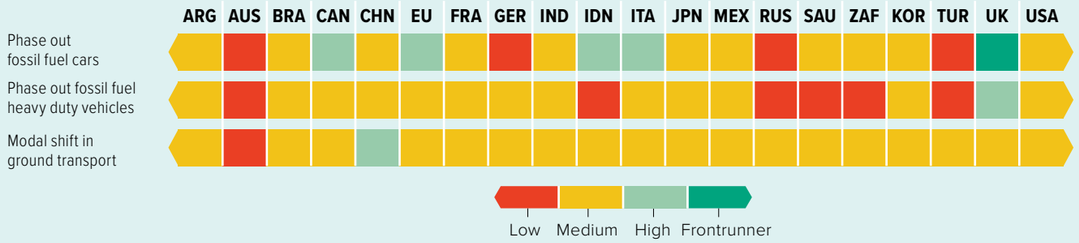
19% Direct **1%** Indirect

Reduction in 2020:	Rebound in 2021:	2015–2019:
-11.5%	**+7.7%**	**+4.9%** (+1.2% p.a.)

In 2020, the first year of the COVID-19 pandemic, CO_2 emissions per capita from the transport sector decreased by 11.8%, but by 2021, per capita emissions had already rebounded by 7.2% – although many companies still allowed their employees to work from home. Total energy-related CO_2 emissions in the transport sector in the G20 rebounded by 7.7%, after a reduction in 2020 of 11.5%. In China and Turkey, per capita emissions rebounded to even higher levels than in 2019.

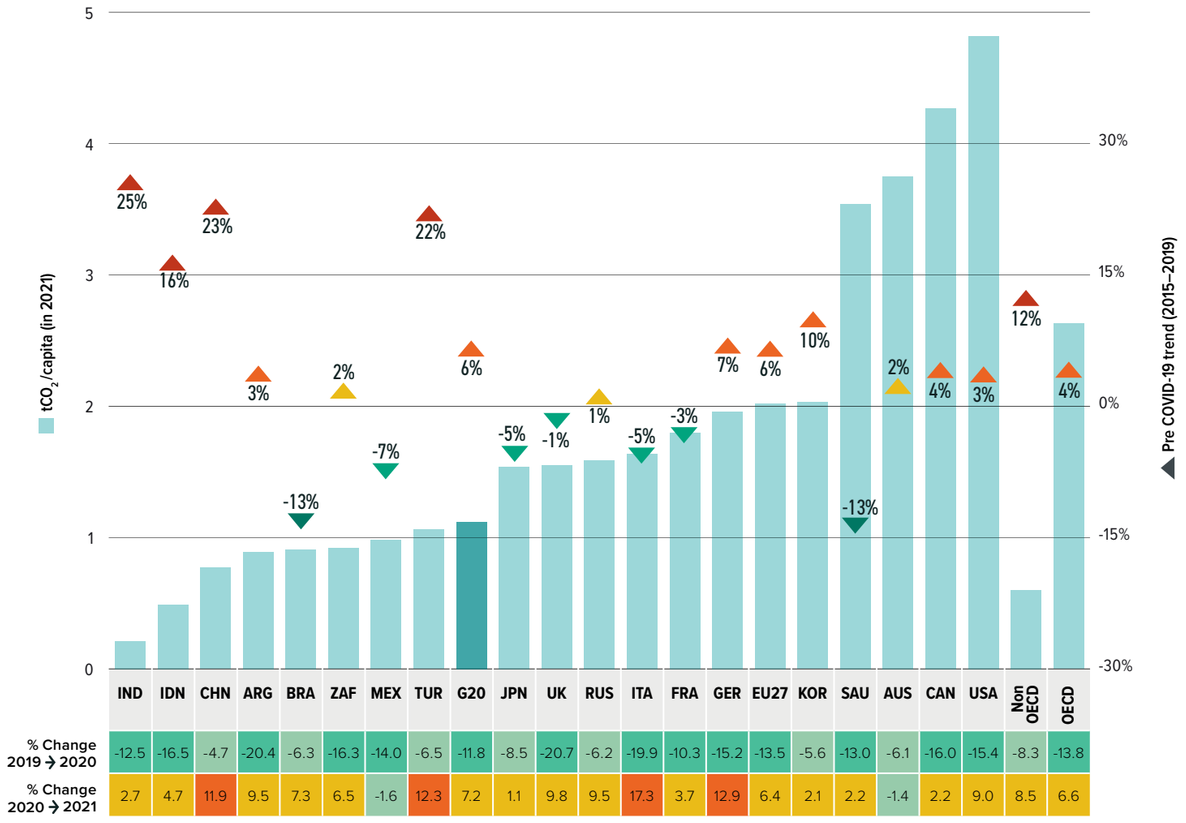
To decarbonise the transport sector, G20 members will need to engage in switching to low-carbon fuels (e.g., through mass electrification including decarbonising heavy-duty vehicles and phasing out fossil fuel cars, while increasing alternative low-carbon fuels, such as biofuels and green hydrogen) as well as modal shifting (e.g., from private to public transport and active transport; moving freight to rail instead of road, non-motorised transport).

Policy assessment



TRANSPORT EMISSIONS CONTINUE TO GROW

G20 transport emissions (per capita)



Rebound after COVID-19 restrictions

Enerdata, 2022[69]

BUILDINGS

Increase energy efficiency and electrification

By 2040, global emissions intensity from buildings need to be reduced by 90% from 2015 levels, and at least 95% below 2015 levels by 2050.[70,71]

CO_2 emissions from this sector include direct emissions from fuel combustion (for space heating, food preparation, etc.), and indirect emissions from energy (incl. electricity) used to build, heat and cool buildings, and district heating.

G20 ENERGY-RELATED CO_2 EMISSIONS IN 2021

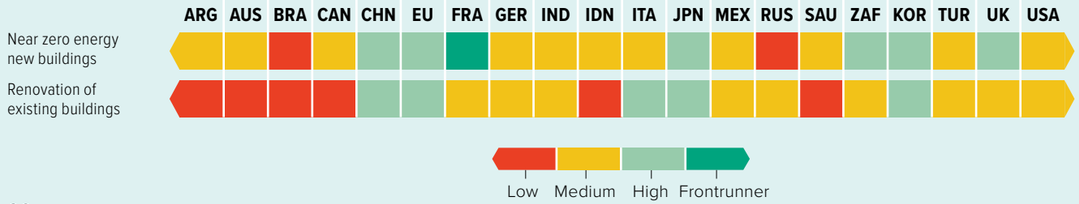
8% Direct **16%** Indirect

Reduction in 2020:	Rebound in 2021:	2015–2019:
-2.1%	**+4.4%**	**+3.2%** (+0.8% p.a.)

In 2021, direct emissions from the buildings sector accounted for 8% of the energy-related CO_2 emissions in the G20. While per capita emissions in the OECD countries of the G20, on average, were reduced by 12% between 2017 and 2021, they increased in non-OECD countries by 19%, reflecting vastly different per capita emissions. Between 2019 and 2020, in most countries, emissions per capita decreased (except for an increase in Indonesia of 34% and in Saudi Arabia of 10%). However, in 2021, in all G20 members (except Australia, Canada, Japan, and Mexico), per capita emissions again increased, showing a strong rebound effect of 4.4% after a decline of 2.1% in 2020.

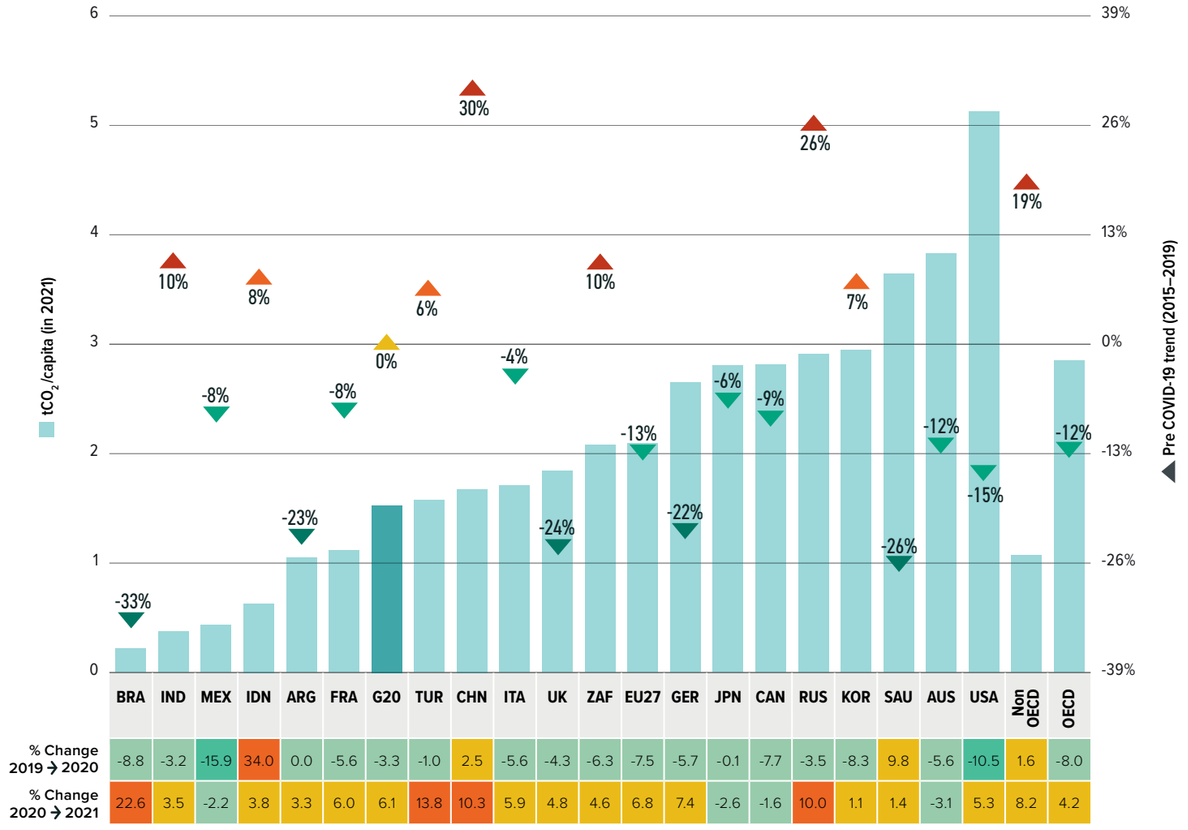
The buildings sector is one of the sectors most urgently in need of decarbonisation. To reduce emissions, G20 members need to develop and implement ambitious energy codes for existing buildings and near zero policies for new buildings, as well as promote retrofitting to reduce heat demand.[72] Achieving zero emissions in the buildings sector is also contingent on upstream decarbonisation (specifically in the power sector) to reduce the sector's indirect emissions.

Policy assessment



OVERALL GROWTH IN BUILDINGS EMISSIONS, BUT AVERAGE PER CAPITA EMISSIONS FROM 2015–2019 UNCHANGED

G20 buildings emissions (incl. indirect emissions) per capita



	BRA	IND	MEX	IDN	ARG	FRA	G20	TUR	CHN	ITA	UK	ZAF	EU27	GER	JPN	CAN	RUS	KOR	SAU	AUS	USA	Non OECD	OECD
% Change 2019 → 2020	-8.8	-3.2	-15.9	34.0	0.0	-5.6	-3.3	-1.0	2.5	-5.6	-4.3	-6.3	-7.5	-5.7	-0.1	-7.7	-3.5	-8.3	9.8	-5.6	-10.5	1.6	-8.0
% Change 2020 → 2021	22.6	3.5	-2.2	3.8	3.3	6.0	6.1	13.8	10.3	5.9	4.8	4.6	6.8	7.4	-2.6	-1.6	10.0	1.1	1.4	-3.1	5.3	8.2	4.2

Rebound after COVID-19 restrictions lifted

Enerdata,2022[73]

INDUSTRY

Increase material and energy efficiency

Industrial emissions need to be reduced by 65–90% from 2010 levels by 2050.[74]

CO_2 emissions in the industry sector result from direct emissions (conversion of energy), indirect emissions (electricity and co-generated heat), and process emissions (mainly from iron, steel, or cement). In 2021, direct emissions from the industry sector accounted for 23% of the energy-related CO_2 emissions in the G20, the highest share of all energy-related CO_2 emissions. On average, energy-related CO_2 emissions have declined by 0.8%/yr since 2015. With decreases in industrial activity due to COVID-19 pandemic lockdowns, emissions fell by 4.5%. However, in 2021 emissions rebounded by 3.3%.

G20 ENERGY-RELATED CO_2 EMISSIONS IN 2021

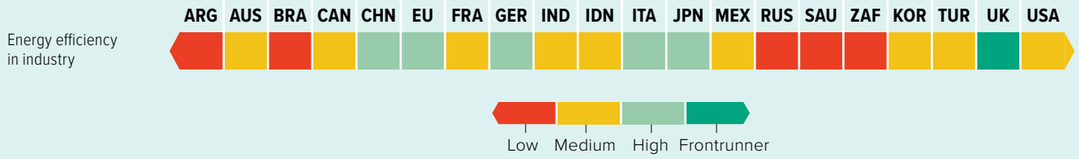
23% Direct **18%** Indirect

Reduction in 2020:	Rebound in 2021:	2015–2019:
-4.5%	**+3.3%**	**-3%** (-0.8% p.a.)

Developing countries of the G20 show higher emissions intensity, partly due to heavy industry moving to emerging and developing countries, along with differences in technological standards and regulations. Developing countries also typically derive a higher share of their GDP from energy-intensive industry, which contributes to higher overall carbon intensity of their economies.[75] To reduce emissions from industry, G20 members need to increase material and energy efficiency, fuel switching, and improve material recycling.

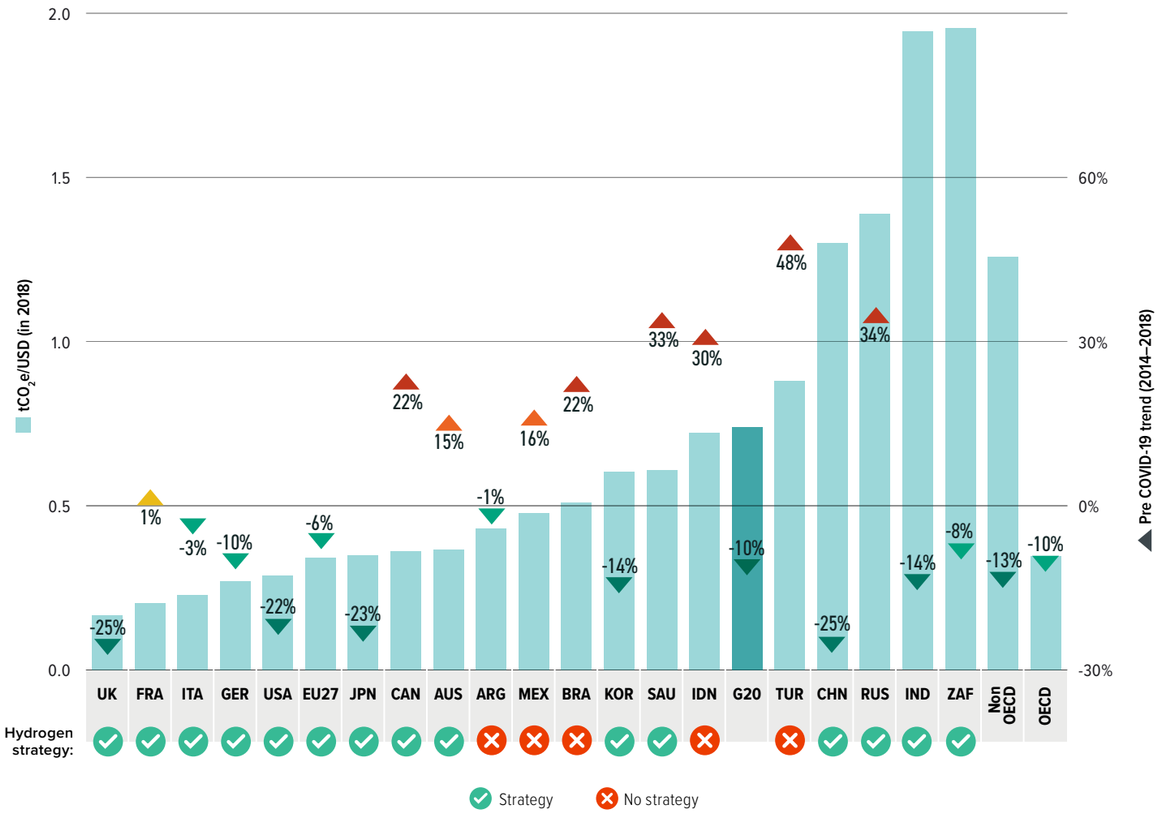
One way to do this is by using green hydrogen to reduce the carbon footprint of the sector. Fifteen members of the G20 already have hydrogen strategies, although some include hydrogen production from coal and gas. To reach net zero, G20 members that have not yet done so should, therefore, focus their strategies on green hydrogen production.[76]

Policy assessment



INDUSTRY EMISSIONS INTENSITY DECREASED IN 12 G20 MEMBERS BETWEEN 2014 AND 2018

G20 industry emissions intensity (incl. indirect emissions)



G20 members with hydrogen strategies

Enerdata, 2022[77]

LAND USE

Stop wildfires and promote reforestation

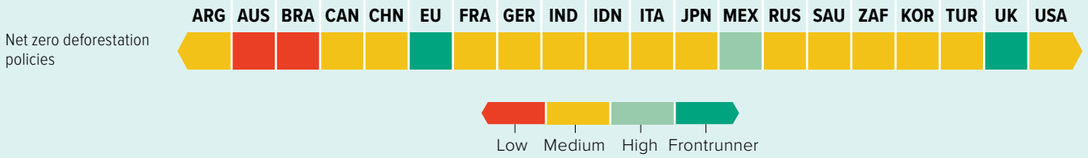
Global deforestation needs to be halted and changed to net zero CO_2 removals by around 2030.[78]

Forests absorb GHGs, regulate water flows, protect biodiversity, and shield coastal communities from extreme weather events and sea level rise, thus helping reduce the impact of climate change. The forests with the largest carbon sinks in the world are situated in Brazil, Canada, China, Russia, and USA.[79]

However, the global forest stock is at risk. Destructive drivers are wildfires, land use change to croplands, cattle pastures, and forestry as well as urbanisation and commodity-driven deforestation.[80] From 2002 to 2021, Brazil lost 27.8 Mha of humid primary forest (important for carbon storage), nearly half of the total forest loss in the country.[81] In Russia, the total area burnt by wildfires in the first half of 2022 had reached 19 Mha – an area bigger than Greece.[82] In Canada, over the last two decades, their managed forest lands have been logged faster than they have grown back.

Halting deforestation and forest degradation is an enormous yet important task. Governments need to develop and implement policies to stop deforestation. They must also ensure that implementing agencies are sufficiently financed. It is important that indigenous land rights are protected, and that indigenous peoples are part of the decision making. Additional measures include using protected area networks, developing deforestation-free supply chains, promoting forest-friendly infrastructure (including through strict impact assessments), and developing optimal land use approaches.[83]

Policy assessment



AGRICULTURE

Reduce methane emissions

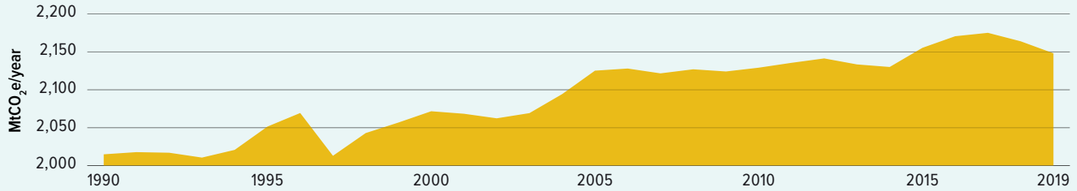
Methane emissions (mainly enteric fermentation) need to decline by 10% by 2030 and by 35% by 2050 (from 2010 levels). Nitrous oxide emissions (mainly from fertilisers and manure) need to be reduced by 10% by 2030 and by 20% by 2050 (from 2010 levels).[84]

Emissions from agriculture accounted for 10% of the G20's total GHG emissions in 2020. However, while it only accounts for 1.7% of the G20's energy-related CO_2 emissions, the sector is responsible for 46% of methane emissions (2019). Methane emissions rose from 1990 to 2019 by 6.6%. In addition to CO_2 emissions and methane emissions, agriculture is responsible for 80% of global nitrous oxide emissions.

Agricultural emissions are primarily caused by digestive processes of livestock and their manure. Synthetic fertilisers, higher demand for food, feed and biofuels and more resource-intensive production result in ever more emissions.[85] Demand for space for livestock and feed also drives forest destruction to use the land for grazing and fodder production, thereby reducing natural carbon sink capacities.

Sustainable agricultural practices are needed to feed a growing world while also minimising emissions. Measures include reducing enteric fermentation through adapting the diets of livestock and using new technologies, improving manure management, changing rice types, and upgrading cultivation and clearance techniques. Reducing production emissions should be augmented with behavioural changes by resource-intensive consumers. Such changes include making dietary changes in favour of vegetables and fruits, reducing consumption of animal-derived products, and reducing food waste.[86]

G20 methane emissions from agriculture



Gütschow, J. et al., 2021;[87] Climate and Clean Air Coalition, 2021[88]

FINANCE

Reduce subsidies and increase climate finance

MEXICO, 2022: *A demonstrator holds up a sign that reads: "It is not an investment if it destroys the planet" outside the National Palace in Mexico City, during a global protest. © PEDRO PARDO/AFP via Getty Images*

Paris Agreement: Make finance flows consistent with a pathway towards low-GHG emissions and climate-resilient development.

KEY ACTIONS

- **Risk disclosures:** Make the disclosure of climate risk mandatory for financial institutions and corporations.
- **Production subsidies:** Subsidies to fossil fuel production with the justification of energy security and revenue generation need to be avoided, and clean energy pathways need to be prioritised.
- **Consumption subsidies:** Support for the cost-of-living crisis must not entail higher levels of fossil fuel consumption subsidies and should, instead, prioritise increasing energy efficiency to lower energy bills and encourage switching to low-carbon energy alternatives.
- **Carbon pricing:** Ramp up carbon pricing schemes and expand their coverage in line with climate targets.
- **Public finance:** Commit to ending public finance for all fossil fuels, make good on any existing commitments to end finance for fossil gas, and scale up funding for renewable energy.
- **Climate finance:** G20 members that are obliged to provide climate finance need to increase their contributions to meet the USD 100bn goal, to be at least in line with what a fair share of their contribution would be, based on national income, historic emissions, and size of population.

FINANCIAL POLICIES AND REGULATIONS

Mandate disclosure of climate-related financial risk

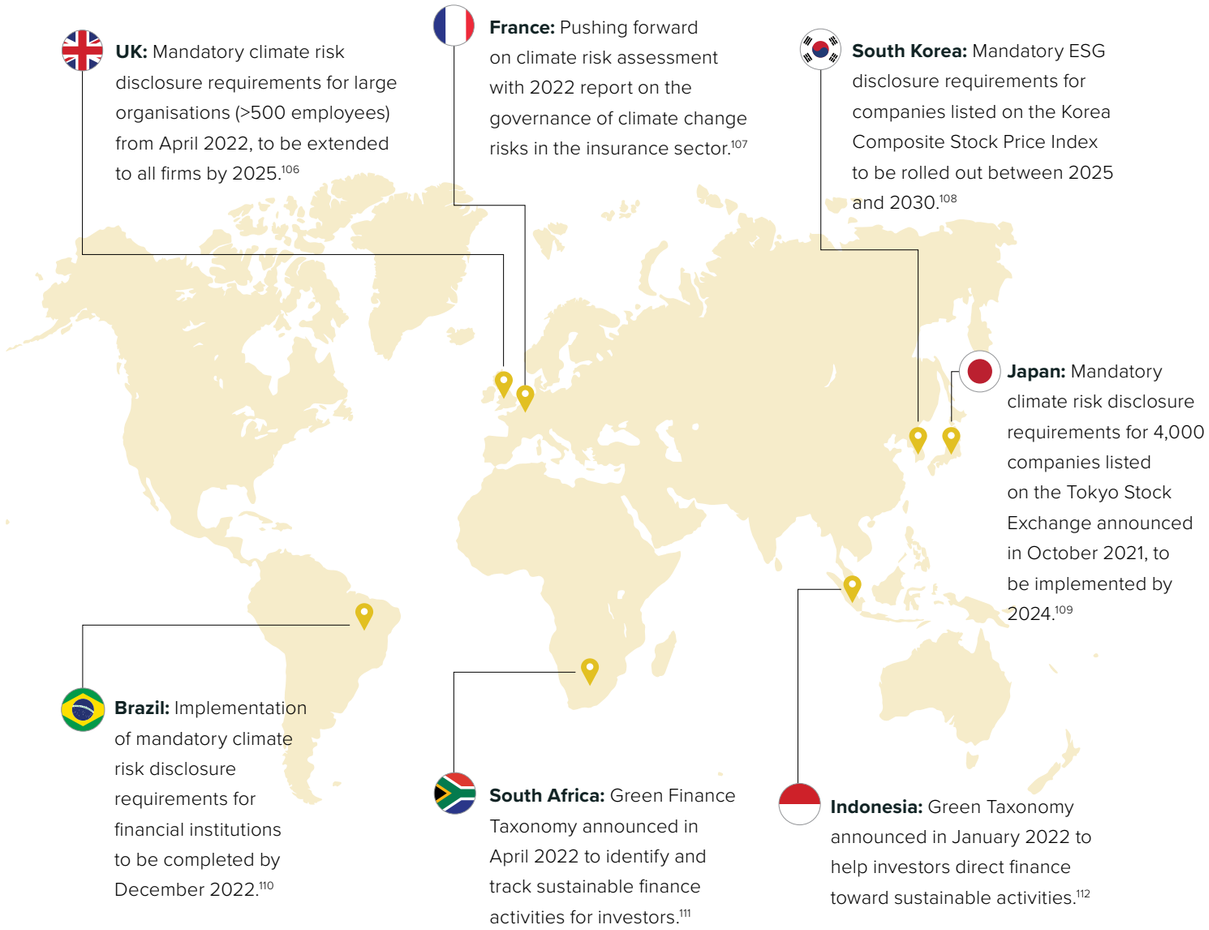
Governments can align financial systems with climate goals through regulations and by enforcing standards of behaviour. The most important of these is the disclosure by companies and financial institutions of climate-related financial risks, which helps to push investment towards green finance and away from risky assets. The Task Force on Climate-Related Financial Disclosure (TCFD) recommended in 2015 that disclosure be broken down by governance, strategy and management of climate risks, as well as the metrics and targets used to assess them.[89] The International Sustainability Standards Board (ISSB) will release a detailed framework building on their recommendations late in 2022.

Some G20 governments have made disclosure mandatory, or committed to doing so – notably France,[90] Brazil,[91] Germany,[92] the EU,[93] the UK,[94] South Korea[95] and Japan.[96] Others have suggested voluntary disclosure.[97] The obligations around disclosure refer in some cases to financial institutions, and in others to corporations. The ISSB framework will likely influence the drafting of regulations in many countries and encourage international standardisation.[98]

Australia, Canada, France, Japan, Mexico, the UK and the EU are also members of the Task Force on Nature-Related Financial Disclosures (TNFD). Acknowledging the complex relationship that nature and biodiversity share with climate change, this initiative lays out recommendations for disclosure along similar lines as the TCFD but for nature-based risks beyond carbon emissions.[99]

Progress has also been made on testing the vulnerability of national financial systems to climate risks. Known as climate 'stress tests', these have been conducted recently by regulators in China,[100] the EU,[101] South Africa,[102] South Korea,[103] and the UK.[104] Building on earlier assessments of climate risk, France released a report in February 2022 on the governance of climate risks in the insurance sector.[105]

SOME G20 MEMBERS ARE MAKING GOOD PROGRESS ON CLIMATE RISK DISCLOSURES



CARBON PRICING AND REVENUES

Accelerate carbon pricing and expand coverage

Pricing carbon effectively can encourage emitters across the entire economy to implement efficiency measures and low-carbon transition plans. Currently, 13 G20 members (compared to only 10 five years ago) have some form of explicit national carbon pricing scheme, such as carbon taxes and emissions trading schemes (ETS). Brazil, Indonesia, Russia, and Turkey are considering introducing such schemes.

In 2021, explicit carbon pricing schemes generated a total revenue of over USD 56.7bn in the G20, with Germany and France recording the highest amounts of USD 15.7bn and USD 11.1bn, respectively.

However, emissions coverage varies, and the price of carbon remains too low across the G20 to align with climate aims. France, Canada, the UK and the EU (ETS) are the only G20 members whose carbon prices were above the USD 40/tCO_2e threshold by 2020 as recommended by the High-Level Commission on Carbon Prices. Some members (Germany, South Korea, the USA) have a carbon price that is defined as "low" (USD 11–39/tCO_2e), while carbon prices in the rest of the G20 remain "very low", below the USD 10/tCO_2e threshold.

Some progress is being made. Under the EU's Carbon Border Adjustment Mechanism (CBAM – draft regulation released July 2021[113]), imports of certain goods to the EU will face a carbon price, based on the GHG emissions generated during their manufacture.

China's national carbon ETS, launched in July 2021, is now used by nearly all liable power stations (more than 2,100), covering 36% of China's total GHG emissions; South Africa proposed to increase their carbon tax rate to reach USD 20/tCO_2e by 2026 and USD 30/tCO_2e by 2030; and the state of Washington in the USA plans to introduce carbon pricing schemes. Progress is too slow, however: Indonesia has delayed the introduction of a carbon pricing scheme due to the energy crisis, while Mexico's carbon tax now exempts fuel and diesel.[114]

Moreover, when emissions coverage is considered for national-level explicit carbon pricing schemes, only schemes in Canada, Germany, Japan, South Africa, and South Korea cover more than 66% of domestic emissions. Most governments have, at least, maintained plans for pricing carbon in the aftermath of the COVID-19 pandemic.[115]

CARBON PRICES ARE RISING, BUT ARE STILL TOO LOW; COVERAGE IN THE G20 REMAINS HIGHLY INSUFFICIENT, EXCEPT IN FEW COUNTRIES

Coverage and average price of explicit carbon pricing schemes

G20 MEMBER	COVERAGE	EXPLICIT PRICE
Argentina	Low	Very low
Australia	None	n/a
Brazil	None	n/a
Canada	High	Sufficient
China	Medium	Very low
France	Medium	Sufficient
Germany	High	Low
India	None	n/a
Indonesia	None	n/a
Italy	Medium	Very low
Japan	High	Very low
Mexico	Medium	Very low
Russia	None	n/a
Saudi Arabia	None	n/a
South Africa	High	Very low
South Korea	High	Low
Turkey	None	n/a
UK	Medium	Sufficient
USA	Low	Low
EU	Medium	Sufficient

I4CE, 2022[116]

COVERAGE*

High	**>66%**
Medium	**33%– 66%**
Low	**<33%**
None	**0%**

EXPLICIT PRICE**

Sufficient	**>USD 40*****
Low	**USD 11–39**
Very low	**USD 1–10**

*Total GHG covered by a carbon price including EU ETS, national and subnational mechanisms.

**Price ranges in some countries based on sector or use type. For EU ETS countries, the prices listed are separate to the EU ETS price (last line of the table).

In some countries, such as South Korea, due to exemptions or extensive use of free allowances, the actual implicit price is much lower than the explicit price.

***The High-Level Commission on Carbon Prices concluded that the explicit carbon price level consistent with achieving the Paris Agreement temperature target is at least USD 40–80/tCO_2 by 2020 and USD 50–100/tCO_2 by 2030.

FOSSIL FUEL SUBSIDIES

Eliminate subsidies for production and consumption

Subsidies for fossil fuels – in the form of budgetary support and tax exemptions – encourage levels of production and consumption that are incompatible with climate goals. They also render renewables less competitive than they would otherwise be, thus providing a disincentive to invest in the technologies required to meet net zero.

In 2009, G20 members committed to "rationalise and phase out over the medium-term inefficient fossil fuel subsidies that encourage wasteful consumption".[117] However, progress has been limited. In 2020 alone, G20 members (excluding Saudi Arabia, for which the OECD inventory does not have data), provided at least USD 147bn in subsidies for coal, oil, and gas according to self-reported data, published by the OECD.

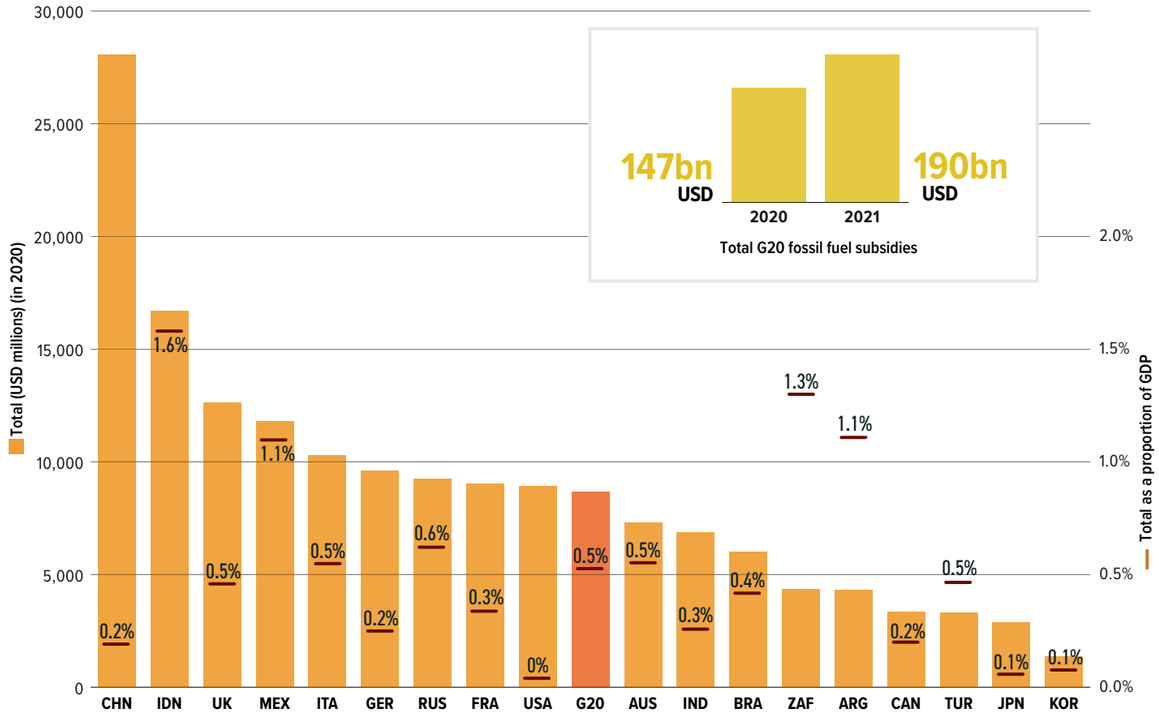
The drop in demand for fossil fuels caused by the COVID-19 pandemic meant that 2020 saw the lowest subsidy numbers of the past decade – despite the early adoption of new support measures in response to the pandemic. However, the eventual rebound of consumption levels, combined with rising oil and gas prices resulting from the escalation in energy prices later in the year, led to a large increase in fossil fuel subsidies in 2021 to USD 190bn.

This included the highest level of support to producers ever tracked by the OECD, at USD 64bn, partly reflecting the attempt to compensate for their losses due to low oil prices and levels of consumption the previous year, during the pandemic. These figures are likely to be underestimates, as transparency and reporting on subsidies remain a key challenge in most G20 members. While G20 members committed to doing joint peer reviews of each other's subsidies in 2013, only China-USA (2016), Germany-Mexico (2017), and Indonesia-Italy (2019) have completed them so far.

The historically high subsidy levels are likely to continue in 2022 due to increased support to consumers through energy price caps in Europe this winter – already implemented in France and being considered in the UK. The pandemic and the energy crisis have put pressure on governments and energy systems. The default response has been to try to shield consumers and producers from adverse effects by subsidising energy production as well as consumption, including through tax exemptions for state-owned fossil fuel and energy companies (such as in South Korea). But this continues to support fossil fuels and hinders the behavioural shifts required to improve efficiency and to invest in, and switch to, low-carbon alternatives.

HIGH LEVELS OF SUBSIDIES FOR FOSSIL FUEL CONSUMPTION AND PRODUCTION CONTINUED, EVEN DURING THE COVID-19 PANDEMIC

G20 fossil fuel subsidies



There is no comparative data for Saudi Arabia. According to a different ('price-gap') methodology used by the International Energy Agency (IEA), Saudi Arabia provided USD 17bn of subsidies to fossil fuel consumption in 2020.[118]

OECD-IEA Fossil Fuel Support Database, 2022[119]

PUBLIC FINANCE FOR ENERGY

End support for all fossil fuels

Besides fiscal policies, like budgetary support and tax exemptions, governments channel financing through public finance institutions, including national and multi-lateral development banks (MDBs) and export credit agencies. They do so by providing direct funding and encouraging private investments by lowering the cost of and risk for capital. Steering this financing away from high-carbon assets and towards appropriate adaptation and mitigation activities is crucial to aligning with the Paris Agreement's goals. During 2019–2020, however, G20 members provided USD 62.1bn/yr of public finance for fossil fuels, mainly oil and gas. The highest providers of public finance were Japan (USD 12.9bn/yr), South Korea (USD 10.2bn/yr), and China (USD 8.4bn/yr).

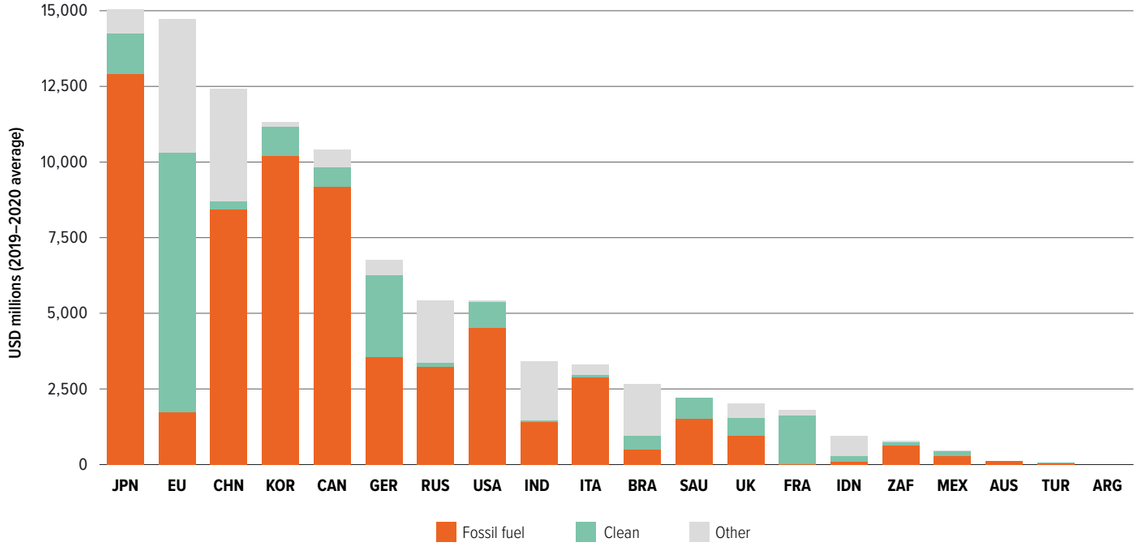
There has been some progress: MDBs and nationally-owned development banks have committed in recent years to mainstream climate considerations in their operations and lending. In 2021, G7 Members and South Korea committed to end overseas finance for unabated coal-fired power plants, and China committed to end coal financing overseas. At COP26, 39 countries and public finance institutions (including G20 members France, Germany, the UK, the USA, and the European Investment Bank) committed to end all use of public finance for international fossil fuel projects – a commitment which was affirmed by the G7 in May 2022.

Still, governments have not provided sufficient clarity around the "limited circumstances" in which financing for fossil fuels, in particular fossil gas investments, are being allowed, and such exceptions have increased considerably in light of the energy crisis. Not only does this fail to address the short-term challenges of the energy crisis, but it also risks making countries dependent on fossil gas for decades, another threat to the Paris Agreement's 1.5˚C warming limit.

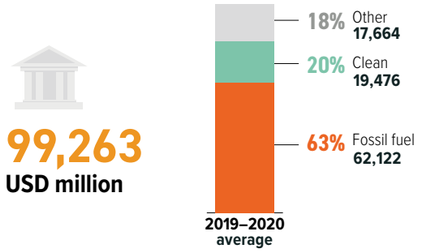
At the same time, G20 members have provided USD 19.5bn to clean energy projects and USD 17.7bn to non-fossil fuel projects, including transmission and other energy infrastructure, large-scale hydropower and nuclear. The EU – through the European Investment Bank and the European Bank for Reconstruction and Development – supplied by far the most public funding to these sectors, accounting for 44% of the funding for clean energy and 25% for other non-fossil-fuel projects. Germany and France were the next largest providers of public funding to clean energy, at USD 2.7bn and USD 1.6bn, respectively. However, roughly 70% of financing classified as "other" goes to transmission infrastructure, which supports a system that is currently heavily dependent on fossil fuels.

G20 PUBLIC FINANCE FOR ENERGY IS STILL HEAVILY SKEWED TOWARDS FOSSIL FUELS

Public finance for energy in the G20



Total G20 public finance



Oil Change International, 2022[120]

*For Argentina, Australia, Brazil, China, India, Indonesia, Mexico, Russia, South Africa, and Saudi Arabia, the available data is limited.

Clean: This includes solar, wind, tidal, geothermal, and small-scale hydro, as well as energy efficiency projects where the energy source(s) involved are not primarily fossil fuels.

Other: This includes large hydropower, biofuels, biomass, nuclear power and incineration, as well as energy efficiency projects where the mix of fossil fuels involved is unknown. More than 70% of the finance in this category is for transmission and distribution projects and other projects where the associated energy sources are unclear.

INTERNATIONAL CLIMATE FINANCE

Countries must contribute their fair share

Trillions of dollars are required to limit global warming to 1.5˚C, and currently no country is mobilising sufficient resources. At the COP15 in Copenhagen in 2009, an annual target was agreed, to jointly mobilise USD 100bn in mitigation and adaptation finance from 'developed countries' towards 'developing countries' by 2020 and up to 2025. But this target has never been met and has been widely criticised as inadequate.

The 'developed countries' are not officially defined, although they are customarily taken as those listed in Annex II to the UNFCCC, of which nine are members of the G20. Together, they reported an annual average international public support amount of USD 40bn between 2017–2018, according to the most recent UNFCCC Biennial Reports. This is almost a 30% increase from USD 31bn annually between 2015–2016. These figures include bilateral and regional climate finance, finance through multilateral climate change funds, and support to multilateral and bilateral institutions that parties cannot specify as climate-specific (e.g., MDBs and UN bodies).

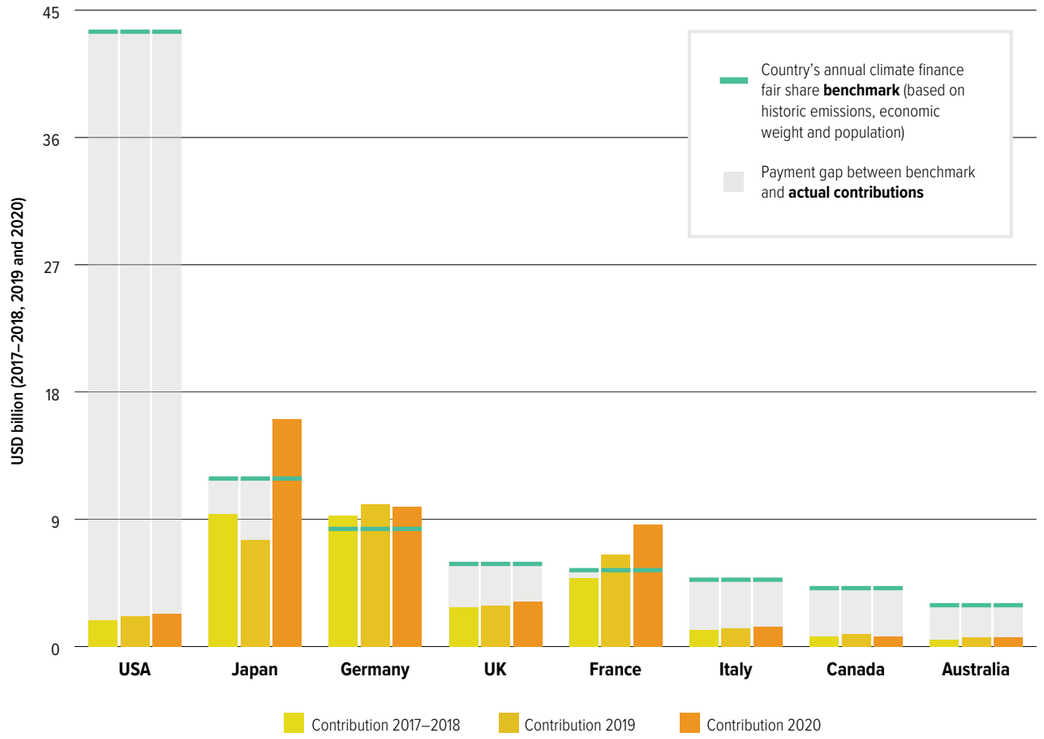
Of the G20 members, Japan is the largest contributor of climate finance, while at the same time being one of the higher financiers of fossil fuels internationally. Financing from Japan typically has a mitigation focus and lower concessionality than other contributors. Germany and France rank second and third.

No official method exists to apportion responsibility to individual Annex II countries for the USD 100bn target. The ODI Fair Share Report does so based on gross national income (GNI), cumulative territorial CO_2 emissions since 1990, and population size, using figures from the Biennial Reports to the UNFCCC for 2017–2018 and the climate-related finance reported to the OECD for 2019 and 2020.

Collectively, the Annex II G20 members should provide USD 87bn of the USD 100bn annual target. Individually, though, some – France, Japan, Germany – are paying more than their fair share, while others – Australia, Canada and the USA – consistently provide less than a third of theirs. The UK and Italy are also behind. The USA, the UK, Canada, Australia, and Italy combined should be responsible for providing USD 61bn, but collectively only provided USD 7.86bn and USD 8.35bn in 2019 and 2020, respectively.

ONLY 3 OF 8 COUNTRIES PROVIDE THEIR FAIR SHARE OF THE USD 100BN ANNUAL CLIMATE FINANCE GOAL

Progress towards G20 Annex II countries' fair share of the USD 100bn annual climate finance goal



Colenbrander, S. et al., 2022[121]

ENDNOTES

1 Chancel, L. (2021). *Climate Change and the Global Inequality in Carbon Emissions 1990 to 2020*.

2 Reuters. (2022). *Climate Change is Driving 2022 Extreme Heat and Flooding.* https://www.reuters.com/world/climate-change-is-driving-2022-extreme-heat-flooding-2022-06-28/

3 Clarke, B., Otto, F., Stuart-Smith, R. and Harrington, L. (2022). *Extreme Weather Impacts of Climate Change: An Attribution Perspective*.

4 IPCC. (2022). *Summary for Policymakers.* In: Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change.

5 UN Global Crisis Response Group on Food, Energy and Finance. (2022). *Global Impact of War in Ukraine: Energy Crisis*. https://news.un.org/pages/wp-content/uploads/2022/08/GCRG_3rd-Brief_Aug3_2022_FINAL.pdf

6 The World Bank. (2022b). *World Commodity Price Data (The Pink Sheet).* Washington D.C.: The World Bank. https://thedocs.worldbank.org/en/doc/5d903e848db1d1b83e0ec8f744e55570-0350012021/related/CMO-Historical-Data-Monthly.xlsx

7 See World Bank, 2022a.

8 Gourinchas, P.O. (2022). *Global Economic Growth Slows Amid Gloomy and More Uncertain Outlook*. https://blogs.imf.org/2022/07/26/global-economic-growth-slows-amid-gloomy-and-more-uncertain-outlook/

9 See IPCC, 2022.

10 Climate Action Tracker. (2022a). *Global Reaction to Energy Crisis Risks Zero Carbon Transition. Analysis of Government Responses to Russia's Invasion of Ukraine.* NewClimateInstitute and Climate Analytics. https://climateactiontracker.org/documents/1055/CAT_2022-06-08_Briefing_EnergyCrisisReaction.pdf

11 Bloomberg. (2022). UK Lifts Shale Gas Fracking Ban in Bid to Boost Fuel Supply. https://www.bloomberg.com/news/articles/2022-09-08/uk-lifts-ban-on-shale-gas-fracking-in-push-to-boost-fuel-supply?leadSource=uverify%20wall

12 Financial Times. (2022). *Canada's Oil Sands: Why Some of The World's Dirtiest Fuel Is Now in Hot Demand.* https://www.ft.com/content/276ecc11-15cd-45ef-8e10-5f64dcde77da

13 Modern Diplomacy. (2022). *The Messy Fate of Coal: War, Heat, and Instability Delay a Global Phaseout*. https://moderndiplomacy.eu/2022/07/27/the-messy-fate-of-coal-war-heat-and-instability-delay-a-global-phaseout/

14 The World Bank. (2022b). *State and Trends of Carbon Pricing 2022*. https://openknowledge.worldbank.org/handle/10986/37455

15 World Meteorological Organization (WMO). (2022). *2021: One of the Seven Warmest Years on Record, WMO Consolidated Data Shows.* https://public.wmo.int/en/media/press-release/2021-one-of-seven-warmest-years-record-wmo-consolidated-data-shows

16 IPCC. (2021). *Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*.

17 See IPCC, 2022.

18 See IPCC, 2022.

19 Enerdata. (2022). *Global Energy and CO2 Data*. https://www.enerdata.net/research

20 Gütschow, J. et al. (2021). *The PRIMAP-hist National Historical Emissions Time Series (1850-2018),* V.2.2. Zenodo open access repository. https://doi.org/10.5281/zenodo.4479172

21 Climate Action Tracker (CAT). (2022b). *Climate Action Tracker Country Assessments*. Climate Analytics, NewClimate Institute. https://climateactiontracker.org/countries/

22 See Enerdata, 2022.

23 Minx, J.C. et al. (2021). A Comprehensive and Synthetic Dataset for Global, Regional, and National Greenhouse Gas Emissions by Sector 1970–2018 With an Extension to 2019. *Earth Syst. Sci. Data*, 13: 5213–5252, https://doi.org/10.5194/essd-13-5213-2021.

24 United Nations Environment Programme (UNEP) and Climate and Clean Air Coalition. (2021). *Global Methane Assessment: Benefits and Costs of Mitigating Methane Emissions.* Nairobi.

25 See United Nations Environment Programme (UNEP) and Climate and Clean Air Coalition, 2021.

26 Climate and Clean Air Coalition. (2021). *Global Methane Pledge*. https://www.ccacoalition.org/en/resources/global-methane-pledge

27 Gütschow, J. et al. (2021). *The PRIMAPhist National Historical Emissions Time Series (1850-2018),* V.2.2. Zenodo Open Access Repository. https://doi.org/10.5281/zenodo.4479172

28 Climate Analytics, World Resources Institute. (2021). *Closing the Gap: The Impact of G20 Climate Commitments on Limiting Global Temperature Rise to 1.5°C*.

29 Ritchie, H. (2019). *Who Has Contributed Most to Global CO2 Emissions?* https://ourworldindata.org/contributed-most-global-co2

30 Climate Action Tracker. (2021). *Warming Projections Global Update, November 2021.* https://climateactiontracker.org/global/temperatures/

31 Climate Action Tracker. (2022a). *Climate Action Tracker Country Assessments*. https://climateactiontracker.org/countries/

32 Climate Action Tracker. (2022b). *CAT Climate Target Update Tracker.* https://climateactiontracker.org/climate-target-update-tracker/

33 Climate Analytics. (2021). *Climate Impact Explorer.* http://climate-impact-explorer.climateanalytics.org/

34 See Climate Action Tracker, 2022b.

35 IDDRI. (2021). *Le Plan National de Relance et de Résilience de la France est-il Climato-Compatible?* https://www.iddri.org/sites/default/files/PDF/Publications/Catalogue%20Iddri/Autre%20Publication/NOTE_PNRR%20FR.pdf

36 Climate Action Tracker. (2022c). *CAT Net Zero Target Evaluations*. https://climateactiontracker.org/global/cat-net-zero-target-evaluations/

37 World Weather Attribution (WWA). (2022) *Without Human-Caused Climate Change Temperatures of 40°C in the UK Would Have Been Extremely Unlikely.* https://www.worldweatherattribution.org/wp-content/uploads/UK-heat-scientific-report.pdf

38 World Weather Attribution (WWA). (2022) *Climate Change Made Devastating Early Heat in India and Pakistan 30 Times More Likely.* https://www.worldweatherattribution.org/wp-content/uploads/India_Pak-Heatwave-scientific-report.pdf

39 Lancet. (2022). *The Lancet Countdown Report 2022* with Climate Analytics analysis.

40 See IPCC, 2022.

41 World Meteorological Organization (WMO). (2022) "This Heatwave is the New Normal," says WMO Secretary-General. https://public.wmo.int/en/media/news/%E2%80%9C-heatwave-new-normal%E2%80%9D-says-wmo-secretary-general

42 Zuo, J., Pullen S., et al. (2015). *Impacts of Heatwaves and Corresponding Measures: A Review.* https://doi.org/10.1016/j.jclepro.2014.12.078

43 World Meteorological Organization (WMO). (2022). *United in Science*. https://public.wmo.int/en/resources/united_in_science

44 Romanello, M. et al. (2022). *The 2022 Report of The Lancet Countdown on Health and Climate Change.* https://www.thelancet.com/countdown-health-climate

45 Climate Action Tracker. (2021). *Warming Projections Global Update.* November 2021. https://climateactiontracker.org/global/temperatures/

46 NASA Earth Observatory. (2022). *Devastating Floods in Pakistan.* https://earthobservatory.nasa.gov/images/150279/devastating-floods-in-pakistan

47 Deutsche Welle. (2022). *Deutschland: Flut im Ahrtal – ein Jahr nach der Katastrophe*.

48 See Climate Analytics, 2021.

49 Statista. (2022). *Population of G20 Countries in 2021 and Projections for 2027.* https://www.statista.com/statistics/722968/g20-population-size/

50 United Nations Environment Programme (UNEP). (2021). *Adaptation Gap Report: The Gathering Storm – Adapting to Climate Change in a Post-Pandemic World.* Nairobi.

51 See United Nations Environment Programme (UNEP), 2021.

52 See United Nations Environment Programme (UNEP), 2021.

53 Climate Policy Initiative. (2021). *Global Landscape of Climate Finance 2021*. https://www.climatepolicyinitiative.org/publication/global-landscape-of-climate-finance-2021

54 See United Nations Environment Programme (UNEP), 2021.

55 See United Nations Environment Programme (UNEP), 2021.

56 International Energy Agency (IEA). (2021b). *Net Zero by 2050: A Roadmap for the Global Energy Sector.*

57 Koide, R., Lettenmeier, M., Akenji, L. et al. (2021). *Lifestyle Carbon Footprints and Changes in Lifestyles to Limit Global Warming to 1.5°C, and Ways Forward for Related Research.* Sustain. Sci. 16: 2087–2099. https://doi.org/10.1007/s11625-021-01018-6

58 International Renewable Energy Agency (IRENA). (2022). Renewable Power Generation Costs in 2021. Abu Dhabi.

59 See International Renewable Energy Agency (IRENA), 2022.

60 https://ec.europa.eu/commission/presscorner/detail/en/AC_22_4126

61 https://www.energy.gov/articles/biden-harris-administration-announces-425-million-expand-state-clean-energy-programs

62 See Enerdata, 2022.

63 See Enerdata, 2022.

64 Rogelj, J. et al. (2018). *Mitigation Pathways Compatible with 1.5°C in the Context of Sustainable Development*, in Masson-Delmotte, V. et al. (eds). Global Warming of 1.5°C. An IPCC Special Report on the Impacts of Global Warming of 1.5°C. https://www.ipcc.ch/.

65 Climate Action Tracker. (2020). *Paris Agreement Compatible Sectoral Benchmarks Study.* https://climateactiontracker.org/publications/paris-agreement-benchmarks/

66 Oil Change International. (2019). *Burning the Gas 'Bridge Fuel' Myth: Why Gas is Not Clean, Cheap, or Necessary.* http://priceofoil.org/2019/05/30/gas-is-not-a-bridge-fuel/

67 See Enerdata, 2022.

68 See Rogelj, J. et al., 2018.

69 See Enerdata, 2022.

70 See Climate Action Tracker, 2020.

71 See Rogelj, J. et al., 2018.

72 Global Alliance for Buildings and Construction, UNEP. (2021). *Decarbonising the Building Sector – 10 Key Measures.* https://globalabc.org/sites/default/files/2021-07/Decarbonizing%20the%20building%20sector.pdf

73 See Enerdata, 2022.

74 See Rogelj, J. et al., 2018.

75 Baumert, K.A. (2005). *Navigating the Numbers: Greenhouse as Data and International Climate Policy. World Resources Institute.* https://www.wri.org/research/navigating-numbers

76 Schenckery, M., Bollino, C.A., et al. (2020). *Adaptive Policy to Leverage Hydrogen in the Energy Transition*. https://www.g20-insights.org/policy_briefs/adaptive-policy-to-leverage-hydrogen-in-the-energy-transition/

77 See Enerdata, 2022.

78 See Rogelj, J. et al., 2018.

79 World Resources Institute, derived from the Harmonised World Soil Database. (n.d.) "Soil Organic Carbon". Accessed through Global Forest Watch Climate. https://www.globalforestwatch.org/topics/climate

80 Food and Agriculture Organization of the United Nations. (2022). Harmonised World Soil Database 1.2. https://www.fao.org/soils-portal/data-hub/soil-maps-and-databases/harmonized-world-soil-database-v12/en/

81 Global Forest Watch. (2021). *Brazil.* www.globalforestwatch.org

82 https://www.greenpeace.org/international/story/44273/climate-emergency-in-russian-forests-in-photos/

83 World Wildlife Fund (WWF). (2015). *WWF Living Forests Report: Saving Forests at Risk*. https://www.worldwildlife.org/publications/living-forests-report-chapter-5-saving-forests-at-risk

84 See Rogelj, J. et al., 2018.

85 Food and Agriculture Organization of the United Nations (FAO). (2021). *Emissions Totals: Agriculture*. http://www.fao.org/faostat/en/#data/GT

86 World Resources Institute (WRI). (2019). *Reducing Greenhouse Gas Emissions from Agricultural Production.* https://research.wri.org/wrr-food/course/reduce-greenhouse-gas-emissions-agricultural-production-synthesis

87 Gütschow, J. et al. (2021). *The PRIMAPhist National Historical Emissions Time Series (1850-2018), V.2.2.* Zenodo Open Access Repository. https://doi.org/10.5281/zenodo.4479172

88 See Climate and Clean Air Coalition, 2021.

89 Task Force on Climate-Related Financial Disclosures (TCFD). (2017). *Recommendations of the Task Force on Climate-Related Financial Disclosures*. https://www.fsb-tcfd.org/

90 Gouvernement de France. (2019). *Le Reporting Extra-Financier des Investisseurs. Ministères Écologie Énergie Territoires.* https://www.ecologie.gouv.fr/

91 Banco Central do Brasil. (2021). *New Regulation on Social, Environmental, and Climate-Related Risk Disclosures.* https://www.bcb.gov.br/content/about/legislation_norms_docs/BCB_Disclosure-GRSAC-Report.pdf

92 Federal Ministry of Finance. (2021). *Setting the Course for The Financial Sector: Climate Action and Sustainability as Core Themes.* https://bundesfinanzministerium.de/Web/DE/Home/home.html

93 European Commission. (n.d.). *Sustainability-Related Disclosure in The Financial Services Sector.* https://ec.europa.eu/info/business-economy-euro/banking-and-finance/sustainable-finance/sustainability-related-disclosure-financial-services-sector_en

94 Department for Business, Energy and Industrial Strategy et al. (2021). *UK to Enshrine Mandatory Climate Disclosures for Largest Companies in Law.* https://www.gov.uk/government/news/uk-to-enshrine-mandatory-climate-disclosures-for-largest-companies-in-law

95 Financial Services Commission. (2021). *Homepage.* https://www.fsc.go.kr/eng/index

96 Nikkei. (2021). *Japan to Require 4,000 Companies to Disclose Climate Risks.* https://asia.nikkei.com/Spotlight/Environment/Climate-Change/Japan-to-require-4-000-companies-to-disclose-climate-risks

97 See Task Force on Climate-Related Financial Disclosures (TCFD), 2017.

98 International Financial Reporting Standards Foundation (IFRS). (2022). *Path to Global Baseline: ISSB Outlines Actions Required to Deliver Global Baseline of Sustainability Disclosures.* https://www.ifrs.org/news-and-events/news/2022/05/issb-outlines-actions-required-to-deliver-global-baseline-of-sustainability-disclosures/

99 https://tnfd.global/about/the-tnfd-forum/

100 Reuters. (2022). *China Central Bank Warns of Default Risks after Climate Stress Test.* https://www.reuters.com/markets/commodities/china-cbank-warns-default-risks-after-climate-stress-test-2022-02-18/

101 European Central Bank (ECB). (2022). *ECB Launches 2022 Climate Risk Stress Test.* https://www.bankingsupervision.europa.eu/press/pr/date/2022/html/ssm.pr220127~bd20df4d3a.en.html

102 South African Reserve Bank. (2021). *Financial Stability Review, Second Edition 2021.* https://www.resbank.co.za/content/dam/sarb/publications/reviews/finstab-review/2021/financial-stability-review/second-edition-fsr/Second%20edition%202021%20Financial%20Stability%20Review.pdf.pdf

103 Bank of Korea. (2022). *Financial Stability Report (June 2021).* https://www.bok.or.kr/eng/bbs/E0000737/view.do?nttId=10066485&menuNo=400042&pageIndex=1

104 Bank of England. (2021). *Guidance for Participants of the 2021 Biennial Exploratory Scenario: Financial Risks from Climate Change.* https://www.bankofengland.co.uk/-/media/boe/files/stress-testing/2021/the-2021-biennial-exploratory-scenario-on-the-financial-risks-from-climate-change.pdf?la=en&hash=2E5CAECE75E701315B51B09303F99FCF8D21C8E2

105 Autorité de Contrôle Prudentiel et de Résolution. (2022). *La Gouvernance des Risques liés au Changement Climatique dans le Secteur de l'assurance.* https://acpr.banque-france.fr/la-gouvernance-des-risques-lies-au-changement-climatique-dans-le-secteur-de-lassurance

106 See Department for Business, Energy and Industrial Strategy et al., 2021.

107 See Autorité de Contrôle Prudentiel et de Résolution, 2022.

108 See Financial Services Commission, 2021.

109 See Nikkei, 2021.

110 See Banco Central do Brasil, 2021.

111 National Treasury Republic of South Africa et al. (2022). *South African Green Finance Taxonomy, 1st Edition.* https://sustainablefinanceinitiative.org.za/wp-content/downloads/SA-Green-Finance-Taxonomy-1st-Edition-Final-01-04-2022.pdf

112 Otoritas Jasa Keuangan. (2022). *Indonesia Green Taxonomy Edition 1.0, 2022.* https://www.ojk.go.id

113 European Union. (2021). *Proposal for a Regulation of the European Parliament and Council on the Establishment of a Carbon Border Adjustment Mechanism (CBAM).* https://www.euractiv.com/wp-content/uploads/sites/2/2021/06/CBAM-Regulation-Draft.pdf

114 See The World Bank, 2022b.

115 See The World Bank, 2022b.

116 I4CE. (2022). Data available upon request. https://www.i4ce.org/

117 G20. (2009). *G20 Leaders' Statement: The Pittsburgh Summit.*

118 See International Energy Agency (IEA), 2021a.

119 OECD-IEA. (2022). *Fossil Fuel Support Database.* http://www.oecd.org/fossil-fuels/data

120 Oil Change International. (2022). *Shift the Subsidies Database.* http://priceofoil.org/shift-the-subsidies

121 Colenbrander, S. et al. (2022). *A Fair Share of Climate Finance? An Appraisal of Past Performance, Future Pledges and Prospective Contributors.* https://cdn.odi.org/media/documentsA_fair_share_of_climate_finance.pdf

AUTHORS AND ACKNOWLEDGEMENTS

Summary Report Leads:
Sebastian Wegner, Florian Mersmann, Mariana Gutiérrez Grados (Berlin Governance Platform)

Country Profiles Lead:
Kim Coetzee (Climate Analytics)

Finance Leads:
Ipek Gençsü, Archie Gilmour (ODI)

Data preparation team:
Andreas Geiges (Lead), Himalaya Bir Shrestha, Marie-Charlotte Geffray, Diane Gedeon (intern), Sarah Schöngart (Climate Analytics); Jérémy Bonnefous, Thierry Badouard (Enerdata)

Contributing authors, expert comments and inputs:
Gerd Leipold, Zeina Abbas (Berlin Governance Platform); Chen Sha (Beijing University of Technology); Andrezj Ancygier, Anna Chapman, Kim Coetzee, Nandani Das, Diane Gedeon, Celeste Gonzalez, Neil Grant, Victor Maxwell, Sharna Nolan, Deborah Ramalope, Carley Reynolds, Claire Stockwell, Luka Vasilj (Climate Analytics); Surabi Menon (ClimateWorks Foundation); William Wills (Centro Clima, Federal University of Rio de Janeiro, Brazil); Chiara Di Mambro (ECCO climate, Italy); Andrew Marquard, Bryce McCall, Caitlin Bergh, Guy Cunliffe (Energy Systems Research Group, University of Cape Town, South Africa); Pascal Charriau (Enerdata); Jazmín Rocco Predassi, Daniela Keesler (Fundación Ambiente y Recursos Naturales, Argentina); Jan Burck, Thea Uhlich, Monica Tavares (Germanwatch, Germany); Jorge Villarreal, Analuz Presbítero (Iniciativa Climática de México, Mexico); Kentaro Tamura (Institute for Global Environmental Strategies, Japan); Fabby Tumiwa, Farah Vianda, Lisa Wijayani, Nasyaibachz Sila Sakti Suryadiyah Nurdin (Institute for Essential Service Reform, Indonesia); Lola Vallejo (Institute for Sustainable Development and International Relations, France); Ümit Sahin, Ayşe Ceren Sarı (Istanbul Policy Center, Turkey); Laetitia Pettinotti (ODI, United Kingdom); Joojin Kim, Gahee Han, Gyuri Cho (Solutions For Our Climate, South Korea); Suruchi Bhadwal, Manish Shrivastava, Pallavi Singh (The Energy and Resources Institute, India); Keisuke Iyadomi, Rachel Chi Kiu Mok (World Bank); Marion Fetet, Sébastien Postic, Adam Poupard (I4CE).

Design: Design for development (www.d4d.co.za)
Editor: Chapel Lane Editing Services: Tanya Goodman

www.climate-transparency.org