Climate Transparency

CLIMATE TRANSPARENCY REPORT

COMPARING G20 CLIMATE ACTION AND RESPONSES TO THE COVID-19 CRISIS

CORONAVIRUS RECOVERY

Includes 2020 emissions data and projections, analysis of stimulus responses, and insights for a Greener Recovery.

2020

ABOUT CLIMATE TRANSPARENCY AND THIS REPORT

14
PARTNERS

Our **global partnership** brings together experts from research organisations and NGOs in the majority of the G20 countries.

20
MAJOR ECONOMIES

Our mission is to **encourage ambitious climate action** in the G20 countries: we inform policy makers and stimulate national debate.

100
INDICATORS

Our Climate Transparency Report is the **world's most comprehensive annual review** of G20 climate action: we provide concise and comparable information on mitigation, finance and vulnerability.

Climate Transparency Report | 2020 consists of this summary report and an in-depth country profile for each of the G20 countries. The country profiles, as well as a technical note on data sources and methodology, can be found at:

www.climate-transparency.org

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FOREWORD BY THE CO-CHAIRS

In a moment of hope, the nations of the world came together in 2015 and committed to arresting catastrophic climate change, ending poverty, protecting the planet, and improving the prospects and lives of everyone, everywhere.

Now, five years since the landmark Paris Agreement and the adoption of the United Nations Sustainable Development Goals (SDGs), humankind is being called upon to honour these commitments and do what is necessary to ensure a more sustainable, equitable, and resilient future as it faces down the COVID-19 pandemic.

The Climate Transparency Report* constitutes this summary report and profiles for all G20 countries. It offers comparable and concise analysis of climate ambition and action across the G20. Independently developed within the international Climate Transparency partnership, the report enables learning across the G20 and offers insights into what can and must be done now to safeguard our common future.

In the 2020 edition of the annual Climate Transparency Report, the existential question of this moment is confronted – what choices need to be made today, in the context of an ongoing global pandemic and economic recession, to ensure that the world does not exceed the 1.5-2°C temperature limit and instead delivers on commitments for a better future for all.

In the first part of this report, "G20 Responses to the COVID-19 Crisis", the focus falls on what has happened in 2020: on the impacts of COVID-19 across G20 countries' emissions, economies, and societies, and the environmental implications of rescue and recovery responses. Looking forward, the G20 needs to prevent against emissions rebounding and growing and, rather, redirect investment and reinvigorate policies aimed at decarbonisation and sustainable transformation.

In the second part of this report, "G20 Climate Action Stocktake", the focus returns to trends and developments in G20 climate ambition and action, which are assessed against the goals of the Paris Agreement. Under the Paris Agreement "ambition mechanism", countries' Nationally Determined Contributions (NDC) to emissions reduction targets are expected to be updated every five years, to reflect a country's highest possible ambition. NDCs are due to be updated in 2020. This stocktake takes a deeper look at the status of vulnerability and adaptation across the G20, trends in and opportunities for greater emissions mitigation across key sectors, and progress on making financial flows consistent with climate-resilient development.

Encompassing the biggest economies, home to more than half the global population, and responsible for approximately three quarters of global Greenhouse Gas (GHG) emissions, the role of the G20 is central to achieving a global green recovery and catalysing more ambitious climate action.

What's new in this year's report?

- This edition of the Climate Transparency Report provides emissions projections and data for the current year, as well as **analysis of COVID-19 responses, stimulus measures, and recommendations for a greener recovery.**
- Insights from a new Climate Transparency series, the **NDC Transparency Check****, provide guidance on what information countries should provide to ensure that their NDC updates are clear, transparent, and understandable – in line with the requirements of the Paris Agreement.
- For the first time, the Climate Transparency Report includes **summary infographics** for each stocktake chapter, capturing the most important data, insights, and opportunities to increase G20 climate action.

Alvaro Umaña
Former Minister of Environment and Energy of Costa Rica and former Ambassador of Costa Rica to the United Nations Copenhagen Climate Change Conference

Peter Eigen
Founder and Chair of the Advisory Council of Transparency International and Co-Founder of the HUMBOLDT-VIADRINA Governance Platform

** Previously called the Brown to Green Report*
*** Find out more at https://www.climate-transparency.org/ndc-transparency-check*

EXECUTIVE SUMMARY

G20 COUNTRIES CAN USE A GREEN RECOVERY TO ADVANCE CLIMATE ACTION

In a time of uncertainty, the G20 can harness the opportunities of a green recovery to set course for a more resilient and sustainable future. In the five years since the adoption of the Paris Agreement, there have been many lessons – some hard and some hopeful. G20 members should heed these lessons as they make decisions that will shape our common future.

The 2020 edition of the Climate Transparency Report unpacks recent developments and longer-term trends, providing key insights into where and how to advance climate action, including through greening the recovery from the COVID-19 crisis.

2020 has exposed our vulnerability to intersecting crises

By the end of October 2020, 1.3 million lives have been lost to COVID-19. This number is still growing and would be much larger if the collateral effects of the pandemic were included.

G20 GDP is projected to decrease by around 4% in 2020, with devastating effects on many levels, exacerbating poverty, inequality, and unemployment. The decline in global GDP in 2020 could lead to an increase of 25 million people being unemployed, 100 million additional people living in poverty, and the number of people facing acute food insecurity doubling to 265 million.

The impacts of the COVID-19 pandemic have been compounded by other vulnerabilities, including exposure and capacity to respond to extreme climate and weather events such as record-breaking floods, heatwaves, and wild-fires in 2020, as well as political and economic turbulence.

Inequalities increase risks and impacts

G20 countries have responded by rolling out recovery packages, including fiscal stimulus measures that are unprecedented in terms of scale and speed. As of the middle of October 2020, announced economic stimulus packages across the G20 totalled USD 12.1tn, but there is an extreme divide in resources between countries.

Advanced economies have had more resources to respond to the crisis, evident in comparing per capita stimulus spending, which range from approximately USD 17,200 per capita in Japan to USD 6,500 in South Korea. By comparison, emerging economies range from around USD 1,000 per capita in Brazil to less than USD 200 in Indonesia.

Differences in vulnerability and resources to respond between G20 countries (and the rest of the world) underscores the need for greater international cooperation and support. It is in the interest of all countries to contribute to a robust and sustainable global recovery and to avoid global divergence.

Future resilience requires strong G20 leadership and immediate action on the climate crisis

In 2020, the G20 Saudi Arabian Presidency identified climate change as one of the most pressing challenges of the 21st century, noting that the urgency to act on climate change is growing, and that the G20 need to be at the forefront of necessary transitions.

The 2015 Paris Agreement set clear goals to strengthen the global response to the threat of climate change. Achieving the mitigation goal of limiting the global temperature increase to 1.5°C would reduce the risks and impacts of climate change and the costs of adaptation. To do so, global CO_2 emissions need to decrease by 45% by 2030 and reach net-zero by 2050. Deeper reductions are required among the biggest emitters and more advanced economies.

G20 energy-related CO_2 emissions are projected to decrease by 7.5% in 2020. This reduction appears to be temporary, mainly the result of the impacts of and responses to the COVID-19 pandemic. Without transformational climate action by countries, emissions growth will rebound and the goals of the Paris Agreement will not be reached.

Mid-century net-zero emissions targets are gaining ground in the G20

There is growing recognition that a fundamental, structural shift is required. The race to net-zero emissions among the G20 began in earnest between 2019 and 2020. In June 2019, France and the UK set net-zero targets for 2050, and by the end of the year the EU and Germany made similar

announcements. In 2020, Canada, China, South Africa, South Korea, and Japan joined in (with China aiming to be carbon-neutral before 2060).

More and more companies, regions, and cities are also making net-zero by 2050 commitments, such as Buenos Aires, Cape Town, London, Mexico City, New York City, and Tokyo. Political commitments need to make their way into enhanced NDC targets and long-term strategies – which are due to be updated in 2020 – and recovery packages.

Yet most current COVID-19 recovery packages are moving in the opposite direction

Approximately 30% of stimulus spending is going into environmentally-intensive sectors. Analysis of recovery packages in these sectors reveals that, by and large, G20 members are supporting emissions-intensive and environmentally-damaging industries with little consideration overall to the climate or improving resilience.

Comparing G20 stimulus responses thus far:

- 10 countries are providing support to the domestic coal sector and 10 provide support to the gas sector
- 9 countries are providing support to the oil sector
- 14 countries bailed out their national airline companies without conditions attached. Only France has included conditions in its bailout.
- 7 countries are providing unconditional support to the automobile industry. Only Germany and France are providing support with environmental conditions attached.

Nevertheless, 17 G20 countries (excluding Mexico, Russia, and Saudi Arabia) are providing some support to green industries, focusing mainly on the expansion of renewable energy capacities and low-emissions transport**.**

Greening COVID-19 responses can be used to align recovery with long-term goals

Five Green Recovery Principles can be used to chart a climate-smart way out of the crisis, while protecting and creating jobs, supporting economic growth, and increasing resilience. It is not too late to correct course, as programmes are still being rolled out.

1. G20 governments can **direct investment to sustainable infrastructure** to accelerate energy transitions, including to renewable energy, storage and transmission infrastructure, and zero-carbon transport and industry.
2. **Investments in nature-based solutions and the environment** offer opportunities for resilient job creation – especially for vulnerable rural populations. Key opportunities include landscape restoration, protection of forests and afforestation, and wildfire prevention as well as sustainable agricultural practices.
3. To support immediate employment and structural shifts to green industries, G20 members can **invest in education and R&D.** Efforts can go towards training for and innovation in zero-carbon energy and industry technologies and climate-resilient agriculture.
4. **Conditional bailouts** can protect jobs, deliver other public benefits, and bring companies in line with long-term climate commitments. Attaching conditions is particularly important where support is going to fossil fuel or other emissions-intensive industries.
5. G20 members can **reinforce policy, regulations, and incentives** to support a sustainable transition. Tax rebates, subsidies, and other incentives can be used to boost the renewable energy industry, zero-emissions transport, industrial efficiency, and environmental protection – while also boosting the economy.

In applying these principles, G20 members can build on recent climate action gains and advance efforts where progress is lacking by aligning recovery plans with medium- and long-term climate goals.

Positive shifts in energy emissions trends in the G20 show that climate policies work

Before the COVID-19 pandemic hit, the results of climate action in G20 countries were becoming visible in key areas. Significantly, G20 energy-related CO_2 emissions decreased by 0.1% in 2019. This represents a remarkable departure from the 1.9% increase in 2018 and the longer-term annual average growth rate of 1.4% between 2005 and 2017.

Progress in key sectors in the G20 contributed to this positive development in 2019:

- The carbon-intensity of primary energy supply decreased by 0.8%.
- Coal consumption decreased by 2%.
- CO_2 emissions from the power sector decreased by 2.4%.
- Renewables grew to 27% of power generation compared to 25% in 2018. (In 2020, renewables are projected to increase to 28% of power generation – showing the resilience and potential of the industry.)
- Energy-related CO_2 emissions from the agriculture sector decreased by 0.5%.

Policies can propel shifts toward zero-carbon economies:

- **Coal phase-out:** Canada, France, Germany, Italy, and the UK have set coal phase-out targets. Brazil, the EU, and China have policies to reduce coal consumption.
- **Restricting public finance for fossils:** 13 G20 countries have introduced policies to (partially) restrict public finance to coal. Only Brazil, France, and Germany have some restrictions in place for oil and gas.
- **Renewable energy targets:** 16 G20 members have policies to increase renewable generation (Australia, Canada, Mexico, and USA are the exceptions). Over the last five years, the emissions intensity of the power sector in the G20 has decreased by 10% and the share of renewables in power generation grew by 20%.
- **Building sector:** 18 G20 members (Argentina and Russia are the exceptions) have polices in place for near-zero energy new buildings. France, Italy, and Germany have 1.5°C compatible targets. 13 G20 members have some policies for retrofitting existing buildings, with the EU, Germany, and France having the most ambitious.
- **Carbon pricing:** 18 G20 countries are implementing explicit carbon pricing schemes (India and Australia are the exceptions), but price levels are not yet 1.5°C compatible.
- **Greening the financial sector:** 17 G20 members have initiated discussions or are already implementing some form of green finance principles through national green finance strategies or taxonomies of sustainable finance (India, Saudi Arabia, and South Korea are the exceptions).

All G20 countries now need to advance ambitious climate policies across sectors

Despite some positive developments, fossil fuels still accounted for 81.5% of primary energy supply in 2019, as increases in oil (+1%) and gas (+3%) consumption offset the decrease in coal consumption.

Many G20 countries are lacking effective targets and policies in key sectors. Progress in the transport, building, and industry sectors is lagging and many G20 members are still losing tree cover, diminishing critical carbon sinks.

- In 2019, CO_2 emissions from the transport sector grew by 1.5% (the same as in 2018 and the long-term trend between 2005-2017).
- CO_2 emissions from the building sector grew by 0.9% in 2019 (lower than the 3.2% increase in 2018 but higher than the long-term trend of +0.1% between 2015-2017).
- CO_2 emissions from the industry sector grew by 1.2% (higher than the 1% increase in 2018, but lower than the long-term trend of 1.7% between 2005-2017).

There are clear policy benchmarks to fill the gaps.

- **Fossil fuel subsidies should be phased out by 2025:** Despite political commitments to rationalise and phase out inefficient fossil fuel subsidies, G20 countries provided USD 130bn in subsidies to fossil fuels in 2019, up from USD 117bn in 2018.
- **The G20 can use modal shifting and fuel switching to decarbonise transport:** Only Canada, France, Japan, and the UK have set targets for fossil fuel car phase-out (the UK's target is 1.5°C compatible). No G20 members have policies in place to reduce absolute emissions from freight or long-term strategies to shift transport demand to low- or zero-emissions alternatives.
- **Decarbonising industry requires greater efficiency and innovation:** Most G20 countries do not score highly on industry efficiency policies. Apart from Italy, Japan, Germany, and India, most G20 countries do not have extensive energy efficiency policies in place for industry. Six G20 countries now have national hydrogen strategies.
- **(Net) zero deforestation targets:** No G20 countries have targets for reaching zero deforestation by the 2020s (1.5°C compatible), although China, the EU, and Mexico have targets for net-zero deforestation. Australia, France, and Canada have no policies in place.

The NDC updates, which are expected in 2020, offer a key opportunity to enhance overall ambition and set clear sectoral targets. Though parties to the Paris Agreement are obliged to provide NDC updates in 2020, some countries have indicated that they will only do so in 2021 ahead of COP26. This offers a decisive opening for parties to enhance their NDC updates to represent their highest possible ambition – as stipulated in the Paris Agreement.

Ambitious climate action is pivotal to a sustainable, equitable, and resilient future

G20 climate action can reinforce economic recovery and bring substantial co-benefits to support the UN Sustainable Development Goals (SDGs), amplifying the positive outcomes of stimulus spending in the long-term. Co-benefits of climate action include improvements to health and wellbeing, jobs and economic value creation, biodiversity and environmental resilience, financial security and fiscal benefits, and enhanced energy access and security.

Ultimately, greening COVID-19 recovery responses offers a unique opportunity for G20 countries to accelerate just, low-carbon transitions and to deliver on Paris Agreement goals – reducing vulnerability, limiting global warming, and bringing our economies in line with sustainable development.

PART 1

G20 RESPONSES TO THE COVID-19 CRISIS

"The post-Corona recovery packages can lead to a greener and more just world. Unfortunately, many do not live up to that aspiration. The Climate Transparency Report provides an excellent overview of the recovery programs with good examples as well as missed chances."

Joseph Stiglitz

A SUSTAINABLE GLOBAL RECOVERY IS IN THE INTEREST OF ALL

USA | A worker installs photovoltaic solar panels on the roof of a department store in New Jersey. Photo by Robert Nickelsberg/Getty Images

Photo of Joseph Stiglitz by Daniel Baud and the Sydney Opera House

Taken together, the events of 2020 have demonstrated the importance of working collectively to identify, manage and respond to global crises. It has also exposed the tenuousness of incremental progress and sounded a clear call to hasten efforts to build the equitable, inclusive, and sustainable future envisioned in the Paris Agreement and the UN SDGs. The window of opportunity to set a new course through decisive action is still open.

The novel coronavirus that caused the COVID-19 pandemic was first identified in the last days of December 2019. It quickly spread across borders and was declared a global pandemic by the World Health Organisation (WHO) on 11 March 2020.[1] By April 2020, it had brought much of the world to a virtual standstill.

Across countries, the lockdown, shelter-in-place, and stay-at-home orders dramatically changed the lives of people in unprecedented ways.[2] Capital cities and urban hubs around the world were vacated, roads and streets emptied, public transport stations and other critical infrastructure were minimally staffed and suddenly underutilised.

At the same time, health services and hospitals were urgently expanded and, in some cases, overflowed. Public and other resources were rerouted in ways unimaginable just months before, not only to health services but also to directly support citizens and companies suddenly grappling with a loss of income and security.

In many countries, the COVID-19 crisis coincided with, amplified, or sparked responses to structural economic and societal issues.[3] In others, extreme weather events – a harbinger of the environmental impacts we can expect with rising temperatures – intersected with the pandemic, affecting vulnerable populations particularly badly.[4]

The COVID-19 pandemic has exposed inequalities within and between countries when it comes to the pre-existing state of and access to healthcare, preparedness to respond to crises, the resilience of the economy, and the resources available to provide support and stimulate economic activity.[5]

The role of the state in identifying and managing risks, providing social protections, and facilitating international coordination has been brought into sharp focus.[6] So, too, has the potential for external shocks to wipe out hard-won progress when it comes to poverty, healthcare, education, employment, fiscal stability, and development.[7]

Compared with more advanced economies, emerging market and developing countries have limited fiscal space to address the crisis. This is having a large impact on debt levels and the fiscal situation in such countries. Much needed foreign direct investment (FDI) has also contracted. Global FDI is projected to decrease by 40% in 2020/21 and inflows to developing countries are expected to drop even more than the global average.[8] [9] A growing number of developing countries face the risk of sovereign debt crises and reduced fiscal resources could severely undermine the prospects of achieving the SDGs by 2030.[10] The decline in global GDP in 2020 could lead to an increase of 25 million people being unemployed, 100 million additional people living in poverty, and the number of people facing acute food insecurity doubling to 265 million.[11]

It is in the interest of all countries to contribute to a robust and sustainable global recovery and to avoid global divergence. To achieve this, developed countries will need to provide assistance to developing and emerging countries.[12] The still-unfolding response to COVID-19 – including how the biggest economic stimulus in recent history will be spent – offers G20 countries a unique chance to redirect and align policies in support of a properly planned and just transition to a prosperous, low-carbon economy.

IMPACTS OF THE COVID-19 CRISIS ON CO_2 EMISSIONS

A temporary decrease in emissions will not have a lasting impact on the climate. Sustained annual decreases toward net-zero emissions by 2050 are necessary to arrest global warming. Efforts to use recovery measures to accelerate the decoupling of economic activity and CO_2 emissions could help G20 countries to meet Paris Agreement goals.

Responses to the COVID-19 pandemic have had a dramatic effect on global anthropogenic CO_2 emissions in 2020 and are expected to result in the largest annual drop in recent history. A year-on-year decrease of between 4% and 9% is currently projected, much larger than the 1.4% decrease seen in the 2008/09 global financial crisis or any other

modern economic crisis.[13] In the G20, energy-related CO_2 emissions are projected to drop by around 7.5%.[14]

However, concentrations of CO_2 in the atmosphere continued to rise in 2020.[15] [16] If global emissions in 2020 decrease, for example, by 7.5% compared to 2019 levels, they will be almost 60% higher than in 1990 and equivalent to total emissions in 2011.[17] In other words, the world is still injecting CO_2 into the atmosphere.

Sustained annual decreases in total CO_2 emissions are necessary to keep within the carbon budget that remains to meet the global temperature goal of the Paris Agreement. To limit warming to 1.5°C above pre-industrial levels, global CO_2 emissions need to be reduced by 45% by 2030 (compared to 2010 levels) and reach net-zero by 2050.[18]

Global daily CO_2 emissions reductions resulting from responses to the COVID-19 pandemic seem to have already peaked in early April, when they fell to a level 17% lower than just one year before.[19] However, some countries' daily CO_2 emissions are already back to or exceeding 2019 levels.

For example, dramatic CO_2 emissions reductions were recorded in China in the first quarter of 2020, but the country was already approaching business-as-usual by the middle of March and surged past 2019 levels in May 2020.[20] In contrast, the USA, India, the EU, and the rest of the world witnessed their biggest reductions, thus far, in the second quarter of 2020. A more varied rebound in CO_2 emissions has followed across different countries, depending on factors such as their approaches to lockdown, the progression of the pandemic, underlying emissions profile, and the economic impacts of COVID-19. Towards the third quarter of 2020, daily CO_2 emissions remained lower than the previous year in most countries but were higher than they were under the initial lockdown.

A high degree of uncertainty remains regarding the course of the pandemic and recovery. Some projections forecast emissions continuing to grow at a lower rate, while others show an increase on previous rates, or even an overshoot of previous projections up to 2030.[21] Evidence suggests that COVID-19 recovery responses, thus far, have been disproportionately directed towards emissions-intensive and environmentally-damaging sectors.[22] This could contribute to emissions rebounding at a faster rate.

By the end of 2020, CO_2 emissions are projected to be lower in all G20 members compared to 2019, and approximately 7.5% lower across the G20.

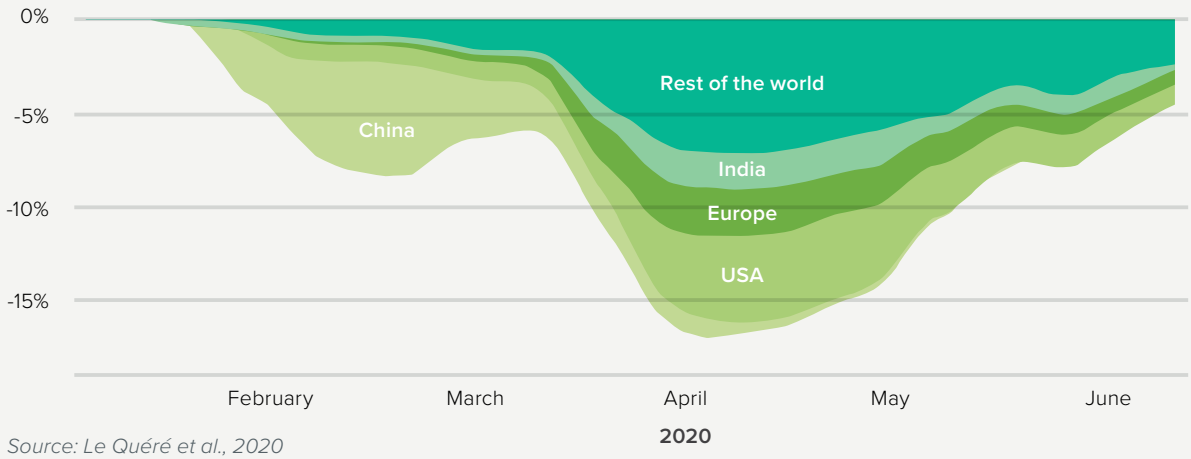
There are considerable differences in projected emissions reductions across countries – ranging from -2.7% in China to -12.3% in Mexico. The exact causes of differences will require further research and greater certainty on the final reductions. However, there may be some links to longer-term trends at play, in addition to the impacts of the pandemic and responses.

Mexico, the UK, and Germany are among the G20 members with the deepest CO_2 reductions in 2020. These countries also witnessed greater than average emissions reductions in key sectors in 2019, due in part to climate-related policies.

Mexico, the UK, and Germany witnessed greater than average reductions in the energy intensity of their

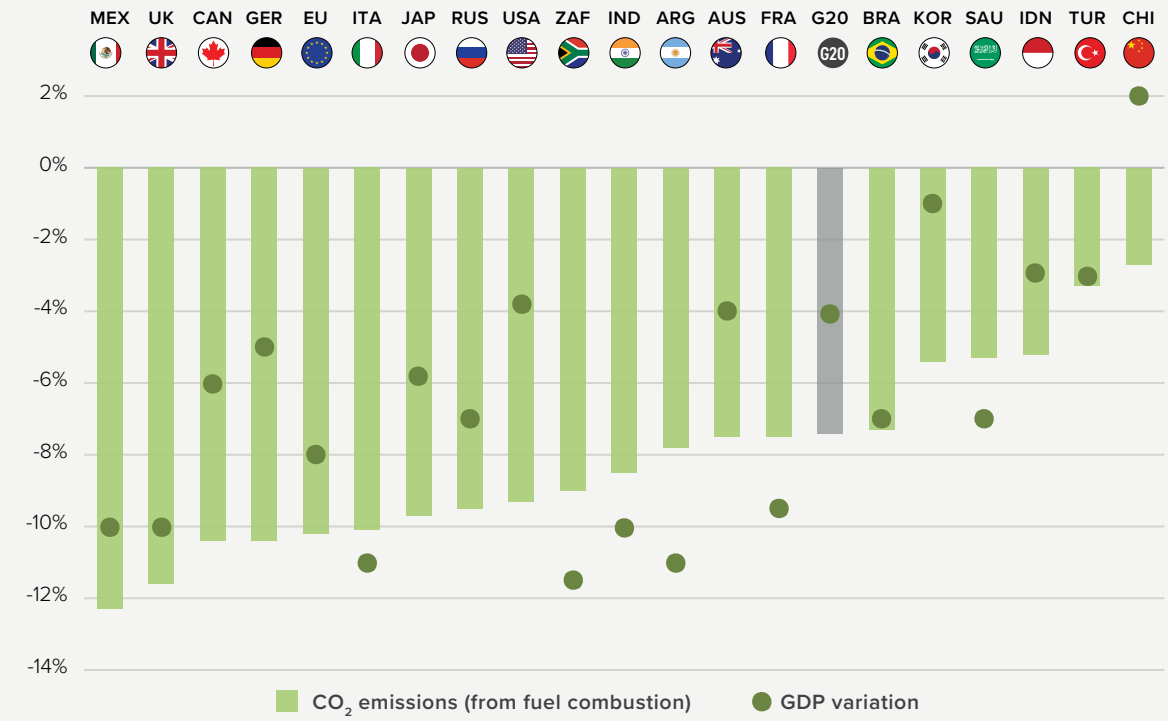
IN APRIL 2020 GLOBAL CO_2 EMISSIONS WERE 17% LOWER THAN IN 2019

% Change in global daily fossil CO_2 emissions (2020)



Source: Le Quéré et al., 2020

Projected % change in G20 GDP and energy-related CO_2 emissions (2020)



Source: Enerdata, 2020

economies between 2013 and 2018 (-18%, -16% and -12%, respectively). Germany and the UK also witnessed significant decreases in the emissions intensity of their power sectors over the past five years (-23% and -51%, respectively) and per capita emissions from the building sector (-17% and -27%, respectively). Compared to the G20 cohort, the UK and Germany have more ambitious policies for reducing emissions in power and building sectors. Mexico also recorded decreases in the emissions intensity of its power sector (-4%) and building sector (-6%) over the same period, although to a lesser degree than the UK and Germany. Mexico also has comparatively more ambitious policies in place for near-zero energy new buildings.

Turkey, Indonesia, and South Korea are among the five countries with comparatively smaller reductions in CO_2 emissions in 2020. These countries also witnessed above average growth in emissions in key sectors in 2019.

Between 2013 and 2018, G20 countries decreased the energy intensity of their economies by 11.6%. Turkey (+2%), South Korea (-4%), and Indonesia (-6%) were all behind this trend. Turkey and South Korea also registered high increases in per capita transport emissions between 2013 and 2018 (+38% and +14%, respectively) and do not have ambitious policies to decarbonise transport. Indonesia and South Korea recorded higher growth in building sector emissions per capita between 2014 and 2019 (+14% and +9%, respectively).

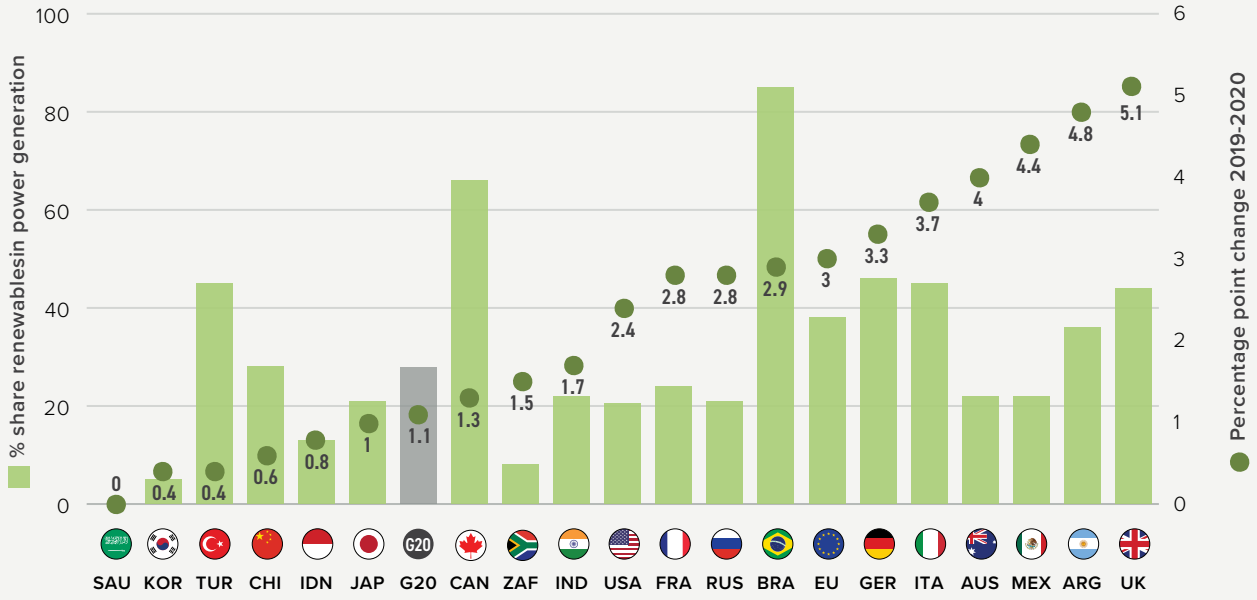
In conjunction with some parallels with longer-term trends, differences in governments' COVID-19 responses and underlying economic factors are likely to impact both 2020 GDP and CO_2 emissions reductions. In the cases of South Africa and Mexico, the deep decrease in GDP may also reveal the economic crises already underway in these countries ahead of – and compounded by – the COVID-19 pandemic.[23]

The share of renewables in power generation is projected to increase in all G20 countries in 2020.

One notable feature contributing to the decrease in CO_2 emissions is a projected increase in the share of renewables in power generation in all G20 countries in 2020 (in 2019, 18 G20 countries saw increases). Several factors may have caused this change: renewables being cheaper, preferential access for renewables, favourable hydrological conditions for hydroelectric power and a reduction of peak demand, which is typically met with gas. The gain in renewables is a signal of climate policies and economic factors at work in G20 countries.

RENEWABLES ARE PROJECTED TO INCREASE IN ALL G20 COUNTRIES IN 2020

Projected % share of renewables in power generation in the G20 and percentage point change (2020)



Source: Enerdata, 2020

Projected change in energy consumption and sectoral emissions in the G20 (2020)

	Energy consumption			% Changes in sectoral emissions	
	% Change final (Mtoe)	% Change primary (Mtoe)	% Change electricity (TWh)	Power sector	Transport sector
Argentina	-5.5%	-5.9%	-1.8%	-11.0%	-16.2%
Australia	-5.6%	-6.4%	-4.1%	-7.9%	-7.8%
Brazil	-4.8%	-11.0%	-3.1%	-16.1%	-7.3%
Canada	-8.9%	-4.8%	-5.8%	-13.5%	-9.2%
China	1.3%	-1.1%	1.9%	-0.1%	-4.3%
EU	-4.6%	-6.0%	-3.2%	-11.8%	-11.8%
France*	-7.9%	-5.0%	-3.9%	6.2%	-15.4%
Germany	-3.0%	-2.6%	-3.2%	-15.4%	-6.1%
India	-7.6%	-6.9%	-3.5%	-5.9%	-15.8%
Indonesia	-4.9%	-5.1%	-2.8%	-4.1%	-9.9%
Italy	-4.4%	-6.6%	-6.2%	-13.2%	-18.9%
Japan	-5.2%	-5.7%	-4.2%	-5.9%	-8.7%
Mexico	-11.5%	-8.6%	-6.8%	-9.6%	-16.8%
Russia	-4.6%	-6.0%	-3.8%	-9.1%	-9.5%
Saudi Arabia	-5.6%	-4.4%	-4.7%	-5.1%	-6.8%
South Africa	-9.7%	-7.7%	-6.6%	-7.9%	-16.5%
South Korea	-1.0%	-1.3%	-0.7%	-0.8%	-4.8%
Turkey	-1.2%	-3.9%	-2.9%	-6.3%	-2.9%
UK	-7.2%	-7.4%	-2.9%	-13.0%	-16.4%
USA	-8.2%	-7.2%	-1.9%	-7.3%	-10.7%
G20	-4.7%	-4.9%	-1.4%	-4.5%	-9.6%

Source: Enerdata, 2020

** Power sector emissions increased in France due to nuclear maintenance, increasing typically low fossil fuel generation slightly in 2020.*

COMPARING G20 RECOVERY PACKAGES

In the wake of immediate rescue measures, G20 governments have an opportunity to use economic and policy responses to the COVID-19 crisis to pave a path to a green recovery and sustainable development. By and large, G20 members have not yet used this opportunity. Instead, the majority are investing in existing or traditional infrastructure, with little consideration overall to decarbonisation or improving resilience in the long-term. But it is not too late to switch to a greener path, as programmes are still being rolled out.

Among the G20, the COVID-19 pandemic resulted in lockdowns of varying length and severity, and responses have included interrelated phases of rescue and recovery.[24]

Rescue measures typically encompass short-term stabilisation policies, such as providing economic relief, bolstering healthcare services, and offering immediate support and protection to individuals and companies confronted with a sudden loss of income and security. Recovery measures, on the other hand, typically focus on public investment responses that aim to prevent recession, stimulate demand, and recover economic growth and employment levels.[25] As such, recovery measures tend to take a longer-term view than rescue measures and can explicitly try to maximise the future value of present investment.[26]

The following analysis of G20 responses to the COVID-19 pandemic is informed by 2020 data and projections from Enerdata, as well as analysis from Vivid Economics' Greenness of Stimulus Index,[27] Carbon Brief's "Green Recovery" tracker,[28] the Energy Policy Tracker,[29] the Oxford Coronavirus Government Response Tracker,[30] and country reports.

Argentina

Argentina's economic response has focused primarily on rescue measures for the economy and healthcare system as well as support for vulnerable populations groups, workers, and businesses. Support for companies has not yet been made conditional on achieving environmental or climate objectives. Measures targeted at increasing commodity exports and fossil fuels have been introduced, and the government disbursed over USD 289m to companies already benefiting from the Unconventional Gas Plan. This amount is equivalent to the expenditure on all the public health equipment, laboratories and pharmaceuticals related to the pandemic.

Australia

The Australian fiscal package includes specific health spending, and support for households, workers, and businesses. The government has expressed its intention to pursue a "gas-led" recovery. Australia has provided unconditional support to coal, oil, and gas sectors and extended USD 437m in loans and tax deferrals to the airline industry. Some funding for clean energy has been provided, for example for hydrogen and battery storage, through the federal and state governments. In the state of Victoria, conservation laws in the logging industry have been suspended.

Brazil

A considerable proportion of Brazil's stimulus spending has gone to supporting the economically vulnerable, with approximately 60% of the population receiving financial aid (126 million people). The government has also provided economic support to the industrial and transport sectors, including the airline industry, without any environmental conditions attached. Meanwhile, deregulation in land use in the Amazon is likely to increase logging, mining, agriculture and forestry activities. Due to a decrease in energy demand, electricity auctions were postponed, which will likely benefit the gas sector. However, the government has announced financial mechanisms for green bonds for sustainable infrastructure, which are expected to attract up to USD 34bn by 2029.

Canada

The Canadian government has directed support towards the healthcare system, households, and businesses. In the energy sector, support for fossil fuels is stronger than for clean energy, and tax relief has been extended to the oil and gas sectors in Alberta. The gas sector will also benefit from extended export credit capacity. About USD 252m has been provided to the country's airports. However, the September Throne Speech emphasised green recovery measures and investments, including for renewable energy, afforestation, zero-carbon public transport, and building retrofits. An additional USD 530m was made available through the Emissions Reductions Fund to reduce the labour costs of upgrading methane monitoring and reduction technologies. Furthermore, recipients of support from the Large Employer Emergency Financing Facility will have to disclose annual climate-related reports, including assessments of future operations on sustainability and climate goals.

China

Thus far, China's economic recovery plan has not focused on climate change mitigation. Part of China's stimulus response included faster coal permit approvals, and project approvals for new coal power plants have accelerated in 2020, with an additional 40.8 GW approved.[31] The government also announced an unconditional USD 3.5bn bailout of Cathay Pacific airline as well as support for the automotive industry. Several provinces are assisting fossil fuel car manufacturers through subsidies for buyers. On the other hand, China launched its New Infrastructure Plan in June 2020, with USD 1.4tn-2.5tn directed to innovation, digitalisation, and modern infrastructure. It includes investments in renewable energy, high-speed and inner-city rail, and electric vehicle (EV) charging infrastructure.

EU

On top of initial rescue measures, in July 2020 EU leaders approved the "Next Generation EU" recovery plan totalling EUR 750bn. Roughly 30% of the package is dedicated to green measures in support of the EU Green Deal. Loans and grants to member states will have environmental conditions attached. One priority of the programme is to increase economic and social resilience. There are also plans for sustainable agriculture, which could have a major influence on land use. Of all G20 members, the EU package contains the strongest contribution towards environmental and climate objectives.

France

About 30% of the announced stimulus spending thus far in France will be directed toward an ecological and low-carbon transition, with savings of 57 $MtCO_2e$ expected over the investment lifetime. An addition EUR 30bn for green investments was announced in September 2020, including EUR 9bn for the development of a hydrogen industry and other green technologies, EUR 4.7bn for the state railways and EUR 6.7bn for improving insulation in homes and public buildings. Support for emissions-intensive (airlines and automotive) industries has also been made conditional on environmental and climate performance. For example, France supported the French-Dutch bailout of Air France-KLM with more than USD 7bn, but with the condition that the company reduces emissions by 50% and introduces a minimum standard of 2% renewable fuel by 2030. How these environmental conditions will be enforced in practice, however, has not yet been stipulated.

Germany

The initial German stimulus package focused on economic support to industries, healthcare, welfare, and vaccine R&D spending. An additional USD 45bn stimulus "Package for the Future" was announced in June 2020 includes measures to support the green transition in transport and energy as well as some support for green agriculture and industry. Significantly, buying electric and hybrid vehicles will be supported, whereas traditional vehicles will not. Major programmes have been announced for hydrogen technology, public transport, building efficiency and forestry. However, the government bailed out three airlines, TUI Fly (USD 1.98bn), Lufthansa (USD 9.9bn) and Condor (USD 600m) without environmental conditions, though it acquired a 20% stake in Lufthansa.

India

India's initial stimulus package focused on support for healthcare and welfare, but further measures have included significant support for fossil fuels, particularly promoting domestic coal production. However, India has since introduced measures to support renewable energy and green transport initiatives, such as the "Green Railway Initiative". India is also channelling USD 780m towards an afforestation programme through the Compensatory Afforestation Management and Planning Authority (CAMPA) fund. This plan is designed to stimulate the rural and semi-urban economy while providing essential ecosystem benefits.

Indonesia

The OECD projects a 3.3% GDP decrease in 2020, although the Asian Development Bank indicates a smaller decrease of 1%.[32] The Indonesian recovery package focuses on social protection, small and medium enterprises, jobs, and state-owned enterprises. The state-owned power company, PLN, and oil and gas company, Pertamina, continue to receive support in the form of subsidies as part of existing policies, while other state-owned enterprises received additional capital injections. However, some positive measures have also been announced, including subsidies for biodiesel fuel consumption and tax reductions for various renewable energy projects. Additionally, a planned relaxation of regulation for land use and forestry was repealed.

Italy

The Italian recovery programme has focused on healthcare, welfare and emergency support for businesses and contains only small contributions to a green recovery. While the Alitalia airline has received a EUR 3bn unconditional bailout, the government is providing a subsidy of up to EUR 10,000 per electric vehicle purchase until the end of 2020. Fossil fuel vehicle purchases will also be subsidised, though at a lower level. In addition, the government is providing support

to active transport and private installations of energy efficiency retrofits (such as heat pumps), solar photovoltaics, and electric vehicle charging points.

Japan

Japan's two stimulus packages include funding for healthcare, welfare, and employment protection as well as a large share for industry and transport sectors. Additionally, regulatory roll-back saw reduced environmental performance-based taxes on certain passenger cars. Building on the UNFCCC's "June Momentum for Climate Change", the government organised the "Online Platform for Sustainable and Resilient Recovery from COVID-19" to discuss a green recovery. However, few specific environmental measures have been announced in the stimulus packages thus far.

Mexico

Alongside healthcare and social programmes, a large proportion of the Mexican stimulus package is directed towards infrastructure investments, including a flagship oil refinery and airport expansion, plus tax breaks for Pemex, Mexico's state-owned oil company. Furthermore, the federal government has announced changes to market rules, which give priority to the government's own oil-fired power plants by adding barriers to wind and solar dispatch. However, support for active transport infrastructure is being advanced in some cities, although the national Sustainable Urban Mobility Strategy is underfunded.

Russia

The Russian recovery package primarily focuses on a tax holiday for businesses along with social payments for families and medical workers. No reference is made to measures that mitigate climate change. The government has supported airlines and airports (USD 500m) and the automotive industry (USD 360m) without conditions attached. Meanwhile, tax incentives for exploration in the Arctic and a temporary ban on imports of some fuels have further benefited the oil and gas industry.

Saudi Arabia

The Saudi-Russia oil price war and COVID-19 related drop in oil prices impacted Saudi Arabia especially hard and reduced government revenue. The government provided electricity subsidies for businesses in the commercial, industrial, and agricultural sectors (programme cost USD 240m), halving the price of petroleum domestically. Despite the pandemic, the National Renewable Energy Programme has moved forward with its second procurement round and is producing very low cost photovoltaic bids (USD 0.0162/kWh).

South Africa

The OECD projects a 11.5% GDP decrease in 2020, higher than the Ministry of Finance's 7.8% projection. A substantial stimulus programme has focused on the immediate response to the crisis with healthcare and welfare measures. Unfortunately, loan guarantees (USD 10.6bn) and certain tax measures (USD 3.7bn) have allotted specific support to businesses in South Africa's polluting energy and industry sectors and South African Airways will receive a USD 600n bailout. The government also initiated a three-month deferral of carbon tax payments.

South Korea

The South Korean government aims to provide USD 376bn to mitigate the pandemic's impacts, of which USD 63bn will go to South Korea's ambitious "Green New Deal". However, the Green New Deal is expected to reduce only 12.3 $MtCO_2e$ up to 2025, indicating that GHG emissions reduction is likely not the focus of the package. Furthermore, the government extended its 30% tax reduction for car manufacturers, which was supposed to end in 2020, and lowered the car sales tax from 5% to 1.5% for consumers. Additionally, USD 2.5bn was provided to airlines and USD 3bn to the largest producer of coal in South Korea.

Turkey

Turkey's COVID-19 recovery package focuses on healthcare, social protection, employment and economic stimulus with little to no reference to environmental or climate objectives. The package includes support for Turkish Airlines, a reduction of the VAT on domestic airline travel from 18% to 1%, and a bailout of the mining sector. A positive measure is the announcement of a "Green Tariff" for power from renewable sources and support for solar power.

UK

The UK recovery package has the intention of "building back greener". However, airlines (USD 2.2bn) and car manufacturers have received unconditional support. Nevertheless, the public transport operator TfL has been bailed out with USD 2bn, which is considered a green bailout. This is complemented with an increase in the congestion charge in London and promotion of active transport through investments in cycling and walking paths (USD 2.5bn). Energy efficiency is also being advanced, in particular in homes and public sector buildings (USD 3.7bn), while support for wind energy is being directed towards what will become the world's largest offshore wind farm.

USA

The large USA recovery package is focused on healthcare, welfare measures, payroll protection and direct support for businesses. In line with the present policy of the administration, no measures for climate protection are included. Airlines and cargo carriers received USD 60bn and airports an additional USD 10bn without any environmental conditions attached. The gas industry has also been afforded tax credits, and additional funding for coal has been made available through the Department of Energy. Amtrak, the national rail company, has also received support. Announcements of new environmental rules have been rolled back indefinitely, and the Environmental Protection Agency will be exercising "enforcement discretion" indefinitely through the pandemic. Positive environmental stimulus has been seen on a state level, however, with support for electric vehicles, public transport, offshore wind, and geothermal energy.

IMPACTS OF COVID-19 ON THE AVIATION SECTOR

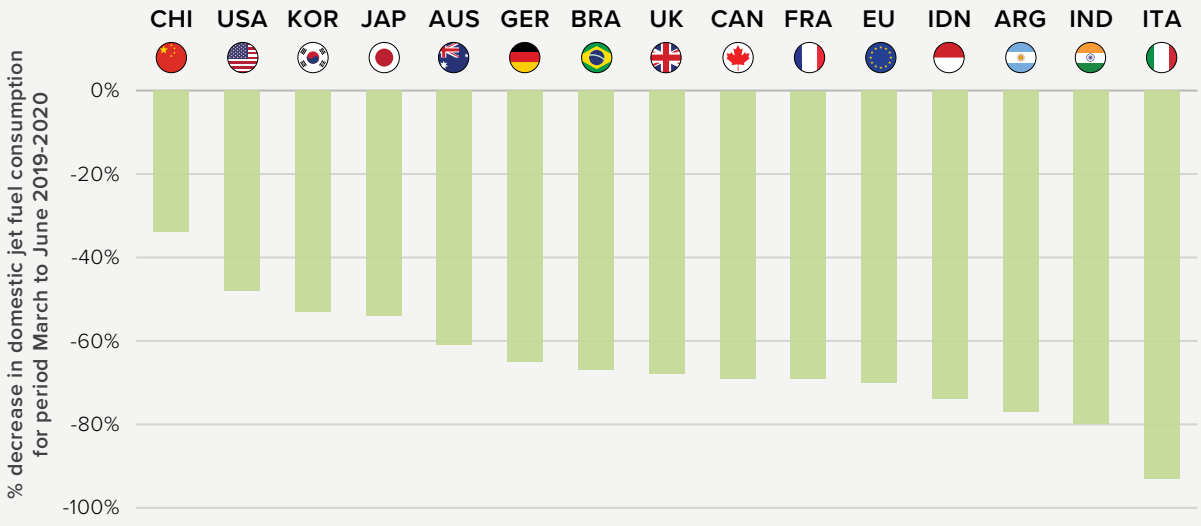
The pandemic has had an extreme impact on aviation demand, due in part to countries' use of travel bans as part of their COVID-19 responses. Domestic jet fuel consumption between March and June 2020 was dramatically lower than in the same period in the previous year. China, which was already loosening restrictions in March, still registered fuel consumption 34% lower than the previous year in this period. Apart from China and the USA (-48%), G20 members more than halved their consumption, typically by two thirds, and in the case of Italy by a staggering 93%.

Overall, airlines and airports have received at least USD 90bn in support. With the exception of France, support has been provided without conditions, although some countries provided targeted support for the development of cleaner fuels and increasing aircraft efficiency. G20 countries should take a long-term view of their air connectivity needs and commercial standing of airlines, and aid to the sector must be aligned with climate mitigation goals.[33]

It is unlikely that this industry will recover to previous growth rates (per capita emissions from aviation had grown 19% between 2012-2017 in the G20). Confidence in air travel will take time to recover and overall demand may decrease due to changes in norms when it comes to things like business or leisure travel.[34]

The support provided to airlines in G20 countries could be better directed to cleaner alternatives, which will probably be in greater demand in the future. International cooperation to reduce aviation emissions under the International Civil Aviation Organisation (ICAO) should remain a priority, including the advancement of the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA).[35]

% reduction in domestic jet fuel consumption in the period March to June (2020)



Source: Enerdata, 2020

CLIMATE IMPLICATIONS OF G20 RECOVERY RESPONSES

The trend of support for emissions-intensive and environmentally-damaging industries in COVID-19 stimulus packages risks climate crisis lock-in. Governments can and should redirect support to greener industries and attach conditionalities to encourage the low-carbon transition.

Governments across the world have responded to the COVID-19 economic crisis with financial packages that far outstrip the most recent comparable economic event – the 2008/09 recession.[36]

Vivid Economics' **Greenness of Stimulus Index (GSI)**[37] provides an overview of stimulus spending in all G20 countries and assesses the "greenness" of responses. A positive score indicates an overall environmentally-positive contribution, a negative score the opposite. The index is based on the scale of funds flowing into environmentally-intensive sectors, the existing green orientation of those sectors (baseline), and the efforts which steer stimulus toward (or away from) pro-environmental recovery.

The GSI offers insight into whether a country is using economic responses to the COVID-19 pandemic to reverse negative environmental trends, to build back better and greener – or not.

According to the GSI summary report, announced economic stimulus packages across the G20 totalled USD 12.1tn as at the middle of October 2020.

- USA, EU, Japan, and Germany account for more than 67% or USD 7.9tn.
- China, the UK, Italy, France, South Korea, and Canada account for a further 25% or USD 3tn.
- The remaining 10 economies account for only 8% of the stimulus spending or USD 966mn – despite having 47% of the G20 population, including countries like India, Indonesia, Brazil, Russia, and Mexico.

Of this amount, approximately USD 3.7tn or 30% will go directly to sectors that have a large and lasting (positive or negative) impact on the environment and climate change.[38]

In 16 out of the G20 members, the GSI score is negative. In other words, stimulus spending in environmentally relevant sectors seems to be leaning towards reinvigorating rather than reforming emissions-intensive, environmentally-damaging industries.

In assessing the G20 GSI scores, it is also important to consider levels of development, as well as the size and distribution of the stimulus support. Furthermore, the GSI score does not capture comparative effects of stimulus spending on the environment or climate from a global perspective, but rather the effect of a country's stimulus compared to its baseline environmental performance score.

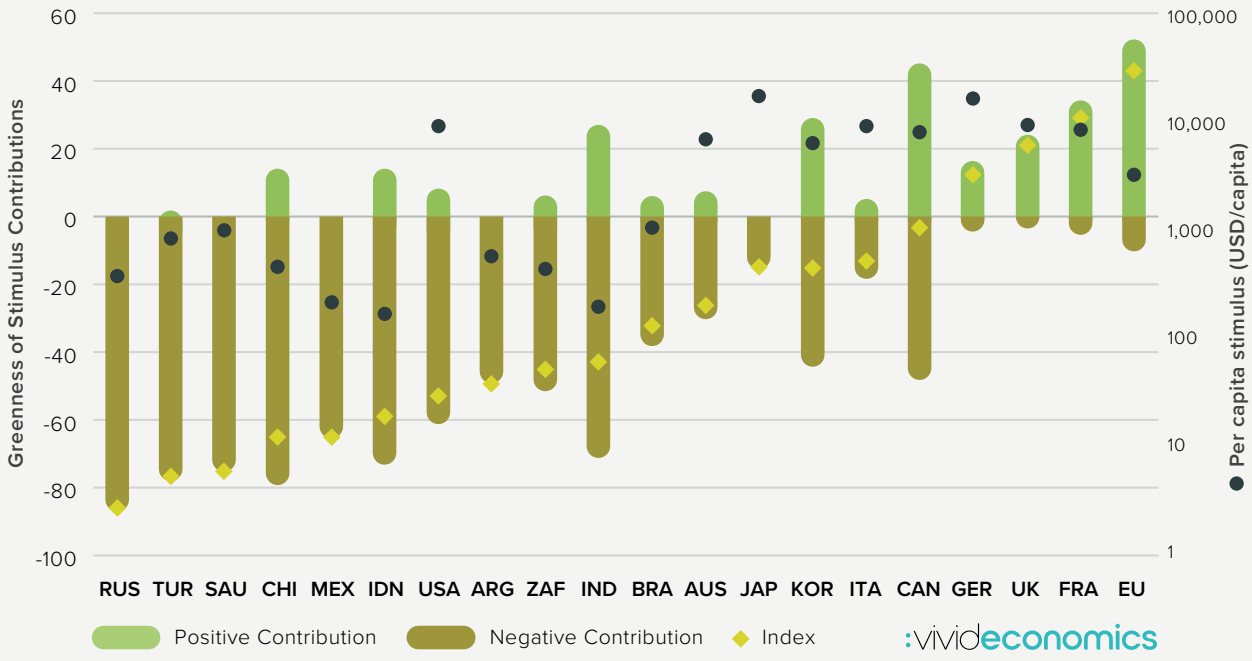
About 54% of total G20 stimulus support in the energy sector has been directed towards fossil fuels (as of the middle of October 2020).[39]

The **Energy Policy Tracker**[40] offers a complementary analysis of G20 stimulus responses, focusing on support that is flowing to the energy sector specifically. Like the GSI, the Energy Policy Tracker finds that governments have largely failed to use stimulus spending to support green energy industries. By the middle of October 2020, of a total commitment of USD 393.4bn of support to energy, 53.5% has been directed towards fossil fuels (86% of which has been provided without conditions for improved environmental action or performance). By energy type, the G20 has collectively committed USD 174.7bn to oil and gas and USD 16.2bn to coal.[41]

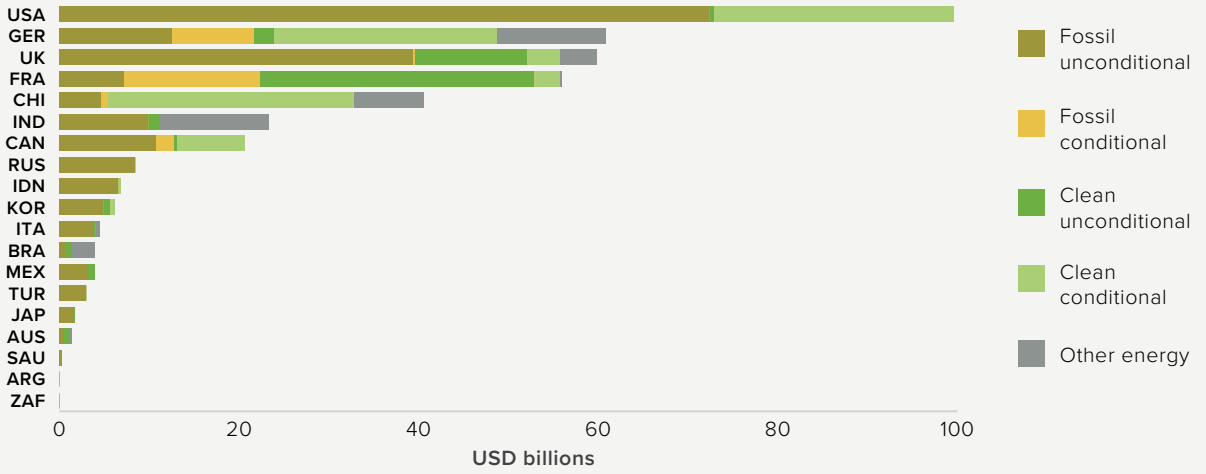
All countries have the opportunity to use COVID-19 responses to improve environmental performance. A greener recovery can protect sustainable development pathways and contribute to meeting climate goals. However, developed countries have more scope to do so and, within the context of the Paris Agreement, have greater responsibility to do so, too.

Current recovery responses are taking us in the wrong direction, but G20 countries still have the opportunity to realign with Paris Agreement and Sustainable Development Goals.

Greenness of Stimulus Index (October 2020)



Energy Policy Tracker: G20 fiscal support to energy sector (mid-October 2020)



INSIGHTS FOR A GREEN RECOVERY

A green recovery could help the G20 achieve the long-term goals of the Paris Agreement. Governments still have an opportunity to redirect stimulus spending and introduce complementary measures to make sure that public resources are used to support a just transition to a low-GHG emissions and climate-resilient future.

In analysing existing recovery responses, a set of principles is emerging that offer immediate and longer-term benefits for sustainable development and climate action. These principals can also contribute to protecting and creating jobs, furthering inclusive growth prospects, and increasing social and environmental resilience. While these principles focus on government actions (mainly at the national level), local government, businesses, communities, and individuals can also take action to support – and benefit from – a greener recovery.

There are many opportunities to capitalise on and build synergies between recovery and climate action. While COVID-19 recovery will be the top priority for most countries in the years to come, the science is clear that this decade will also determine whether we will avoid catastrophic climate change and the social, economic, and environmental crises it would bring about. G20 countries can use green recovery principles to build momentum to achieve the SDGs and Paris Agreement goals.

5 PRINCIPLES FOR A GREEN RECOVERY

The five principles identified here draw on the Climate Action Tracker's "Government roadmap for addressing the climate and post COVID-19 economic crises",[42] Vivid Economics' GSI, and the Smith School's "Net-Zero Emissions Economic Recovery from COVID-19" paper,[43] among other sources.

1 INVEST IN SUSTAINABLE PHYSICAL INFRASTRUCTURE

Direct investment in the form of loans or grants towards sustainable infrastructure can accelerate energy transitions in key sectors:

- **Power:** renewable energy (including solar, wind, biofuels, and green hydrogen in the energy sector), grid modernisation, digitalisation, and negative emissions technology
- **Transport:** active transport infrastructure, electric vehicle infrastructure and low-carbon public transport
- **Industrial:** uptake of efficient appliances, lighting, and digital devices
- **Building:** energy-efficient renovations and retrofits (such as improved insulation, heating, and domestic energy storage systems) and acceleration of zero-emissions buildings

2 INVEST IN NATURE-BASED SOLUTIONS & THE ENVIRONMENT

Land use investments offer opportunities for resilient job creation, especially for vulnerable, rural populations in areas such as:

- **Landscapes and Forestry:** landscape restoration, protection of existing forests and afforestation on degraded land, and wildfire prevention infrastructure
- **Agriculture:** sustainable agricultural practices, including efficient water irrigation systems

3 INVEST IN EDUCATION, RESEARCH & DEVELOPMENT

Investment in education can support immediate employment and support structural shifts in employment to sustainable industries, while Research and Development (R&D) spending can advance the growth of such industries.

- **Power:** solar, wind, storage, and green hydrogen technologies
- **Transport:** innovation in electric vehicle development and deployment, electric batteries, green hydrogen vehicles, low-carbon fuel alternatives and aviation improvements
- **Industry:** energy efficiency, low- or zero-carbon technologies and alternative materials in chemicals, cement, and steel and, for hard to abate sectors, carbon-negative emissions technology
- **Agriculture:** low water use and drought resistant crops

4 INTRODUCE CONDITIONALITY FOR GREENER BAILOUTS

Bailouts are a public investment, which can protect jobs and deliver other public benefits. Governments can use conditionality in bailouts to bring companies in line with long-term commitments to a sustainable, inclusive, and low-carbon future, by:

- Improving/investing in more **environmentally-friendly operations and procurement** procedures
- Enhancing required **disclosures and reporting**, especially on environmental impacts and climate risks
- Increasing **supply chain transparency**
- Supporting **sustainable job transitions** for workers
- Formulating explicit **climate/emissions commitments** and targets

5 REINFORCE POLICY, REGULATIONS, AND INCENTIVES FOR A SUSTAINABLE FUTURE

Governments can use this moment to support a sustainable transition alongside the COVID-19 response and should try to balance trade-offs to keep the pathway to long-term goals open in:

- **Energy:** tax rebates or subsidies for renewables, including tariff adjustments, fiscal reform on fossil fuel subsidies and introduction of fossil fuel/carbon taxes
- **Transport:** tax reductions, rebates, and financial incentives to support accelerated uptake of low-emission transport modes (including public transport and active transport) and electric vehicles (including heavy-duty vehicles, cars, scooters and bicycles)
- **Industry:** tax rebates for products meeting voluntary performance standards, including home appliances and lighting, levies for supporting renewable energy, and incentives for meeting energy-efficiency standards
- **Environment:** environmental protection regulation should be maintained or strengthened, not removed

CO-BENEFITS OF CLIMATE ACTION & A GREEN RECOVERY

The G20 needs to advance ambitious climate action to effectively adapt to and limit global warming. This will require significant transformation of members' economies and societies, but it is also an opportunity to build a better world. There are many ancillary benefits to and synergies between climate change policies and other important goals – including the SDGs. These additional benefits are known as co-benefits.

When it comes to recovering from the COVID-19 pandemic, building climate action into recovery strategies can amplify the long-term positive outcomes and co-benefits of stimulus spending. From investing in green technology and infrastructure, to supporting (re)education and research, or bolstering environmental policies, G20 members can utilise a green recovery to achieve a more sustainable, inclusive, and resilient future.

These are some of the co-benefits that can be expected or designed into climate policies and recovery responses:

IMPROVE PUBLIC HEALTH & WELL-BEING

Countries that implement mitigation and adaptation measures can also expect improved life expectancy and quality of life, less deaths related to pollution and lifestyle disease (e.g. respiratory illness or heart disease), and lower healthcare costs and other economic costs, such as lost working days.

Decreasing emissions: Decarbonising key sectors, introducing more ambitious environmental and air quality regulations, and providing cleaner energy alternatives to households improves air quality. Globally, financial co-benefits of improved air quality alone are estimated to equal approximately 75% of mitigation costs.[44]

Lifestyle changes: Greater use of public and active transport and dietary changes (less meat) contribute to healthier lifestyles and fewer health problems, while reducing individuals' carbon footprint.

Urban planning and green infrastructure: Public and active transport infrastructure, energy-efficient buildings, expansion of green spaces and resilience planning improve safety and quality of life in cities, including through reducing congestion and noise pollution as well as supporting biodiversity.

JOBS & LOCAL ECONOMIC VALUE CREATION

Governments that create strategies for investment, growth, and innovation in sustainable industries can use climate action to support economic growth and development, provide better and more jobs for citizens, and ease the transition for vulnerable and affected groups.

Investing in sustainable industry and infrastructure: Sustainable industry and infrastructure are growth industries that can support climate mitigation and adaptation, while creating jobs and offering high returns on investment. Increased climate action could trigger USD 26tn in investments and generate 65 million low-carbon jobs worldwide by 2030.[45]

Local economic value creation: Building innovation, localisation, and training elements into sustainable industry strategies (e.g. renewable energy, storage, smart grids, green hydrogen, bio agriculture) can not only support national mitigation efforts, but also improve economic conditions and opportunities at the local level. This is especially important in regions that will have to transition from fossil industries.

BIODIVERSITY & THE ENVIRONMENT

Countries can design environmental adaptation and mitigation interventions to be of benefit to indigenous and rural communities; improve the quality of water systems, food security, and other beneficial natural stocks (e.g. fish, soil nutrients); prevent soil erosion and desertification; enable sustainable tourism; and support biodiversity.[46]

Investment in and protection of the environment: Investing in nature-based solutions, sustainable agriculture, and conservation of critical resources (such as rain forests) is important for adapting to climate change and limiting global warming (carbon sinks). Biodiverse areas also provide important buffers against the effects of climate change and could decrease the occurrence of new vector-borne diseases.[47]

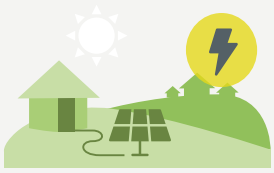
FINANCIAL SECURITY & FISCAL BENEFITS

Governments that align their financial systems with climate goals will also benefit from greater financial stability, improved financial planning, and more financial resources to direct towards social services or invest in sustainable alternatives, innovation, and development.

Preventing stranded assets: Economic shifts and policy changes may turn fossil fuel infrastructure into stranded assets – delaying action increases these risks. Building climate considerations into investment decisions today can support more financially resilient and smart investments in the future.

Subsidies and carbon pricing: Reducing subsidies to fossil fuel industries and introducing carbon pricing can increase critically needed government revenue. Pricing carbon and removing fossil fuel subsidies could generate an estimated USD 2.8tn in government revenues in 2030, more than the GDP of India today. [48]

Adapting and responding to climate hazards: Reducing the physical and financial risks that extreme weather and climate-related hazards pose to infrastructure and human systems is necessary to adapt to climate change. Doing so effectively will also increase financial security and support macroeconomic stability.



ENERGY ACCESS & SECURITY

Transitioning to low- or zero-carbon energy alternatives is in line with and can contribute to increased energy security and access and improve the resilience of energy systems.

Affordable energy access: Decarbonising the power sector is one of the most important mitigation opportunities, with positive follow-on effects for transport, industry and building sectors. Renewable energy has become the cheapest option for new power generation in most countries, offering (in some cases) an opportunity to decrease electricity prices in the future and, in many rural areas, provide electricity access where grid-access is not yet possible.

Energy security: Improving energy efficiency and phasing out fossil fuels will reduce security risks for countries who rely on fossil fuel imports, improving balance of payments and protecting countries from energy price volatility.

PART 2

G20 CLIMATE ACTION STOCKTAKE

Annual assessment of G20 members' progress on Paris Agreement goals, focusing on trends and developments in the three primary areas of climate action:

2020 MUST BE A TURNING POINT FOR CLIMATE ACTION

France | An official inspects oak saplings growing in Montmorency forest where century-old chestnut trees stand without leaves after three consecutive record droughts left them vulnerable to disease. Photo by Cyril Marcilhacy/Bloomberg via Getty Images

By the end of 2019, climate change was firmly on the international agenda due to renewed determination and focus generated by global climate protests and increasingly clearer calls from climate scientists.[49] **Anticipation was mounting for the first update of countries' NDCs, with updates expected to represent a progression on previous commitments and higher ambition. The first year of the new decade needed to be a definitive turning point for climate action. Early reports that the growth of energy-related CO_2 emissions had decreased in 2019 sparked hope that the effects of the Paris Agreement were beginning to show.**[50] **2020 was set to be – and needed to become – a landmark year for scaling up climate ambition and securing pathways to meaningful action.**

In Part 2 of this report, developments up to the end of 2019 are the primary focus, as well as analysis of longer-term trends and the urgency of responding to threats of climate change. It should be restated that the COVID-19 crisis has only added to this urgency. The pandemic has exposed the vulnerability of our economies and societies to major shocks and highlighted the need to increase climate resilience and redouble efforts to meet sustainable development commitments.

G20 countries now have an opportunity to take a hard look at where they were heading before the pandemic and use the tools of recovery to change course. Structural transformation is needed to strengthen security, sustainability, and equality. Concerted efforts to increase climate ambition and action today is crucial to meeting the goals of tomorrow.

The annual Climate Transparency Stocktake of G20 Climate Action is presented in three sections, corresponding to the three main goals of the Paris Agreement. These three goals are fundamental to achieving the aim of the Paris Agreement: to strengthen the global response to the threat of climate change in the context of sustainable development and efforts to eradicate poverty.[51]

All G20 members have ratified (and are thus parties to) the Paris Agreement, except Turkey. However, the United States withdrew from the Agreement – effective 4 November 2020. It is yet to be seen whether the election result will lead to the USA re-joining the Agreement.

Overall, this stocktake finds that the G20's climate ambition and action is behind what would be needed to achieve the Paris Agreement goals. However, progress is being made in key areas, demonstrating the potential for more ambitious climate action.

PARIS AGREEMENT GOALS

Adaptation: Addressing and reducing vulnerability to climate change

Goal 1: Increase the ability to adapt to the adverse impacts of climate change and foster climate resilience and low-GHG development, in a manner that does not threaten food production.

Mitigation: Reducing emissions to limit global temperature increase

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

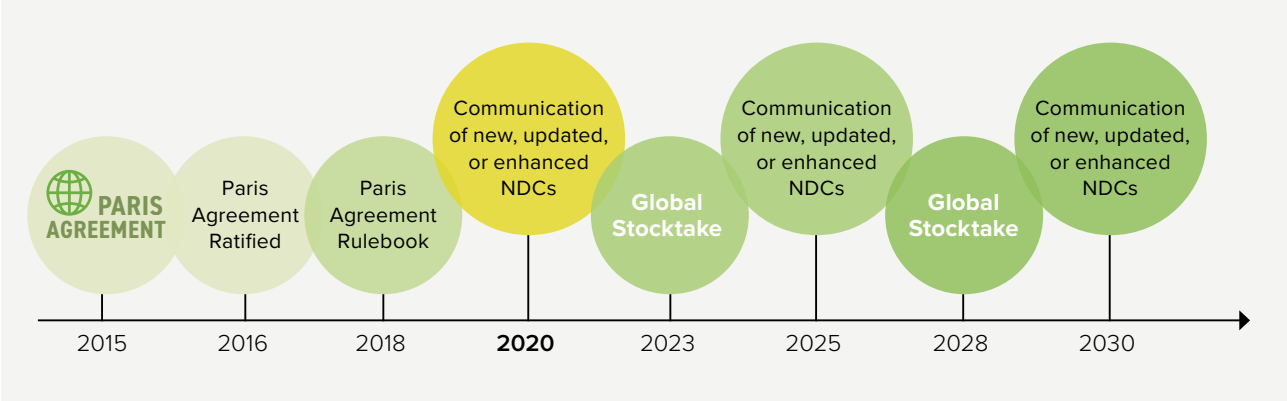
Finance: Making finance flows consistent with climate goals

Goal 3: Make finance flows consistent with a pathway towards low-GHG emissions and climate-resilient development.

THE G20'S NDC UPDATES

All parties to the Paris Agreement need to communicate their NDCs every five years, and successive NDCs should represent a progression beyond the previous and reflect each party's highest possible ambition.[52] NDCs define each party's mitigation contribution, goals for adaptation, and how to make finance flows consistent with these mitigation and adaptation goals.

In this way, the Paris Agreement has built in what is known as a "ratchet" or "ambition" mechanism, whereby climate ambition is scaled up at least every five years, although parties can adjust NDCs at any point to enhance ambition. Alongside the five-year NDC cycle, a Global Stocktake of the implementation of the Agreement will take place every five years – starting from 2023. The Global Stocktakes will be used to inform future NDC updates.



In 2015, countries submitted Intended Nationally Determined Contributions (INDCs) before the Paris Agreement was adopted, which became the first NDCs when the Paris Agreement was ratified. Together, these NDCs fell far short of the required level of ambition – with projected temperature increases under these commitments projected to exceed 2.7°C of warming by 2100.[53]

All G20 members that are party to the Paris Agreement should enhance the targets set out in their NDCs in 2020, to represent their highest possible ambition. As of October 2020, only Japan has submitted a new NDC – and without an increase in its target. Meanwhile, Australia, Russia, and Indonesia have communicated that they will not update targets.

In addition to updating targets, G20 members should provide additional information for clarity, transparency, and understanding. Transparent NDCs are necessary to provide a clear picture of the aggregate effect of countries' efforts and to hold countries and governments accountable for reaching emissions targets.

RECOMMENDATIONS FROM CLIMATE TRANSPARENCY'S NDC TRANSPARENCY CHECK

The NDC Transparency Check provides a robust methodology to assess whether the communication of parties is clear, transparent, and understandable in terms of the Paris Agreement.[54]

According to the Transparency Check, there are five key areas in which G20 members should make NDCs more transparent in their 2020 updates. G20 members need to:

1. **Provide a precise description of the target:** Provide more detailed information on the target itself, especially on how the land sector is included / excluded, and on the period of implementation.
2. **Address fairness and ambition:** Provide detailed information as to how the updated NDC comprises a fair and ambitious contribution to global efforts to mitigate climate change, and specifically how it is a) a progression on the last NDC, mitigation target or action, and b) will reflect the "highest possible ambition", taking into account common but differentiated responsibilities and respective capabilities.
3. **Make a clear link to Paris Agreement goals:** Provide information on a) how national mitigation efforts will contribute to the global temperature goal, b) when emissions are projected to peak (or have peaked), and c) make reference to a national policy goal of net-zero emissions.
4. **Detail planning processes:** Provide information on institutional arrangements for developing and implementing the NDC, including consultation processes that allow for public participation and engagement with local communities and indigenous peoples in a gender-responsive manner.
5. **Describe implementation plans:** Provide information on which policies and measures will be implemented to achieve the target.

2020 NDC UPDATES NEED TO ENHANCE MITIGATION TARGETS

	2015 NDC: Targets for 2030	CAT 'Fair-Share' Evaluation
Argentina	To not exceed a net emission of 483 $MtCO_2e$ (unconditional) and 369 $MtCO_2e$ (conditional) by 2030	Critically insufficient
Australia	To implement an economy-wide target to reduce GHG emissions by 26-28% below 2005 levels by 2030 (incl. LULUCF)	Insufficient
Brazil	To achieve a 37% GHG emissions reduction compared to 2005 by 2025 and a 43% reduction by 2030 (decarbonisation of the economy by the end of the century)	Insufficient
Canada	To reduce GHG emissions by 30% below 2005 levels by 2030	Insufficient
China	To achieve the peaking of CO_2 emissions before 2030, and make best efforts to peak earlier To lower CO_2 emissions per unit of GDP by 60-65% of the 2005 level by 2030 To increase non-fossil-fuel share of electricity to 20% by 2030 To increase forest stock volume by 4.5 billion cubic metres by 2030 compared to 2005	Highly insufficient
EU*	EU-wide target: At least 40% reduction in domestic GHG emissions by 2030 compared to 1990	Insufficient
France	EU-wide target: At least 40% reduction in domestic GHG emissions by 2030 compared to 1990	Insufficient
Germany	EU-wide target: At least 40% reduction in domestic GHG emissions by 2030 compared to 1990	Insufficient
India	To reduce the emissions intensity of GDP by 33-35% by 2030 from the 2005 level	2°C compatible
Indonesia	To unconditionally reduce 26% of its GHG emissions against the business-as-usual scenario by the year 2020 and 29% by the year 2030	Highly insufficient
Italy	EU-wide target: At least 40% reduction in domestic GHG emissions by 2030 compared to 1990	Insufficient
Japan	To achieve 26% emissions reductions by 2030 compared to 2013 (25.4% reduction compared to 2005)	Highly insufficient
Mexico	To unconditionally reduce 25% of GHG and short-lived climate pollutant emissions below business-as-usual by 2030. This commitment implies a reduction of 22% of GHG and a reduction of 51% of black carbon. Net emissions are to peak in 2026, and emissions intensity per unit of GDP will be reduced by around 40% from 2013 to 2030	Insufficient
Russia	To decrease emissions by 25-30% below 1990 levels (incl. land use) by 2030	Critically insufficient
Saudi Arabia	Annually abate up to 130 $MtCO_2e$ by 2030 through contributions that have co-benefits that diversify the economy and mitigate greenhouse gas emissions.	Critically insufficient
South Africa	To achieve emissions by 2025 and 2030 in a range between 398-614 $MtCO_2e$ (incl. land use), as defined in national policy	Highly insufficient
South Korea	To reduce its GHG emissions by 37% from the business-as-usual level (850.6 $MtCO_2e$) by 2030 across all economic sectors, equivalent to 20% below the 2010 level by 2030 (excl. LULUCF)	Highly insufficient
Turkey	To achieve a reduction in GHG emissions of up to 21% from business-as-usual level by 2030	Critically insufficient
UK	To reduce emissions by 57% below 1990 levels (national 2030 target not yet included in NDC)	Insufficient
USA	To achieve an economy-wide target of reducing GHG emissions by 26-28% below the 2005 level by 2025, and to make best efforts to reduce emissions by 28% (incl. land use)	Critically insufficient

The Climate Action Tracker (CAT) quantifies and evaluates climate change mitigation commitments and assess whether a government is doing its "fair share" compared with others towards the global effort to limit warming consistent with the Paris Agreement. Although there are no internationally agreed guidelines on what would constitute a fair level of contribution to the global effort, beyond the general understanding to reflect the "highest possible ambition" and "common but differentiated responsibilities and respective capabilities, in the light of different national circumstances" (Paris Agreement, Article 4.3), governments are expected to provide some justification of their proposed efforts. The CAT's analysis is based on published scientific literature regarding what a country's total contribution would need to be to make a fair contribution to implementing the Paris Agreement.

* *CAT ratings for France, Germany, and Italy refer to the 2015 EU NDC, to which all EU countries committed. Having left the EU, the CAT rating for the UK is based on its national target.*

ADAPTATION

ADDRESSING AND REDUCING VULNERABILITY TO CLIMATE CHANGE

"The consequences of climate change can already be felt. We need to prepare and take decisive action now. The Climate Transparency Report names adaptation measures that are needed and what countries should include in their plans."

Christiana Figueres, Founding Partner, Global Optimism and former Executive Secretary, UNFCCC

India | A farmer prepares a drip irrigation line in a field in Kempalinganapura, Karnataka. Photo by Prashanth Vishwanathan/Bloomberg via Getty Images.

1.5°C BENCHMARKS FOR ADAPTING TO CLIMATE CHANGE

1.5°C compatible mitigation and adaptation actions will require strengthened global-to-local financial architecture that enables **greater access to finance and technology.**

While **adaptation finance has increased** quantitatively, significant further expansion would be needed to adapt to 1.5°C.

Sustainable development strategies can enable transformational adaptation for a 1.5°C warmer world.

Source: Own evaluation based on IPCC SR15

G20 VULNERABILITY TO CLIMATE CHANGE

The annual global temperature in 2019 was 1.1°C warmer than pre-industrial levels (1850-1900), the second hottest year on record.[55]

Global warming leads to changes in the frequency, intensity, duration, and timing of extreme weather events.[56] According to NASA, the last decade (2010-2019) was the hottest ever recorded – with the past five years all being the warmest in 140 years.[57] The annual mean global temperature is likely to be at least 1°C above pre-industrial levels in each of the coming five years (2020-2024), and there is a 20% chance that it will exceed 1.5°C in at least one year.[58]

In many regions, warming greater than the global average is already being experienced, including temperatures two to three times higher than average in the Arctic.[59] Regional differences in the climatic impacts of global warming – mean temperatures, extreme weather, and the probability of drought – interact with other differences, such as levels of development, and affect the vulnerability and adaptation needs of countries and regions.[60] Small island states, low income and developing countries are typically more vulnerable to climate change. However, the effects of climate change will be – and already are being – felt everywhere.

In 2019 and 2020, extreme climatic and weather-related events have brought about high economic and human costs. Although it can be difficult to attribute a discrete event to anthropogenic climate change, research in attribution is finding that extreme events, such as wildfires, heatwaves, droughts and heavy rains, are made more likely by human-caused climate change.[61] [62]

Climate change is already influencing fire seasons around the world, which are linked with higher temperatures and lower levels of rainfall.[63] [64] [65]

- Australian wildfires burnt more than 9m hectares, destroyed over 3,000 houses, and killed 33 people in 2019/2020. Record-breaking temperatures and extremely low rainfall contributed to the unprecedented impacts of the wildfires, at an estimated cost of USD 15bn to the economy.[66]
- By September 2020, fires in the United States had damaged or destroyed more than 16,000 structures, killed 30 people, and forced tens of thousands of people to flee their homes.[67]
- In 2020, Argentina's wetlands experienced the worst fires in over a decade, exacerbated by low water levels and some of the driest conditions since 2008.[68]
- Brazil's Pantanal, the world's largest wetland, is experiencing a drought and the worst wildfires in 15 years.[69]
- Russia has now experienced consecutive years of widespread wildfires, with around half of 2020's fires burning through areas with peat soil.[70] Peat fires can burn longer than forest fires and release vast amounts of carbon into the atmosphere.

Climate change is linked with more severe heatwaves, rainfall, and other weather events.[71]

- In 2019, two intense heatwaves set records in Europe in June and July and lead to an excess mortality of 2,500.[72]
- The 2019 Indian monsoon season rains were 10% above the annual average, contributing to flooding, killing 2,000 people and causing USD 10bn in damage.[73]
- In 2019, typhoon Hagibis caused extreme flooding in Japan, killing 98 people and causing over USD 15bn in damage. Earlier in the year, typhoon Faxai led to USD 7bn in damages.[74]
- In 2020, South Korea experienced the longest monsoon season on record (54 days). Damage from torrential rains, flooding, and landslides resulted in dozens of deaths and economic losses for thousands of people.[75]

Extreme weather events: Resulting fatalities and economic losses in G20 countries

FATALITIES

RANKING IN THE G20		Fatalities: 1999-2018 Annual average	Annual average per million
1	Russia	2,939	20.3
2	France	1,122	18.1
3	Italy	997	16.9
4	Germany	537	6.6
5	India	2,925	2.5

RANKING IN THE G20		Fatalities in 2018
1	India	2,081
2	Japan	1,282
3	Germany	1,246
4	China	378
5	United States	343

ECONOMIC LOSSES

RANKING IN THE G20		Economic losses: 1999-2018 Annual average USD million (PPP)	Annual average per unit GDP (%)
1	United States	51,580	0.35
2	India	14,009	0.26
3	China	35,272	0.25
4	Australia	2,431	0.25
5	Mexico	3,002	0.17

RANKING IN THE G20		Losses in 2018 USD million (PPP)
1	United States	80,081
2	India	37,807
3	Japan	35,839
4	China	28,887
5	Argentina	6,069

Source: Germanwatch – Global Climate Risk Index 2020

Taking a longer perspective, between 1999 and 2018 almost 500,000 people died worldwide as a direct result of extreme weather events and economic losses of nearly USD 3.5tn were incurred.[76]

Across the G20, approximately 11,000 people died annually from extreme weather events over the same period, and economic losses averaged USD 130bn per year.[77] These numbers would be much higher if other impacts, such as sea level rise and air pollution, were considered.

However, these averages do not capture the concentrated or cumulative effects of extreme weather events in a single year. For example, Japan lost 139 lives a year on average to extreme weather events between 1999 and 2018. Yet, in 2018 alone, 1,282 people lost their lives due to extreme rainfall, heatwaves, and typhoons in Japan.[78]

Incidents can also affect vulnerability to future weather and climate events, by altering resilience, capacity to cope, and capacity to adapt.[79] The cumulative effects and shorter time periods between such events can reduce the ability or resources available to prepare for and respond to oncoming crises.

Even if the world manages to arrest global warming at 1.5°C, G20 countries will still need to invest very heavily in adaptation to reduce vulnerability and minimise the human, economic, and social costs of climate change. At 1.5°C, most G20 countries can expect increased water scarcity and drought; longer, more frequent, and more extreme heatwaves; and more variable and less favourable agricultural conditions for key staple foods like maize, rice, soybean, and wheat.

Some G20 countries may be exposed to greater than average weather- and climate-related impacts at 1.5°C, compared to global projections*.

- Australia, Brazil, France, Italy, Mexico, and Turkey will likely be exposed to severe **water scarcity or droughts.** Up to 40% of Brazil (by area) will battle with increased water scarcity, and drought conditions could be experienced 17% of the time – similar to projected global impacts at 3°C of warming.
- Brazil may also have considerably more frequent **heatwaves**, along with Indonesia. It is expected that Australia, India, Mexico, Saudi Arabia, and South Africa will have many more days with **extreme temperatures**. In countries without widespread cooling infrastructure, such as South Africa, extreme temperatures could cause fatalities.

** Based on Arnell, 2019 and Climate Analytics analysis*

GLOBAL IMPACTS OF CLIMATE CHANGE ARE SIGNIFICANTLY HIGHER AT TEMPERATURES OVER 1.5°C

	Baseline: 1981-2010	0.6°C	1.5°C	2°C	3°C
WATER SHORTAGES	% area with increased water scarcity	0	9	15	25
	% time in drought conditions	7	10	13	17
HEAT AND HEALTH	Heatwave frequency % likelihood	33	74	87	97
	Major heatwave frequency % likelihood	5	28	49	79
	Heatwave duration average annual days	2	6	12	37
MAIZE	Reduction in crop duration (days)	0	-7	-10	-15
	Damaging hot spell frequency % likelihood	6	12	18	35
	Reduction in rainfall % likelihood	15	16	18	20
RICE	Reduction in crop duration (days)	0	-5	-7	-12
	Damaging hot spell frequency % likelihood	27	32	35	40
	Reduction in rainfall % likelihood	14	14	15	16
SOYBEAN	Reduction in crop duration (days)	0	-7	-11	-17
	Damaging hot spell frequency % likelihood	1	2	3	5
	Reduction in rainfall % likelihood	14	13	12	12
WHEAT	Reduction in crop duration (days)	0	-7	-11	-18
	Damaging hot spell frequency % likelihood	21	28	34	46
	Reduction in rainfall % likelihood	14	14	15	17

Source: Arnell, 2019

- When it comes to **agricultural impacts**, most G20 countries could experience a reduction in crop duration, reduced rainfall, and an increase in damaging hot spells for key crops, with impacts for local and global food security.

The current needs for adaptation are already significant. Greater levels of mitigation must be pursued to avoid additional adaptation needs and costs. Ultimately, adaptation and mitigation are complementary strategies – and both must be ramped up to manage the risks of climate change.[80] Limiting warming to 1.5°C will help to ensure that adaptation needs remain within manageable bounds; higher levels of warming will cross into magnitudes of change for which adaptation is increasingly difficult.

G20 ADAPTATION PLANS AND STRATEGIES

All G20 countries have adaptation plans, except for Saudi Arabia. Adaptation plans are critical to reducing the impacts of climate change and to achieving key SDGs – such as zero poverty, zero hunger, good health and well-being, and sustainable cities and communities.[81] Adaptation can also bring significant economic, social, and environmental co-benefits.

Significant resources will be required to implement adaptation plans and to increase support to developing countries. Further efforts are needed to meet the Paris goal of increasing the ability to adapt to the adverse effects of climate change and foster climate resilience and low-GHG development.

The cost of adapting to climate change in developing countries could rise to between USD 140bn-300bn by 2030, and USD 280bn-500bn per year by 2050.[83] Adaptation costs are set to increase over time, even if temperatures are held to 2°C by 2100. Adaptation costs will be even higher if the Paris Agreement temperature goal is not met.

NATIONAL ADAPTATION STRATEGIES OF G20 COUNTRIES

● Included in Adaptation Strategy

✓ Yes

	Document Name	Year	Agriculture	Biodiversity	Coastal Areas and Fishing	Education and Research	Energy and Industry	Finance and Insurance	Forestry	Health	Infrastructure	Tourism	Transport	Urbanism	Water	M&E* Processes
Argentina	National Climate Change Adaptation and Mitigation Plan	2019	●	●			●			●	●	●	●			✓
Australia	National Climate Resilience and Adaptation Strategy	2015	●	●	●		●		●	●	●			●	●	✓
Brazil	National Adaptation Plan to Climate Change	2016	●	●			●		●	●	●		●	●	●	✓
Canada	PAN-Canadian Framework on Clean Growth and Climate Change	2016			●	●				●	●					✓
China	National Strategy for Climate Change Adaptation	2013	●	●	●	●	●	●	●	●	●	●		●	●	✓
EU	Strategy on Adaptation to Climate Change	2013	n/a													✓
France	Second National Adaptation Plan 2018-2022 (NAP-2)	2018	●	●	●	●		●	●	●	●	●	●		●	✓
Germany	Strategy for Adaptation to Climate Change (DAS)	2008	●	●	●		●	●	●	●	●	●	●	●	●	n/a
India	National Action Plan on Climate Change	2008	●	●	●	●	●			●	●				●	n/a
Indonesia	National Action Plan for Climate Change Adaptation (RAN-API)	2014	●	●	●	●	●	●	●	●	●		●	●	●	✓
Italy	National Climate Change Adaptation Strategy	2015	●	●	●		●		●	●	●	●	●		●	✓
Japan	National Plan for Adaptation to the Impacts of Climate Change	2015	●		●	●	●	●	●	●	●	●	●	●	●	✓
Mexico	National Strategy on Climate Change (ENCC)	2013	●	●	●	●	●		●	●	●				●	✓
Russia	The National Action Plan for the First Phase of Adaptation to Climate Change for the Period up to 2022	2020	●		●	●	●	●		●	●		●	●		✓
Saudi Arabia	No national adaptation plan or strategy															
South Africa	Draft National Climate Change Adaptation Strategy	2018	●	●	●	●	●	●	●	●	●	●	●		●	✓
South Korea	Adaptation Strategy to Climate Change	2011	●	●	●	●	●		●	●	●				●	✓
Turkey	National Climate Change Adaptation Strategy and Action Plan	2012	●	●	●	●	●	●	●	●		●	●	●	●	n/a
UK	National Adaptation Programme and the Third Strategy for Climate Adaptation Reporting	2018	●	●	●	●	●	●	●	●		●	●	●	●	✓
USA	U.S. Environmental Protection Agency Climate Change Adaptation Plan	2014	●		●	●	●		●	●			●		●	✓

Source: Own Evaluation

** M&E stands for monitoring and evaluation process*

COMPARING G20 CLIMATE ACTION: ADAPTATION

PARIS AGREEMENT

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

GLOBAL TEMPERATURES ARE ALREADY 1.1°C ABOVE PRE-INDUSTRIAL LEVELS

- The last decade was the **hottest ever recorded.**
- Global warming **increases the frequency and intensity extreme weather events.**
- As temperatures rise to 1.5°C, most G20 countries can expect increased water scarcity and drought; longer, more frequent, and more extreme heatwaves; and more variable and less favourable agricultural conditions.
- **More severe impacts** are projected at 1.5°C for Australia, Brazil, France, India, Indonesia, Italy, Mexico, Turkey, Saudi Arabia, and South Africa.

G20 COUNTRIES ARE EXPERIENCING THE IMPACTS OF CLIMATE CHANGE

Between 1999 and 2018, G20 countries lost about **220,000 lives and USD 2.6tn** to extreme weather events.

19 G20 COUNTRIES HAVE ADAPTATION PLANS

(Saudi Arabia is the exception)

- Finance and insurance, tourism, and urbanism are only included in 9 plans.
- Newcomers: **Argentina** 2019 | **Russia** 2020.

KEY OPPORTUNITIES FOR ENHANCING CLIMATE ADAPTATION

AGRICULTURE R&D & FOOD SECURITY

Global food demand is set to increase by 50% by 2050. Without ambitious adaptation and mitigation, yields may decrease by 30%.

PROTECT THE NATURAL ENVIRONMENT

Natural systems play an important regulatory and buffer function against the impacts of climate change as well as contributing to mitigation efforts.

INCREASE URBAN RESILIENCE

Cities are already home to half the worlds population – and urbanisation rates are growing.

FUTURE PROOF INFRASTRUCTURE

Physical infrastructure will need to withstand the extremes of climate change.

INCREASE DISASTER PREPAREDNESS

Risk management can reduce the impacts of extreme events and make recovery quicker and cheaper.

Based on Global Commission on Adaptation, 2019 [82]

Resources for adaptation must be scaled up to reduce vulnerability to climate change and achieve Sustainable Development Goals.

The **cost of adapting to climate change** in developing countries could rise to between USD 140bn-300bn by 2030, and USD 280bn-500bn per year by 2050.

MITIGATION

REDUCING EMISSIONS TO LIMIT GLOBAL TEMPERATURE INCREASE

"The G20 represents some of the highest emitting countries in the world. They therefore have a responsibility to lead with ambitious climate action. The Climate Transparency Report not only helps these countries understand how much more they need to do, but also helps citizens in holding these governments accountable for implementing the Paris Agreement."

Tasneem Essop, Executive Director of Climate Action Network (CAN) International

China | Wind turbine manufacturing at a factory in Zhongshan, Guangdong. Photo by plus49/ Construction Photography/Avalon/Getty Images

In the G20, energy-related emissions account for more than two thirds of GHG emissions (primarily CO_2), with industry, agriculture, and waste accounting for the remainder (excl. land use and forestry). The mitigation efforts needed to meet the Paris Agreement temperature goal, will require transitions of unprecedented scale across sectors.

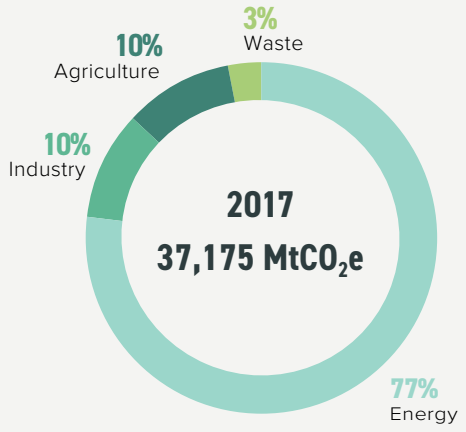
This part of the Stocktake focuses on the required transitions in key sectors, including power, transport, building, and industry, as well as agriculture and land use. These transitions will have to happen in the next 10 to 30 years, to meet the Paris temperature goal.

G20 countries can and should face this common challenge together. However, there are significant differences in cumulative, current, and per capita emissions across the G20. Each country also faces different trajectories based on their level of development, population size and growth, and available resources.

As a group, G20 countries are responsible for more than 90% of cumulative historical CO_2 emissions over the last 250 years: the USA is estimated to be responsible for 25% emissions, followed by the EU (22%), China (12.7%), Russia (6%), Japan (4%), and India (3%).[85]

The Paris Agreement principle of common but differentiated responsibility and respective capabilities sets a basis for larger mitigation efforts by countries that account for a greater share of cumulative historical and current emissions and those who have better resources to do so, including by providing support to developing countries.

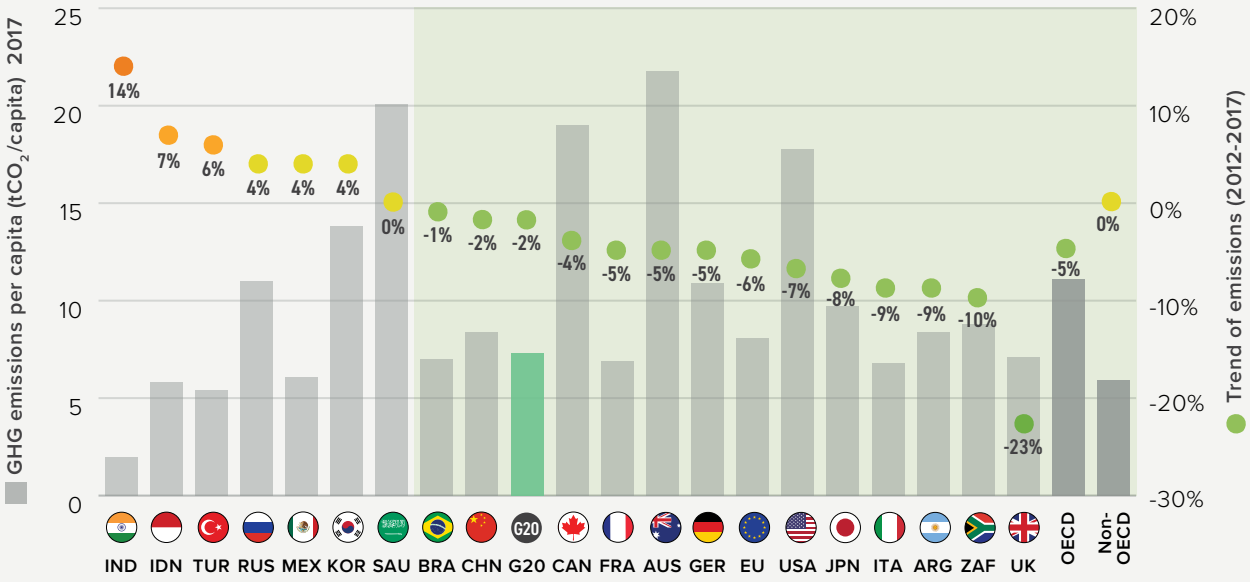
G20 GHG emissions by sector (2017)



Sources: Gütschow et al., 2019; Climate Action Tracker, 2020

PER CAPITA GHG EMISSIONS DECREASING IN 13 G20 MEMBERS

Per capita GHG emissions (incl. land use) in the G20 (2017)



Data for Argentina is for 2016 and trend for 2011-2016.
Sources: Climate Action Tracker, 2019; Gütschow et al., 2019; World Bank, 2019

ENERGY OVERVIEW

1.5°C BENCHMARKS TO LIMIT GLOBAL WARMING

NET-ZERO EMISSIONS BY 2050

To meet the 1.5° C goal, global net CO_2 emissions need to be 45% below 2010 levels by 2030 and will have to reach net-zero by 2050.

LESS FOSSIL FUELS IN THE ENERGY MIX

The share of fossil fuels in the global primary energy mix needs to fall to 67% by 2030 and to 33% by 2050 (and to substantially lower levels without Carbon Capture and Storage).

Sources: Own evaluation based on IPCC SR15; Kuramochi et al., 2017

G20 ENERGY-RELATED CO_2 EMISSIONS

Annual growth rate

-0.1% in 2019

+1.9% in 2018

+1.4% 2005-2017

Source: Enerdata, 2020

Energy-related CO_2 emissions account for the bulk of GHG emissions in the G20. To reduce energy-related CO_2 emissions to net-zero by 2050, increased energy efficiency, reduced demand (including lifestyle and consumption shifts), fuel switching, and electrification – in tandem with decarbonisation of the power sector – will be necessary in all major sectors.

G20 energy-related CO_2 emissions decreased by 0.1% in 2019 compared to an increase of 1.9% in 2018, indicating possible gains in the energy transition and a departure from the longer-term trend of an annual average growth rate of 1.4% between 2005 and 2017. This has been heralded as a positive and somewhat unexpected development. It offers some hope that limiting warming to 1.5°C is still possible, as global net CO_2 emissions needed to peak by 2020 to achieve this.[84] Nevertheless, urgent action is required to accelerate and advance climate action in the coming decade, to move from peak to deep decline and to fully decouple economic growth from emissions.

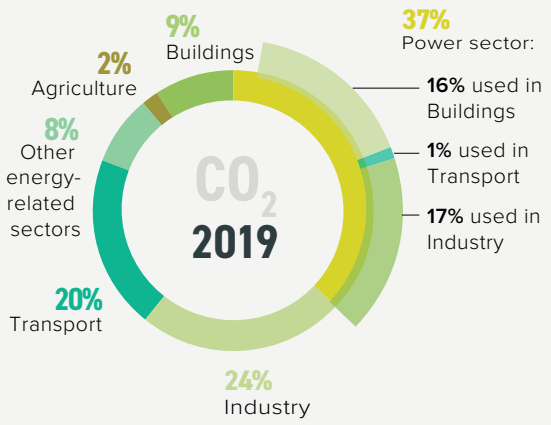
Total primary energy supply grew at a much-reduced rate compared to previous years, increasing by 0.7% compared to 2.2% in 2018, reflecting in part an economic slowdown in the OECD (where growth slowed from 2.4% in 2018 to 1.6% in 2019) and non-OECD countries (where growth slowed from 5.4% in 2018 to 4.4% in 2019). However, this decline also reveals continued gains in energy efficiency in the G20.

The primary energy supply is becoming less carbon-intensive in the G20 (it decreased by 0.8% in 2019). However, many countries are switching from coal to gas and the overall energy mix continues to be dominated by fossil fuels (81.5%).

In OECD G20 countries, fossil fuel consumption decreased by 1.7% in 2019, driven by an 11% decrease in coal consumption. The UK (-29%), Germany (-20%), Canada (-14%) and the USA (-12%) saw the most significant decreases in coal consumption in 2019. However, except for the UK, the decrease in coal demand was mainly compensated with an increase in natural gas and oil.

In non-OECD countries, coal demand remained stable – a significant change from the long-term trend of an annual average growth of 4% between 2005 and 2017 and the 2% growth in 2018. However, overall fossil fuel consumption still grew by 1.8% in non-OECD countries, with natural gas and oil both growing at a higher rate of 4%.

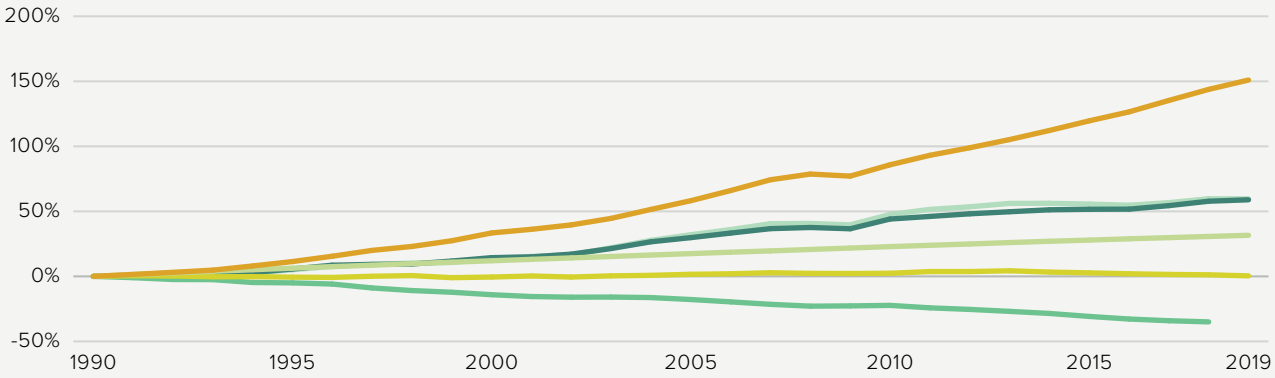
G20 energy-related CO_2 emissions by sector (2019)



Source: Enerdata, 2020

MORE RENEWABLE ENERGY, GREATER EFFICIENCY, AND SLOWER GDP GROWTH LED TO ENERGY-RELATED CO_2 EMISSIONS DECREASE IN 2019

Main factors influencing G20 energy-related CO_2 emissions (2019)



GDP
2.9% in 2019 | 2018: **3.6%** | 2005-17: **3.4%**

ENERGY-RELATED CO_2 EMISSIONS
-0.1% in 2019 | 2018: **1.9%** | 2005-17: **1.4%**

TOTAL PRIMARY ENERGY SUPPLY
0.7% in 2019 | 2018: **2.2%** | 2005-17: **1.5%**

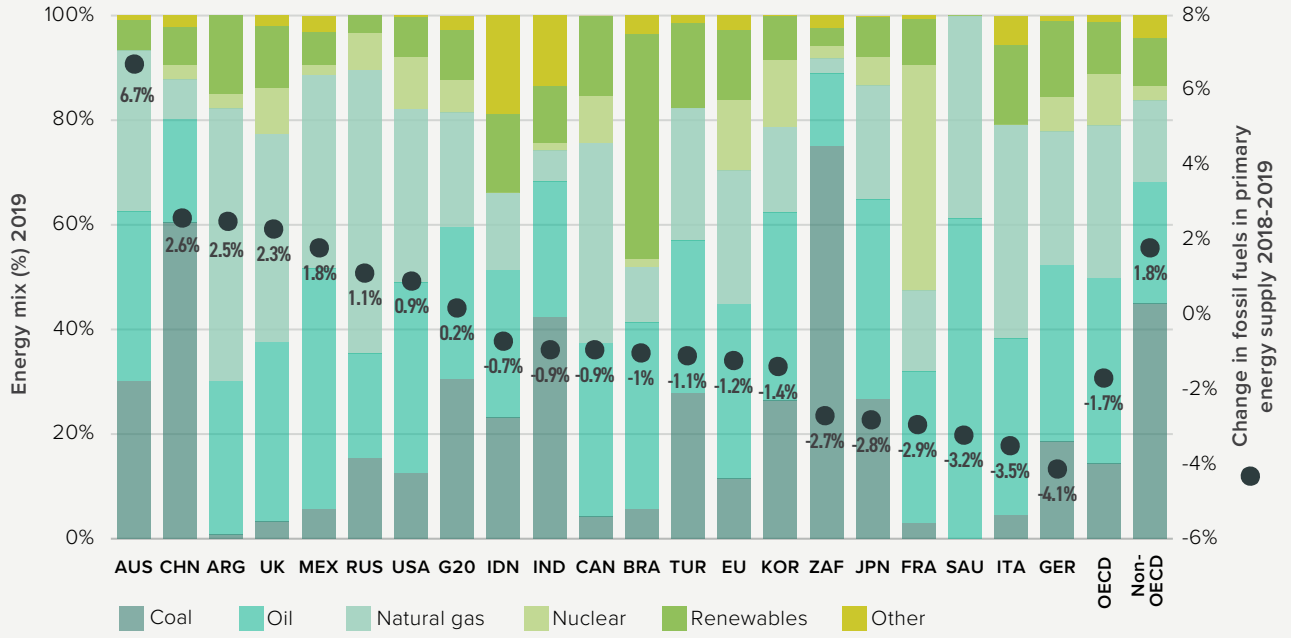
POPULATION
0.7% in 2019 | 2018: **0.7%** | 2005-17: **0.8%**

CARBON INTENSITY OF ENERGY SECTOR
-0.8% in 2019 | 2018: **-0.2%** | 2005-17: **0%**

ENERGY INTENSITY OF ECONOMY
-1.4% in 2018 | 2005-17: **-1.8%**

*Source: Enerdata, 2020**

Energy mix in G20 countries (2019)



Source: Enerdata, 2020

** The Enerdata database is revised and updated continually, which can contribute to changes in reported numbers in the Climate Transparency Report year-on-year.*

PROGRESS ON A JUST TRANSITION

PARIS AGREEMENT

Countries agreed to **take into account the imperatives of a just transition** of the workforce and the creation of decent work and quality jobs in accordance with nationally defined development priorities.

1.5°C COMPATIBILITY

Social justice and equity are core aspects of climate-resilient development that aims to limit global warming to 1.5°C, addressing challenges and inevitable trade-offs, widening opportunities, and ensuring that options, visions, and values are deliberated between and within countries and communities.

Source: IPCC SR15

A well-planned and just transition can maximise the co-benefits of necessary economy-wide transitions, fairly distribute and manage the costs, and build social and political acceptance through inclusive processes. A just transition can also promote the creation of decent jobs, social protection for job losses and displacement, skills development, and community regeneration.

The transformation of key industries in response to the threat of climate change will affect workers and communities. Important climate policies, such as phasing out subsidies and establishing carbon pricing, can also lead to higher prices for certain goods – including energy prices. Compensatory measures can be developed for low-income groups, and revenues from carbon pricing can be directed towards supporting a just transition and advancing other public goods, such as energy access, healthcare, education, and sustainable infrastructure.[86]

At COP24 in 2018, the Solidarity and Just Transition Silesia Declaration was adopted. Ten G20 members are signatories to the declaration: Argentina, Canada, the EU, France, Germany, Indonesia, Japan, South Korea, the UK, and the USA. The Declaration stresses that a "just transition of the workforce and the creation of decent work and quality jobs are crucial to ensure an effective and inclusive transition to low-GHG emission and climate-resilient development, and to enhance the public support for achieving the long-term goals of the Paris Agreement".[87] The Declaration also notes the "importance of a participatory and representative process of social dialogue involving all social partners to promote high employment rates, adequate social protection, labour standards and wellbeing of workers and their communities, when developing nationally determined contributions, long-term low-GHG emission development strategies and adaptation planning processes".

In many G20 countries, policies, processes, and strategies are being developed to build just transition architecture into decarbonisation measures. Significant developments have been made in incorporating just transition principles, for example, in coal phase-out plans in Canada, Germany, the EU, and South Africa. There are additional national and regional government initiatives in Australia, China, France, Indonesia, the UK, and the USA.

- **Canada** established a Task Force to engage with stakeholders on a just transition for coal workers, as the country aims to phase out coal power by 2030. In 2019, a CAD 150m fund was established to support affected communities, in addition to funding for coal worker transition centres. In the last federal election (October 2019), the government also promised to pass a "Just Transition Act" (legislation is still pending).
- **Germany** adopted a coal exit law in July 2020 that sets out a roadmap for phasing out coal power by 2038 that paves the way for EUR 40bn support to coal regions and provides compensation for coal plant operators.[88] This law follows the 2019 recommendations of the multi-stakeholder Commission on Growth, Structural Change and Employment.[89]
- **The EU** established the Platform for Coal Regions in Transition, aiming at stakeholder knowledge sharing and exchanges of experiences in affected regions. The EU also created the Just Transition Mechanism, designed to mobilise at least EUR 100bn between 2021 and 2027.[90]
- **South Africa** has explicitly recognised a just transition as a priority in its National Development Plan (2012) and its NDC. The National Planning Commission has begun a social dialogue process to determine pathways for a just transition. A series of multi-stakeholder dialogues has identified key priorities, including analysing employment vulnerabilities of affected workers, and pilot "hotspots" for intervention (such as closing mines), yet explicit transition policies have yet to be developed. The South African energy sector is the most coal dependent in the G20 and the country is the seventh biggest coal exporter globally, making worker transition pathways and local economic resilience in coal-dependent regions a priority for a just transition.[91]

At the UN Climate Roundtable in 2020, UN Secretary-General Guterres stressed that all climate "solutions must prioritise vulnerable nations and communities through just transition polices, international cooperation, and solidarity".[92] G20 countries can and should develop national just transition policies.

POWER SECTOR

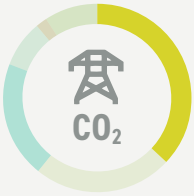
1.5°C BENCHMARKS TO LIMIT GLOBAL WARMING

Global power (electricity) generation must be decarbonised and the share supplied by renewable energy and other CO_2-free technologies needs to increase to 98-100% by 2050.

Coal use in the power sector needs to peak by 2020 and phase out rapidly. Coal must be completely phased out by 2030 in the EU/OECD, by 2037 in non-OECD Asia, and by 2040 in the rest of the world.

Sources: Own evaluation based on IPCC SR15; Kuramochi et al., 2017

G20 ENERGY-RELATED CO_2 EMISSIONS 2019 – POWER SECTOR



37.5%

Annual growth rate

-2.4% in 2019

+2.5% in 2018

+1.6% 2005-2017

Source: Enerdata, 2020

2019 was a good year for power sector decarbonisation, with CO_2 emissions from the power sector decreasing by 2.4%. Over the last five years, the emissions intensity of the power sector in the G20 has decreased by 10% and the share of renewables in power generation grew by 20%, reflecting effective implementation of key policies, among other factors.

The power sector accounts for the highest share of G20 CO_2 emissions (37.5%), including heat from electricity production that is partly used for district heating. In 2019, emissions from the power sector decreased by 2.4%, almost completely reversing the previous year's increase of 2.5%. Only two countries registered an increase, but at a lower rate than the previous year. In 2019, power sector emissions increased in Indonesia (growing at a rate of 5.6% compared to 7.6% in 2018) and China (2% compared to 6.5% in 2018).

South Africa, Indonesia, India, Saudi Arabia, and Australia have the highest CO_2 emissions per unit of power produced in the G20. However, emissions intensity decreased in all but Indonesia between 2014 and 2019.

Excluding Saudi Arabia, these countries have a high proportion of coal in the power mix and a smaller proportion of renewables compared to the G20 average. None of these countries have coal phase-out plans and South Africa, Indonesia, and India intend on adding coal capacity up to 2030. However, power expansion plans allocate a significantly larger proportion for new renewable energy in all four, and this is becoming more and more attractive as coal finance dries up and renewables become cheaper.

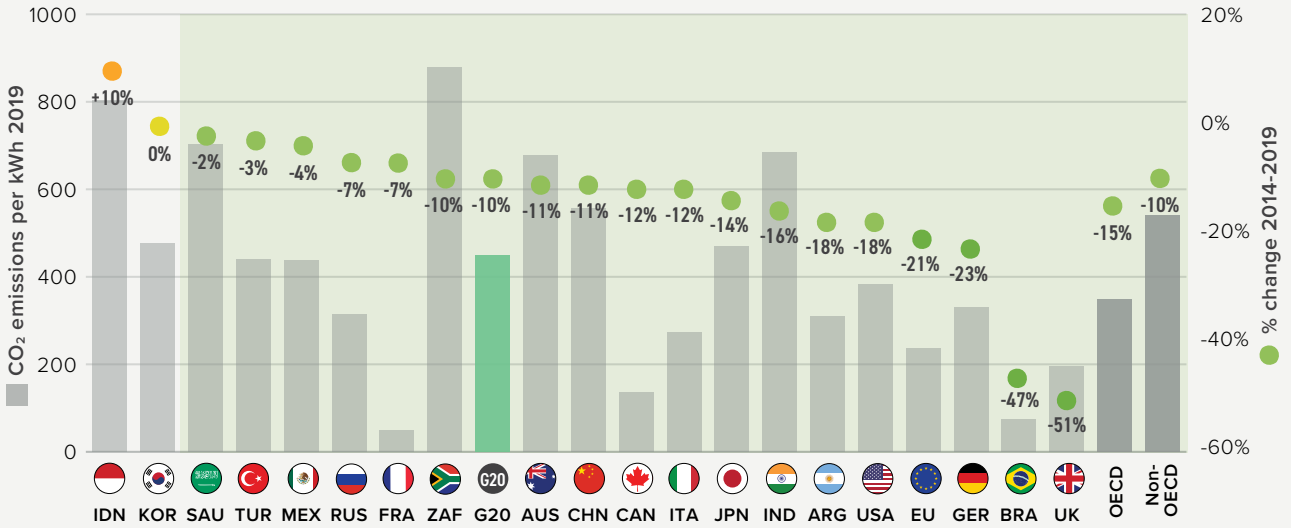
South Africa Total Installed Capacity 51.3 GW[93] | Generation: 88% coal power / 6% renewable energy

South Africa does not have a coal phase-out policy or plan. The 2019 Integrated Resource Plan (2019 IRP) includes 1,500 MW of new coal power before 2030, in addition to almost 6,000 MW of committed coal capacity (for the completion of remaining units on two 4,800 MW plants, Medupi and Kusile).[94] The rest of South Africa's aging coal fleet will mainly retire in the 2030s and 2040s, with several plants remaining operational until 2050 and beyond.

The 2019 IRP also proposes an expansion of renewable energy capacity, from a current total of 3,800 MW (excluding large hydro) to a total of 26,700 MW of grid-connected renewables and 6,000 MW of distributed solar photovoltaics in 2030. However, no new renewable energy has been procured since 2015. After many delays, the next bid window for new renewable energy is set to open in December 2020.[95] South Africa does not have a long-term renewable energy target for 2050.

THE EMISSIONS INTENSITY OF THE POWER SECTOR DECREASED IN 18 G20 MEMBERS BETWEEN 2014 AND 2019

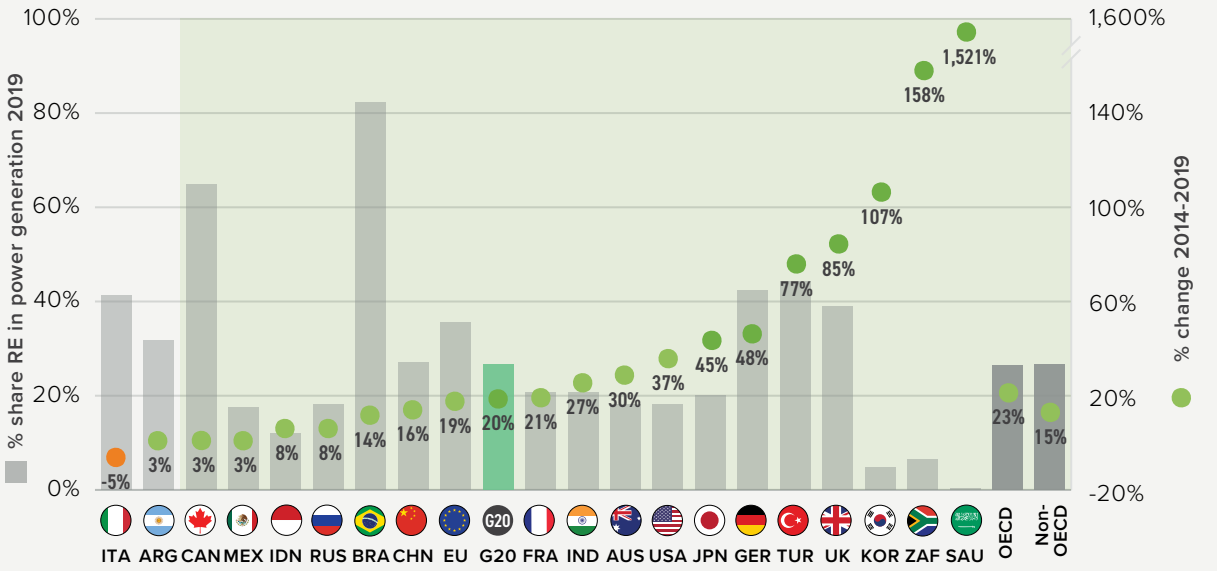
Emission intensity of the power sector in the G20 (2019)



Source: Enerdata, 2020

Low	No policy to increase the share of renewables	No target or policy in place for reducing coal
Medium	Some policies to increase the share of renewables	Some policies in place for reducing coal
High	Policies and longer-term strategies / targets to significantly increase the share of renewables	Policies + coal phase-out decided
Front-runner	Short-term policies + long-term strategies for 100% renewables in the power sector by 2050 in place	Policies + coal phase-out date before 2030 (OECD and EU28) or 2040 (rest of the world)

Share of renewables (incl. large hydro) in power generation in the G20 (2019)



Source: Enerdata, 2020

Indonesia Total Installed Capacity 69.6 GW[96] | Generation: 63% coal power / 12% renewable energy

Rather than phasing out coal, Indonesia increased its coal capacity from 26,800 MW in 2018 to 27,100 MW in 2019. Renewables compete with subsidised coal generation (e.g. loan guarantees, tax exemptions, royalties, and coal price caps). However, in 2020 the Minister of Energy and Mineral Resources announced the government's intention to explore the option of replacing around 11 GW of older fossil fuel power plants with renewables, including 23 coal-fired power plants that are over 20 years old (total capacity 5,700 MW). Further to this, the Minister stated that after the current 35,000 MW expansion programme is complete (2023-2025), all new capacity will be renewables. Additionally, the Ministry is exploring a strategy to increase renewable energy uptake to meet the 23% renewable energy target in 2025, as stipulated in the 2014 National Energy Policy.[97]

India Total Installed Capacity 372.7 GW[98] | Generation: 71% coal power / 21% renewable energy

While India has had several energy efficiency and renewable energy expansion policies in effect, it has no plan for phasing out coal and the 2018 National Electricity Plan (2018 NEP) envisages an additional 46,000 MW of coal by 2022.[99] If India implements its 2018 NEP, the share of coal power capacity will decrease to 38% by 2027. In the long-term, the share of coal in power generation is likely to decrease further due to the economic competitiveness of renewables and difficulties in financing and insuring new coal power plants.

Australia Total Installed Capacity 49.7 GW[100] | Generation: 57% coal power / 18% renewable energy

The federal government has encouraged utilities to extend the lives of coal-fired power plants, continues to promote investment in new coal plants, and provides subsidies for coal production and consumption.[101] The 2020/21 federal budget will fund upgrades to an aging coal-fired power station.[102] Australia is the biggest coal exporter in the world, accounting for 29% of the world's coal exports – it uses only 16% of its coal production domestically. There is no federal policy for a transition away from coal.

To accelerate the global phase-out of coal power, G20 countries also need to end public financial support for coal domestically and abroad. Public resources can instead be directed towards sustainable alternatives and supporting a just transition for affected workers and communities.

In contrast, the EU recorded a substantial decrease of 13.9% in energy-related CO_2 emissions from the power sector in 2019, with notable decreases in Germany (-17.9%), France (-15.9%), and the UK (-14.8%). Power sector emissions also dropped in the USA (-6.8%) and Argentina (-11.8%). These countries all registered larger decreases in emissions intensity of power generation between 2014 and 2019 than the G20 average.

EU 15% coal / 36% renewable energy / 22% natural gas

Coal power plants have already been phased out in three EU countries: Belgium, Sweden, and Austria. Another 11 countries have announced plans to phase out coal by 2025 or 2030, except for Germany, which plans to only phase out coal by 2038.[103] In Czechia and Spain, coal phase-out is under discussion, with 2025 as the potential phase-out date discussed in the latter. Poland has announced a 2049 phase-out date.[104] Only four EU member states (Bulgaria, Croatia, Romania, and Slovenia) have neither made plans nor held discussions on the future phase-out of coal in their countries. If EU countries decide to strengthen emissions

targets to 55-60% by 2030 compared to 1990 levels as proposed by the EU Commission, then a phase-out of coal by 2030 will be necessary.[105]

- **Germany** aims to increase the share of renewables in power generation from 43% in 2019 to 65% by 2030 and to decommission 25% of current coal capacity by 2022, a further 25% by 2030, and the remainder by 2038.[106]
- **France** aims to almost double the share of renewable power generation to 40% by 2030 and will close down its remaining four coal power plants by 2022. France has no long-term strategy or target for renewable energy.[107]
- **The UK** will phase out coal by 2024. Between April and June 2020, the UK achieved its longest period of coal-free power generation since the industrial revolution, lasting almost 68 consecutive days.[108] In the first quarter of 2020, renewables provided a record 47% of power generation.[109] [110]

United States 25% coal / 18% renewable energy / 37% natural gas

The USA does not have a coal phase-out plan nor does it have a long-term target for renewable energy. Despite government backing, the coal industry is declining – between 2011 and 2020 95 GW of coal capacity was closed or switched to another fuel.[111] Coal is being supplanted with comparably cheaper natural gas and renewable energy.

Argentina 1% coal / 32% renewable energy (25.6% hydro) / 59% natural gas

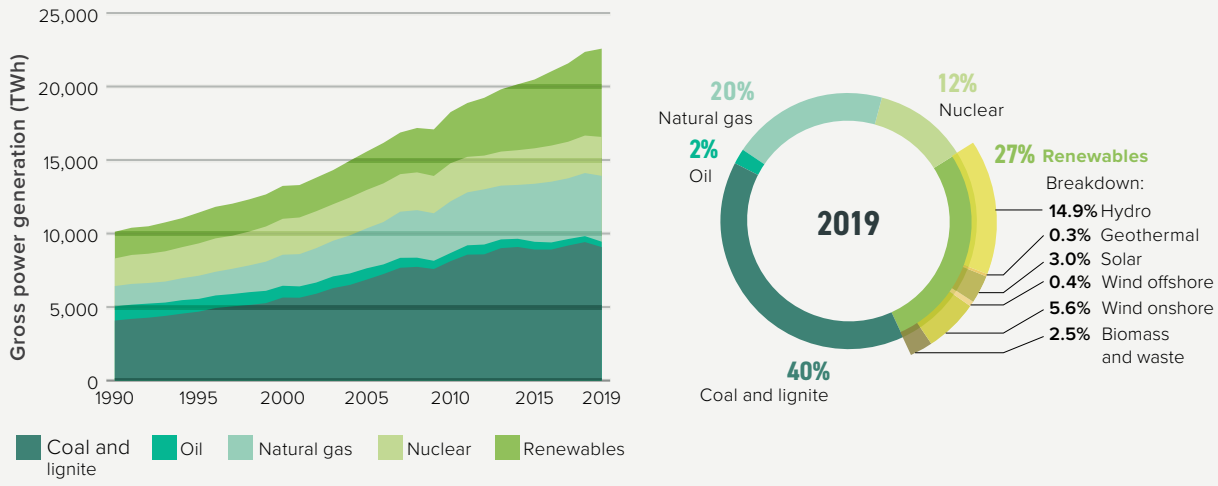
Argentina has no long-term strategy for variable new renewables but aims to increase the share in the power mix to 20% (10,000 MW of installed capacity) by 2025 and 26% by 2030. Since 2016, the government has awarded almost 5,000 MW of new renewable energy projects through the RenovAr programme.[112]

Renewables now account for almost 27% of gross power generation in the G20, compared to 22% in 2014 and 19% in 2010. The share of hydropower and biomass has stayed constant over the past 10 years (at 15% and around 2% of the total mix, respectively). Growth in the share of renewables has primarily been driven by new wind (which increased from 2% in 2010 to 6% in 2019) and solar (from 0.2% in 2010 to 3% in 2019) installations.

Renewable energy costs have plummeted in the last decade and can now outcompete even the cheapest coal power.[113] In 2019, half of new solar and wind installations outperformed all fossil fuel alternatives.[114] Over the past 10 years, the cost of solar photovoltaics decreased by 82%, concentrated solar power (CSP) by 47%, onshore wind by 39%, and offshore wind by 29%.[115] Research shows that 100% renewable – or close to – is possible by 2030.[116]

The decarbonisation of other sectors – such as transport, industry, and buildings – is contingent on a decarbonised power sector. To fully decarbonise the power sector by 2050, G20 countries must avoid relying on natural gas as a "transition fuel"[117] and, instead, aim for 100% zero-carbon power.

RENEWABLES ACCOUNTED FOR 27% OF POWER GENERATION IN THE G20 IN 2019



Source: Enerdata, 2020

TRANSPORT SECTOR

1.5°C BENCHMARKS TO LIMIT GLOBAL WARMING

LOW-CARBON FUELS TO INCREASE TO 60% BY 2050

To meet the 1.5°C goal, the share of low-carbon fuels in the transport fuel mix must increase to about 60% by 2050 globally.

SELL THE LAST FOSSIL FUEL VEHICLE BY 2035

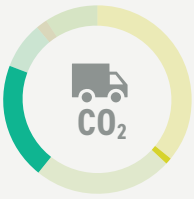
The last fossil fuel passenger vehicle should be sold by 2035 and the entire passenger fleet should move to 100% zero-carbon by 2050. Heavy-duty vehicles also need to switch to low-carbon fuels by 2050.

LOW-CARBON FUELS FOR AVIATION & SHIPPING

A 1.5°C compatible pathway for aviation and shipping is needed and should include plans to increase aircraft efficiency, switch to low-carbon fuels, and encourage modal shifts in demand.

Source: Own evaluation based on IPCC SR15; Kuramochi et al., 2017

G20 ENERGY-RELATED CO_2 EMISSIONS 2019 – TRANSPORT SECTOR



20% Direct emissions

0.8% Electricity-related emissions

Annual growth rate

+1.5% in 2019

+1.5% in 2018

+1.5% 2005-2017

Source: Enerdata, 2020

G20 transport emissions continued to grow at a steady pace of 1.5% in 2019, the same as in 2018 and the long-term annual average between 2005 and 2017. Without more ambitious climate action in the transport sector, worldwide transport emissions are set to grow by 60% by 2050.[118] Accounting for almost 70% of global transport emissions, the G20 needs to urgently decarbonise transport to decrease emissions from this sector.[119]

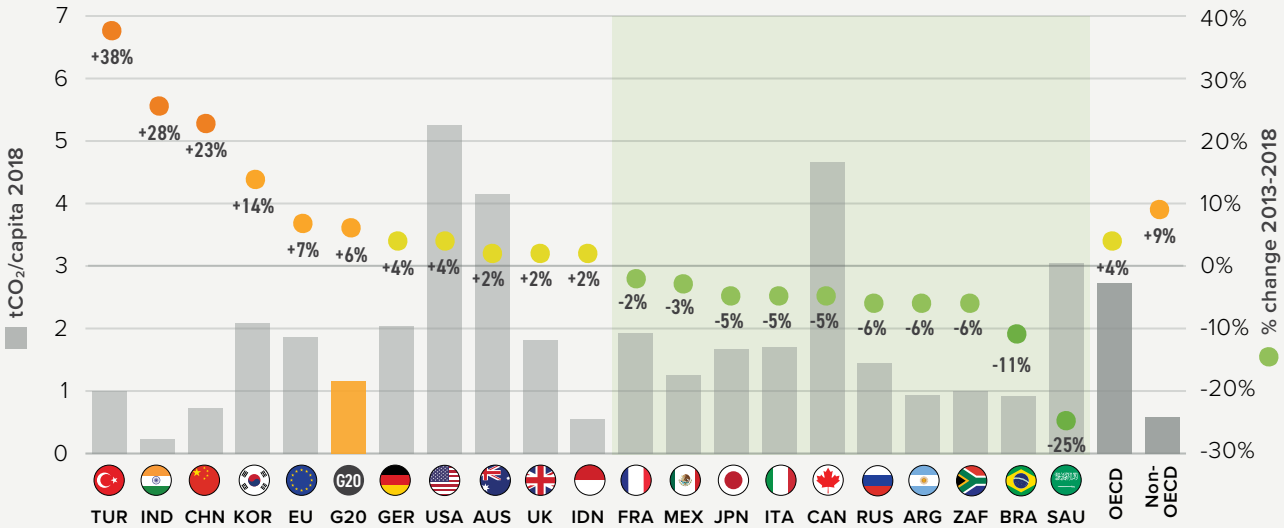
G20 transport emissions per capita (excl. aviation) increased by 6% between 2013 and 2018, while aviation emissions per capita grew by a startling 19% between 2012 and 2017. Historically, transport activity – and thus emissions – has been closely correlated with economic development and trade, as well as income levels. In the G20, this can be seen in the significant differences in transport emissions per capita between OECD and non-OECD countries. In 2018, transport emissions (excl. aviation) resulted in 2.7 tCO_2 per capita in the OECD – more than four times the 0.6 tCO_2 per capita in non-OECD countries. This difference is even more stark when looking at aviation, where OECD countries emitted 0.4 tCO_2 per capita in 2017 – almost 6.5 times the non-OECD rate of 0.07 tCO_2 per capita. However, in some non-OECD countries, per capita emissions are growing at a fast pace.

Decarbonising transport will require G20 countries to implement policies and targets aimed at modal switching and fuel switching:[120]

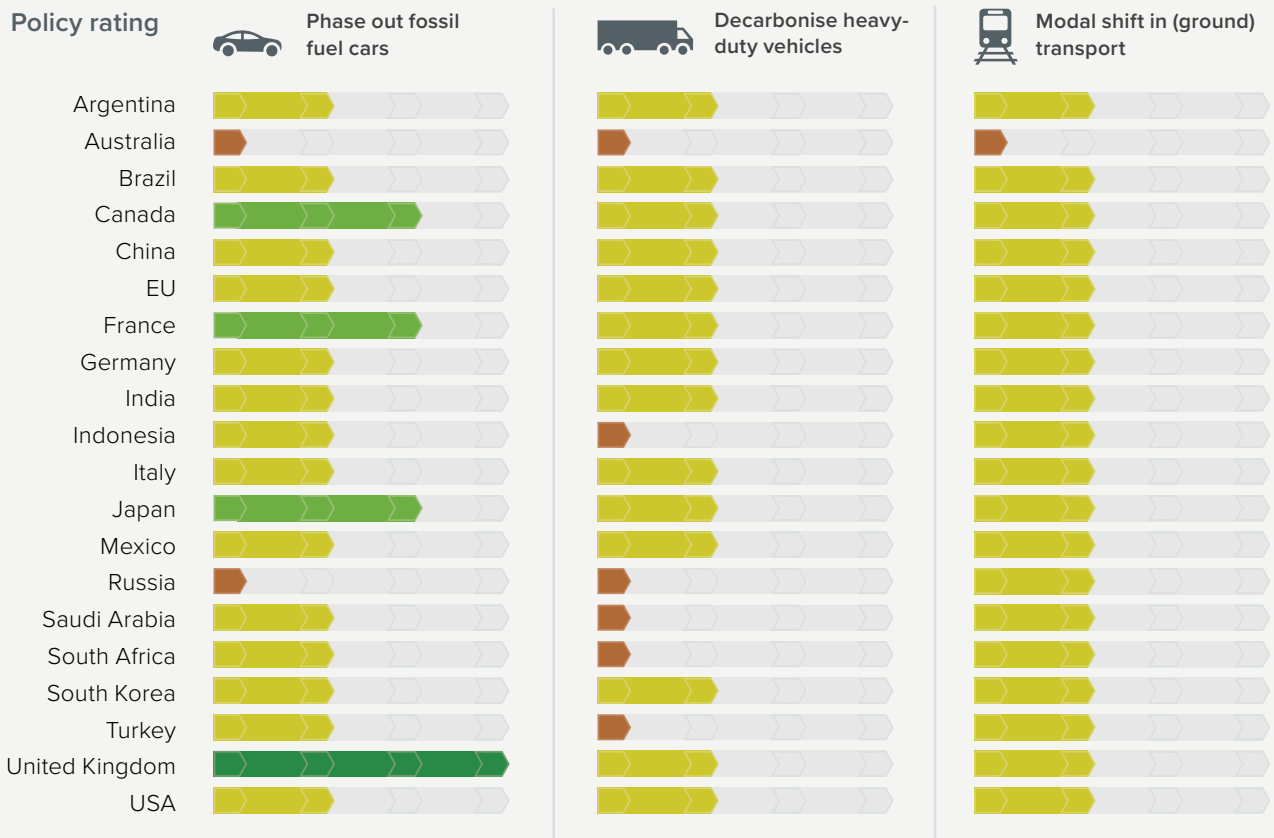
- **Modal Shifting** relates to changes in transportation that contribute to reduced emissions, while still meeting mobility demands. Shifting passenger demand from private to public transport or moving freight via rail instead of road are examples of **modal shifts in ground transport.**
- **Fuel Switching** relates to changes in energy use or the energy mix in transport, i.e. meeting energy needs more efficiently while generating lower emissions. To decarbonise transport, mass electrification will be required – including **decarbonising heavy-duty vehicles and phasing out fossil fuel cars**, while increasing alternative low-carbon fuels, such as biofuels and green hydrogen.

10 G20 MEMBERS REDUCED TRANSPORT EMISSIONS PER CAPITA BETWEEN 2013 AND 2018

Transport emissions per capita (excl. aviation) in the G20 (2018)



Sources: Enerdata, 2020; The World Bank, 2019



Low	No policy for reducing emissions	No policy	No policy
Medium	Some policies such as energy / emissions performance standards	Some policies such as energy / emissions performance standards or support	Some policies such as support programmes to shift to rail or non-motorised transport
High	Policies + national target to phase out	Policies + strategy to reduce absolute emissions	Policies + longer-term strategy
Front-runner	Policies +ban on new fossil-fuel-based light-duty vehicles by 2035	Policies + innovation strategy to phase out emissions from freight transport by 2050	Policies + longer-term strategy consistent with 1.5°C pathway

The United States, Canada, and Australia have the highest transport emissions (excl. aviation) and, along with the UK, the highest aviation emissions per capita in the G20.

United States Transport emissions per capita: excl. aviation +4% (2013-2018) / aviation +17% (2012-2017)

The USA has no target to phase out fossil fuel cars and has recently rolled back other regulations aimed at reducing transport emissions. In 2020, Corporate Average Fuel Economy (CAFE) and GHG emissions standards for passenger cars and light trucks were weakened by the National Highway Traffic Safety Administration (NHTSA) and the Environmental Protection Agency (EPA).[121] A number of states have been blocked from increasing emissions standards for cars and trucks beyond federal standards – California and 22 other states have filed lawsuits against this rule.[122] Meanwhile, federal tax credits for EVs are being undercut in 24 states that have imposed additional EV fees (e.g. higher annual registration costs). Although the USA also has no long-term strategy for reducing emissions from freight transport or modal shifting, energy efficiency standards for heavy-duty vehicles are in place.[123] There are also several programmes aimed at shifting passenger demand to public and non-motorised options, and the SmartWay Initiative promotes greater supply chain sustainability.[124]

Australia Transport emissions per capita: excl. aviation +2% (2013-2018) / Aviation +11% (2012-2017)

Australia performs the worst in the G20 when it comes to policies to decarbonise the transport sector: it has no target to phase out fossil fuel cars, no plans to phase out emissions from freight transport, no efficiency or emissions standards for heavy-duty vehicles, and no longer-term strategy for promoting modal shifts in public or freight transport. Although there have been some positive announcements in recent years, no decisions or plans have been forthcoming. The Ministerial Forum of Vehicle Emissions has yet to take any decisions on imposing fuel efficiency standards for light vehicles, and the national electric vehicle strategy to reduce 10 $MtCO_2e$ by 2030 that was announced in the 2019 Climate Solutions Package has not yet been released.[125]

While Canada has high transport per capita emissions, it – along with the UK, Japan, and France – has the most ambitious plans to phase out fossil fuel cars. The UK is the frontrunner in the G20, planning to sell its last fossil fuel car by 2030, which is 1.5°C compatible.

Road transport accounts for 85.6% of transport emissions in the G20. The entire passenger fleet needs to be fully decarbonised by 2050, alongside modal shifts to low-carbon public and active transport.

UK last fossil fuel car sold by 2030

In 2020, the UK announced plans to bring forward its planned phase-out of "conventional" diesel and petrol cars from 2040 to 2030, or earlier pending consultation with industry.[126] If followed through, this would make the UK a world leader in this regard. The UK should aim for the earliest possible phase-out in line with the timeframe advocated by the UK government's statutory advisory body, the Committee on Climate Change.[127]

France last fossil fuel car sold by 2040

The 2019 Mobility Law sets a ban on the sale of fossil fuel-based cars by 2040 and aims for a fivefold expansion of electric vehicle charging stations. The law also regulates the possibility to develop "low emission zones" in cities. A bonus-malus scheme taxes the purchase of emissions-intensive vehicles to finance subsidies for the purchase of electric and low-emissions cars.[128] [129]

Canada 100% EV sales by 2040

The Zero-Emission Vehicle (ZEV) Infrastructure Programme aims for EVs to account for 100% of sales by 2040 (100% by 2035 would be 1.5°C compatible).[130] A Clean Fuel Standard, including annual carbon intensity reduction requirements for liquid fuels, is set to be finalised in the second half of 2020. However, the Advisory Council on Climate Action warned in May 2019 that measures are insufficient to achieve ZEV targets.

Japan last fossil fuel car sold by 2050

In 2018, the Japanese government announced that by 2050 all cars sold would be electrified (this is not compatible with the 1.5°C benchmark). The country aims to have electric vehicles account for 20-30% of car sales by 2030. [131]

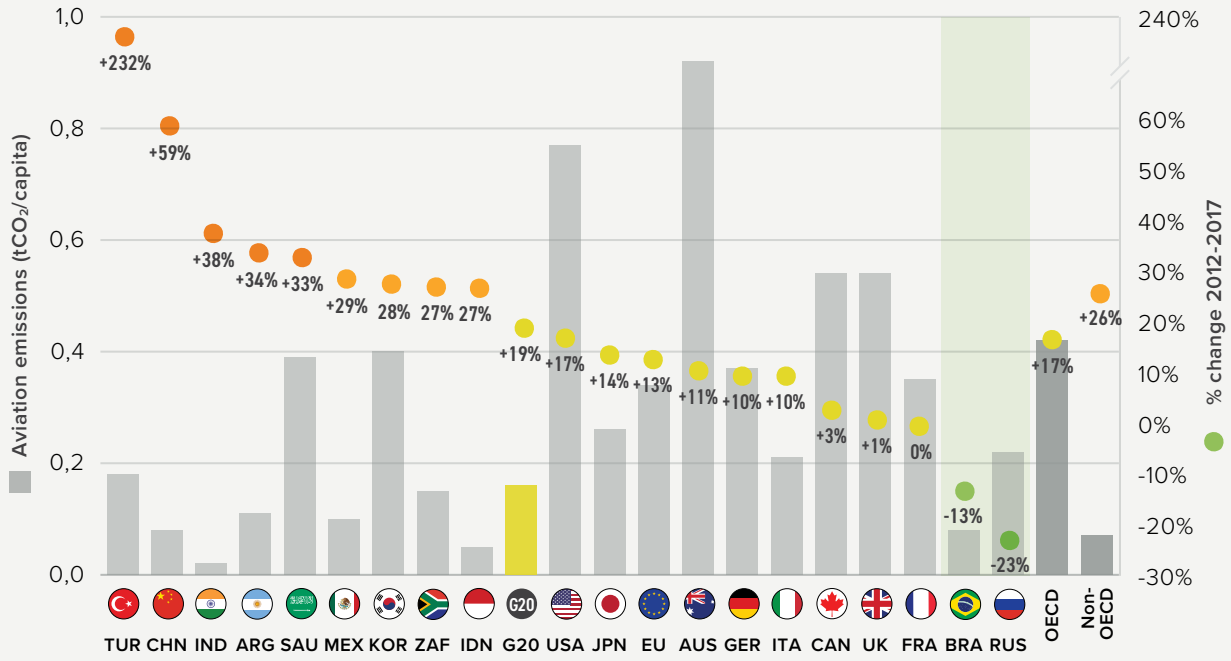
No G20 country has long-term strategies for modal shifting; however, several countries have policies or programmes that set explicit targets to increase the share of public transport and/or increase rail freight in the short- to medium-term.

China has the most progressive policy for modal shifting in passenger transport and aims for public transport to represent 30% of motorised travel in urban centres by 2020.[132]

South Africa's Green Transport Strategy (2018) aims to shift 30% of freight transport from road to rail, and 20% of passenger transport from private cars to public transport and active alternatives within seven years of implementation.[133]

AVIATION EMISSIONS PER CAPITA INCREASED IN 17 G20 MEMBERS BETWEEN 2012 AND 2017

Aviation emissions per capita (domestic and international) in the G20 (2017)



Source: Enerdata, 2020

Italy is striving towards shifting about 10% of passenger transport demand from private cars to public transport, carpooling, bicycles and walking by 2030.

Brazil's Plan for Logistics and Transportation aims to increase the share of rail from 25% in 2005 to 35% in 2025.[134] [135]

Between 2012 and 2017, G20 aviation CO_2 emissions per capita increased by 19% (compared to an increase of 10% between 2011 and 2016).

According to the International Council on Clean Transportation, total global aviation CO_2 emissions increased by 32% between 2013 and 2018.[136] Of total commercial aviation emissions in 2018, passenger transport accounted for around 80%. The five countries with the highest global share of passenger aviation emissions in 2018 (according to country of departure) were: USA (23%), China (13%), the UK (4.1%), Japan (3.1%), and Germany (2.9%).[137]

Aviation has been one of the fastest growing sources of emissions over the past decade. Moreover, aircrafts release nitrogen oxides (NOx), soot, and water vapour, which combine to have a net warming effect that roughly doubles the impact of CO_2 emissions.[138] Although the industry committed to improving fuel efficiency by 1.5% per year between 2009 and 2020, efficiency gains have not been able to keep up with increased demand.[139]

The UN International Civil Aviation Organisation (ICAO) adopted a climate goal to keep net emissions below 2020 levels, primarily through using the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA).[140] However, the impact of the COVID-19 pandemic on aviation in 2020 may result in shifting the baseline year to 2019 or "pre-pandemic levels".[141]

To meet this goal, G20 countries and the aviation industry need to increase investments to develop and scale up sustainable aviation fuels and to explore alternatives, such as hydrogen or electricity.[142] In addition, removing subsidies, introducing policy frameworks to manage demand (such as frequent flyer taxes), and investing in alternatives (high-speed rail) can help G20 countries reduce emissions from aviation.

BUILDING SECTOR

1.5°C BENCHMARKS TO LIMIT GLOBAL WARMING

LOWER GLOBAL EMISSIONS FROM BUILDINGS

Global emissions from buildings need to be halved by 2030, and be 80-85% below 2010 levels by 2050, mostly through increased efficiency, reduced energy demand and electrification.

NEW BUILDINGS: ZERO-ENERGY COMPLIANT

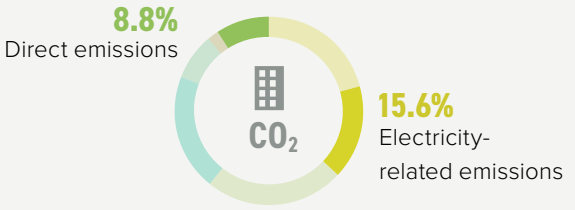
All new buildings must be zero-energy compliant by 2020 in the OECD and 2025 in non-OECD countries.

OLD BUILDINGS: ANNUAL DEEP RENOVATION

The existing building stock needs annual deep renovation rates of 5% in the OECD and 3% in non-OECD countries by 2020.

Source: Own evaluation based on IPCC SR15; Kuramochi et al., 2017

G20 ENERGY-RELATED CO_2 EMISSIONS 2019 – BUILDING SECTOR



Annual growth rate **+0.9%** in 2019

+3.2% in 2018

+0.01% 2005-2017

Sources: Enerdata, 2020

Building sector emissions increased by 0.9% in 2019, recovering slightly from a significant divergence from the long-term trend (+0.1%) in 2018 when emissions grew by 3.2%. Building sector emissions currently account for 24.4% of energy-related CO_2 emissions in the G20. However, compared with growth trends in the industry and transport sectors, emissions in the building sector have grown at a lower rate since 2005. Cost-effective technologies and best practices need to be used to reduce emissions – especially in developing countries where housing, electricity, and improved cooking facilities are being advanced to millions of people.[143] Decarbonisation efforts will also need to consider climate adaptation needs in the building sector – for example, when meeting changing heating and cooling needs.

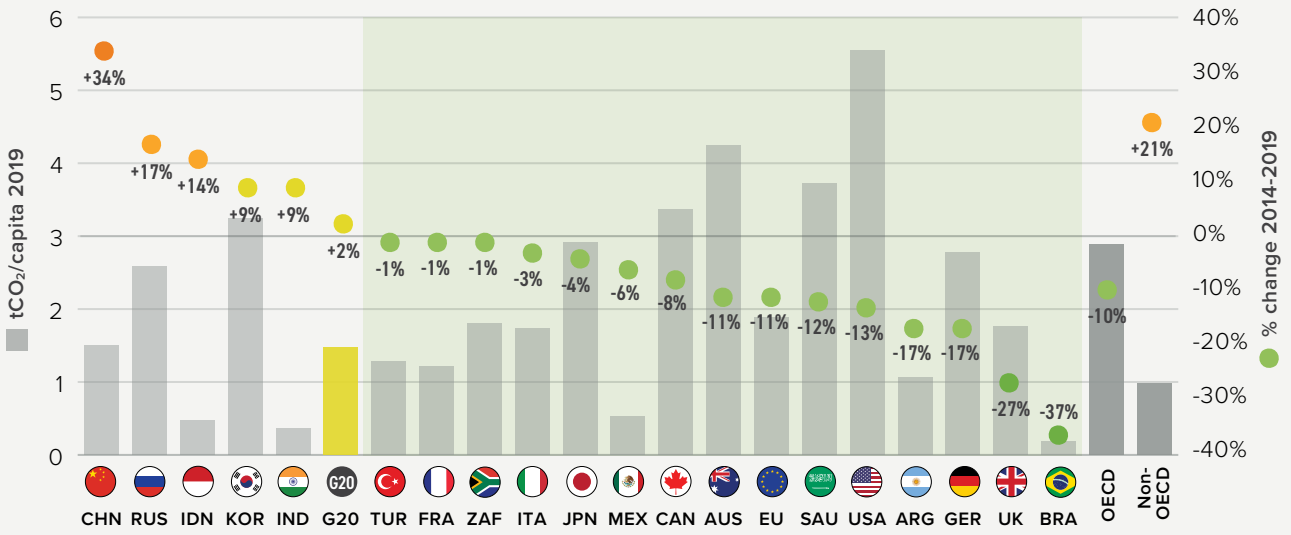
The building stock structure varies significantly across the G20, as do emissions from the sector. OECD countries typically have a large, aging building stock that requires retrofitting to decrease emissions intensity. In non-OECD countries, the building stock is set to increase over the coming decades, requiring greater attention to new building codes to prevent against emissions increasing. Per capita emissions in the building sector of OECD countries were almost three times that of non-OECD countries in 2019 (2.9 tCO_2/capita and 0.9 tCO_2/capita, respectively). As might be expected, building sector emissions have decreased between 2014 and 2019 in the OECD (-10%), while they have increased in non-OECD countries over the same period (+21%).

The USA, Australia, and Saudi Arabia have the highest per capita building emissions in the G20 and lack strong policies to substantially reduce emissions in the sector. While they all have some policies for new buildings, Australia and Saudi Arabia do not have any policies for retrofitting existing buildings. Though emissions have been decreasing across these countries, more ambitious policies will be necessary to meet the 1.5°C goal.

Per capita emissions in the build sector have grown steeply in China, Russia, and Indonesia between 2014 and 2019, moving these countries in the wrong direction. China introduced new building regulations in 2019 that may help slow this trend.

PER CAPITA BUILDING EMISSIONS DECREASED IN 15 G20 COUNTRIES BETWEEN 2014 AND 2019

Building emissions (incl. indirect emissions) per capita in the G20 (2019)



Source: Enerdata, 2020

	Near-zero energy new buildings	Retrofit of existing buildings
Low	No policies	No policies
Medium	Some policies such as building codes, standards or fiscal / financial incentives for low emissions options	Some policies such as building codes, standards or fiscal / financial incentives for low emissions options
High	Policies + national strategy for near-zero energy buildings	Policies + retrofitting strategy
Front-runner	Policies + national strategy for all new buildings to be near-zero energy by 2020 (OECD) or 2025 (non-OECD)	Policies + strategy to achieve annual deep renovation rates of 5% (OECD) or 3% (non-OECD by 2020)

China established the Zero-Energy Buildings Technology Standard in 2019 and aims to increase the energy efficiency of new buildings by 20% by 2020 and for 50% of new buildings to be certified green buildings. By 2030, 30% of new and renovated buildings are planned to be near-zero energy compliant.[144] However, these targets are not yet compatible with 1.5°C benchmarks.

Indonesia has green building standards (commercial and residential) for its major cities. The government also aims to decrease the energy intensity of buildings by 1% per year to 2025. However, ambitious standards for residential energy use are lacking and there is no national target for new buildings to be near-zero energy.[145]

Russia's latest Energy Efficiency Action Plan includes a target to ensure all capital upgrades to housing result in a minimum C rating for energy efficiency from 2022. However, the plan does not include a specific renovation rate. A sweeping 2018 plan to increase energy efficiency across the Russian economy sets a target of a 15% reduction in electricity and thermal energy consumption in apartment buildings by 2030. However, there are conflicting targets for policies in non-residential buildings and only limited mandatory technical requirements for administrative and public buildings. Russia has no strategy for new near-zero energy buildings.

On the other side, the EU is leading 1.5°C compatible strategies for new buildings. Emissions from the buildings sector in the EU are covered by the Energy Performance Buildings Directive (EPBD).[146] This directive was amended in 2018 and obliges member states to introduce minimum energy performance requirements and ensure that, from 2021, all new buildings are "nearly-zero energy buildings".

Japan, Mexico, South Africa, South Korea, and Turkey also have national policies and strategies in place for near-zero new buildings, although they are not yet 1.5°C compatible.

Japan's 2014 Strategic Energy Plan aims to achieve net-zero energy buildings by 2020 for new non-residential buildings and by 2030 for new public buildings nationwide.[147] For residential buildings, Japan aims to achieve net-zero energy for all newly constructed houses by 2030 (2020 for all new buildings would be 1.5°C compatible).

Mexico's Roadmap for Building Codes and Standards (2017) aims to reduce energy consumption by 35% in the building sector and to construct only near-zero energy buildings by 2050 (2025 would be 1.5°C compatible).[148] The Roadmap also envisages that all states will enforce an energy building code by 2030. In 2020, new targets were set for energy efficiency, with the goal to reduce energy consumption by 3.7% annually between 2031-2050.

South Africa's National Development Plan sets a goal for zero-emissions buildings by 2030.[149] The draft National Energy Efficiency Strategy foresees a 54% improvement in average energy performance of new commercial buildings by 2030, compared to the 2015 baseline.[150] There are ambitious mandatory energy building codes for new residential and non-residential buildings.

South Korea implemented a Zero-Energy Building Certification System in 2017. Mandatory energy codes apply to both residential and commercial buildings. South Korea is gradually applying stricter energy conservation designs to meet zero-energy building standards for all new buildings by 2025. Starting in 2020, new public buildings of 1,000 m^2 or greater will be required to have net-zero energy consumption.

Turkey has an Energy Performance of Buildings Code, which enforces insolation standards, and the 2018 Energy Efficiency Action Plan (NEEAP), which outlines a goal of "nearly-zero energy buildings" for newly built private and public buildings.[151] Target years for this goal were intended for publication in 2019, but so far these have still not been announced.

When it comes to retrofitting existing buildings, the EU EPBD obliges member states to submit long-term renovation strategies, leading to the full decarbonisation of its buildings stock by 2050 and specific milestones for 2030. However, the current renovation rate is only 1% annually and a 5% rate would be needed for 1.5°C compatibility. France and Germany have submitted long-term plans for retrofitting existing buildings. The EU Commission is expected to release its "Green Wave" initiative in the second half of 2020 under the Green New Deal.

- **France** aims to reduce energy consumption in the building sector by 28% by 2030 and achieve carbon neutrality for the buildings stock by 2050. A mandatory building code for renovations is in place. France's 2020 National Low-Carbon Strategy anticipates 500,000 thermal renovations yearly between 2015-2030 and 700,000 for 2030-2050.[152]
- **Germany's** Climate Action Plan 2050 aims to make the entire building stock near-climate-neutral by 2050 (an 80% energy reduction from 2008 levels).[153] This would require doubling current annual renovation rates to 2% annually.

Similar to other sectors, achieving zero emissions in the building sector will require upstream decarbonisation (specifically in the power sector) as well as the phase-out of fossil fuels for heating.

INDUSTRY SECTOR

1.5°C BENCHMARKS TO LIMIT GLOBAL WARMING

REDUCE INDUSTRIAL EMISSIONS

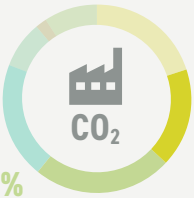
To meet the 1.5°C goal, industrial emissions need to be reduced by 65-90% from 2010 levels by 2050.

DEVELOP LOW EMISSION TECHNOLOGIES

All new installations in emissions-intensive industries must be low-carbon after 2020. Very low or zero-emissions production technologies need to be developed by 2030-2040 for steel, iron, cement, and concrete.

Own evaluation based on IPCC SR15; Kuramochi et al., 2017; Bataille 2019

G20 ENERGY-RELATED CO_2 EMISSIONS 2019 – INDUSTRY SECTOR



16.7% Electricity-related emissions

23.5% Direct emissions

Annual growth rate

+1.2% in 2019

+1.0% in 2018

+1.7% 2005-2017

Source: Enerdata, 2020

The industry sector has the highest share of energy-related CO_2 emissions in the G20, larger than buildings or transport sectors – and emissions are growing. Iron and steel account for 6-8% of global energy-related CO_2 emissions, while cement accounts for 6%.[154] Demand for these materials is projected to grow significantly over the coming decades, with global steel demand increasing by 15-40% and demand for cement increasing by 12-23% by 2050.[155] To meet the Paris Agreement temperature goal, industry needs to be decarbonised between 2050-2070, possibly with some compensation by negative emissions technology or natural carbon sinks.

CO_2 emissions in the industrial sector result from direct emissions (conversion of energy), indirect emissions (electricity and co-generated heat), and process emissions (mainly from iron, steel, and non-metallic mineral products – predominantly cement). Reducing industry emissions will require increasing material and **energy efficiency**, emissions efficiency (fuel switching), increasing and improving material recycling, reducing demand (e.g. less demand for private vehicles), and decarbonising production.

Emissions intensity in industry is higher in non-OECD countries than in OECD countries, partly due to the shift in heavy industry to emerging and developing countries, differences in technological standards, and regulations. Developing countries also typically have a higher share of their GDP coming from energy-intensive industry, which contributes to higher overall carbon intensities.[156] Further industrialisation in developing countries is expected to increase economic growth and the standards of living of their populations.[157] At the same time, step-change policy, technological, and other interventions are needed to avoid increasing emissions and to, instead, support sustainable development pathways.

South Africa, India, China, and Russia have the highest emissions intensity of industry among the G20. However, effective energy-efficiency policies are contributing to significant decreases in China (-28%) and India (-12%). In South Africa and Russia, upstream decarbonisation of the power sector and low-carbon steel technology will be critical in addition to energy efficiency measures.

China has already made considerable gains in energy efficiency in the last two decades, and mandatory energy efficiency policies cover almost 70% of industry. Energy efficiency has been a long-standing goal, with efficiency targets set out in most of the country's Five-Year Plans in recent decades. The 13th Five-Year Plan (2016-2020) contains a mandatory national target to reduce energy intensity to 15% below 2015 levels by 2020.[158]

India's Perform, Achieve and Trade (PAT) scheme aims to reduce energy consumption in energy-intensive industries with an associated market-based mechanism to enhance cost effectiveness through certification of excess energy saving, which can then be traded.[159] The first cycle (2012-2015) reduced the energy consumption of more than 400 energy-intensive enterprises by 5.3% (above the initial 4.1% target). The current phase (2017-2020) targets savings of 3%.

South Africa has the highest industrial emissions intensity in the G20, in large part due to the emissions intensity of the power sector (26% of industrial emissions come from electricity use in the sector and only 14% from direct emissions). Upstream decarbonisation will be necessary to reduce the emissions intensity of South African industry.

Russia is the fifth largest steel producer in the world, after China, India, Japan, and the USA. Russia's steel production uses twice the energy consumption of competitors in Japan or the USA and is 25% more energy-intensive than that of China. This is due to its reliance on older and less efficient production technologies.[160] To decrease industrial emissions intensity, Russia will have to switch to efficient, low-carbon technologies.

In addition to India, the most progressive industrial energy efficiency policies in the G20 are those in Italy, Japan, and Germany.

Italy is considered a top-performing country when it comes to emissions intensity, with lower industry intensity in general as well as implementation of comprehensive policies, such as mandates for energy managers, audits for facilities, and energy management systems (EnMS). The 2017 Italian National Energy Strategy aims to promote energy efficiency in small and medium-sized enterprises (SMEs) through calls for co-financing of energy audits and management systems.[161] Existing voluntary programmes, in cooperation with businesses, focus on the promotion of energy efficiency.

Japan has developed a mix of regulatory measures, voluntary actions, and financial incentives to successfully encourage energy efficiency in industry. The Act on the Rational Use of Energy (1978, revised in 2018) covers 90% of industrial use of energy.[162] The Act sets energy efficiency benchmarks for industry sub-sectors, such as iron and steel, cement, and electricity supply. Companies covered by the scheme are required to take measures to improve energy efficiency and report their energy use annually.

Germany forms part of the EU Emissions Trading Scheme (ETS), which creates an incentive to reduce emissions (and thus also energy consumption) in the industry sector. Large companies have been obliged to conduct energy audits since 2015. Starting in 1995, German industry has held a voluntary agreement with the federal government to decrease emissions. This was updated in 2012, with targets for annual reductions in energy intensity up to 2022. Tax exemptions are provided when companies reach these goals. The federal government also provides funding to small and medium-sized companies to improve energy efficiency. Germany aims to generate 25% of its electricity from Combined Heat and Power (CHP) by 2020.[163]

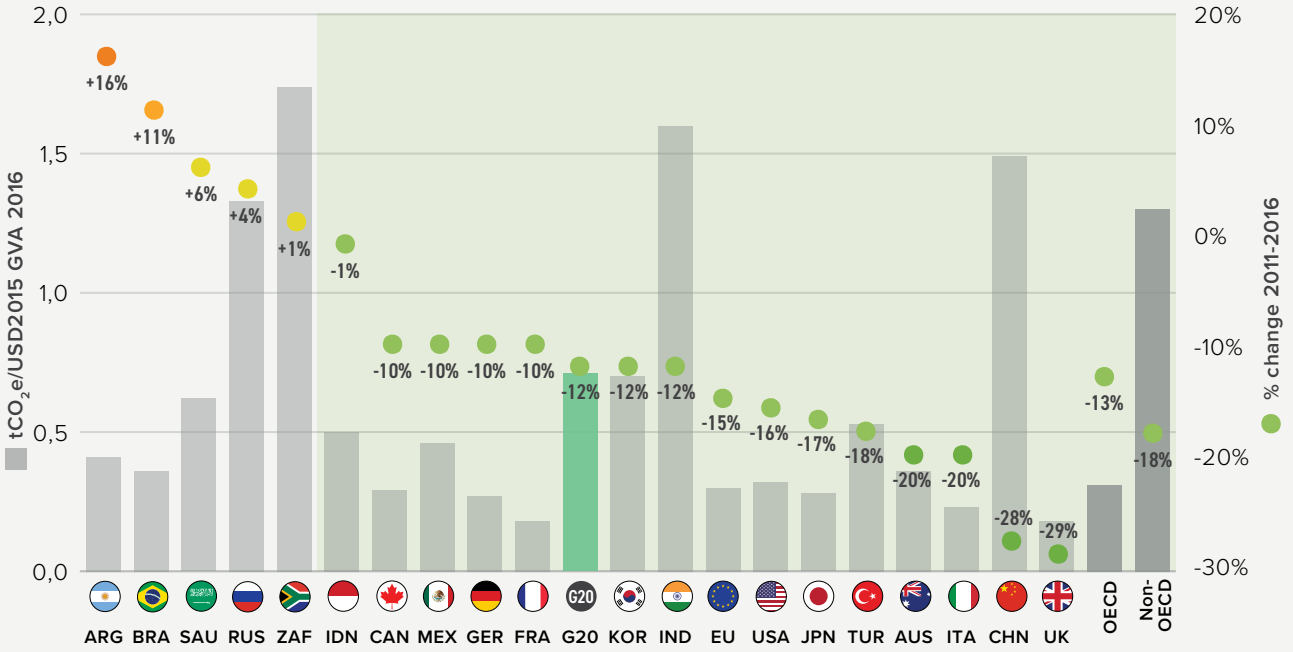
In addition to applying existing technologies and policy tools, G20 governments are turning their attention to the development and deployment of zero-carbon technologies – including zero-carbon hydrogen.[164] Six G20 members currently have hydrogen strategies (Australia,[165] EU,[166] France,[167] Germany,[168] Japan,[169] and South Korea[170]). Not all strategies focus exclusively on green hydrogen, some include hydrogen production from coal, gas, and nuclear. Nevertheless, developing hydrogen strategies and infrastructure is a positive step towards zero-carbon hydrogen.

Governments also need to develop economy-wide and sector-specific policies, to create an enabling environment for the necessary technological and structural shifts – such as disclosure requirements, emissions targets, and effective carbon pricing.

Decreasing industry emissions will require zero-carbon technology developments, such as green hydrogen.

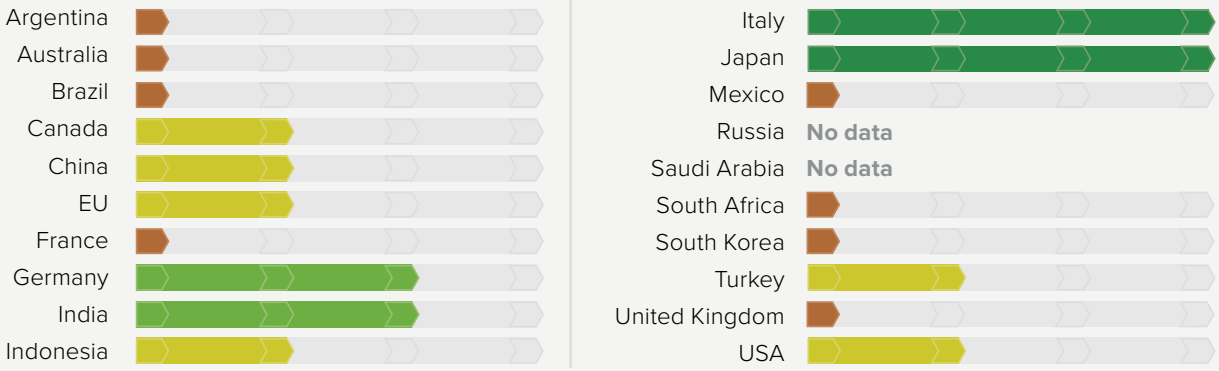
INDUSTRY EMISSIONS INTENSITY DECREASED IN 15 G20 MEMBERS BETWEEN 2011 AND 2016

Industry emissions intensity (incl. indirect emissions) in the G20 (2016)



Sources: Gütschow et al., 2019; Enerdata, 2020

Energy efficiency policies



Low	Medium	High	Front-runner
0-49% average score on the policy-related metrics in the ACEEE's International Energy Efficiency Scorecard	50-79% average score on the policy-related metrics in the ACEEE's International Energy Efficiency Scorecard	80-89% average score on the policy-related metrics in the ACEEE's International Energy Efficiency Scorecard	over 90% average score on the policy-related metrics in the ACEEE's International Energy Efficiency Scorecard

ACEEE's Industry Efficiency score covers: voluntary agreements, mandates for energy managers, mandatory energy audits, EnMS policies, combined heat and power (CHP) policies, and motor standards. For more information, see: https://www.aceee.org/research-report/i1801

AGRICULTURE & LAND USE

1.5°C BENCHMARKS TO LIMIT GLOBAL WARMING

STOP NET DEFORESTATION BY 2025

Net deforestation needs be stopped by 2025, with forests providing net CO_2 removals by 2030.

REDUCE EMISSIONS FROM FORESTRY AND LAND USE

Emissions from forestry and other land use must be reduced to 95% below 2010 levels by 2030.

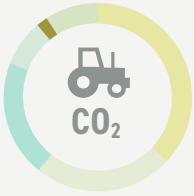
METHANE EMISSIONS MUST DECLINE

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).

Sources: Own evaluation based on IPCC SR15; Kuramochi et al., 2017

G20 ENERGY-RELATED CO_2 EMISSIONS 2019 – AGRICULTURE SECTOR

1.8%
(excl. land use)



Annual growth rate

-0.5% in 2019

-0.1% in 2018

+0.5% 2005-2017

Source: Enerdata, 2020

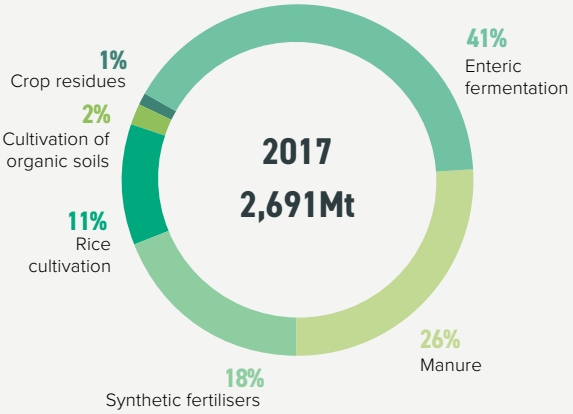
Agriculture, forestry, and other types of land use accounted for 23% of global GHG emissions from 2007-2016.[171] Energy-related CO_2 emissions make up only a small percentage of GHG emissions, with the bulk of CO_2 arising from forestry and other land use (FOLU), and methane (CH_4) and nitrous oxide (N_2O) emissions from agriculture.

Agriculture Sector

Higher demand for food, feed, water, and more resource-intensive production and consumption are driving emissions upward. Climate change is also contributing to desertification and land degradation, compounding land use trends. Sustainable intensification of land use practices, ecosystem restoration (including reforestation), afforestation, waste management, and lifestyle changes to less resource-intensive diets can help mitigate emissions from the land use and agriculture sector.[172]

G20 GHG emissions from agriculture continue to increase, driven by population growth and changing diets. In addition to CO_2 emissions, agriculture is responsible for 45% of methane emissions and 80% of nitrous oxide emissions globally. Livestock breeding is the main driver, enteric fermentation accounted 40% of agricultural emissions in 2017. Globally, cattle and dairy cows alone emit more GHGs than any single country, except China.[173] Demand

G20 GHG emissions from agriculture



Source: FAO STAT, 2019

for livestock and feed also contributes to GHG emissions through the destruction of forests and other natural land for grazing, production of fodder, and pasture. Lower consumption of animal products, as well as more sustainable agricultural practices, can reduce these emissions.

Land use

From 2001 to 2019, there was a 9.7% loss in tree cover globally, equivalent to 105 Gt CO_2 emissions.*[174] The total area of humid primary forests decreased globally by 94% in this time, accounting for 16% of total tree-cover loss.[175] Halting deforestation and forest degradation should be prioritised, not only to support the stability of critical carbon stocks and to maintain sequestration potential, but also to protect biodiversity and maximise the resilience and adaptive capacity of forest ecosystems.

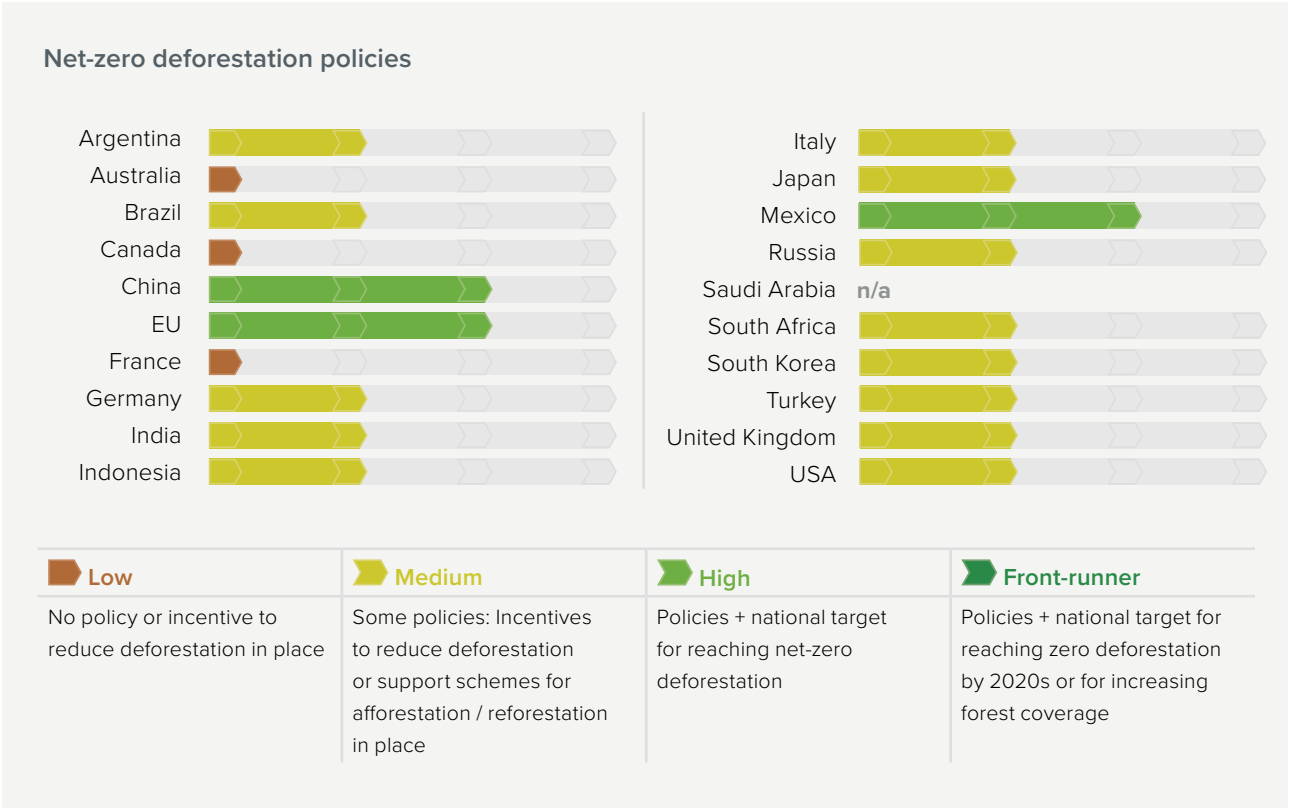
In the G20, Russia, Brazil, Canada, the USA, and Indonesia have had the highest relative tree-cover loss between 2001 and 2019, while Australia and Argentina are recording significant losses in critical forest assets – the Eastern Australian Forests and the Gran Chaco.[176] G20 countries should aim for zero deforestation.[177] Net-zero deforestation policies are a starting point to prevent further losses of critical natural resources, alongside pro-forestation and restoration efforts.

Russia lost 64 Mha of tree cover between 2001 to 2019 (excl. gains), equivalent to an 8.4% decrease in tree cover since 2000

Russia currently has no long-term strategy for reducing deforestation to zero. Despite significant deforestation, forestry has been a large net sink for CO_2 emissions for many years. Wildfires are increasingly a threat to Russia's vast forests, in part due to increasingly dry and hot temperatures. Forest management still includes burnings, and significant clear-cutting continues to occur in Russia's forests. To avoid a projected decline in the current tree cover, primary forests must be protected from these practices. A 2019 study calculated that managed land in Russia has a total annual mitigation potential of 545-940 $MtCO_2e$, indicating a greater potential than the latest emission reductions from the sector (-591 $MtCO_2e$ in 2018).[178]

Brazil Deforestation rates increased by 112% between 2012 and 2018

If conservation measures are not introduced, up to 31% of the Brazilian Amazon could be destroyed by 2030 and 40% by 2050.[179] Contributing factors include land grabbing,



** Global forest watch data for 2019 was not complete/available when compiling country profiles, but is included here in the summary report.*

illegal logging, pasture and cattle ranching, the expansion of mechanised agriculture (specifically for animal feed, soy, and palm oil), infrastructure (roads and dams), and forest fires. According to Brazil's NDC, the government aims to restore and reforest 12 million hectares and achieve zero illegal deforestation by 2030. However, recent budget cuts for monitoring and enforcement agencies and a roll-back of environmental regulations show that Brazil is going in the wrong direction with regards to these targets.

Canada lost 42.9 Mha of tree cover between 2001 and 2019 (excl. gains), equivalent to a 10% decrease in tree cover since 2000

Commodity-driven deforestation rates account for less than 1% of tree-cover loss in Canada. Instead, forest degradation and forest fires are the major threats to the carbon sequestration capacity of Canadian forests. As Canada's approach to LULUCF under the UNFCCC excludes "natural disturbance", these substantial emissions are excluded from national accounts.

The USA lost 40.3 Mha of tree cover between 2001 to 2019 (excl. gains), equivalent to a 14% decrease in tree cover since 2000

The 2015-2020 Forest Plan aims to sustain the country's forests, but there is no quantitative national target. In March 2019, the president signed a Public Lands Bill, adding half a million hectares of protected wilderness.

Indonesia lost 26.8 Mha of tree cover between 2001 to 2019 (excl. gains), equivalent to a 17% decrease in tree cover since 2000

The land use sector accounted for 43% of Indonesia's total emissions in 2016 at 635 $MtCO_2e$. In 2020, Indonesia received the first payment of USD 56mn from Norway under the REDD+ scheme. According to the verification process conducted by the Norwegian Government from Nov 2019 to March 2020, the emission reduction achieved by Indonesia in the 2016-2017 period was 11.2 $MtCO_2$. Although land use emissions are highly uncertain, this sector's emissions have increased nearly 200% from 1990 to 2016 levels. The Peatland Restoration Agency intends to restore 2.4 million hectares of peatland to reduce fires and peat decomposition emissions. The National Action Plan for Greenhouse Gas Emission Reduction (RAN-GRK) also outlines actions for sustainable peatland management, decreasing the deforestation and land degradation rate, and improving carbon sequestration projects. Indonesia has not set a target to halt deforestation and still faces alarmingly high rates of commodity-driven deforestation.

Australia lost 6.11 Mha of tree cover between 2001 to 2019 (excl. gains) equivalent to a 14% decrease in tree cover since 2000

Australia has no policies or incentives in place to reduce deforestation. Deforestation levels are high compared to global standards, particularly in the state of Queensland. Australia is the only developed country that is considered a deforestation hotspot and 3-6 million hectares of forest could be lost in eastern Australia alone by 2030.[180] The primary driver of deforestation is pasture creation for livestock, which accounts for 88% of forest clearing.[181] Forest fires are not accounted for in the national emissions inventory, and the government assumes that equivalent emissions (around 830 $MtCO_2e$ based on the fires in 2020 up to 11 February) will be sequestered by forest regrowth. Yet, the scale and intensity of the fires affects the rate of forest regrowth and carbon sequestration. Australia needs to protect existing forests and take necessary adaptation measures to guard against the devastating wildfires witnessed in recent years.

Argentina lost 5.92 Mha of tree cover between 2001 to 2019 (excl. gains), equivalent to a 15% decrease in tree cover since 2000

The primary drivers of deforestation in Argentina are agriculture, livestock, and infrastructure (roads and pipelines).[182] The 2017 National Action Plan on Forests and Climate Change aims to reduce GHG emissions from the forest sector by at least 27 $MtCO_2e$ by 2030; however, no baseline is provided. The 2007 Native Forests Law aims to reduce deforestation of native forests but has been systematically defunded and lacks enforcement. In September 2019, former President Macri announced a target of net-zero deforestation by 2030 at the UN. However, only 4.5% of the budget required by law for the implementation of the Native Forest Law was allocated under the 2019 budget. Argentina needs to ensure necessary resources are allocated to meet policy targets and deforestation commitments.

Alongside deforestation targets and policies, G20 countries can use protected area networks, develop deforestation-free supply chains, promote forest-friendly infrastructure (including through strict impact assessments), and develop optimal land use approaches.[183] Combining mitigation and adaptation approaches in land use and agricultural sectors can also provide significant co-benefits, reducing costs and adding to overall climate resilience.

COMPARING G20 CLIMATE ACTION: MITIGATION

PARIS AGREEMENT

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

THE G20 ARE NOT ON TRACK FOR A 1.5°C WORLD

The 2015 **NDCs would lead to 2.7°C** or higher global temperature increases

Global net CO_2 emissions need to be 45% below 2010 levels by 2030 and reach net-zero by 2050

G20 members **need to update NDC targets** to reflect highest possible ambition in 2020/21

G20 TRENDS SHOW PROGRESS IN KEY SECTORS

G20 Emissions Intensity of the Power Sector 2014-2019 (CO_2 emissions per kWh – % change)

IDN	KOR	SAU	TUR	MEX	RUS	FRA	ZAF	G20	AUS	CHN	CAN	ITA	JPN	IND	ARG	USA	EU	GER	BRA	UK
10%	0%	-2%	-3%	-4%	-7%	-7%	-10%	-10%	-11%	-11%	-12%	-12%	-14%	-16%	-18%	-18%	-21%	-23%	-47%	-51%

G20 Growth in Share of Renewables in Power Generation (incl. large hydro) 2014-2019 (% change)

ITA	ARG	CAN	MEX	IDN	RUS	BRA	CHN	EU	G20	FRA	IND	AUS	USA	JPN	GER	TUR	UK	KOR	ZAF	SAU
-5%	3%	3%	3%	8%	8%	14%	16%	19%	20%	21%	27%	30%	37%	45%	48%	77%	85%	107%	158%	1521%

G20 Transport Emissions per capita (exl. aviation) 2013-2018 (tCO_2e/capita – % change)

TUR	IND	CHN	KOR	EU	G20	GER	USA	AUS	UK	IDN	FRA	MEX	JPN	ITA	CAN	RUS	ARG	ZAF	BRA	SAU
38%	26%	23%	14%	7%	6%	4%	4%	2%	2%	2%	-2%	-3%	-5%	-5%	-5%	-6%	-6%	-6%	-11%	-25%

G20 Aviation Emissions per capita 2012-2017 (tCO_2e/capita – % change)

TUR	CHN	IND	ARG	SAU	MEX	KOR	ZAF	IDN	G20	USA	JPN	EU	AUS	GER	ITA	CAN	UK	FRA	BRA	RUS
232%	59%	38%	34%	33%	29%	28%	27%	27%	19%	17%	14%	13%	11%	10%	10%	3%	1%	0%	-13%	-23%

G20 Building Sector Emissions per capita 2014-2019 (tCO_2e/capita – % change)

CHN	RUS	IDN	KOR	IND	G20	TUR	FRA	ZAF	ITA	JPN	MEX	CAN	AUS	EU	SAU	USA	ARG	GER	UK	BRA
34%	17%	14%	9%	9%	2%	-1%	-1%	-1%	-3%	-4%	-6%	-8%	-11%	-11%	-12%	-13%	-17%	-17%	-27%	-37%

G20 Emissions Intensity of Industry 2011-2016 (tCO_2e/USD 2015 GVA – % change)

ARG	BRA	SAU	RUS	ZAF	IDN	CAN	MEX	GER	FRA	G20	KOR	IND	EU	USA	JPN	TUR	AUS	ITA	CHN	UK
16%	11%	6%	4%	1%	-1%	-10%	-10%	-10%	-10%	-12%	-12%	-12%	-15%	-16%	-17%	-18%	-20%	-20%	-28%	-29%

2019 TURNING POINTS

CO_2 energy-related emissions down 0.1% in 2019

- Carbon-intensity of primary energy supply **-0.8%**
- Coal consumption **-2%**
- CO_2 emissions from the power sector **-2.4%**
- **27%** of power generated from RE, compared to 25% in 2018
- Energy-related CO_2 emissions from the agriculture sector **-0.5%**

2019 STICKING POINTS

Fossil fuels still 81.5% of primary energy | transport, industry, and building sectors require more urgent action

- Consumption grew in Gas **+3%** and Oil **+1%**
- CO_2 emissions from the transport sector **+1.5%**
- CO_2 emissions from the building sector **+0.9%** in 2019
- CO_2 emissions from the industry sector **+1.2%**

KEY POLICY OPPORTUNITIES FOR ENHANCED MITIGATION

Countries scoring:
Low Medium High Frontrunner

RENEWABLE ENERGY: POWER GENERATION MUST BE DECARBONISED BY 2050
Brazil, Germany, and the UK have ambitious renewable energy policies but no G20 member has 1.5°C compatible targets. Australia, Mexico, USA, and Canada do not have policies in place to increase renewables.

COAL PHASE-OUT: COAL USE NEEDS TO PEAK IN 2020, THEN PHASE OUT RAPIDLY
Canada, France, Italy, and the UK have 1.5°C compatible coal phase-out dates targets (by 2030 or earlier), Germany follows with a phase out date of 2038.

FOSSIL FUEL CAR PHASE-OUT: LAST FOSSIL FUEL CAR TO BE SOLD IN 2035
The UK is in the process of setting a 2030 target for the last sale of a fossil fuel car, followed by Canada and France with a 2040 target, and Japan 2050. Australia and Russia have no policies in place.

HEAVY-DUTY VEHICLE DECARBONISATION: SWITCH TO LOW-CARBON FUELS BY 2050
No countries have ambitious policies for decarbonising heavy-duty vehicles.

MODAL SHIFTING (GROUND) TRANSPORT: SWITCH TO LOW-CARBON ALTERNATIVES
No countries have ambitious policies with long-term strategies for modal shifting in ground transport. Australia has no policies in place.

NEAR-ZERO ENERGY NEW BUILDINGS: NEAR-ZERO BY 2020 (OECD) & 2025 (NON-OECD)
France, Italy, and Germany are frontrunners (1.5°C compatible policies) and 7 G20 countries have high ambition policies in place. Only Russia and Argentina have no policies.

RETROFIT EXISTING BUILDINGS: ANNUAL RENOVATION RATE OF 5% (OECD) & 3% (NON-OECD) BY 2020
No G20 countries have 1.5°C compatible policies for retrofitting existing buildings. The EU, Germany, and France are leading with high ambition policies.

INDUSTRY ENERGY EFFICIENCY: EFFIECIENY POLICES ACROSS INDUSTRY
Italy and Japan are frontrunners. Germany and India follow with high ambition policies.

(NET) DEFORESTATION: ZERO DEFORESTATION BY 2020S & INCREASING FOREST COVERAGE
China, EU, and Mexico have the most ambitious policies but not yet 1.5°C compatible.

FINANCE

MAKING FINANCE FLOWS CONSISTENT WITH CLIMATE GOALS

"We are at a crossroads: one road leads to climate crisis with extreme heat, fires and flooding increasingly impacting G20 countries, the other to a resilient, sustainable and inclusive future for all. G20 leaders need to reaffirm their commitment to the right course. The Climate Transparency Report identifies clear opportunities for the G20 to enhance climate ambition on the road to COP26 and to align their financial systems with the Paris goals and the SDGs."

Laurence Tubiana, CEO European Climate Foundation

UK | A jack up barge on the foreshore near Workington, installing the power cable that will carry electricity from the Robin Rigg offshore wind farm. Photo by Ashley Cooper/Construction Photography/Avalon/Getty Images.

1.5°C BENCHMARKS FOR ALIGNED FINANCE FLOWS

Investment in green energy and infrastructure needs to outweigh fossil fuel investments by 2025.

1.5°C compatible mitigation and adaptation actions will require **strengthened global-to-local financial architecture** that enables greater access to finance and technology.

In addition to climate-positive allocation of public funding, **a redirection of 5-10% of annual capital revenue** could be necessary to limit warming to 1.5°C.

The mobilisation of institutional investors and mainstreaming of **climate finance within the financial and banking system regulation** and access by developing countries to low-risk and low-interest finance through development banks needs to be facilitated.

Sources: Own evaluation based on IPCC SR15; Kuramochi et al., 2017

Making finance flows consistent with low-emission, climate-resilient development pathways is critical to achieving the Paris Agreement temperature targets and supporting sustainable development. This will require a structural shift in finance flows away from investments and consumption patterns that are incompatible with climate goals – specifically fossil fuels and related infrastructure.

Accounting for 85% of global GDP and two thirds of global foreign direct investment flows, the G20 has a critical role to play in achieving this third goal of the Paris Agreement.[184] G20 members are well positioned to lead in multilateral coordination efforts, which are crucial to effectively managing the systemic risks posed by climate change. Developed G20 countries are also obliged under the Paris Agreement to provide support to developing countries – including through the provision of climate finance.[185]

To bring finance flows into alignment with the Paris Agreement, governments and other quasi-governmental finance actors can make use of several familiar tools:

1. **Financial Polices and Regulations** can be amended or introduced to internalise climate-related risks and costs, green the financial architecture, and signal the redirection of the economy in line with climate goals. Examples include climate-related risk disclosure, credit policies, and lending requirements that shift public and private spending away from projects with climate risks and towards green alternatives.
2. **Fiscal Policies** can be harnessed to influence economic activity through price signals. Examples include redirecting harmful fossil fuel subsidies towards promoting mitigation (e.g. renewable energy) and adaptation (e.g. sustainable farming) activities, while adjusting government spending and revenues (e.g. raising revenue by increasing the cost of CO_2 emissions-intensive activities and products through carbon pricing).
3. **Public Finance** can be redirected to green and climate responsive investments and activities, lowering costs and risks and encouraging private capital to follow suit. Examples include redirecting public funding away from climate negative projects (e.g. coal mining) to green projects through more transparent national and international public finance institutions.

FINANCIAL POLICIES AND REGULATIONS

G20 economies can lead in greening their financial systems through internalising and managing the systemic risks that climate change poses to the financial system.

The World Economic Forum's 2020 Global Risks Report, published in January 2020, rated climate action failure as the number one risk by impact (and number two in likelihood) over the next 10 years.[186] Alongside climate action failure, biodiversity loss, extreme weather, natural disasters, human-made environmental disasters, and water crises all featured in the top 10.

CLIMATE-RELATED RISKS FOR THE ECONOMY AND FINANCIAL SYSTEM[187]

- **Physical risks:** extreme and high frequency climatic events cause economic losses, both directly and indirectly – e.g. floods can damage physical assets and disrupt food production value chains.
- **Transition risks:** climate change policies can shift asset values or lead to higher costs of doing business, especially if implemented too late or without appropriate transition planning – e.g. policies for phasing out coal can decrease the lifespan of power plants, impacting their asset value, or might increase the costs of running such a plant.
- **Liability risks:** compensation may be sought for the impacts of climate change and climate policy – e.g. parties may seek financial compensation for losses they experience due to climate change impacts.

Climate-related risks are already disrupting supply chains, production, and operations in many sectors. These risks may also lead to changes in demand for products and services, as well as changing resource and input prices, and revaluation of assets. Through these routes, climate-related risks can affect national tax revenue raising, challenge debt repayment, and hinder economic growth.[188] As a consequence, the financial system can face increased default rates, lower asset values, and greater risks in portfolios, among other outcomes.[189]

G20 governments, central banks, and other quasi-governmental institutions must work to mitigate climate-related risks by enacting financial policies and regulations to align finance flows with low-carbon, climate-resilient development.[190]

- **Green finance principles** guide the alignment of national financial architecture across both public and private actors with climate change objectives.
- **Macro-prudential policies** focus on the supervision of the activities of financial sector actors, managing the systemic risks of the financial system as a whole, as opposed to asset-level or company-level risk management.[191]

Green Finance Principles

G20 countries have acknowledged the need to adjust national financial system architectures and all but three (India, Saudi Arabia, and South Korea) have initiated discussions or are already implementing some form of green finance principles through national green finance strategies or taxonomies of sustainable finance.

The degree to which a country has a national plan or taxonomy reflects broader political will and attention to climate change implications in the financial sector. Significant progress has been made in the last two years in response to the work of the Task Force on Climate-related Financial Disclosure (TCFD), which was established in December 2015 by the G20's Financial Stability Board. The TCFD's mandate is to "develop voluntary, consistent climate-related financial risk disclosures".[192] [193]

In early 2020, the **EU** Taxonomy for sustainable activities was published by the Technical Expert Group (TEG) on sustainable finance of the European Commission.[194] [195] [196] This classification system is noteworthy in its wide reach across developed economies in the G20. In 2020, financial market participants are expected to be mandated to present disclosures in relation to the taxonomy covering adaptation and mitigation activities by the end of 2021 (for companies this is expected in 2022). Alignment with the taxonomy is expected to support both public and private actors in programming and accessing sustainable finance. However, there are on-going discussions about the measurement methods, thresholds, scope, and unintended consequences of the taxonomy.[197]

Other G20 countries are also developing or have developed taxonomies, such as **China** and **Mexico**. It remains to be seen how cross-border interpretations and learnings will evolve across G20 countries.

Macro-prudential Policies

As a group, G20 countries are making steady progress on advancing macro-prudential policies aimed at reducing and managing the risks that climate change poses to the stability of the financial system.[198] The primary instruments available to central banks and regulators include:

1. **Enhanced supervisory review, risk disclosure, and market discipline:** instruments that identify the state of the financial actors, institutions, or investments themselves (including risk disclosure, risk assessment and stress tests).

G20 FINANCIAL POLICIES AND REGULATION

Mandatory Voluntary Under discussion None

	Green financial principles	Enhanced supervisory review, risk disclosure and market discipline		Enhanced capital and liquidity requirements			
Instruments	**E.g. Green Finance Taxonomy**	**Climate risk disclosure requirements**	**Climate-related risk assessment and climate stress-testing**	**Liquidity instruments**	**Lending limits**		**Differentiated reserve requirements**
Objective	General discussion / process of implementation of principles aligning prudential and climate change objectives in the national financial architecture	Disclose the climate-related risks to which financial institutions are exposed	Evaluate the resilience of the financial sector to climate shocks	Mitigate and prevent market illiquidity and maturity mismatch	Limit the concentration of carbon-intensive exposures	Incentivise low carbon-intensive exposures	Limit misaligned incentives and channel credit to green sectors
Argentina	Yes	Voluntary	None	None	None	None	None
Australia	Yes	Under discussion	Under discussion	None	None	None	None
Brazil	Yes	Mandatory	None	None	None	None	None
Canada	Yes	Voluntary	Under discussion	None	None	None	None
China	Yes	Mandatory	None	None	None	Mandatory	Mandatory
European Union	Yes	Under discussion	None	None	None	None	None
France	Yes	Mandatory	Voluntary	None	None	None	None
Germany	Yes	Voluntary	Voluntary	None	None	None	None
India	No	Voluntary	None	None	None	Mandatory	None
Indonesia	Yes	None	Mandatory	None	Under discussion	Mandatory	None
Italy	Yes	Voluntary	Voluntary	None	None	None	None
Japan	Yes	Under discussion	None	Voluntary	None	None	None
Mexico	Yes	None	Voluntary	None	None	None	None
Russia	Yes	None	None	None	None	None	None
Saudi Arabia	No	None	None	None	None	None	None
South Africa	Yes	Voluntary	None	None	None	None	None
South Korea	No	None	None	Mandatory	None	None	None
Turkey	Yes	None	None	None	None	None	None
United Kingdom	Yes	Voluntary	None	None	None	None	None
United States	Yes	None	None	None	None	None	None

Source: Analysis based on a revised version of data presented in D'Orazio and Popoyan, 2019 [222] [223]

2. **Enhanced capital and liquidity requirements:** instruments implemented by banks to direct flows towards climate-positive activities or away from climate-negative activities (including liquidity and lending limits and differentiated reserve requirements).

The G20 is also well represented in the Central Banks and Supervisors Network for Greening the Financial System (NGFS). The NGFS is a voluntary network, established in 2017 by central banks and supervisory authorities from China, France, Germany, Mexico, Singapore, Sweden, the Netherlands, and the UK. Since then, the network has grown to 37 members – 17 of which are from the G20. The NGFS aims to define and promote best practices, including monitoring climate risks, developing taxonomies, promoting climate-related financial disclosures, and incorporating climate-related risks into prudential frameworks.[199] [200]

Enhanced Supervisory review, risk disclosure, and market discipline

A number of G20 countries have enhanced their supervisory review frameworks, predominantly through climate risk disclosure requirements. In addition, more guidance is emerging on the evaluation of climate-related risks and climate stress testing, though it remains largely voluntary and only penetrates financial system actors to varying degrees between countries.

- In September of 2019, **Germany's** Federal Financial Supervisory Authority (BaFin) published a compendium of best practices relating to sustainability risks for credit institutions, insurance undertakings, and asset management companies, discussing how to integrate climate-related financial risks into disclosed risks.[201]
- In mid 2019, a group of 18 banks in **Argentina** signed a Sustainable Finance Protocol to facilitate the integration of Environmental, Social, and Governance (ESG) criteria into their operations. The commitments of these banks include the creation of financial products with positive environmental and social impact, as well as the optimisation of risk analysis systems with an environmental and social focus.

Enhanced capital and liquidity requirements

The improvement of capital and liquidity instruments remains strongest in G20 emerging economies in Asia. By contrast, G20 developed economies are lagging, though it is recognised that prudential authorities hold differing mandates and functions in differing nation states.[202]

- In mid-2019, the Reserve Bank of **India** increased the percentage of adjusted net bank credit to be made available for Green Bonds from 10-15%.

FISCAL POLICIES: SUBSIDIES & CARBON PRICING

All G20 countries need to phase out fossil fuel subsidies and introduce effective carbon pricing schemes, alongside complementary fiscal policies directed towards adaptation efforts and a just transition to a low-emission and climate-resilient economy.

Fiscal policy levers, such as subsidies and taxes, influence private investment decisions and consumer behaviour by affecting the price of goods.[203]

G20 governments have historically used such levers to provide significant support to fossil fuel industries, contributing to their growth and profitability. Fiscal policies that benefit fossil fuel industries, whether directly (e.g. subsidies to coal production) or indirectly (e.g. support to fossil fuel consumption or import taxes on electric vehicles), also inhibit the development and commercialisation of renewable and sustainable alternatives.

G20 countries can use carbon and energy pricing mechanisms to bring finance flows in line with the Paris Agreement temperature goal. This includes not only introducing new fiscal instruments (such as feed-in tariffs, renewable certificates, and public tenders for renewables) but also reforming existing ones (such as fossil fuel and land use subsidies).

Fiscal policy reforms will also need to contend with the socio-economic challenges associated with a low-carbon transition to turn these into opportunities. Critically, policy reforms need to support job creation – with attention paid to quality, location, education, and training needs – and the protection of the communities most affected (e.g. coal mining communities).

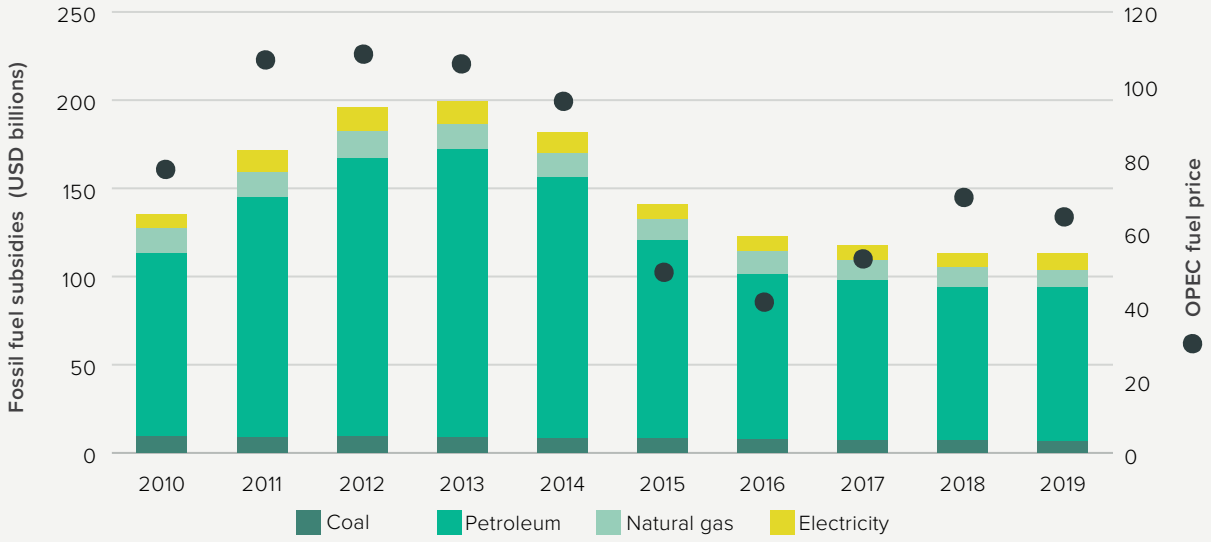
Fossil fuel subsidies[204]

In 2009, G20 countries committed to "rationalise and phase out over the medium-term inefficient fossil fuel subsidies that encourage wasteful consumption" but not much has changed since then.[205]

G20 countries, excluding Saudi Arabia, Turkey, and the UK, provided USD 130bn in subsidies to coal, oil, and gas in 2019. This represents an increase on USD 117bn in 2018.

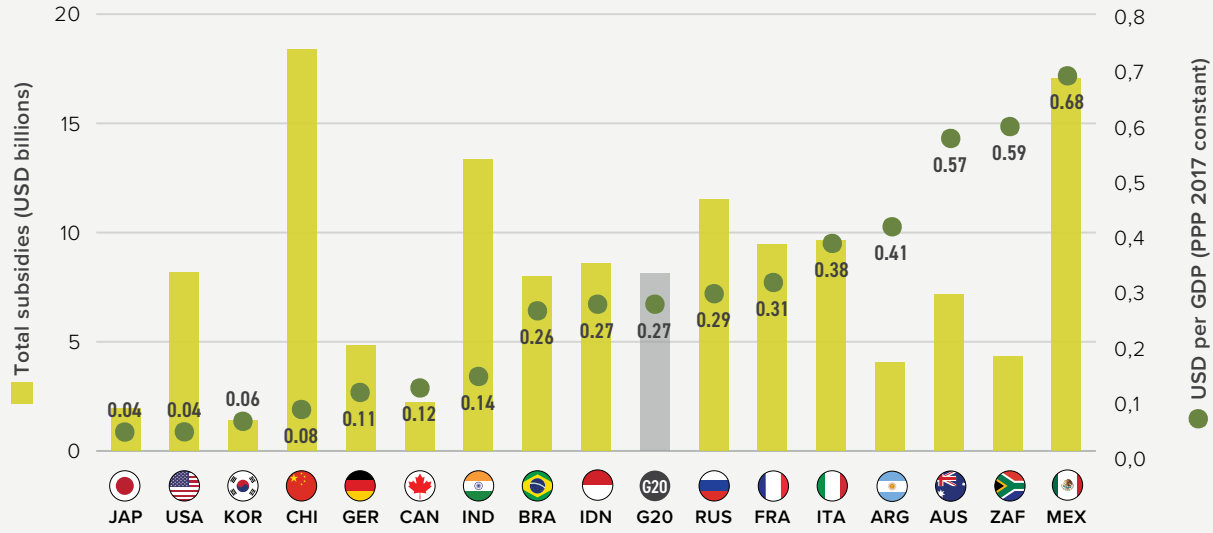
G20 COUNTRIES PROVIDED USD 130BN IN SUBSIDIES TO COAL, OIL, AND GAS IN 2019

G20 fossil fuel subsidies by year



Source: OECD-IEA Fossil Fuel Support database, 2020

G20 fossil fuel and fossil fuel electricity subsidies (2019)*



Source: OECD-IEA Fossil Fuel Support database, 2020

** Data for Turkey in 2019 for was not included in the OECD database; however, USD 5bn in subsidies were recorded by the SHURA Energy Transition Centre.*

However, this remains a decrease on the 10-year high of USD 233bn in 2013.[206] It should be noted, however, that G20 expenditure on fossil fuel subsidies is affected by the price of fossil fuels – changes do not always indicate changes in fiscal policies. For example, the general decline in subsidies provided to oil and gas since 2013 is in, large, part due to the dramatic decline in oil prices over the same period.

When it comes to absolute spending on fossil fuel subsidies, China, Mexico, India, Russia, Italy, France, Indonesia, and the USA were all above the G20 average in 2019. Mexico, South Africa, Australia, Argentina, Italy, France, and Russia were all above the G20 average when looking at fossil fuel subsidies per unit of GDP in the same year.

In all G20 member states except Germany, the largest subsidies are directed toward petroleum as opposed to coal, natural gas, or electricity. In Germany, coal subsidies are largely being used to support the coal transition up to 2038 – with support for hard coal miners until 2027 and for the rest of the coal industry over the next 20 years.[207]

Fossil fuel subsidies are larger for consumption than production in the majority of G20 countries, except Japan, Mexico, and Russia. However, subsidies directed at supporting fossil fuel consumption tend to be more straightforward to identify and quantify than those directed at supporting the production of fossil fuels.[208]

Spending on fossil fuel subsidies is not stable year-on-year, however, and trends can be reversed – either due to external factors or changes to fiscal policies. Factors affecting fossil fuel subsidies include fluctuations in fossil fuel prices, exchange rates, economic growth, energy demand and mix (e.g. drought may decrease hydropower reserves), natural disasters (e.g. post Fukushima fuel switching from nuclear to gas), political conditions (e.g. "yellow vest" protests in France), etc. Successful fossil fuel subsidy reforms will depend on effective inclusion of socio-economic considerations, as well as robust regulations relating to transparent accounting and hard targets.

Fossil fuel subsidies in G20 countries (USD billions)

Increase | Decrease

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Argentina	5.1	8.7	8.2	10.5	14.0	15.0	15.7	9.2	6.7	4.1
Australia	5.4	6.7	5.8	5.4	5.1	4.4	7.1	8.1	7.4	7.2
Brazil	27.4	33.8	35.7	33.6	29.1	16.5	13.4	9.7	8.3	8.0
Canada	4.6	2.9	3.2	3.2	3.3	2.2	2.4	2.5	2.2	2.2
China	18.1	20.7	37.0	36.9	32.7	33.3	18.4	21.4	19.4	18.4
France	3.6	5.5	5.8	5.9	5.7	5.3	6.0	7.0	9.3	9.5
Germany	6.9	6.9	6.0	6.0	6.2	5.0	5.3	5.1	5.1	4.8
India	8.2	13.9	14.6	20.7	13.1	12.7	10.3	10.7	11.1	13.4
Indonesia	15.1	30.7	33.8	30.5	29.6	10.3	9.6	7.7	8.1	8.6
Italy	12.9	15.6	16.2	17.2	18.0	15.7	14.6	12.8	10.9	9.6
Japan	2.2	2.6	3.1	3.4	2.6	2.6	3.0	2.4	1.9	1.9
Mexico	7.2	16.8	18.5	8.6	3.3	4.9	17.2	5.1	4.0	17.1
Russia	5.9	7.7	8.9	9.5	7.0	4.6	7.0	10.2	12.7	11.5
South Africa	2.6	3.0	4.4	3.4	3.3	3.1	2.4	2.9	3.0	4.3
South Korea	1.9	1.9	1.8	2.0	2.0	1.7	1.4	1.5	1.5	1.4
United States	15.2	10.8	11.4	11.2	10.3	8.7	6.6	6.4	5.3	8.2

Countries for which information was incomplete at the time of compiling data have been excluded.

Source: OECD-IEA Fossil Fuel Support database, 2020

- **The EU and all its Member States** have committed to a phase-out of fossil fuel subsidies by 2020, yet little progress has been made. In the most recent National Energy and Climate Plan (2019), several countries failed to recognise existing subsidies as such or even discussed the introduction of new subsidies.[209]
- **Indonesia** introduced reforms in petroleum and petrol pricing from 2014-2017 (combined with compensation for poor consumers), but subsidies have been creeping back in over the past two years and prices were again fixed in 2019 ahead of elections.[210]
- **Mexico** implemented fossil fuel subsidy reforms as part of a larger programme of energy sector reforms initiated in 2013; however, reforms have halted and been challenged following a change in political leadership.

Carbon pricing

A total of 18 G20 countries have implemented or are in the process of implementing explicit carbon pricing schemes, such as carbon taxes and emission trading schemes (ETS). Australia and India do not have, nor are they considering, carbon taxes or emissions trading schemes.

- In early 2020, the three-year pilot phase of **Mexico's** national carbon market – the first emissions trading system in Latin America – started.
- In 2019, **South Africa** became the first African nation to launch a carbon tax.
- In 2019, **Germany** established an explicit carbon price at the national level (in the heating and road transport sectors) with a fixed price of EUR 25/tCO_2 in 2021, which will increase to EUR 55/tCO_2 in annual increments to 2025.[211]

Brazil, Indonesia, Russia, Saudi Arabia, and Turkey have all identified the potential for an explicit carbon pricing scheme, yet key details are still to be established.[212]

Carbon pricing is more effective when high enough effective tax rates are set and cover a substantial share of total emissions. G20 members that have implemented pricing schemes tend to have either relatively high effective tax rates or effective coverage, except for South Korea, which has both.

Among those G20 members that have an explicit national carbon pricing scheme, the ETSs in France, South Korea, and the EU present the highest carbon tax rates. The highest rate can be observed in France at USD 48/tCO_2 – following a six-fold increase in the tax rate since its introduction in 2014. However, further planned increases have been put on hold due the large-scale protests in 2018. In contrast, Japan, Mexico, South Africa, and Argentina present the lowest carbon tax rates (ranging between USD 0.3/tCO_2e and USD 6/tCO_2e).

When it comes to coverage, South Africa, South Korea, and Japan have the highest shares of emissions covered. The highest coverage is observed in South Africa, where the scheme covers 80% of domestic emissions.[213] Meanwhile, Argentina, China, France, and the UK have the lowest shares of emissions covered (between 20% and 35% of total emissions).

Present carbon prices are not high enough to be consistent with the Paris Agreement. The High-Level Commission on Carbon Prices estimated that carbon prices of at least USD 40-80/tCO_2 by 2020 and USD 50-100/tCO_2 by 2030 are required to cost-effectively reduce emissions in line with the temperature goal of the Paris Agreement.[214]

Explicit and effective carbon pricing schemes can raise significant revenues. These revenues can be redistributed to protect those most vulnerable to the transition impacts, and thereby boost the political feasibility and justness of the transition. Carbon revenues can also be used to boost investment in sustainable infrastructure, public goods, and social safety nets.[215] Ideally, the introduction or strengthening of a carbon pricing scheme should be accompanied by a consistent plan of investments to create more sustainable alternatives that will allow people to efficiently switch their behaviour.[216]

In 2019, France and Canada were the two G20 countries with the highest carbon revenues as a proportion of GDP, with total revenues of USD 9.3bn and USD 5.6bn, respectively.[217] Canada and Japan were the only G20 countries whose carbon revenues were higher than their fossil fuel subsidies in 2019.

All G20 countries need to introduce carbon pricing schemes, and these need to cover a substantial share of the total carbon emissions across sectors at high enough effective tax rates.

PUBLIC FINANCE

All G20 countries need to end public finance for fossil fuel at home and overseas, and those with a historic responsibility or ability to provide climate finance to developing countries should ramp up support and offer it consistently.

G20 governments steer investments through public finance institutions, including development banks and green investment banks, by providing direct funding and encouraging private investments by lowering the cost of and risk for capital. Through such channels, governments can support climate action nationally and abroad – or, conversely, lock countries into high-carbon economies.

Developed G20 countries also have an obligation under the Paris Agreement to provide climate finance to developing countries, and public resources are a key aspect of these obligations.[218]

Public finance for fossil fuels

Between 2016 and 2018, G20 public institutions provided an average of USD 65bn per year to fossil fuels through public finance[219] – a negligible decline compared to the period 2013-2015 (USD 68bn average annually). Oil and gas finance remain the largest categories of public finance in energy, together representing over 80% of the G20's average annual support.

While G20 public finance for fossil fuels has remained stable for the period 2016-2018 compared to 2013-2015, there are large variations between countries.

China (USD 24.8bn), Canada (USD 10.6bn), Japan (USD 9.5bn), and South Korea (USD 6.4bn) provided the highest annual average levels of public finance for fossil fuels over

POLICIES RESTRICTING FOSSIL FUEL SUPPORT AT BILATERAL INSTITUTIONS[222]

- Brown indicates there are no restrictions in place at any of the country's included institutions.
- Yellow indicates a partial restriction or full restrictions at some institutions only, or no support to the fossil fuel category identified in spite of no explicit restrictions.
- Green indicates a full restriction across all institutions.

Country	Coal exclusion policies	Oil exclusion policies	Gas exclusion policies
Argentina	Yellow	Brown	Brown
Australia	Yellow	Brown	Brown
Canada	Green	Brown	Brown
Brazil	Yellow	Yellow	Yellow
China	Brown	Brown	Brown
France	Green	Yellow	Yellow
Germany	Yellow	Yellow	Yellow
India	Brown	Brown	Brown
Indonesia	Brown	Brown	Brown
Italy	Yellow	Brown	Brown
Japan	Yellow	Brown	Brown
Mexico	Yellow	Brown	Brown
Russia	Brown	Brown	Brown
Saudi Arabia	Yellow	Brown	Brown
South Africa	Brown	Brown	Brown
South Korea	Yellow	Brown	Brown
UK	Green	Brown	Brown
USA	Yellow	Brown	Brown

Source: Oil Change International & Friends of the Earth U.S., 2020

the period 2016-2018. These same countries provide the highest levels per unit of GDP as well.

Notably, China's public finance for oil and gas nearly doubled between 2016 and 2018, when compared with the 2013 to 2015 period. This increase was driven by just six multibillion-dollar transactions from the China Development Bank.[220] Australia, Mexico, Brazil, South Africa, USA, Saudi Arabia, Germany, Japan, and South Korea decreased public finance for fossil fuels in the 2016-2018 period.

A growing number of G20 member governments are restricting public spending on fossil fuels through public finance institutions. To date, such restrictions have largely been focused on coal – in part, an outcome of the 2015 OECD agreement on Coal-Fired Electricity Generation Sector Understanding that applies to export credit agencies (ECAs). The OECD Agreement is expected to be enhanced as part of its 2020 review. However, several G20 countries continue to support coal by exploiting the loopholes of the OECD Agreement, including funding coal-related infrastructure (e.g. coal transportation between mines and power plants) or providing funding indirectly, through financial intermediaries.

Multilateral development banks (MDBs) and nationally-owned development banks have also made commitments in recent years to mainstream climate considerations in their operations and lending. This has led to further commitments to restrict fossil fuel spending, in most cases related to coal. However, there are still substantial gaps when it comes to restrictions for MDB's support of fossil fuels, particularly for oil and gas, and there is not yet any criteria in place for how to discern which projects are "Paris-aligned". To date, no MDB has put policies in place that are truly aligned with a 1.5°C future, although the European Investment Bank (EIB) is showing leadership in this area.[221]

To align public finance with Paris Agreement goals, G20 efforts must extend restrictions beyond coal and include all development finance institutions and their intermediaries. This means that there must be clear strategies for an oil and gas phase-out, both domestically and internationally, and clarity on their use as transition fuels.

Climate finance

The eight developed G20 countries and the EU (Annex II under the UNFCCC) who are obliged to provide climate finance to developing countries (non-Annex-II) reported annual average support of USD 43bn between 2017 and 2018.[225] This amounts to an almost 50% increase from the USD 31bn annually between 2015 and 2016.

These figures, reported through countries' biennial reports to the UNFCCC, include:

- bilateral and regional climate finance
- finance channelled through the multilateral climate change funds
- support to multilateral and bilateral institutions that parties cannot specify as climate-specific (e.g. MDBs and UN bodies)

Japan remains the largest contributor of climate finance among the G20 with flows delivered predominantly through the Japanese Bank for International Cooperation (JICA), typically with a mitigation focus and lower concessionality than other contributors. **Germany** and **France** follow, making use of KfW and the French Development Agency (AFD), respectively. While not obliged under the UNFCCC, Russia has provided data on climate finance provision in its reporting to the UNFCCC.

International climate finance to developing countries (2017-2018)

Country	Total USD millions (2017/18 average, constant PPP)
Russia	7.28
Canada	500.58
Australia	632.73
Italy	1,154.12
United States[226]	3,118.45
United Kingdom	4,090.99
EU	6,400.02
France	6,567.57
Germany	8,398.22
Japan	12,253.49
Total	**43,123.45**

Source: UNFCCC

COMPARING G20 CLIMATE ACTION: FINANCE

PARIS AGREEMENT

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

G20 MEMBERS HAVE THE TOOLS TO ALIGN FINANCE WITH CLIMATE GOALS

FINANCIAL POLICIES & REGULATIONS

Includes: green finance principles, risk disclosure, climate stress tests, enhanced capital liquidity requirements.

FISCAL POLICIES

Includes: ending fossil fuel subsidies, subsidising low-carbon technology, carbon pricing.

PUBLIC FINANCE

Includes: domestic and international public finance and investment, climate finance.

THE G20 IS MAKING PROGRESS ON MITIGATING CLIMATE-RELATED RISKS

Principles to align prudential and climate change objectives

17 G20 COUNTRIES initiated discussions or are already implementing some form of green finance principles (India, Saudi Arabia, and South Korea are the exceptions).

Disclosing climate-related risks to financial institutions

13 G20 COUNTRIES have implemented or are discussing climate risk disclosure requirements. In Brazil, China and France such disclosures are already mandatory.

Evaluating the resilience of the finance system to climate shocks

7 G20 COUNTRIES introduced climate-related risk assessment and climate stress-test, only in Indonesia are these mandatory.

Limiting commercial banks' exposure to climate-related risks and incentivising low-carbon lending

5 G20 COUNTRIES use some form of enhanced capital and liquidity requirements (China, India, Indonesia, Japan, and South Korea).

CARBON PRICING SCHEMES ARE COMING INTO PLAY, BUT PRICES AND COVERAGE MUST BE INCREASED TO PARIS COMPATIBLE LEVELS

18 G20 COUNTRIES are implementing explicit carbon-pricing schemes, such as carbon taxes and emission trading schemes (ETS) – India and Australia are the exceptions.

HIGHEST CARBON TAX (USD/tCO_2e)

France (48.6), South Korea (31.2), and the EU (27.9)

HIGHEST % OF EMISSIONS COVERED BY CARBON TAX

South Africa (80%), South Korea (70%), and Japan (68%)

TOP CARBON REVENUES IN 2019 (USD)

EU 17.5bn, France 10.1bn, Canada 5.6bn, Germany 3.6bn, USA 3.1bn, Japan 2.4bn, Italy 1.5bn, UK 1.2bn

G20 MEMBERS ARE STILL SUPPORTING FOSSIL FUELS WITH PUBLIC FINANCE AND SUBSIDIES

Public finance for fossil fuels:

USD 65BN PER YEAR

(2016-2018)

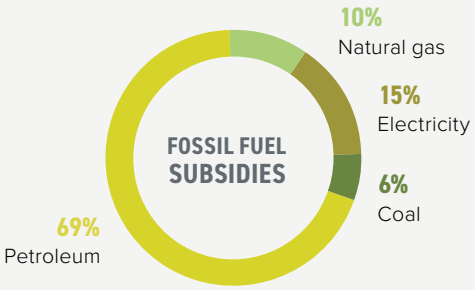
China 24.8bn, Canada 10.6bn, Japan 9.5bn, and South Korea 6.4bn

Fossil Fuel Subsidies:

USD 130BN

(2019)

Subsidies to petroleum, fossil fuel electrcity, gas, and coal (excluding Saudi Arabia, Turkey, and the UK)



KEY OPPORTUNITIES FOR ALIGNING CLIMATE FINANCE WITH CLIMATE GOALS

GREEN THE FINANCIAL SYSTEM

PHASE OUT FOSSIL FUEL SUBSIDIES BY 2025

HIGH-COVERAGE CARBON PRICING:

USD 40-80 by 2020 & USD 50-100 by 2030

END PUBLIC FINANCE FOR FOSSIL FUELS

SUFFICIENT & PREDICTABLE CLIMATE FINANCE

ENDNOTES

1. World Health Organisation. (2020). "WHO Director-General's Opening Remarks at the Media Briefing on COVID-19, 11 March 2020". https://www.who.int/dg/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19--11-march-2020
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AUTHORS AND ACKNOWLEDGMENTS

The Climate Transparency Report, comprising this summary report and 20 country profiles, was compiled by the international Climate Transparency partnership.

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We express gratitude to the following contributors for their expert comments, inputs, and guidance:

Enerdata: Thierry Badouard, Isabelle Blanchon, Fabien Gaillard-Blancard, Pascal Charriau, Karine Pollier; **Climate Works Foundation:** Surabi Menon; **European Climate Foundation:** Emmanuel Guerin, Bert Metz, Brice Roinsard; **Climate Analytics:** Bill Hare; **GSCC:** Ed King, Ragnhild Pieper; **Humboldt-Viadrina Governance Platform:** Pia Gleich, Aleksandra Zebrowska; **Institute for Climate Economics:** Marion Fetet; **Solutions for Our Climate:** Gahee Han, Joojin Kim; **Independent reviewers:** Catherine Abreu, Ahmet Acar, Kathy Bardswick, Dale Beugin, Ayşe Ceren Sarı, Eom Daye, Angelina Davydova, Alexey Kokorin, Axel Michaelowa, Adam McGibbon, Greg Muttit, Teika Newton, Pao-yu Oei, Leo Roberts, Deger Saygin, Yael Taranto, Wendel Trio; **International Institute for Sustainable Development:** Anna Geddes, Balasubramanian Viswanathan; **Oil Change International:** Bronwen Tucker; **UNFCCC Secretariat; University of Bochum:** Paola D'Orazio**; Vivid Economics:** Mateo Salazar, Julian Payne, Caroline Stuyt, David Wingate; **World Bank:** Keisuke Iyadomi, Rachel Chi Kiu Mok.

Design: Design for development (www.d4d.co.za); **Editing and proofreading:** Tanya Goodman

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