Down To Earth

THE NUMBERS BEHIND CLIMATE CHANGE

The imperative of equity for urgent and bold action on combatting catastrophic climate change

CSE Down To Earth

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Published by
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We know that climate change is real and urgent. The planet can barely afford any more carbon dioxide emissions. But we need to continue to emit for our survival and development as these emissions are linked to economic growth. What then do we do? What is the carbon budget available to us? More importantly, which countries should be allowed to emit and how much?

Sunita Narain and Avantika Goswami

DEATH RACE

Our annual carbon dioxide (CO_2) emissions have grown about 70 times since the pre-industrial era, reaching nearly 36.4 gigatonnes (Gt) in 2019. Unless we bring them down to 18.22 Gt by 2030, we are headed for catastrophic climate events

Source: An analysis by *Down To Earth* and the Centre for Science and Environment, Delhi, based on data from Climate Watch and Our World in Data

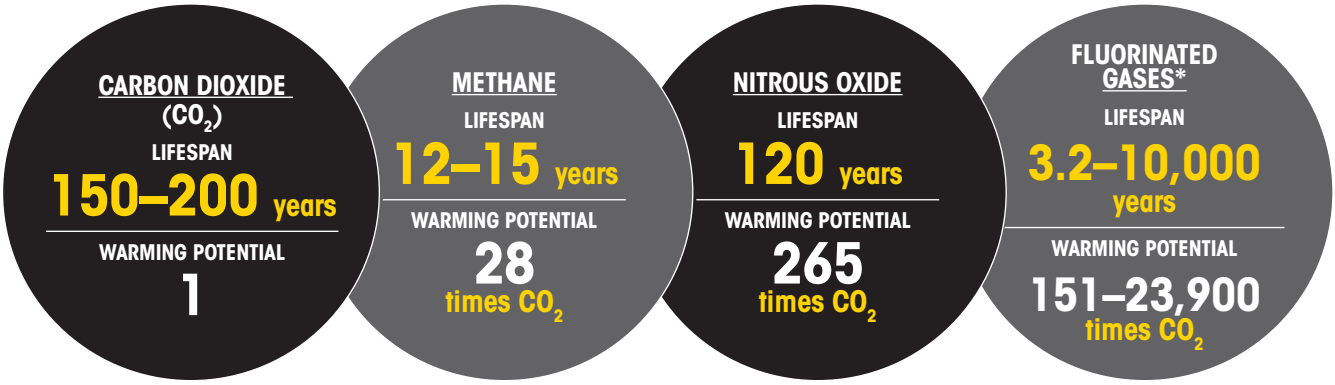
Climate change is real. We now know that for certain. We are already experiencing doomsday scenarios that climate scientists had projected for the distant future. The UN's top climate science body, Intergovernmental Panel on Climate Change (IPCC), in its latest Sixth Assessment Report (AR6), *Climate Change 2021: The Physical Science Basis*, only confirms what we already know and see in the world around us: wildfires triggered by extreme heat and moisture loss; devastating floods caused by extreme rain events; and tropical cyclones powered by the changing temperatures between the sea and land surface. The report also clearly says that human activities, for certain, are to be blamed for these climate events. Anthropogenic carbon dioxide (CO_2) and other greenhouse gases (GHGs) have warmed the planet beyond its tolerance level. In May 2021, the atmospheric CO_2 level reached 419 parts per million (ppm), as measured by the US' National Oceanic and Atmospheric Administration's Mauna Loa Atmospheric Baseline Observatory in Hawaii. This is nearly 45 per cent above IPCC's accepted pre-industrial baseline of 278 ppm in 1750.

What is even more worrying is that the world is running out of carbon space and time to fix the problem. Currently, we release about 36.4 gigatonnes (Gt) of CO_2 every year into the atmosphere from fossil fuel burning and cement manufacture. IPCC says we need to budget our carbon emissions based on the planet's processing ability to keep the average global temperature rise to 1.5°C above pre-industrial levels—the guardrail of keeping the world safe from catastrophic climate impacts. As per its estimate provided in 2018, the world needs to cut emissions by 45–50 per cent compared to the 2010 levels by 2030, and by 2050 turn carbon net-zero—emit only what can be "soaked up" by natural sinks like forests or oceans or what can be "cleaned" through still-experimental technologies, like carbon capture and storage.

AR6 says that starting in 2020, the world is left with a total carbon budget of 400 $GtCO_2$ for all time to come. This means that once we cross this threshold, whenever we cross it, we are headed towards a temperature rise of more than 1.5°C.

UNSPARING GASES

While CO_2 is the most emitted greenhouse gas, there are several others with a higher warming potential



* It is a family of gases containing fluorine
Warming potential values are for 100-year time horizon

Source: UN IPCC reports

All this information coming from the world of buttoned-up scientists should scare us into action that is real and meaningful. Instead it has turned into an intense battle between different blocs of countries, and scientists discussing climate change are forced to confront the politics of who emits how much. There are also huge uncertainties (*more on this later*) in the planet's carbon budget.

Three reasons make this budgeting complex.

One, the pollutants—primarily greenhouse gases (GHGs) like CO_2 and methane—have an extraordinarily long life. CO_2 emitted in, say, 1900, is still in the atmosphere. Historical emissions (see 'Unsparing gases') continue to warm up the planet just like current emissions.

Two, these pollutants are linked to economic growth. The bulk of CO_2 emissions are from burning of fossil fuels, which are used to generate electricity, transport goods and power our houses and factories. So, when the world discusses climate change, it is discussing the economy, and not just the ecology, of the planet.

Three, since greenhouse gases persist in the atmosphere and the emissions are due to wealth generation in countries, combatting climate change is about sharing growth between nations—which means sharing the carbon budget.

In an extremely unequal world, this is a most inconvenient reality, especially if we factor in the issues of equity and climate justice. The science and politics of climate change are inseparable. We, therefore, try to decode the following:

THEN AND NOW: Who have been the big emitters through the centuries, and where do they stand today? Who stands where in terms of per capita emissions and which countries need a larger share of the carbon budget to develop?

NATIONAL TARGETS: What will the Nationally Determined Contributions—voluntary national goals, part of the 2015 Paris Agreement—add up to? Which countries have set tough targets and which ones are sitting easy?

CARBON BUDGET: What is the carbon budget to keep the world to 1.5°C? Which country has appropriated how much of the budget?

TARGET 2030: Going forward, which countries are likely to hog the carbon budget in 2020–30?
And based on all this, what then is the agenda going forward?

SECTION 1
THEN AND NOW

PRIME POLLUTERS

China, US and EU-27 (excluding the UK) currently emit over 50 per cent of the world's 36.44 $GtCO_2$

The continent of Africa and India, each with 17 per cent of the world's population, contribute just 4 per cent and 7 per cent respectively to the world's CO_2 emissions

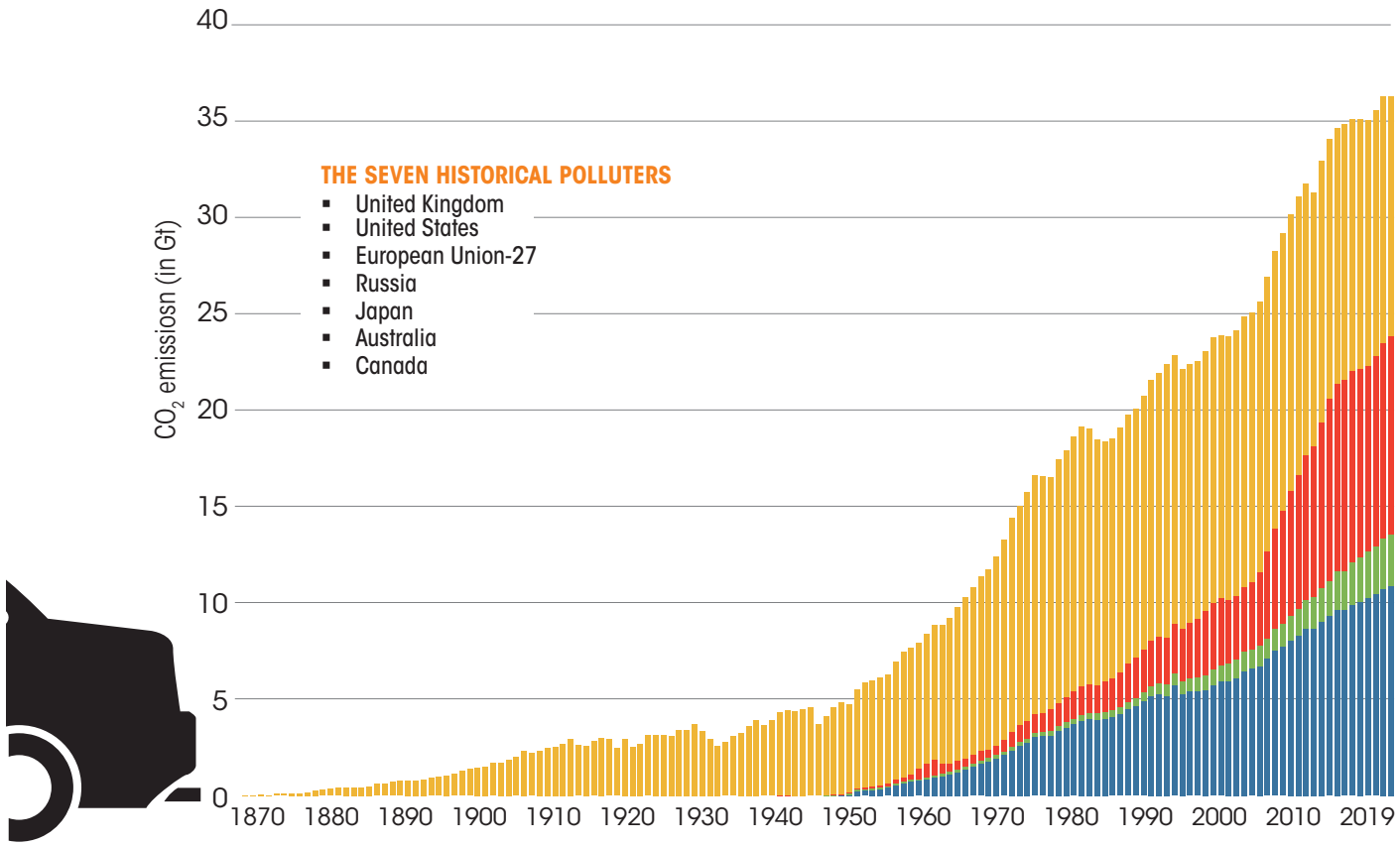
The developing world has a right to economic growth without pollution, which requires unprecedented funding

The world emitted 36.4 gigatonnes (Gt) of CO_2 in 2019—the last year for which global data for GHG emissions is available. This is only from the fossil fuel and cement sectors. China alone emitted 28 per cent of the world's total CO_2 (see 'CO_2 emissions in 2019'). Add the US and EU-27 (minus the UK), and the countries account for 50 per cent of the world's CO_2 emissions. If we add Russia, Japan, UK, Canada and Australia, the share goes up to 62 per cent (see 'Historical defaulters' and 'Current culprits').

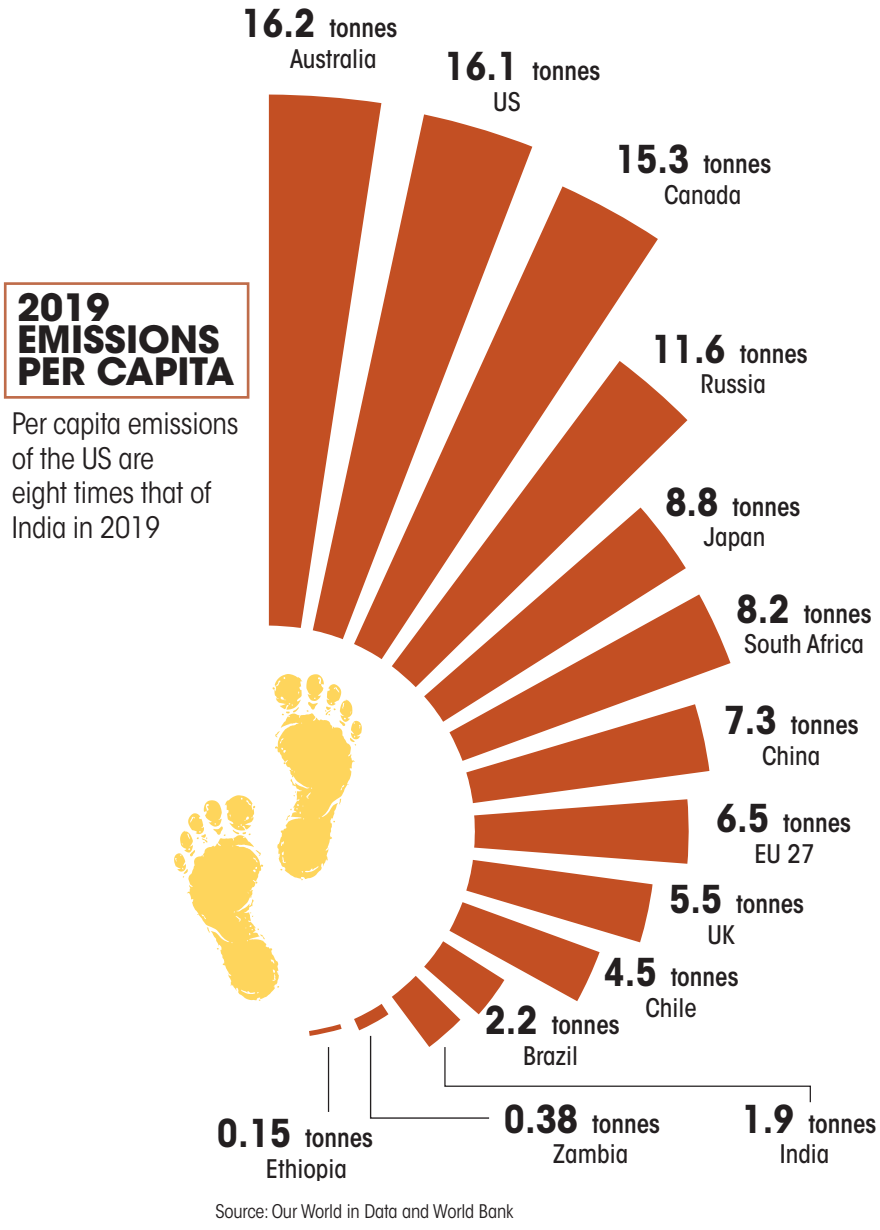
India, which is the fourth largest (third, if we do not account for EU-27 as a group), contributed some 2.62 Gt of CO_2 emissions in 2019—compared to China's 10.17 $GtCO_2$ and US' 5.28 $GtCO_2$. India

HISTORICAL DEFAULTERS

Developed countries (in orange) are responsible for almost all CO_2 emitted till the 1980s...



Source: Our World in Data



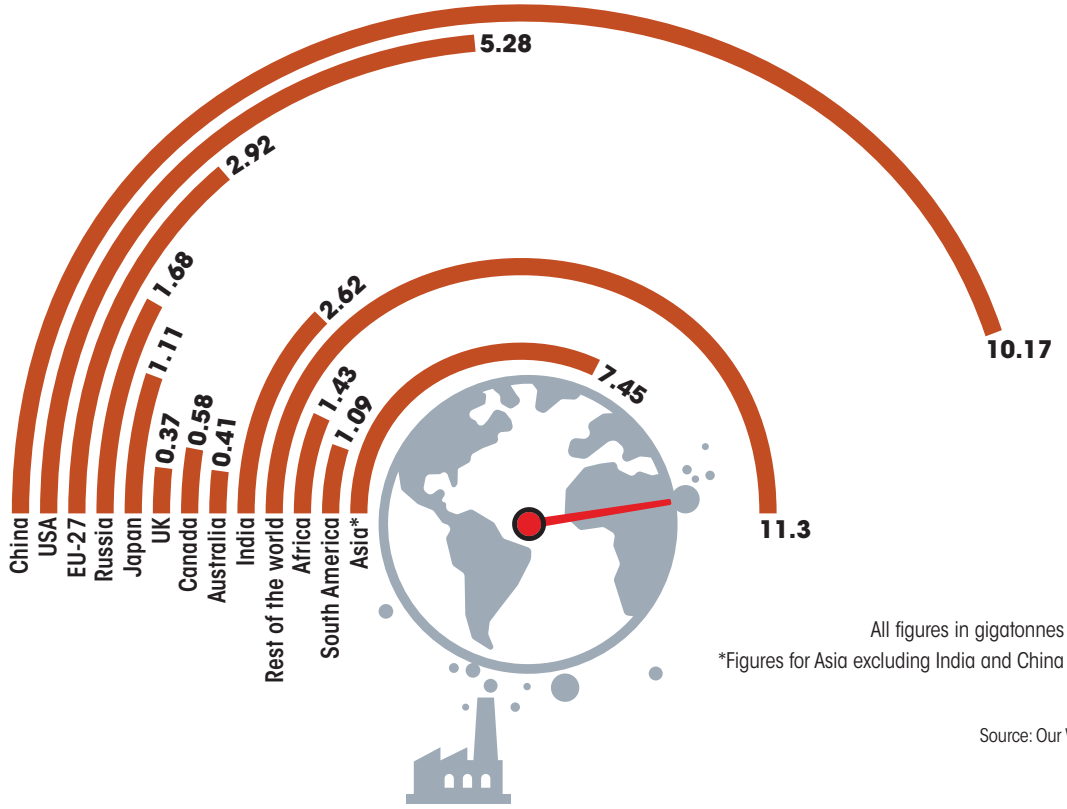
Source: Our World in Data and World Bank

added 7 per cent to the world's CO_2 emissions in 2019.The entire continent of Africa, with 17 per cent of the world's population, contributed a mere 4 per cent to global emissions in 2019.

Let us look at it from another perspective. India and Africa are quite low in the human development index. They need to grow economically, provide energy to their people, industrialise and urbanise. All of this will add to the emissions because CO_2 emissions are still directly linked to a country's gross domestic product. And

CO_2 EMISSIONS IN 2019

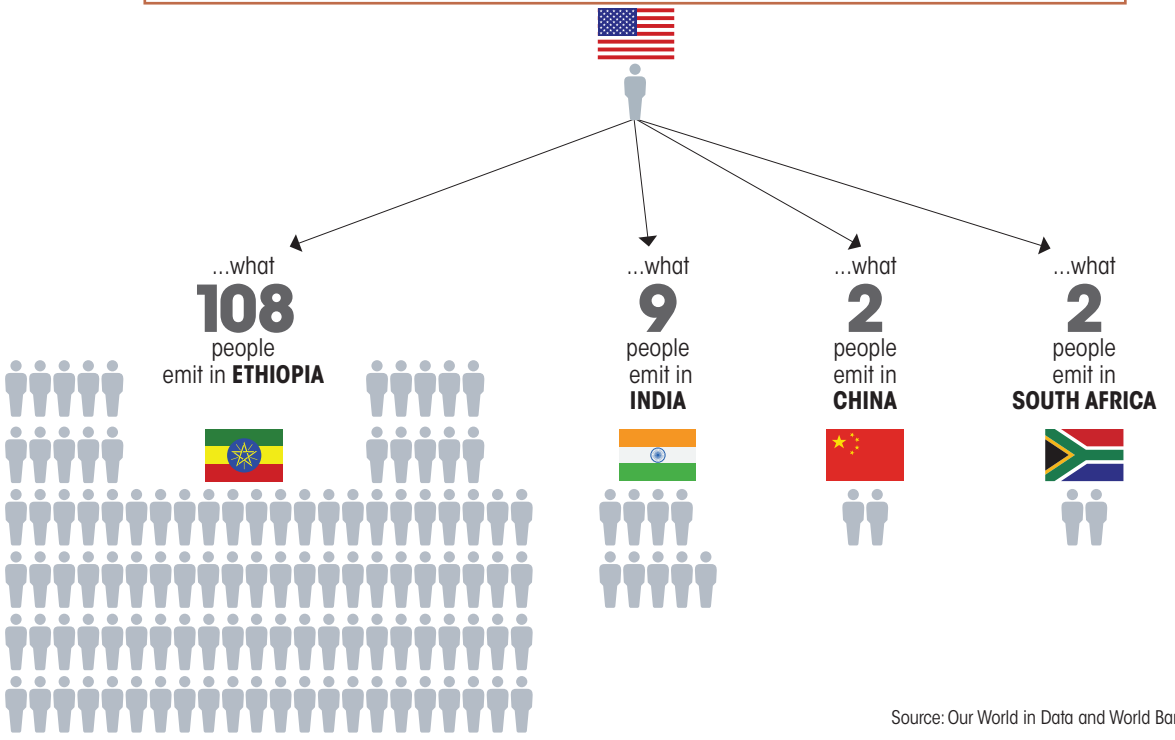
China was the wold's prime emitter in 2019, releasing as much CO_2 as the US, EU-27, Russia and Japan combined



All figures in gigatonnes
*Figures for Asia excluding India and China

Source: Our World in Data

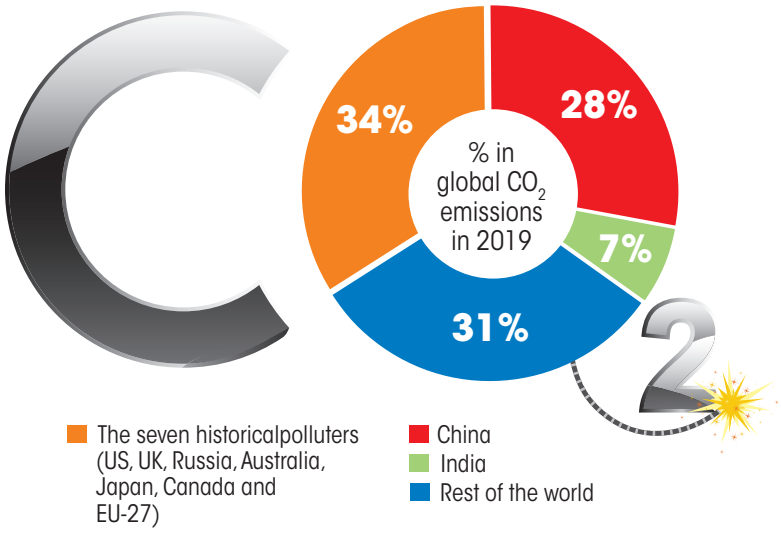
WHAT ONE PERSON EMITS IN THE US IS EQUAL TO...



Source: Our World in Data and World Bank

CURRENT CULPRITS

Countries' share in global CO_2 emissions in 2019



Source: Our World in Data

this when the world is running out of the carbon budget—the IPCC 2021 report (AR6) has already declared "code red" and said that humanity is hurtling towards a climate catastrophe.

We, therefore, have two choices: either accept the climate apartheid, or enhance efforts to ensure economic growth without pollution, so that the developing world is given the right to develop. The latter option means funding the transformation in these nations at a scale never done before. In terms of per capita—how much is emitted by each person per year—the differences are even more stark and indeed cannot be accepted in a civilised world. (See '2019 emission per capita' and 'What one person emits in the US...')

SECTION 2
NATIONAL TARGETS

OFF BY A MILE

Even enhanced Nationally Determined Contributions are not nearly enough to limit global temperature rise to 1.5°C

Many poor countries, with low annual emissions, have committed more than rich countries

This is a mockery of the principle of Common but Differentiated Responsibilities and a human rights concern

Many Nationally Determined Contributions of countries of the South are conditional—will be done if finances and technology are transferred

Under the Paris Agreement, adopted in 2015 as an international treaty to limit and cut greenhouse gases, countries agreed to provide voluntary targets called Nationally Determined Contributions (NDCs) for how they will limit or reduce emissions (see 'Route to NDCs' on *p*16). The agreement also stated that NDCs would work to achieve the goal of keeping global temperature rise this century to well below 2°C above the pre-industrial level and to pursue efforts to limit the rise to 1.5°C.

As per the agreement's "ratcheting mechanism", countries are expected to submit progressively more ambitious NDCs every five years. Accordingly, countries had to submit their second NDC by late 2020, but of the 192 parties to the Paris Agreement a majority did not meet this deadline. As of October 15, 2021, a total of 113 countries (112 countries plus EU-27) have submitted new NDC targets, while 49 countries have not, as per Climate Action Tracker, an independent scientific analysis produced by two Germany-based research organisations, Climate Analytics and New Climate Institute.

EU-27 and the UK have submitted more ambitious NDCs of reducing GHG emissions by 55 per cent and 68 per cent respectively below the 1990 levels by 2030. The US, under the new President Joe Biden, has upped its target and pledged 50–52 per cent reduction below the 2005 levels by 2030. Japan has proposed a stronger NDC target of 46 per cent reduction of GHG emissions below the 2013 levels by 2030 but is yet to formally submit it (see 'Unequal world' on *p*16).

Down To Earth and the Centre for Science and Environment, Delhi, and have worked to project the emissions of 45 countries—a mix of developed and developing economies, including EU-27—for 2020–2030. For this, the percentage reduction targets for GHG emissions under the NDCs submitted by these countries have been considered. Wherever available, updated or second NDCs, as of September 2021, have been considered. The remaining countries have been considered as "rest of the world".

Since India and China have emission intensity targets (reduction of CO_2 emissions per unit of GDP) for their NDC, we have not applied any emissions reductions and assumed that their emissions remain the same in both scenarios for simplicity of analysis.

It is also important to note that in many cases, countries have

ROUTE TO NDCs

Key milestones in framing Nationally Determined Contributions (NDCs) under the Paris Agreement

2015
Countries are invited to submit Intended Nationally Determined Contributions (INDCs); The Paris Agreement is adopted, 191 countries ratify the Agreement

2018
Talanoa Dialogue takes stock of how close the countries are to achieving the goals of the Paris Agreement

2020
Formal NDC cycle begins; countries must submit new or updated NDCs

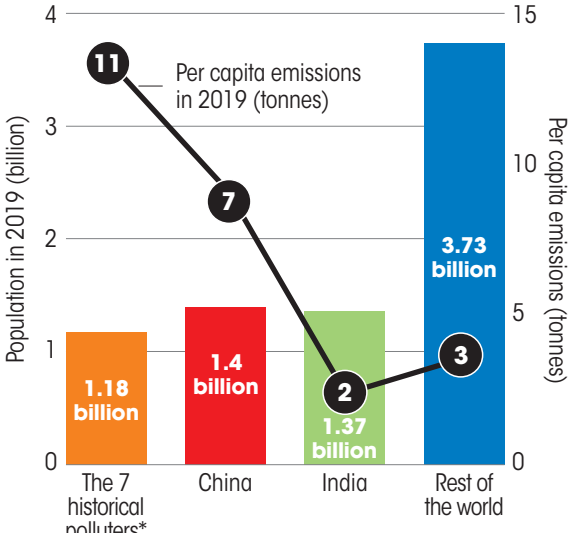
2021
UNFCCC NDC Synthesis Report 1 (February) and Report 2 (September) assess impacts of updated NDCs

2023
Global Stocktake will evaluate collective progress towards achievement of the Paris Agreement's goals

provided "conditional" NDCs—they will enhance their level of ambition if climate finance and other support is provided. For instance, Ethiopia has said that it will reduce emissions by 14 per cent (unconditional) and 68.8 per cent (conditional) by 2030 as compared to "business as usual" (BAU) scenario. Zambia commits to reduce its emissions by 25 per cent (under limited international support) and towards 47 per cent (with substantial international support). For calculation of the NDC, we have assumed that these conditions will be met. But what this implies is that if these conditions are not met, then emissions projected under NDCs will be higher.

UNEQUAL WORLD

Developed nations enjoy high per capita emissions



*US, UK, Russia, Australia, Japan, Canada and EU-27
Source: Our World in Data and World Bank

We project emissions for 2020-2030 in two scenarios:

(i) Assuming that the NDCs are fully achieved by 2030, or the NDC scenario: As per IPCC, global emissions need to reduce by 45 per cent over 2010 levels by 2030 to keep the temperature rise to 1.5°C. In 2010, global CO_2 emissions were 33 Gt. Therefore, the world needs to keep its annual CO_2 emissions at less than 18.2 Gt in 2030 to meet this target (see 'Not nearly enough').

(ii) Assuming that no emission reduction efforts were undertaken between 2020 and 2030, or the BAU scenario, where we have taken the median rate of change of emissions annually over the past decade (2010-2019).

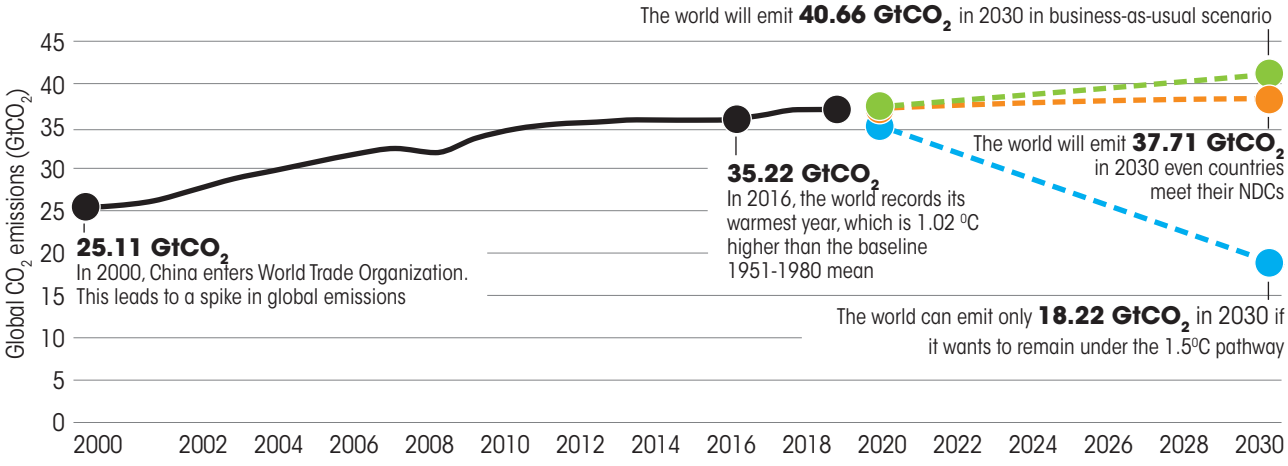
Not ambitious: The sum of the enhanced NDCs do not keep the world temperatures to 1.5°C:

Our analysis reveals that if the world achieves the enhanced and conditional NDCs it would be emitting 37.71 $GtCO_2$ in 2030. This is more than double the amount of CO_2 the world should be emitting in 2030. To put another way, if the NDCs of these 45 countries are fully implemented, the world will emit 408.99 $GtCO_2$ in 2020-2030, as against the available budget of 400 $GtCO_2$.

Under BAU, the world would emit 425.73 $GtCO_2$, which is just 16.73 $GtCO_2$ higher than the NDC scenario, in 2020-2030 (see

NOT NEARLY ENOUGH

The world will cross the 1.5°C threshold by 2030 even if countries meet their enhanced nationally determined targets



Source: Analysis by *Down to Earth* and the Centre for Science and Environment, Delhi, based on data from Climate Watch and Our World in Data

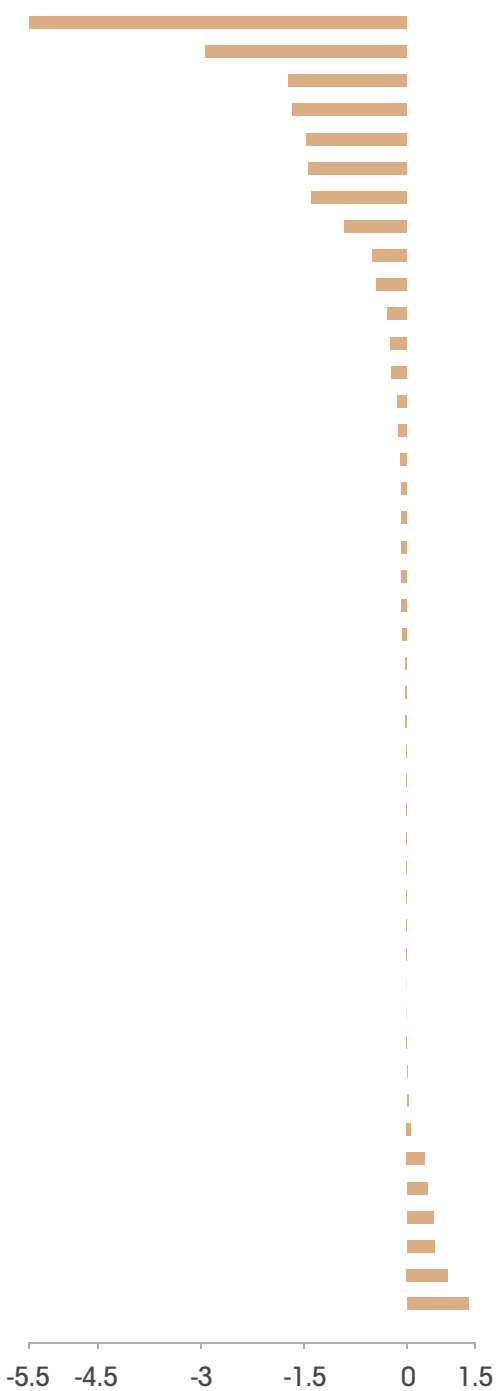
PROJECTED EMISSIONS FOR THE DECADE

2020-2030

While NDC of most countries will reduce their emissions, for some like Russia, they will lead to an increase

Figures in $GtCO_2$

	BAU	NDC
United States	51.60	46.11
EU-27	28.48	25.54
Canada	6.74	5.01
Japan	11.47	9.79
South Korea	7.33	5.87
South Africa	5.69	4.25
Kazakhstan	4.23	2.83
Brazil	6.11	5.21
Australia	4.58	4.07
United Kingdom	3.40	2.97
Oman	1.16	0.88
Colombia	1.34	1.11
Chile	1.07	0.84
Norway	0.45	0.32
Tajikistan	0.21	0.09
Switzerland	0.41	0.32
Botswana	0.14	0.05
Azerbaijan	0.48	0.40
Serbia	0.66	0.58
Zambia	0.12	0.04
New Zealand	0.42	0.34
Bosnia and Herzegovina	0.31	0.25
Moldova	0.08	0.05
Mauritius	0.06	0.05
Costa Rica	0.10	0.08
Iceland	0.04	0.02
Montenegro	0.03	0.02
Eritrea	0.01	0.01
Grenada	0.004	0.002
Micronesia	0.002	0.001
Marshall Islands	0.002	0.001
Cook Islands	0.001	0.0004
Dominica	0.002	0.001
China	126.29	126.29
India	39.03	39.03
Liechtenstein	0.001	0.001
Equatorial Guinea	0.05	0.06
Belarus	0.73	0.76
Singapore	0.42	0.48
Nicaragua	0.07	0.33
Russia	19.61	19.91
Ukraine	2.21	2.60
Argentina	1.88	2.28
Vietnam	4.65	5.25
Ethiopia	0.31	1.13



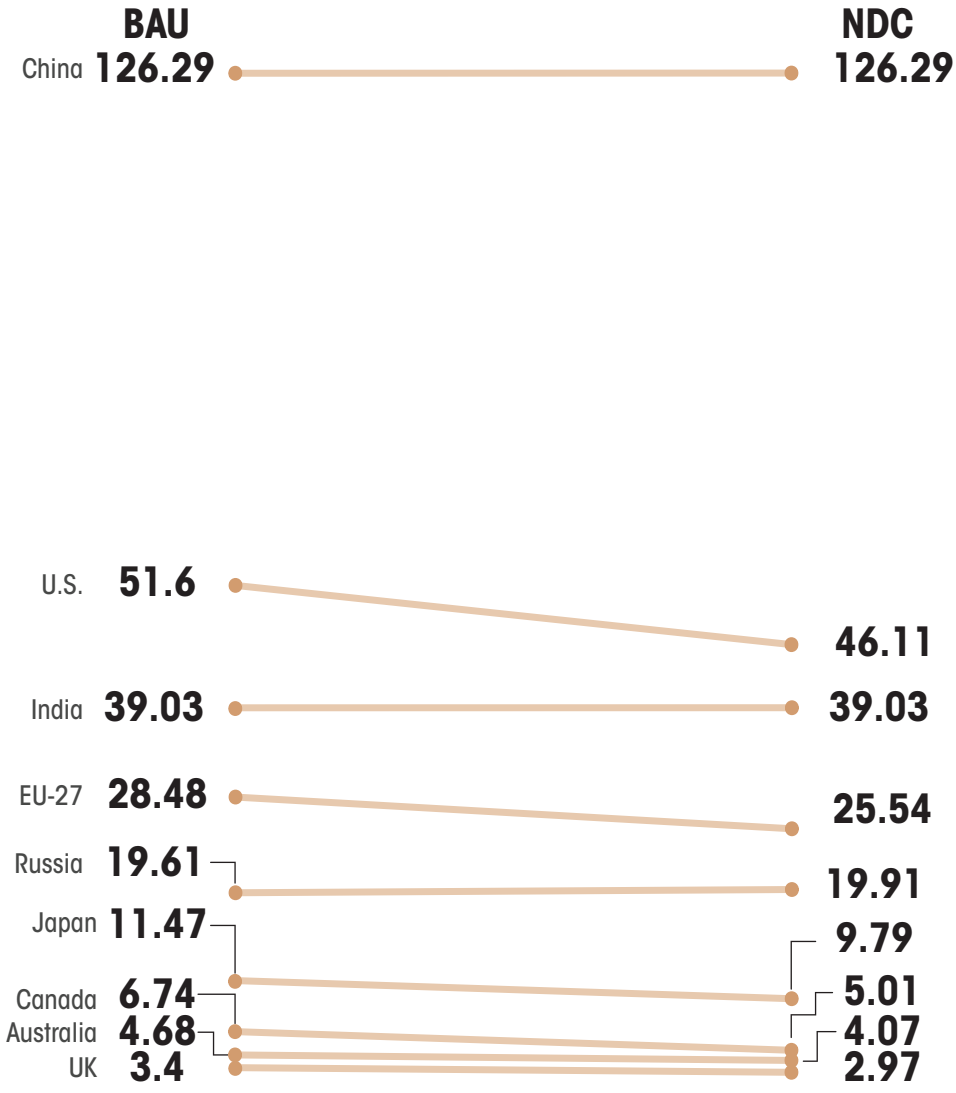
Note: We have assumed constant emissions in "business as usual" (BAU) and nationally determined contributions (NDC) scenarios in the case of China and India as these countries do not have quantified targets for reduction.

Source: Analysis by the Centre for Science and Environment, Delhi, based on data from Climate Watch and Our World in Data

PROJECTED EMISSIONS OF TOP EMITTERS 2020-2030

Business as usual (BAU) *v* if Nationally Determined Contributions (NDCs) are achieved

Figures in $GtCO_2$



Source: Analysis by the Centre for Science and Environment, Delhi, based on data from Climate Watch and Our World in Data

'Projected emissions for the decade 2020-2030' on *p*18 and 'Projected emissions of top emitters 2020-2030' on *p*19).

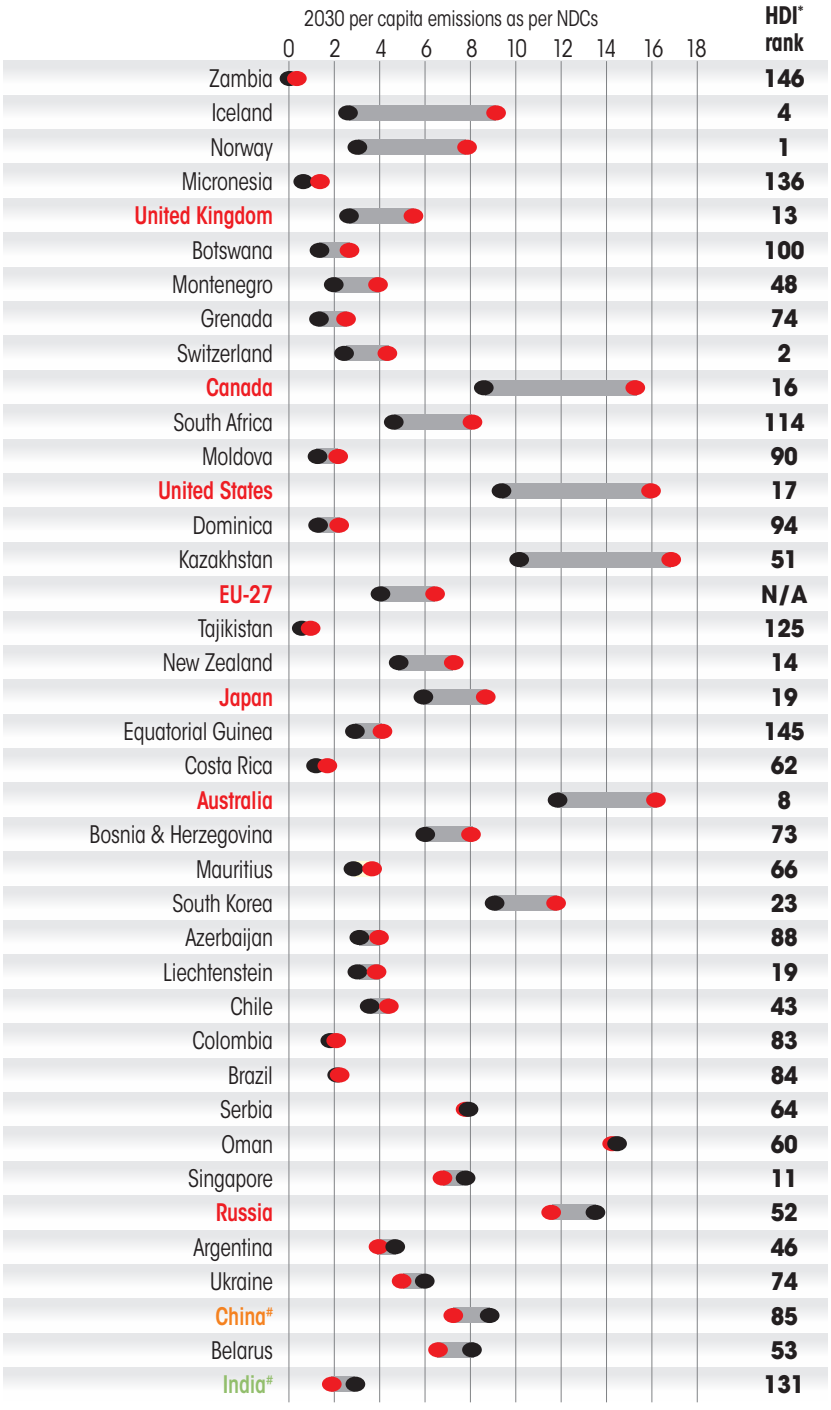
Not fair: Poor countries with small carbon footprint have committed more than rich countries with a large carbon footprint:

The comparison of per capita emissions in the 45 countries in 2019 and then again in 2030, if the NDCs are achieved, reveals how skewed the global burden of CO_2 reduction is against developing countries (see 'Low on ambition'). Zambia and Micronesia, ranked

LOW ON AMBITION

Developed countries have pledged lower emissions reduction by 2030 than many developing countries

- 2030 per capita emissions as per NDCs
- 2019 per capita emissions



#For China and India, business-as-usual scenario has been used
*Human Development Index rates countries on the basis of life expectancy, education, and per capita income indicators; Source: Analysis by *Down to Earth* and Centre for Science and Environment, Delhi, based on data from Climate Watch and Our World in Data

146th and 136th in Human Development Index (HDI), have pledged to reduce their per capita emissions by over 50 per cent, while Japan and Australia will reduce them by 30 per cent by 2030. Russia will increase them by 16 per cent.

Botswana, ranked 100 in HDI, has committed a 15 per cent reduction in GHG emissions by 2030 as compared to 2010 levels. The country's total emissions in 2010 were 0.0045 $GtCO_2$ and would be 0.0039 $GtCO_2$ in 2030. Its per capita emissions in 2010 were 2.28 tonnes and would be reduced to 1.39 tonnes in 2030. Under the BAU scenario, it would have increased its per capita emissions to 7.54 tonnes by 2030. Instead it will reduce them to even below the 2010 levels.

Clearly, countries low on HDI and with already minuscule per capita footprint, are shouldering the burden of emissions reductions, while major historical polluters play a small part. This is not only a mockery of the principle of Common but Differentiated Responsibilities, but a serious human rights concern as poor nations attempt to constrain their developmental health in trying to abide by the Paris Agreement.

More importantly, it speaks to the need for enhanced financial and technology transfer—at scale and speed. The fact is many of the NDCs, submitted by countries of the South are conditional and dependent on these transfers to happen.

SECTION 3
CARBON BUDGET

UNFAIR SHARE

Till 1989, the original seven emitters appropriated 77% the world's carbon space

Between 1990 and 2019, China, along with the original seven, had released 67% of the world's emissions

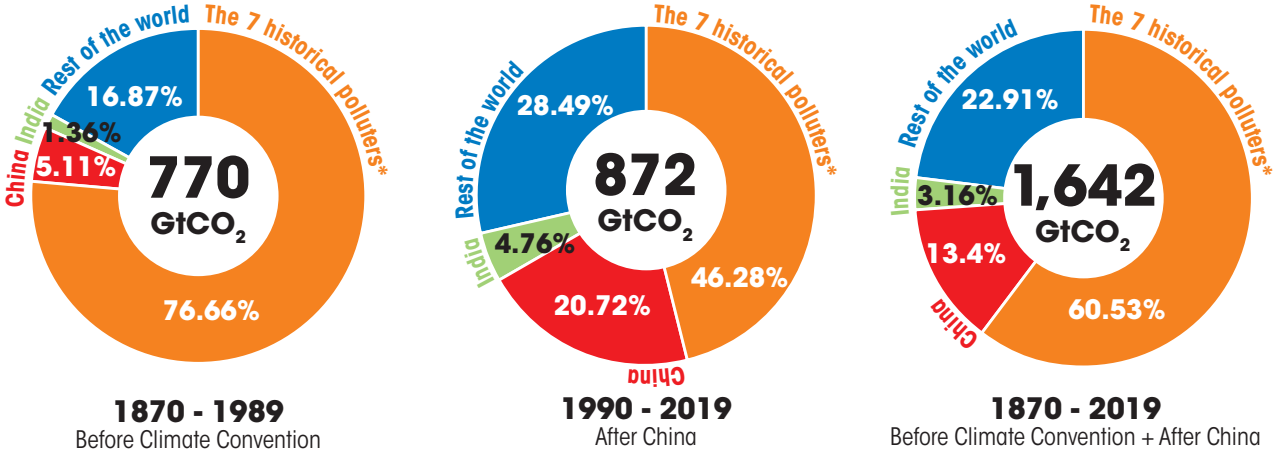
The remaining, roughly 66 per cent of the world's population, released about 33%

The carbon budget is constructed on the premise that there is a linear relationship between rising global temperatures and the level of accumulated atmospheric CO_2. As CO_2 level rises, atmospheric temperature rises as well—thus a higher temperature threshold like 2°C allows us to emit a higher amount of CO_2. These are carbon budgets rather than GHG budgets (which would include methane, nitrous oxide and other greenhouse gases) and the large range for 1.5°C budgetary allocations (of CO_2) partly reflects varying assumptions on how fast non-CO_2 GHG emissions can be mitigated. Fossil CO_2 emissions accounted for less than 68 per cent of GHG emissions in 2018. Thus, while the carbon budget as a concept is useful for policy making in key sectors such as energy, total GHG emissions and the overall emissions budget is equally critical.

IPCC's Fifth Assessment Report (AR5), published in 2014, found that the world can emit 2,250 $GtCO_2$ between 1861 and 2100 for a 66 per cent chance of staying within 1.5°C. IPCC AR6 published in 2021 revealed a revised estimate. Starting 2020, the world now has a total budget of 400 $GtCO_2$ for a 66 per cent probability to limit the temperature rise to 1.5°C. But before we assess the remaining car-

PROBLEMATIC TWO

The developed countries and China are responsible for over 70 per cent of CO_2 emissions so far



*US, UK, Russia, Australia, Japan, Canada and EU-27

Source: Analysis by *Down to Earth* and the Centre for Science and Environment, Delhi, based on data from Climate Watch and Our World in Data

PAST PRIVILEGE

The developed world grew on unchecked CO_2 emissions since the 1870s, leaving little for the rest of the world

	% of total emissions for BCC (1870-1989)	% of total emissions for AC (1990-2019)	% of total emissions for BCC + AC (1870-2019)	% share in the world population in 2019
US	**31.26**	**19.32**	**24.92**	**4.28**
EU-27	**23.21**	**12.06**	**17.29**	**5.83**
Russia	**8.31**	**5.72**	**6.94**	**1.88**
UK	**7.18**	**1.80**	**4.32**	**0.87**
Japan	**3.59**	**4.24**	**3.93**	**1.65**
Canada	**2.17**	**1.88**	**2.02**	**0.49**
Australia	**0.94**	**1.25**	**1.11**	**0.33**
7 historical polluters	**76.66**	**46.28**	**60.53**	**15.33**
+ China	**5.11**	**20.72**	**13.40**	**18.21**
7 historical polluters + China	**81.77**	**67.00**	**73.93**	**33.54**
Rest of world (excluding China, including India)	**18.23**	**33.25**	**26.07**	**66.46**
India	**1.36**	**4.76**	**3.16**	**17.81**
South Africa	**1.08**	**1.42**	**1.26**	**0.76**
South Korea	**0.38**	**1.62**	**1.04**	**0.67**
Brazil	**0.58**	**1.23**	**0.92**	**2.75**
Vietnam	**0.09**	**0.33**	**0.22**	**1.26**
World emissions in gigatonnes				
World	**769.92**	**871.78**	**1,641.69**	**-**

Source: Analysis by *Down to Earth* and the Centre for Science and Environment, Delhi, based on data from Climate Watch and Our World in Data

REMAINING CARBON BUDGET WILL BE EXHAUSTED IN THIS DECADE

Figures in $GtCO_2$

World CO_2 emissions (Fossil fuel and cement)	1870-2019	1,641.69
	BAU 2020-2030	425.73
	NDC 2020-2030	408.99
Remaining IPCC AR6 budget to stay on the 1.5°C trajectory 2020 onwards*		386.80

*We assume that land-use, land-use change and forestry (LULUCF) emissions account for 3% of CO_2 emissions and reduce the 400Gt budget accordingly for this analysis; BAU: business and usual; NDC: Nationally Determined Contributions

Source: Our World in Data, IPCC and CSE Analysis

bon budget, we must see which countries have used up the available budget to keep the world temperature rise to 1.5°C. Unsurprisingly, historical emissions from 1870 to 2019 reveal a deep inequity (see 'Problematic two' on *p*23).

Before Climate Convention (BCC): 1870-1989

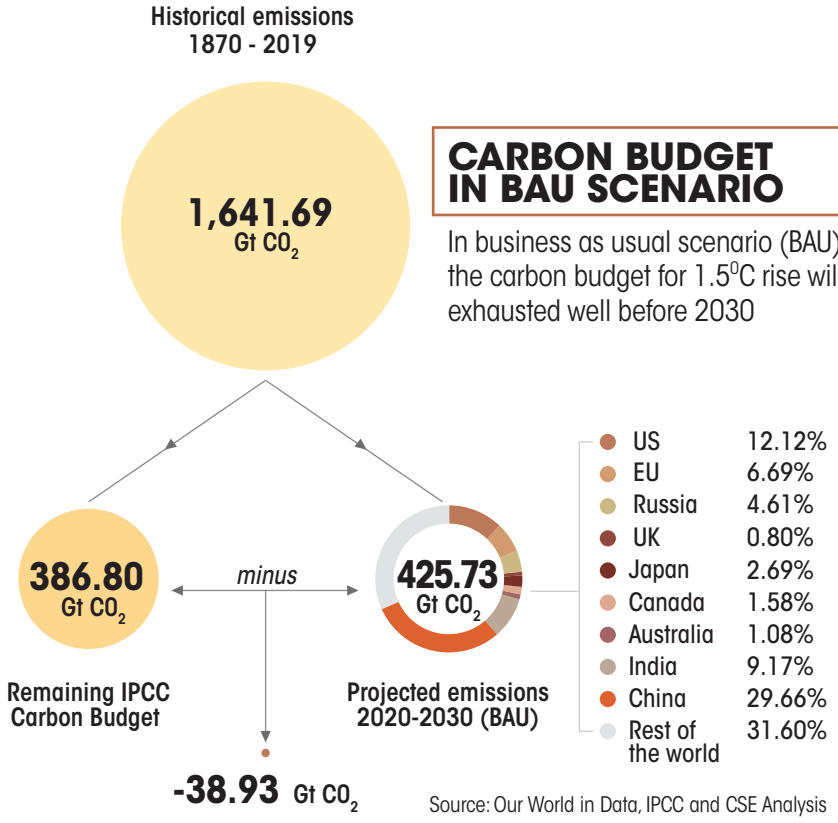
From 1870 to 1989—three years before the United Nations Framework Convention on Climate Change (UNFCCC) was drafted and decided on an international environmental treaty to combat human interference with the climate system—six countries (UK, US, Russia, Japan, Australia and Canada) and the EU contributed 77 per cent of the world's total CO_2 emissions. The US alone contributed 31.26 per cent, while China's figure stood at 5.11 per cent (see 'Past privilege'). The rest of the world, including India, did not matter.

After China (AC): 1990-2019

Between 1990 and 2019, there was a new entrant—China—which increased its share in global emissions from 5.11 per cent to 20.72 per cent in these three decades. The big jump came after China joined the World Trade Organization in early 2000 and its share of emissions in the world increased with its economic and trade might.

CARBON BUDGET IN BAU SCENARIO

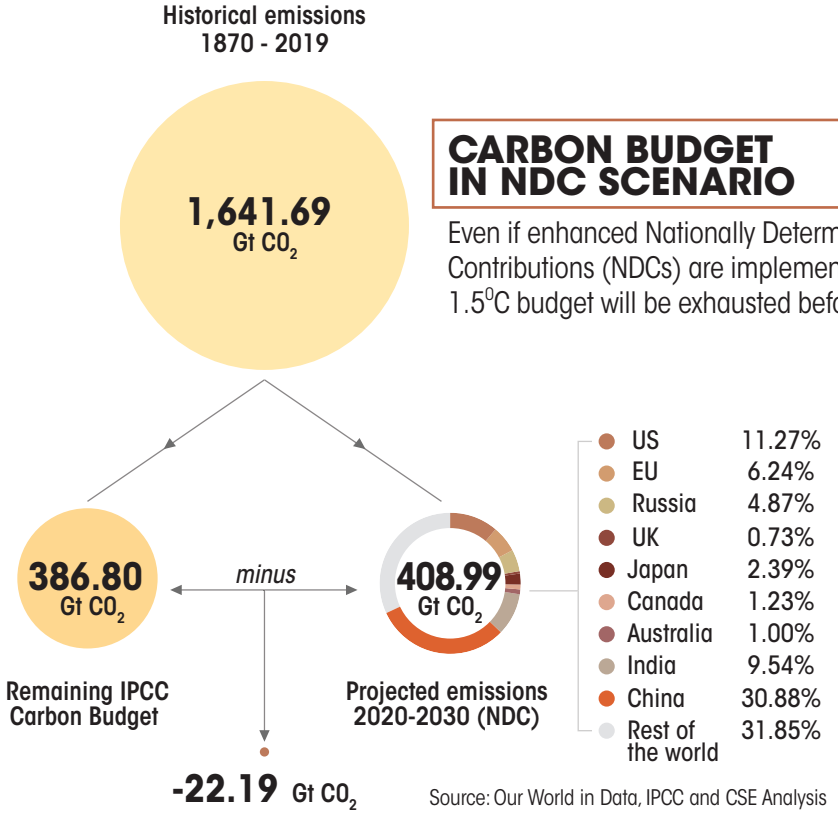
In business as usual scenario (BAU), the carbon budget for 1.5^{0}C rise will be exhausted well before 2030



Source: Our World in Data, IPCC and CSE Analysis

CARBON BUDGET IN NDC SCENARIO

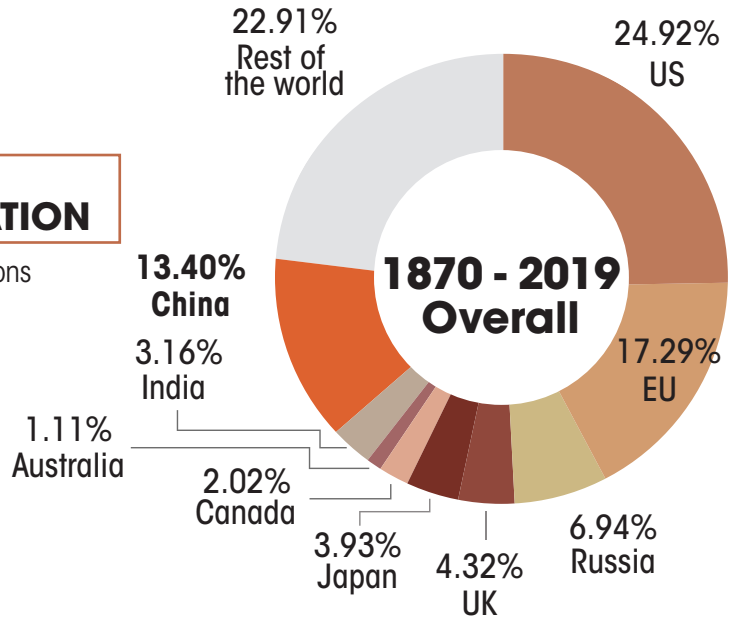
Even if enhanced Nationally Determined Contributions (NDCs) are implemented fully, the 1.5^{0}C budget will be exhausted before 2030

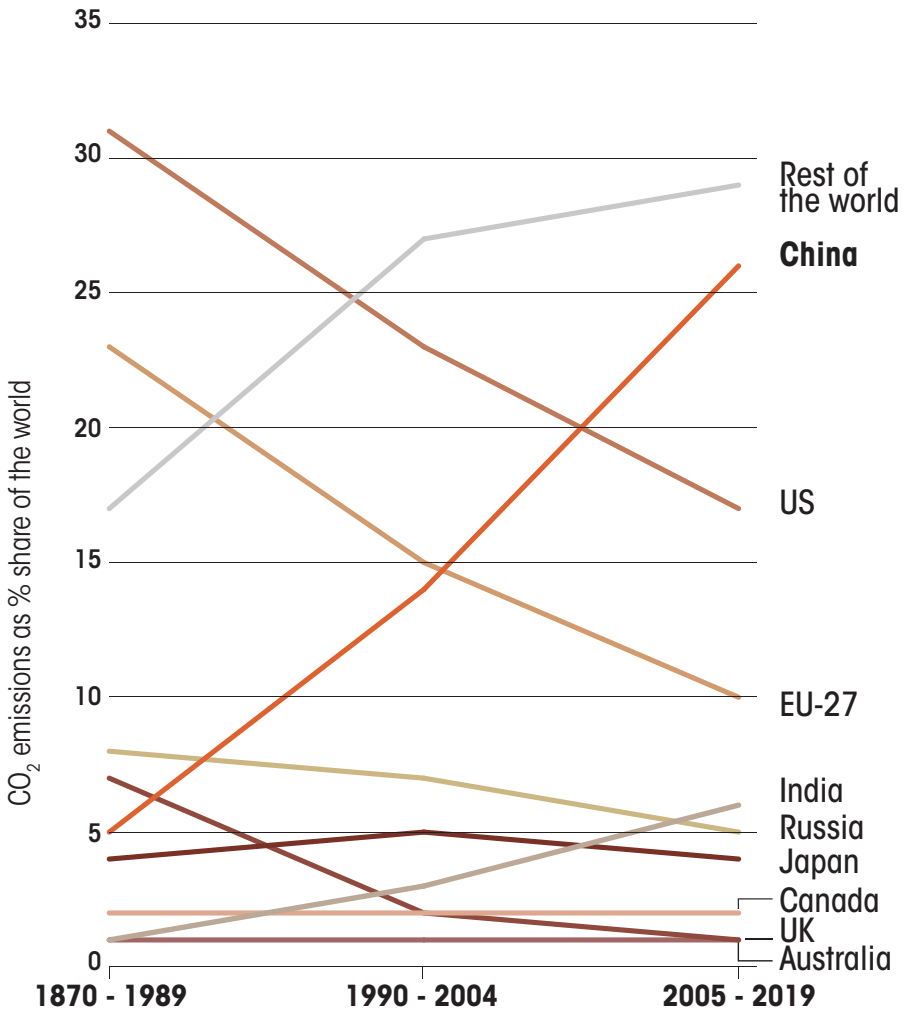


Source: Our World in Data, IPCC and CSE Analysis

RISE OF THE DRAGON NATION

Historical CO_2 emissions
1870 - 2019
(as % of the world)





Source: Our World in Data

In 2005-2019, China's emissions increased to some 26 per cent of the world.

China's emissions increased but those of the rest of the already-rich world did not decrease substantially. In fact, they only adjusted to make way for China—the country that had quickly become the cheap manufacturing centre of the world and where goods were now made for export. By 2019, the carbon space was occupied by the original seven and China. These countries contributed some 67 per cent of the emissions between 1990 and 2019. The remaining world, with 66 per cent of the population, was left to occupy some 33 per cent of the carbon space.

BCC+AC: 1870-2019

The carbon budget appropriation is even more stark if you take the entire period—since the beginning of the industrial revolution in 1870 to current times, 2019 . From 1870 to 2019, US, EU-27, Russia, UK, Australia , Canada and Japan, with less than 15 per cent of the world's population (in 2019), had contributed 61 per cent of the total emissions in the atmosphere.

Once you add China to this, the contribution rises to 74 per cent of the total CO_2 emissions from some 34 per cent of the total's population (see 'Rise of the dragon nation' on *p*27). India, the third or fourth largest emitter, has taken up a mere 3.16 per cent of the pie despite having 18 per cent of the world's people.

Taking IPCC's 2014 CO_2 budget of 2,250 Gt (1870 onwards) to keep the global temperature rise to 1.5°C means that the world has exhausted 73 per cent of the budget by 2019. And these countries (original 7+China) have appropriated 54 per cent of this budget.

It would be an understatement to say that the historical division of the carbon pie has been extremely inequitable.

SECTION 4
TARGET 2030

HOW IT ENDS

In the coming 10 years, China will take up 33% of the remaining carbon budget

Despite heavy reduction targets, the original seven, along with China, will occupy 62% of this budget

The remaining world, with 66% of the population, will be left with about 38% of the budget

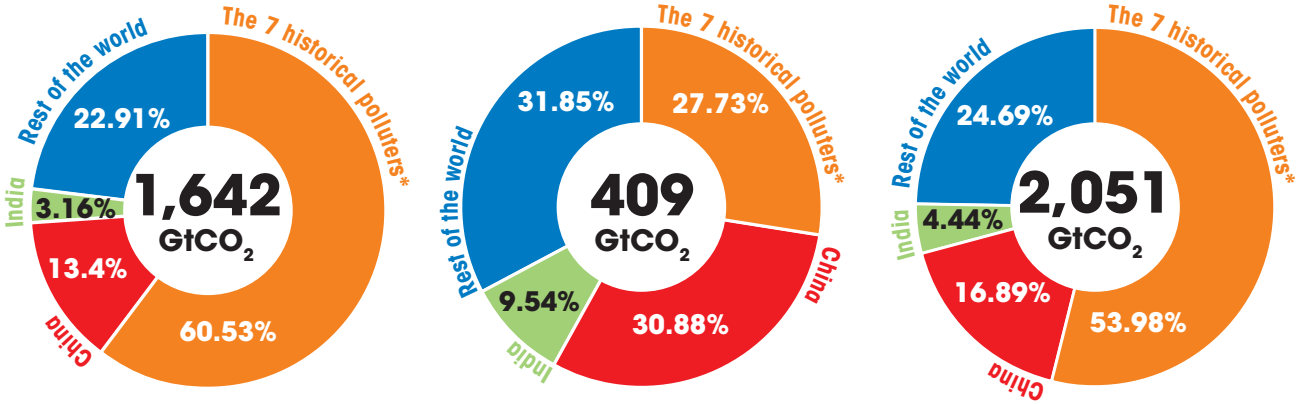
What then is the carbon budget that remains—the amount of carbon dioxide we can emit going forward if we are to limit temperature rise to 1.5 °C?

In AR6, IPCC does not include the historical budget but states that the remaining budget is 400 Gt of CO_2 for the world to have a 66 per cent probability of staying below 1.5°C. Till 2019, the world had emitted 1,642 $GtCO_2$ (see 'Unchanged future'). If the IPCC AR5 budget is used, then this would mean that 73 per cent of the budget had been exhausted and 608.3 $GtCO_2$ remains. But now we know that only 400 $GtCO_2$ remains to keep the world below 1.5°C rise, according to the revised estimate published in AR6. This carbon budget includes emissions from land use, land-use change and forestry (LULUCF), roughly 3.3 per cent. If this is deducted, then the world has a remaining carbon budget for fossil fuel emissions of 387 Gt from 2020 to keep the temperature rise to 1.5°C, as per AR6.

It should not be a surprise to learn that the world will exhaust the remaining carbon budget before 2030—even assuming the implementation of the full NDCs by countries (see 'Carbon budget in

UNCHANGED FUTURE

China and the developed world are likely to account for almost 70 per cent CO_2 emissions from 1870 to 2030



*US, UK, Russia, Australia, Japan, Canada and EU-27

Source: Analysis by *Down to Earth* and Centre for Science and Environment, Delhi, based on data from Climate Watch and Our World in Data

PERPETUAL GAP

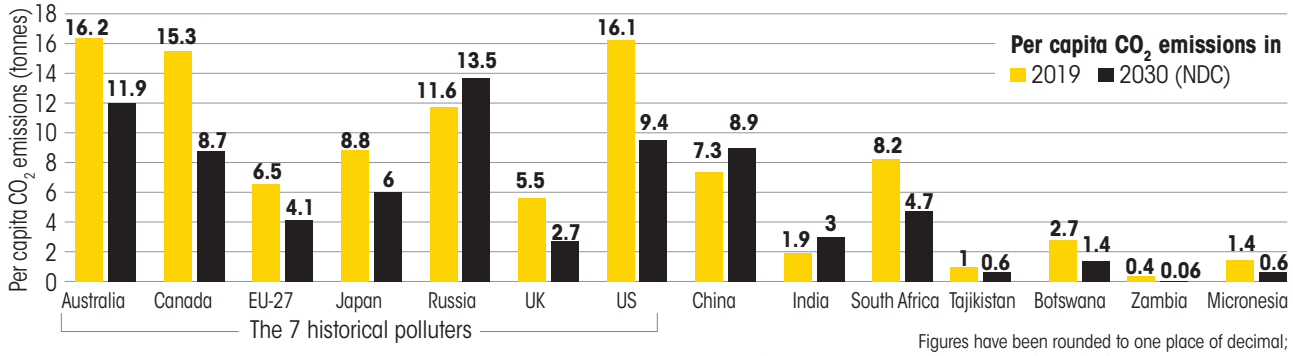
Even in NDC scenario, developed countries and China will continue to emit almost 60 per cent of future CO_2 emissions

	% of total emissions for BCC + AC (1870-2019)	% of total emissions if NDCs are met 2020-2030	% of total emissions for BCC+AC+NDC (1870-2030)
US	**24.92**	**11.27**	**22.20**
EU-27	**17.29**	**6.24**	**15.09**
Russia	**6.94**	**4.87**	**6.52**
UK	**4.32**	**0.73**	**3.60**
Japan	**3.93**	**2.39**	**3.63**
Canada	**2.02**	**1.23**	**1.86**
Australia	**1.11**	**1.00**	**1.08**
7 historical polluters	**60.53**	**27.73**	**53.98**
China	**13.40**	**30.88**	**16.89**
7 historical polluters + China	**73.93**	**58.60**	**70.87**
Rest of world (excluding China, including India)	**26.07**	**41.40**	**29.13**
India	**3.16**	**9.54**	**4.44**
South Africa	**1.26**	**1.04**	**1.22**
South Korea	**1.04**	**1.44**	**1.12**
Brazil	**0.92**	**1.27**	**0.99**
Vietnam	**0.22**	**1.28**	**0.43**

Source: Analysis by *Down to Earth* and Centre for Science and Environment, Delhi, based on data from Climate Watch and Our World in Data

STARK CONTRAST

Per capita emissions of developed countries and China will remain high even in 2030



Figures have been rounded to one place of decimal;
Source: Analysis by *Down to Earth* and Centre for Science and Environment, Delhi, based on data from Climate Watch and Our World in Data

CO_2 BUDGET: LIMITED AND APPROPRIATED

Historical contribution of countries and their future plans

Country	% of IPCC AR5 budget exhausted by 2019	% of IPCC AR6 budget exhausted by 2030 **(BAU)**	% of IPCC AR6 budget exhausted by 2030 **(NDC)**
US	18.18%	13.33%	11.91%
EU-27	12.61%	7.36%	6.60%
Russia	5.06%	5.07%	5.14%
UK	3.16%	0.88%	0.77%
Japan	2.87%	2.96%	2.53%
Australia	0.81%	1.18%	1.05%
Canada	1.47%	1.74%	1.29%
China	9.78%	32.63%	32.63%
India	2.31%	10.09%	10.09%
Rest of the world	**43.75%**	**24.76%**	**27.98%**

As the world exceeds the budget, we have taken it as a % of the contribution
AR5 Budget - 2250 $GtCO_2$ (between 1870-2100)
AR6 Budget - 400 $GtCO_2$, adjusted to 387 $GtCO_2$ (2020 onwards)

Source: Our World in Data, IPCC and CSE Analysis

BAU scenario' and 'Carbon budget in NDC scenario' on *p*26). This itself is a huge question mark because big emitters, like the US, have ambitious plans, but as yet these seem to be stuck and it is difficult to say if the scale of reduction will be achieved at all.

In the current decade—billed rightly as the last chance to avert serious and catastrophic climate change—we see some change.

Of the historical emitters, US, EU-27, UK and Canada have put forward substantial reduction targets. If these are realised—and there are questions about this still—the contribution of this group of countries to the world's emissions in the decade 2020-30 will reduce from 21.19 per cent to 19.47 per cent. However, this is still not a "fair share"—not by a stretch—if you take the contribution of these countries to the stock of emissions already in the atmosphere, which is in fact the cause of the temperature rise. Between 1870 and 2030, these countries with minuscule global populations will still

account for nearly half the CO_2 emissions in the atmosphere even if their NDCs are achieved (see 'Perpetual gap' on *p*31).

But what makes the last-chance decade even more inequitable is the enduring rise of the world's next superpower, China. In this decade, China has not given any emission reduction targets—only a commitment to reduce its carbon dioxide emissions per unit of GDP by 65 per cent from the 2005 levels. According to our estimate, China's emissions in 2030 would be 12.65 Gt—up from 10.17 Gt in 2019. This is also what has been estimated by Climate Action Tracker. The tracker says that "under China's most binding peaking and non-fossil share NDC targets, the country's emission levels would reach between 13.2 to 14.0 $GtCO_2e$ in 2030, an increase of 20% to 28% from 2010 levels."

Based on our estimate, China will emit 126 Gt of CO_2 in the coming 10 years. This means that its emissions will take up 33 per cent of the left over carbon budget, as per AR6 (see 'CO_2 budget: limited and appropriated'). As a result, the original 7+China will occupy 62 per cent of the budget, for this decade. Seen as a whole—from 1870 onwards to 2030, even if NDCs are achieved—these countries will be responsible for 71 per cent of the world's emissions. In 2030, the per capita CO_2 emissions will remain inequitable by large margins (see 'Stark contrast' on *p*31).

SECTION 5
AGENDA

COP 26

World must not dilute or erase climate justice. It is the imperative for future cooperation and for an ambitious climate agreement

COP26 must discuss how countries will front-load emissions reduction by 2030 based on their cumulative historical emissions

It must focus on the growing vulnerability of countries because of extreme weather events and to pay for loss and damage

The problem is not theoretical; neither is it a moralistic issue. But in what world, language or situation is it acceptable for about 70 per cent of the world's people—most of whom still do not have access to energy and stand at the bottom on most human development indicators—to be left with some 30 per cent of the world's available carbon budget? Now unless we can tell these billions to stop exhaling CO_2, or stop doing everything that we know makes the world economy prosperous, they will emit. The world, as a result, will breach the guardrail of 1.5°C. This is why equity is a

THE STORY IN NUMBERS

China and the developed world will continue to have the lion's share of the planet's carbon budget in 2020-30, while the burden of reducing emissions will be borne unfairly by many developing countries

Carbon budget

400 gigatonnes (Gt)
is the remaining carbon budget for the world, starting 2020, to have a 66% probability of staying on 1.5°C trajectory

36.4 Gt
is the annual amount of anthropogenic CO_2 (from fossil fuel and cement) the planet emits

At the current rate, we will run out of the planet's carbon budget in 2030, even if we achieve nationally determined contributions

Budget hoggers

33%
of the carbon budget for the 1.5ºC trajectory will be consumed by China's emissions in 2020-30

29%
of the carbon budget for the 1.5ºC trajectory will be consumed by the original 7 polluters (US, UK, EU-27, Russia, Japan, Australia, Canada) in 2020-30

38%
of the carbon budget will be available for the rest of the world in 2020-30

NDCs not ambitious...

18.2 $GtCO_2$
is what the world needs to emit in 2030 to keep the temperature rise to 1.5°C

37.71 $GtCO_2$
is what the world will emit in 2030 even if it achieves enhanced NDC

...And the burden is unfair

85%
is the reduction in per capita emissions by 2030, compared to 2019 levels, as per NDCs pledged by Zambia

53%
is the reduction in per capita emissions by 2030, compared to 2019 levels, as per NDCs pledged by Micronesia

30%
is the reduction in per capita emissions by 2030, compared to 2019 levels, as per NDCs pledged by Japan and Australia

16%
is the hike in per capita emissions by 2030, compared to 2019 levels, as per Russia's NDCs

pre-requisite to an ambitious and effective climate agreement. It is not something that can be diluted, discarded or erased. Dissect the data any way and the conclusion will be the same—few countries have appropriated the carbon budget (see 'Appropriation of world emissions') and their accumulated emissions are the cause of the temperature increase, which is taking the world towards catastrophe.

There is another inconvenient truth: though the rich (including China) have polluted the world almost beyond redemption, the remaining world cannot be denied the right to develop. This transformation must happen, but without further jeopardising the planet, which will need huge funding and technology support. This is not about charity, but about fixing what has been broken, in the interest of all. This part of the world cannot be wished away, it cannot be shouted and screamed at and bullied, into a low-carbon pathway.

Agenda for COP26

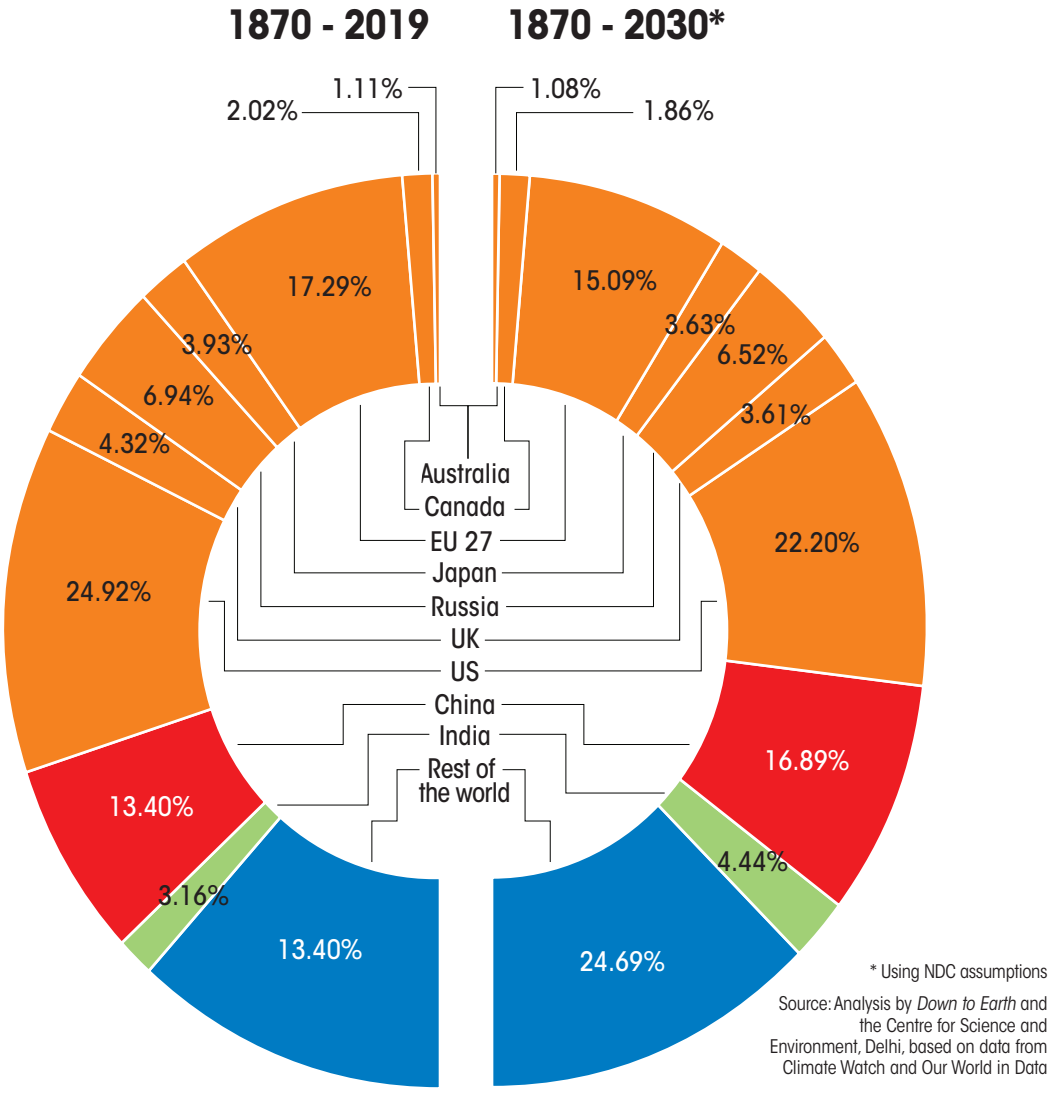
Factoring these variables, CoP26 must deliberate the following five issues: First, not to work to erase the reality of climate injustice, but to work with it for the future. In 1992, at the Rio Conference, when the UN Framework Convention on Climate Change was agreed upon, it was built on the principle of common but differentiated responsibility. This simply meant that the already-rich countries would reduce emissions, create space for the emerging world to grow, and the emerging world would grow differently with the help of enabling funds and technology. But in the next 30 years, the single biggest effort has been to undermine, and to finally erase, the principle of equity from climate negotiations. The 2015 Paris Agreement, which was lauded by all, removed the last vestiges of historical responsibility from the text. Climate justice was relegated to a footnote.

The second agenda is to stop proselytising the concept of net zero—it only deepens inequity and delays action. IPCC says the world must be net zero by 2050 and halve its emissions by 2030 over the 2010 levels to stay on the 1.5°C trajectory. If the world has to be net zero by 2050, then the differential must apply, and the rich (7+ China) must be net zero by 2030 at the very latest. We need clear plans for 2030 from all, particularly from the emitters of the past and the present.

The third agenda has to be turning the spotlight on China. For long, the country has hidden behind the Group of 77 (developing

APPROPRIATION OF WORLD EMISSIONS

% of total world emissions for the given period



* Using NDC assumptions

Source: Analysis by *Down to Earth* and the Centre for Science and Environment, Delhi, based on data from Climate Watch and Our World in Data

countries) to hide its real intention of gaining "equivalence" with the rest of the big polluters by 2030. The fact is that in this decade (2020-30), China will occupy 33 per cent of the available carbon budget. This means there is no space for the rest of the world to grow. The country has no absolute emissions reduction target. This is unacceptable. China today is yesterday's US and it is difficult to see how the world will call it out.

The fourth agenda is finance—real, tangible and at the scale of the transformation needed. For long this promise has been sidelined and has led to a breakdown of trust between countries. This agenda is linked to discussions on market-based mechanism, which is on the table at COP26. Currently the effort is to find creative ways to "buy" cheap emission reductions from the developing world. It is a redo of the disastrous Clean Development Mechanism, but the intent is the same. This will only add to the crisis of climate change.

The fact is today the world—including India and countries in Africa—need to act to reduce emissions. Instead of cheap carbon offset options, the market mechanisms must formulate a way to fund transformational and expensive options in these countries. This means they need to be designed with a floor on the cost of abatement that this mechanism will fund. This means not just talking the talk, but running the walk.

The fifth agenda for COP26 is the near-stuck discussion on "loss and damage". We are seeing huge devastations, caused by weird weather events. With each disaster, people lose their ability to cope—to live in their repeatedly hit and devastated region; they get increasingly impoverished and desperate. This adds to their insecurity and to the insecurity of the world. Climate change is a great leveller. So, it is time for an effective agreement to underwrite the losses and damages and to hold the polluters responsible.

Agenda for India

What should India do? We are victims of climate change impacts—we know this and IPCC reconfirms that we will see the worst of the devastation of this increasingly warming world. We are the world's third highest emitter of greenhouse gases (fourth if we take EU-27 as a group) but the scale of our past, current and future emissions is not comparable to that of the original 7+China—neither in absolute terms nor in per capita.

Now that the world has run out of carbon space, we can keep insisting that we are the victims, but it will not be to much avail. We need a strategy to ramp up our actions to combat climate change—because we have the advantage of doing things differently. We also have the reason to do this for our own benefit—clean air and clean

energy. We must be strident on the need for global action, stress on the inequity of inaction, and show leadership in not just walking, but running the talk. It is a tall order given that emissions of carbon dioxide are still directly linked to economic growth. But it is the order of the times we live in.

ANNEXURE 1: CO_2 emissions of 2020-2030 in BAU scenario (all emissions in gigatonnes)

Country	2019	% of world 2019	2020	2021	2022	2023	2024
Argentina	0.18	0%	0.18	0.18	0.17	0.17	0.17
Australia	0.41	1%	0.41	0.41	0.41	0.41	0.42
Azerbaijan	0.04	0%	0.04	0.04	0.04	0.04	0.04
Belarus	0.06	0%	0.06	0.06	0.06	0.07	0.07
Bosnia and Herzegovina	0.03	0%	0.03	0.03	0.03	0.03	0.03
Botswana	0.01	0%	0.01	0.01	0.01	0.01	0.01
Brazil	0.47	1%	0.48	0.49	0.51	0.52	0.54
Canada	0.58	2%	0.58	0.59	0.59	0.60	0.61
Chile	0.08	0%	0.09	0.09	0.09	0.09	0.09
China	10.17	28%	10.38	10.59	10.80	11.01	11.23
Colombia	0.10	0%	0.11	0.11	0.11	0.11	0.12
Cook Islands	0.00	0%	0.00	0.00	0.00	0.00	0.00
Costa Rica	0.01	0%	0.01	0.01	0.01	0.01	0.01
Dominica	0.00	0%	0.00	0.00	0.00	0.00	0.00
Equatorial Guinea	0.01	0%	0.01	0.01	0.01	0.00	0.00
Eritrea	0.00	0%	0.00	0.00	0.00	0.00	0.00
Ethiopia	0.02	0%	0.02	0.02	0.02	0.02	0.02
EU-27	2.92	8%	2.86	2.80	2.75	2.69	2.64
Grenada	0.00	0%	0.00	0.00	0.00	0.00	0.00
Iceland	0.00	0%	0.00	0.00	0.00	0.00	0.00
India	2.62	7%	2.75	2.88	3.03	3.18	3.34
Japan	1.11	3%	1.10	1.08	1.07	1.06	1.05
Kazakhstan	0.31	1%	0.32	0.34	0.35	0.36	0.37
Liechtenstein	0.00	0%	0.00	0.00	0.00	0.00	0.00
Marshall Islands	0.00	0%	0.00	0.00	0.00	0.00	0.00
Mauritius	0.00	0%	0.00	0.00	0.01	0.01	0.01
Micronesia	0.00	0%	0.00	0.00	0.00	0.00	0.00
Moldova	0.01	0%	0.01	0.01	0.01	0.01	0.01
Montenegro	0.00	0%	0.00	0.00	0.00	0.00	0.00
New Zealand	0.04	0%	0.04	0.04	0.04	0.04	0.04
Nicaragua	0.01	0%	0.01	0.01	0.01	0.01	0.01
Norway	0.04	0%	0.04	0.04	0.04	0.04	0.04
Oman	0.07	0%	0.08	0.08	0.09	0.09	0.10
Russia	1.68	5%	1.70	1.71	1.73	1.75	1.76
Serbia	0.05	0%	0.06	0.06	0.06	0.06	0.06
Singapore	0.04	0%	0.04	0.04	0.04	0.04	0.04
South Africa	0.48	1.31%	0.48	0.49	0.50	0.50	0.51

2025	2026	2027	2028	2029	2030	2020-2030 BAU	2020-2030 BAU % of world
0.17	0.17	0.17	0.17	0.17	0.16	1.88	0.44%
0.42	0.42	0.42	0.42	0.42	0.42	4.58	1.08%
0.04	0.04	0.05	0.05	0.05	0.05	0.48	0.11%
0.07	0.07	0.07	0.07	0.07	0.07	0.73	0.17%
0.03	0.03	0.03	0.03	0.03	0.03	0.31	0.07%
0.01	0.01	0.02	0.02	0.02	0.02	0.14	0.03%
0.55	0.57	0.59	0.60	0.62	0.64	6.11	1.44%
0.61	0.62	0.62	0.63	0.64	0.64	6.74	1.58%
0.10	0.10	0.10	0.10	0.11	0.11	1.07	0.25%
11.46	11.69	11.92	12.16	12.40	12.65	126.29	29.66%
0.12	0.13	0.13	0.13	0.14	0.14	1.34	0.32%
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00%
0.01	0.01	0.01	0.01	0.01	0.01	0.10	0.02%
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00%
0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.01%
0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00%
0.03	0.03	0.03	0.03	0.04	0.04	0.31	0.07%
2.58	2.53	2.48	2.43	2.38	2.34	28.48	6.69%
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00%
0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.01%
3.51	3.68	3.87	4.06	4.26	4.48	39.03	9.17%
1.04	1.03	1.02	1.01	1.00	0.99	11.47	2.69%
0.38	0.39	0.41	0.42	0.44	0.45	4.23	0.99%
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00%
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00%
0.01	0.01	0.01	0.01	0.01	0.01	0.06	0.01%
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00%
0.01	0.01	0.01	0.01	0.01	0.01	0.08	0.02%
0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.01%
0.04	0.04	0.04	0.04	0.04	0.04	0.42	0.10%
0.01	0.01	0.01	0.01	0.01	0.01	0.07	0.02%
0.04	0.04	0.04	0.04	0.04	0.04	0.45	0.11%
0.10	0.11	0.12	0.12	0.13	0.14	1.16	0.27%
1.78	1.80	1.82	1.84	1.85	1.87	19.61	4.61%
0.06	0.06	0.06	0.06	0.06	0.06	0.66	0.16%
0.04	0.04	0.04	0.04	0.04	0.04	0.42	0.10%
0.52	0.52	0.53	0.54	0.54	0.55	5.69	1.34%

CONTINUED...

...CONTINUED

Country	2019	% of world 2019	2020	2021	2022	2023	2024
South Korea	0.61	2%	0.62	0.63	0.64	0.65	0.66
Switzerland	0.04	0%	0.04	0.04	0.04	0.04	0.04
Tajikistan	0.01	0%	0.01	0.01	0.01	0.01	0.02
Ukraine	0.22	1%	0.22	0.22	0.21	0.21	0.20
UK	0.37	1%	0.36	0.35	0.34	0.33	0.32
US	5.28	15%	5.18	5.08	4.97	4.87	4.78
Vietnam	0.25	1%	0.27	0.29	0.32	0.35	0.38
Zambia	0.01	0%	0.01	0.01	0.01	0.01	0.01
Total of 45	**28.33**	**77.74%**	**28.57**	**28.83**	**29.11**	**29.41**	**29.73**
Rest of the world	**8.11**	**22.26%**	**8.24**	**8.34**	**8.43**	**8.51**	**8.57**
World	**36.44**		**36.81**	**37.17**	**37.55**	**37.92**	**38.30**

Notes:
The above 45 countries have been selected since their NDCs have percentage reduction targets of emissions for 2030 and are quantifiable
BAU emissions till 2030 have been projected based on the median annual rate of change of the past decade (2010-2019)
This analysis uses only annual production-based carbon dioxide (CO_2) emissions from the burning of fossil fuels for energy and cement production.
Land use change and consumption emissions are not included.

Data Sources:

- Carbon Dioxide Emissions - Our World in Data based on Global Carbon Project, https://ourworldindata.org/co2-and-other-greenhouse-gas-emissions
- CSE analysis for business-as-usual emissions

2025	2026	2027	2028	2029	2030	2020-2030 BAU	2020-2030 BAU % of world
0.67	0.68	0.68	0.69	0.70	0.71	7.33	1.72%
0.04	0.04	0.04	0.04	0.04	0.04	0.41	0.10%
0.02	0.02	0.02	0.03	0.03	0.03	0.21	0.05%
0.20	0.20	0.19	0.19	0.19	0.18	2.21	0.52%
0.31	0.30	0.29	0.28	0.27	0.26	3.40	0.80%
4.68	4.59	4.50	4.41	4.32	4.23	51.60	12.12%
0.41	0.44	0.48	0.52	0.57	0.62	4.65	1.09%
0.01	0.01	0.01	0.01	0.01	0.02	0.12	0.03%
30.07	**30.43**	**30.82**	**31.22**	**31.66**	**32.11**	**331.971**	**77.98%**
8.61	**8.64**	**8.64**	**8.63**	**8.60**	**8.54**	**93.756**	**22.02%**
38.68	**39.07**	**39.46**	**39.86**	**40.25**	**40.66**	**425.727**	

ANNEXURE 2: CO_2 emissions of 2020-2030 if NDCs are implemented (all emissions in gigatonnes)

Country	NDC	2019	2020	2021	2022	2023	2024
Argentina	Cap net emissions of 359 $MtCO_2e$ in 2030	0.179	0.184	0.189	0.193	0.198	0.203
Australia	-11-15% GHG below 2005 by 2030 excluding LULUCF	0.411	0.404	0.397	0.391	0.384	0.377
Azerbaijan	35% reduction in GHG emissions by 2030 compared to 1990	0.040	0.039	0.039	0.038	0.038	0.037
Belarus	At least 28% reduction in GHG emissions by 2030 compared to 1990 (excluding LULUCF) without any conditions.	0.062	0.064	0.065	0.066	0.067	0.068
Bosnia and Herzegovina	Reduce emissions by 12.8% (unconditional) and 17.5% (conditional) by 2030; 50% (unconditional) and 55% (conditional) by 2050, compared to 2014 levels	0.027	0.026	0.025	0.024	0.024	0.023
Botswana	15% reduction in GHG emissions by 2030 compared to 2010	0.006	0.006	0.006	0.006	0.005	0.005
Brazil	Reduce greenhouse gas emissions by 37% below 2005 levels in 2025, and by 43% below 2005 levels in 2030	0.466	0.467	0.468	0.470	0.471	0.472
Canada	-40-45% GHG below 2005 by 2030	0.577	0.556	0.536	0.516	0.496	0.476
Chile	A goal of 95 $MtCO_2eq$ by 2030 excluding LULUCF	0.084	0.083	0.082	0.080	0.079	0.078
China	Carbon intensity, peak emissions, non fossil energy and forest stock	10.175	10.378	10.586	10.797	11.013	11.234
Colombia	Maximum of 169.44 $MtCO_2e$ in 2030	0.102	0.102	0.102	0.101	0.101	0.101
Cook Islands	38% reduction by 2020 (unconditional) and 81% reduction by 2030 (conditional) in GHG emission from electricity generation compared to 2006	0.000	0.000	0.000	0.000	0.000	0.000
Costa Rica	2030 cap of 9.11 $MtCO_2e$ net-emissions and a maximum net-emissions budget of 106.53 $MtCO_2e$ from 2021 to 2030	0.009	0.008	0.008	0.008	0.008	0.008
Dominica	17.9% by 2020, 39.2% by 2025 and 44.7% by 2030 reduction in GHG emissions below 2014 levels (164.5 Ggs est.)	0.000	0.000	0.000	0.000	0.000	0.000
Equatorial Guinea	20% reduction in emissions by 2030 compared to 2010 levels, in order to achieve a 50% reduction by 2050	0.006	0.006	0.006	0.006	0.006	0.006
Eritrea	The government of Eritrea is committed to reduce the CO2 emissions from fossil fuels by 4.2% in 2020, 6.2% by 2025 and 12.0% by 2030 compared to the projected BAU of the reference year of 2010. If additional support is availed, it can further be reduced by 12.6% in 2020, 24.9% by 2025 and 38.5 by the year 2030.	0.001	0.001	0.001	0.001	0.001	0.001
Ethiopia	Reduce GHG emissions by 14% (unconditional) and 68.8% (conditional) by 2030 compared to BAU	0.016	0.031	0.045	0.060	0.074	0.089
EU-27	-52.8% GHG below 1990 by 2030 excluding LULUCF	2.917	2.818	2.719	2.619	2.520	2.421
Grenada	40% reduction of the 2010 emissions levels by 2030	0.000	0.000	0.000	0.000	0.000	0.000
Iceland	"Economy-wide net reduction of at least 55% in greenhouse gas emissions by 2030 compared to 1990"	0.003	0.003	0.003	0.003	0.002	0.002
India	Emissions intensity, non fossil power, sink	2.616	2.747	2.885	3.029	3.180	3.339
Japan	-46% GHG below 2013 by 2030	1.107	1.071	1.035	0.998	0.962	0.926
Kazakhstan	15% (unconditional) to 25% (conditional) reduction in GHG emissions by 2030 compared to 1990	0.314	0.304	0.295	0.286	0.276	0.267
Liechtenstein	40% reduction in GHG emissions by 2030 compared to 1990	0.000	0.000	0.000	0.000	0.000	0.000
Marshall Islands	GHG reduction of at least 45% below 2010 levels by 2030.	0.000	0.000	0.000	0.000	0.000	0.000
Mauritius	30% reduction in GHG emissions by 2030 compared to the BAU scenario (7 $MtCO_2e$)	0.005	0.005	0.004	0.004	0.004	0.004
Micronesia	28% (unconditional) up to 35% (conditional) reduction in GHG emissions by 2025 compared to 2000	0.000	0.000	0.000	0.000	0.000	0.000

						NDC		BAU		
2025	2026	2027	2028	2029	2030	2020-2030	2020-2030 NDC % of world	2020-2030	2020-2030 BAU % of world	Absolute difference NDC-BAU
0.208	0.212	0.217	0.222	0.227	0.232	2.284	0.006	1.881	0.004	0.403
0.370	0.363	0.357	0.350	0.343	0.336	4.073	0.010	4.579	0.011	-0.506
0.037	0.036	0.035	0.035	0.034	0.034	0.402	0.001	0.484	0.001	-0.082
0.069	0.070	0.071	0.072	0.074	0.075	0.760	0.002	0.733	0.002	0.027
0.022	0.022	0.021	0.020	0.020	0.019	0.246	0.001	0.307	0.001	-0.061
0.005	0.005	0.005	0.004	0.004	0.004	0.055	0.000	0.142	0.000	-0.087
0.474	0.475	0.476	0.477	0.479	0.480	5.209	0.013	6.113	0.014	-0.904
0.455	0.435	0.415	0.395	0.375	0.355	5.010	0.012	6.737	0.016	-1.726
0.077	0.075	0.074	0.073	0.072	0.070	0.843	0.002	1.065	0.003	-0.222
11.458	11.688	11.921	12.160	12.403	12.651	126.289	0.309	126.289	0.297	0.000
0.101	0.100	0.100	0.100	0.100	0.099	1.107	0.003	1.343	0.003	-0.236
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	-0.001
0.008	0.007	0.007	0.007	0.007	0.007	0.083	0.000	0.098	0.000	-0.015
0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.002	0.000	-0.001
0.006	0.006	0.006	0.006	0.006	0.005	0.061	0.000	0.050	0.000	0.011
0.000	0.000	0.000	0.000	0.000	0.000	0.005	0.000	0.010	0.000	-0.004
0.103	0.118	0.132	0.146	0.161	0.175	1.134	0.003	0.307	0.001	0.826
2.322	2.223	2.123	2.024	1.925	1.826	25.539	0.062	28.481	0.067	-2.942
0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.004	0.000	-0.001
0.002	0.002	0.002	0.001	0.001	0.001	0.023	0.000	0.036	0.000	-0.013
3.506	3.682	3.866	4.059	4.262	4.475	39.030	0.095	39.030	0.092	0.000
0.890	0.854	0.818	0.782	0.746	0.710	9.793	0.024	11.467	0.027	-1.674
0.258	0.248	0.239	0.230	0.220	0.211	2.834	0.007	4.226	0.010	-1.392
0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.001	0.000	0.000
0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.002	0.000	-0.001
0.004	0.004	0.004	0.004	0.004	0.004	0.045	0.000	0.061	0.000	-0.016
0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.002	0.000	-0.001

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Moldova	70% (unconditional) and up to 88% (conditional) reduction in GHG emission in 2030 compared to 1990	0.006	0.006	0.005	0.005	0.005	0.005
Montenegro	Economy-wide GHG emission reduction target of 35% by 2030 compared to base year (1990) emissions, excluding LULUCF	0.002	0.002	0.002	0.002	0.002	0.002
New Zealand	Reduce greenhouse gas emissions to 30% below 2005 levels by 2030	0.037	0.036	0.035	0.034	0.033	0.032
Nicaragua	69 $MtCO_2e$ in 2030 or 10% reduction compared to BAU (77 $MtCO_2e$)	0.006	0.010	0.014	0.018	0.022	0.026
Norway	At least 50% and towards 55% reduction in greenhouse gas emission by 2030 compared to 1990 levels	0.042	0.040	0.038	0.036	0.033	0.031
Oman	Oman commits to reduce GHG Emissions by 4% (unconditional) and 7% (conditional) by 2030 compared to BAU (125.254 $MTCO_2e$)	0.072	0.073	0.074	0.076	0.077	0.078
Russia	-24% GHG below 1990 by 2030 excluding LULUCF	1.678	1.700	1.722	1.744	1.766	1.788
Serbia	9.8% reduction in GHG emissions by 2030 compared to 1990	0.055	0.054	0.054	0.054	0.053	0.053
Singapore	Singapore's NDC is an economy-wide absolute GHG emissions limitation target to peak its GHG emissions at 65 $MtCO_2e$ around 2030. Singapore's GHG emissions in 2030 are expected to amount to no higher than 65 $MtCO_2e$.	0.039	0.040	0.041	0.041	0.042	0.043
South Africa	In 2030, South Africa's emissions will be in a range between 398 and 440 $MtCO_2eq$	0.479	0.463	0.448	0.433	0.417	0.402
South Korea	Reduce GHG emissions by 24.4% by 2030 compared to 2017 levels (709.1$MtCO_2e$)	0.611	0.598	0.585	0.573	0.560	0.547
Switzerland	Reduce greenhouse gas emissions by at least 50% by 2030 compared to 1990 levels	0.038	0.036	0.035	0.034	0.032	0.031
Tajikistan	Not exceeding 80-90% (amounts to 1.7-2.2 tCO_2e per capita) (unconditional) of 1990 level by 2030; achieve 65-75% (amounts to 1.2-1.7 tCO_2e per capita) (conditional) of 1990 level by 2030	0.009	0.009	0.009	0.008	0.008	0.008
Ukraine	65% reduction below 1990 levels by 2030	0.223	0.225	0.228	0.230	0.232	0.234
UK	-69% GHG below 1990 by 2030 excluding LULUCF	0.370	0.353	0.336	0.320	0.303	0.286
US	-43-50% GHG below 2005 by 2030 excluding LULUCF	5.285	5.103	4.920	4.738	4.556	4.374
Vietnam	Reduce total GHG emissions by about 9% compared to the BAU scenario	0.248	0.286	0.324	0.362	0.401	0.439
Zambia	Zambia commits to reduce its GHG emissions conditionally by at least 25% (under limited international support) and towards 47% (with substantial international support) compared to 2010 levels	0.007	0.006	0.006	0.005	0.005	0.004
Total of Countries with NDCs		28.33	28.34	28.37	28.41	28.46	28.52
Rest of the World without NDCs		8.11	8.24	8.34	8.43	8.51	8.57
World		36.44	36.58	36.71	36.84	36.97	37.09

Notes:

NDC targets have % reductions for GHG. The same % has been applied to CO_2 emissions for the carbon budget.

Where available, NDC targets have been considered exclusive of LULUCF emissions, taking Climate Action Tracker's (CAT's) estimates of the new NDCs minus LULUCF. For example, the US goal of 50-52% reduction is estimated by CAT to be 43-50% when excluding LULUCF. If this is not available, the % target inclusive of LULUCF has been considered.

If a NDC has a GHG ($GtCO_2e$) volume target for 2030, it has been converted to $GtCO_2$ by multiplying with 0.74, since CO_2 is typically 74% of all GHG.

As India and China do not have quantifiable NDC targets, the BAU figures have been taken. This has also been applied for the Rest of the World for 2020-2030 in a NDC scenario.

Where available, conditional NDC targets have been used for calculations (instead of unconditional targets).

If a range is given in a NDC, for example, for the US NDC of 50-52%, the median has been taken–51%.

Where available, updated or second NDCs have been considered, as available on September 20, 2021.

Data Sources: Climate Watch, Climate Action Tracker

0.005	0.004	0.004	0.004	0.004	0.003	0.050	0.000	0.076	0.000	-0.026
0.002	0.002	0.002	0.001	0.001	0.001	0.020	0.000	0.027	0.000	-0.008
0.031	0.030	0.029	0.028	0.027	0.026	0.341	0.001	0.416	0.001	-0.076
0.030	0.035	0.039	0.043	0.047	0.051	0.334	0.001	0.068	0.000	0.266
0.029	0.027	0.025	0.022	0.020	0.018	0.319	0.001	0.451	0.001	-0.131
0.080	0.081	0.082	0.084	0.085	0.086	0.876	0.002	1.158	0.003	-0.282
1.810	1.832	1.854	1.875	1.897	1.919	19.907	0.049	19.608	0.046	0.300
0.053	0.052	0.052	0.052	0.051	0.051	0.579	0.001	0.661	0.002	-0.082
0.044	0.045	0.046	0.046	0.047	0.048	0.483	0.001	0.423	0.001	0.061
0.387	0.371	0.356	0.341	0.325	0.310	4.253	0.010	5.691	0.013	-1.437
0.534	0.521	0.508	0.495	0.482	0.469	5.871	0.014	7.330	0.017	-1.458
0.029	0.028	0.027	0.025	0.024	0.023	0.324	0.001	0.413	0.001	-0.090
0.008	0.008	0.008	0.007	0.007	0.007	0.087	0.000	0.208	0.000	-0.121
0.236	0.238	0.241	0.243	0.245	0.247	2.598	0.006	2.213	0.005	0.386
0.270	0.253	0.236	0.220	0.203	0.186	2.966	0.007	3.405	0.008	-0.439
4.192	4.009	3.827	3.645	3.463	3.281	46.107	0.113	51.601	0.121	-5.494
0.477	0.515	0.554	0.592	0.630	0.668	5.248	0.013	4.649	0.011	0.599
0.004	0.003	0.003	0.002	0.002	0.001	0.042	0.000	0.122	0.000	-0.080
28.59	28.68	28.78	28.89	29.02	29.17	315.24	77.08%	331.97	77.98%	-16.73
8.61	8.64	8.64	8.63	8.60	8.54	93.76	22.92%	93.76	22.02%	0.00
37.21	37.32	37.42	37.52	37.62	37.71	408.99		425.73		-16.73

ANNEXURE 3: Per Capita CO_2 emissions (all emissions in tonnes)

Country	Population 2019	Population 2030	2019 emissions (in tonnes CO_2)	2019 emissions per capita (in tonnes CO_2 per capita)	Emissions in 2030 BAU (in tonnes CO_2)	
Argentina	44938712	49191000	178939546.00	3.98	164615176.88	
Australia	25365745	28268000	411015667.00	16.20	420610451.46	
Azerbaijan	10024283	10709000	39820063.00	3.97	47719862.19	
Belarus	9417849	9223000	62483877.00	6.63	70306305.14	
Bosnia and Herzegovina	3301000	3127000	26621092.00	8.06	29094036.27	
Botswana	2303697	2774000	6316388.00	2.74	20921336.24	
Brazil	211049527	223852000	465715770.00	2.21	639047680.57	
Canada	37593384	40927000	576650511.00	15.34	643350722.21	
Chile	18952038	19458000	84266622.00	4.45	108191568.94	
China	1397715000	1425238000	10174681100.00	7.280	12650937075.85	
Colombia	50339443	53417000	102202444.00	2.03	140454471.60	
Costa Rica	5047561	5468000	8507521.00	1.69	9330699.28	
Dominica	71808	73000	161664.00	2.25	204345.61	
Equatorial Guinea	1355986	1874000	5633778.00	4.15	3765969.84	
Ethiopia	112078730	144944000	16255141.00	0.15	41131232.40	
EU-27	447580063	443152000	2916906140.00	6.52	2335658193.49	
Grenada	112003	116000	287951.00	2.57	404076.13	
Iceland	360563	381000	3321657.00	9.21	3152196.81	
India	1366417754	1503642000	2616448820.00	1.91	4475015395.34	
Japan	126264931	119276000	1106664426.00	8.76	990838995.23	
Kazakhstan	18513673	20613000	313797848.00	16.95	450312619.27	
Liechtenstein	38019	39000	145802.00	3.83	97954.73	
Mauritius	1265711	1270000	4686810.00	3.70	6421433.38	
Micronesia	113815	127000	158997.00	1.40	269729.15	
Moldova	2663251	2553000	5957810.00	2.24	7686604.38	
Montenegro	622028	618000	2461441.00	3.96	2508736.36	
New Zealand	4979300	5360000	36540963.00	7.34	38978010.39	
Nicaragua	6545502	7392000	5548625.00	0.85	6799715.54	
Norway	5347896	5831000	42440799.00	7.94	39744211.80	
Oman	4974986	5936000	71684606.00	14.41	140122653.28	
Russia	144406261	141770000	1678366791.00	11.62	1872500702.81	
Serbia	6945235	6496000	54666675.00	7.87	64858839.60	
Singapore	5703569	6153000	38944802.00	6.83	38012238.61	
South Africa	58558267	65956000	478608101.00	8.17	551158212.79	
South Korea	51709098	51473000	611263215.00	11.82	714713766.38	
Switzerland	8575280	9132000	37681506.00	4.39	37492416.04	
Tajikistan	9321018	11557000	8979885.00	0.96	31387432.65	
Ukraine	44386203	41241000	223229393.00	5.03	183934500.02	
UK	66836327	69540000	369878396.00	5.53	264574535.63	
US	328239523	348269000	5284696657.00	16.10	4231622292.46	
Vietnam	96462106	104164000	247708911.00	2.57	619348913.56	
Zambia	17861030	24326000	6720490.00	0.38	15824829.32	
World	7673656872	8501479000	36441387580.00	4.75	40656502631.57	

Data sources:

- Carbon Dioxide Emissions - Our World in Data based on Global Carbon Project, https://ourworldindata.org/co2-and-other-greenhouse-gas-emissions
- Population - World Bank, https://datacatalog.worldbank.org/dataset/population-estimates-and-projections
- Human Development Index - Human Development Report Office calculations based on data from UNDESA (2019a), UNESCO Institute for Statistics (2020), United Nations Statistics Division (2020b), World Bank (2020a), Barro and Lee (2018) and IMF (2020)

	Emissions in 2030 BAU per capita (in tonnes CO_2 per capita)	Emissions in 2030 NDC (in tonnes CO_2)	2030 emissions per capita NDC (in tonnes CO_2 per capita)	% change in per capita emissions – 2019 *v* NDC 2030	HDI rank
	3.35	231620000.00	4.71	18%	46
	14.88	336266704.98	11.90	-27%	8
	4.46	33765657.25	3.15	-21%	88
	7.62	74656591.92	8.09	22%	53
	9.30	18831279.30	6.02	-25%	73
	7.54	3855879.65	1.39	-49%	100
	2.85	480056998.40	2.14	-3%	84
	15.72	354507195.36	8.66	-44%	16
	5.56	70300000.00	3.61	-19%	43
	8.88	12650937075.85	8.88	22%	85
	2.63	99286561.54	1.86	-8%	83
	1.71	6741400.00	1.23	-27%	62
	2.80	97257.22	1.33	-41%	94
	2.01	5493068.80	2.93	-29%	145
	0.28	175380000.00	1.21	734%	173
	5.27	1825720939.06	4.12	-37%	N/A
	3.48	156086.40	1.35	-48%	74
	8.27	1011511.35	2.65	-71%	4
	2.98	4475015395.34	2.98	55%	131
	8.31	709939619.46	5.95	-32%	19
	21.85	210910464.75	10.23	-40%	51
	2.51	119380.80	3.06	-20%	19
	5.06	3626000.00	2.86	-23%	66
	2.12	83356.00	0.66	-53%	136
	3.01	3333484.68	1.31	-42%	90
	4.06	1245062.65	2.01	-49%	48
	7.27	26299727.30	4.91	-33%	14
	0.92	51060000.00	6.91	715%	128
	6.82	17837269.63	3.06	-61%	1
	23.61	86199802.80	14.52	1%	60
	13.21	1919223274.32	13.54	16%	52
	9.98	50916415.31	7.84	0%	64
	6.18	48100000.00	7.82	14%	11
	8.36	310060000.00	4.70	-42%	114
	13.89	469181175.12	9.12	-23%	23
	4.11	22518754.71	2.47	-44%	2
	2.72	7093153.90	0.61	-36%	125
	4.46	247040497.20	5.99	19%	74
	3.80	186148644.38	2.68	-52%	13
	12.15	3280562742.16	9.42	-41%	17
	5.95	668220000.00	6.42	150%	117
	0.65	1358166.34	0.06	-85%	146
	4.78	37707169678.88	4.44	-7%	N/A

ANNEXURE 4: Historical CO_2 emissions (all emissions in gigatonnes CO_2)

Country	1870-1989	% of world	1990-2004	% of world	2005-2019	% of world	1990-2019	% of world	1870-2019	% of world	
Australia	7.26	0.94%	4.87	1.33%	6.05	1.20%	10.92	1.25%	18.18	1.11%	
Canada	16.70	2.17%	7.83	2.14%	8.58	1.70%	16.41	1.88%	33.10	2.02%	
China	39.38	5.11%	50.21	13.72%	130.40	25.78%	180.61	20.72%	219.99	13.40%	
EU-27	178.72	23.21%	55.35	15.12%	49.76	9.84%	105.11	12.06%	283.83	17.29%	
India	10.44	1.36%	12.70	3.47%	28.79	5.69%	41.50	4.76%	51.93	3.16%	
Japan	27.66	3.59%	18.46	5.04%	18.47	3.65%	36.93	4.24%	64.58	3.93%	
Russia	63.97	8.31%	25.52	6.97%	24.38	4.82%	49.90	5.72%	113.87	6.94%	
UK	55.26	7.18%	8.65	2.36%	7.08	1.40%	15.73	1.80%	70.99	4.32%	
US	240.66	31.26%	84.34	23.05%	84.11	16.63%	168.45	19.32%	409.11	24.92%	
Rest of the world	**129.89**	**16.87%**	**98.04**	**26.79%**	**148.19**	**29.30%**	**246.23**	**28.24%**	**376.11**	**22.91%**	
World	**769.92**		**365.96**		**505.81**		**871.78**		**1641.69**		

Source: Analysis by the Centre for Science and Environment, Delhi, based on data from Climate Watch and Our World in Data

NOTE: CARBON BUDGET ASSUMPTIONS

This analysis covers a 45-country set that is a mix of developed and developing economies

EMISSIONS

- This analysis uses only annual production-based carbon dioxide (CO_2) emissions from the burning of fossil fuels for energy and cement production. Land use change and consumption emissions are not included.
- BAU emissions till 2030 have been projected based on the median annual rate of change of the past decade (2010-2019)

NDCs

- The latest NDCs are considered as of September 21, 2021.
- Where available conditional NDCs are considered, and if a percentage range is given, the median has been used.
- If an NDC has a GHG ($GtCO_2e$) volume target for 2030, it has been converted to $GtCO_2$ by multiplying with 0.74, since CO_2 is typically 74% of all GHG.
- If the NDC target has a percentage reductions for GHG, the same percentage has been applied to CO_2 emissions.
- As India and China do not have quantifiable NDC targets, the BAU figures have been taken even in the NDC scenario for 2030. This has also been applied for the Rest of the World for 2020-2030 in an NDC scenario.

REMAINING CARBON BUDGET

- As per the IPCC AR6 report, the carbon budget for a 66% chance of limiting warming to 1.5°C is 400 $GtCO_2$. Since our analysis excludes CO_2 emissions from land use, land-use change and forestry (LULUCF), the remaining budget has been reduced in proportion.
- According to the World Resources Institute, LULUCF comprises 3.3%of human-made CO_2 emissions: https://www.wri.org/insights/4-charts-explain-greenhouse-gas-emissions-countries-and-sectors
- Thus, the 400 Gt budget has been reduced by 3.3% to 387 $GtCO_2$.

	BAU				NDC			
	2020-2030 BAU	2020-2030 BAU % of World	1870-2030 BAU	1870-2030 BAU % of world	2020-2030 NDC	2020-2030 NDC % of world	1870-2030 NDC	1870-2030 NDC % of world
	4.58	1.08%	22.76	1.10%	4.07	1.00%	22.25	1.08%
	6.74	1.58%	39.84	1.93%	5.01	1.23%	38.11	1.86%
	126.29	29.66%	346.27	16.75%	126.29	30.88%	346.27	16.89%
	28.48	6.69%	312.31	15.11%	25.54	6.24%	309.37	15.09%
	39.03	9.17%	90.96	4.40%	39.03	9.54%	90.96	4.44%
	11.47	2.69%	76.05	3.68%	9.79	2.39%	74.38	3.63%
	19.61	4.61%	133.48	6.46%	19.91	4.87%	133.78	6.52%
	3.40	0.80%	74.40	3.60%	2.97	0.73%	73.96	3.61%
	51.60	12.12%	460.71	22.28%	46.11	11.27%	455.21	22.20%
	134.53	**31.60%**	**510.64**	**24.70%**	**130.28**	**31.85%**	**506.39**	**24.69%**
	425.73		**2067.42**		**408.99**		**2050.69**	

DATA SOURCES

Carbon Dioxide Emissions

- Our World in Data based on Global Carbon Project, https://ourworldindata.org/co2-and-other-green-house-gas-emissions
- Climate Watch, https://www.climatewatchdata.org/

Nationally Determined Contributions

- Climate Watch, https://www.climatewatchdata.org/
- Climate Action Tracker, https://climateactiontracker.org/

Population

- World Bank, https://datacatalog.worldbank.org/dataset/population-estimates-and-projections

Human Development Index

- Human Development Report Office calculations based on data from UNDESA (2019a), UNESCO Institute for Statistics (2020), United Nations Statistics Division (2020b), World Bank (2020a), Barro and Lee (2018) and IMF (2020)

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