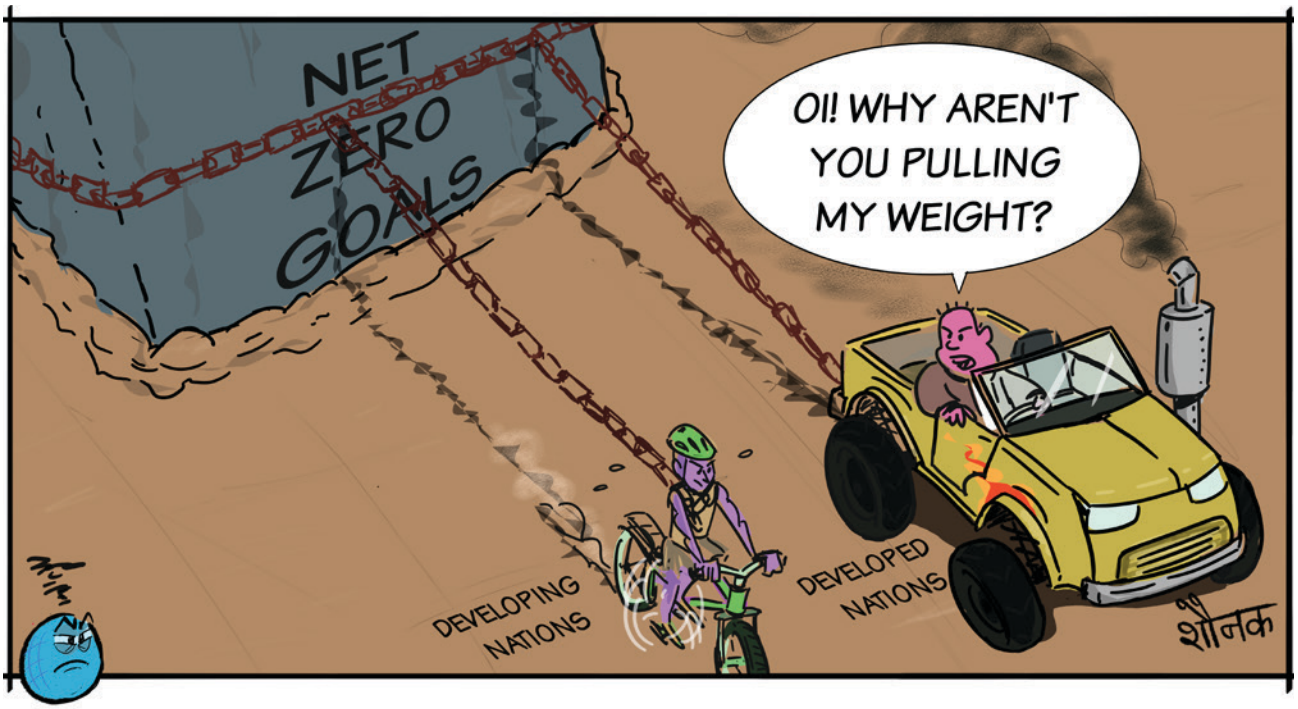
CEEW THE COUNCIL | COP26

The Carbon Space Implications of Net Negative Targets

Ankur Malyan and Vaibhav Chaturvedi

Issue Brief | November 2021



Introduction

The Paris Agreement was a landmark in the global climate discourse. The Nationally Determined Contributions (NDCs) submitted to the United Nations Framework Convention on Climate Change (UNFCCC) under the agreement allowed countries to propose ambitious mitigation actions based on their national circumstances. However, collective ambition based on NDC commitments has been found to be inadequate to limit the global temperature rise to "well below 2°C" (UNEP 2020).

India is a climate leader that has delivered on its commitments. It has already installed more than 40 per cent of the non-fossil fuel electricity generation capacity target proposed under earlier NDCs. Now, the ambition has been set to 500 GW by 2030 (MoP, GoI 2021).

Further, it has made significant progress on its pledge to reduce, by 2030, the emission intensity of its GDP by 45 per cent compared with 2005 levels. In 2016, it had already reduced its GDP's emissions intensity by as much as 24 per cent (MoEFCC 2021).

By contrast, the developed world has failed to deliver on its pre-2020 commitments. Since 2008, rich countries have emitted the equivalent of nine times India's annual emissions over and above the limit they committed to (Prasad, Pandey and Bhasin 2021). The US, EU, China, and many developed countries have announced net-zero targets in response to the need to stay below 1.5°C. However, evidence from the past raises concerns about their future course of action.

1. Are current net-zero pledges enough?

Net-zero targets are a sign of commitment to a low-carbon world, but it is critical to understand whether the proposed pledges are sufficient. This is especially true at a time when most developing countries, including India, are negotiating for their right to development and their fair share of the global carbon space.

The Council on Energy, Environment and Water's (CEEW) independent research explores the potential carbon space consumption by ten big emitters[1] if they were on track to achieve their post-2030 commitments or current pledges. Table 1 describes the cumulative CO2 emissions, historical and future, across scenarios. The current pledges scenario reflects the existing NDC and net-zero targets. Whereas, the advanced net-zero scenario reflects the changes if the US, the EU and China advance their net-zero targets by a decade. The third scenario presents the emissions if these three nations, in addition to advancing their net-zero year, go for net negative targets in future (more details are presented in the methodology in the annexure).

The analysis finds that although China has proposed a 2060 net-zero target, it would consume 28 per cent and 10 per cent of the total global carbon space available for 1.5°C and 2.0°C targets, respectively, by 2030[2]. Additionally, by 2030, the US and the EU would consume 10 per cent and 6 per cent, respectively, of the space available for a 1.5°C target. They would consume 4 per cent and 2 per cent of the carbon space available for a 2.0°C target by 2030. Thus, between 2020 and 2030, these three regions would consume 45 per cent — and by 2050, 91 per cent — of the 1.5 °C carbon space. By mid-century, these regions would be consuming 32 per cent of the 2.0°C carbon space.

Though the committed 2070 net-zero by India is two decades later than the US and the EU and a decade later than China, cumulatively (1850-2100), it would emit 59 per cent less than China, 58 per cent less than the US and 49 per cent less than the EU.

> **Under current net-zero pledges, 1.5 °C carbon budget would be surpassed by 33%.**

Table 1 Cumulative CO_2 emissions across countries and scenarios

Countries	1850-2019	2020-2100		
	Historical emissions	Current pledges	Advanced net-zero years	Advanced net-zero years with net negative targets
USA	400.98	68.66	50.24	-5.26
EU	348.85	42.79	28.31	-27.19
China	220.91	267.28	186.16	95.16
Russian Federation	113.88	40.65	40.65	40.65
Japan	63.61	15.83	15.83	15.83
India	53.21	146.19	146.19	146.19
Canada	32.26	8.75	8.75	8.75
Mexico	18.31	8.32	8.32	8.32
South Korea	17.51	10.40	10.40	10.40
Brazil	15.01	5.35	5.35	5.35
Total of 10 countries	1284.53	614.23	500.22	298.22

Note: For India, a 2040 peaking - 2070 net-zero year combination has been considered, as described in Chaturvedi and Malyan (2021)

Source: Authors' analysis

1 For this analysis, we have considered the following nations: China, US, India, EU, the Russian Federation, South Korea, Japan, Canada, Mexico and Brazil. The selection of these countries is based on their relatively high current share of total global emissions and the availability of explicit public information regarding their future vision and targets.

2 Considered the carbon space described in the IPCC AR6 report for a 1.5 °C (67th percentile) target, which is equal to 400 $GtCO_2$ from 2020-2100. For a 2.0 °C (67th percentile) target, it is 1,150 $GtCO_2$.

> By advancing the net-zero year by a decade, the US, the EU and China could save 28.5% of the 1.5 °C carbon space.

Overall, these ten countries' current NDC and net-zero targets and proposed pledges (refer annexure) would surpass the 1.5°C carbon space by 33 per cent by 2050. However, these pledges remain compliant to 2°C by 2100.

2. Carbon space consumption if net-zero years of China, the EU, and the US were advanced by 10 years

In case China, the EU and the US advanced their net-zero years by a decade, a significant share of the global carbon space would be freed up for the developing world. If China brought forward its net-zero year by a decade and peaked emissions in 2025, it would free up a staggering 81 $GtCO_2$ of carbon space. The carbon space freed up if the EU and the US advanced their net-zero targets by a decade would be 14.5 $GtCO_2$ and 18.4 $GtCO_2$, respectively. China, the EU and the US would be able to save 28.5% of the global carbon budget to stay below 1.5 °C, just by advancing their net-zero years by a decade.

> Between 2050 and 2100, the US, the EU and China could sequester 202 $GtCO_2$; freeing up space for developing nations.

3. Carbon space consumption if the three largest polluters reached net negative emissions in their current target years

The Government of India and many scholars have time and again emphasised the need for large developed economy polluters to become net negative by 2050 to free up additional carbon space for developing countries. If the three largest emitters — China, the US and the EU — sequestered additional carbon dioxide[3] over and above the net-zero target, they would collectively sequester 202 $GtCO_2$ between 2050 and 2100. This would free up significant carbon space for India and other Asian, African and Latin American nations to pursue their developmental agendas. This still implies that China's post-2020 emissions would account for 23.8 per cent of the 1.5°C global carbon space. Ideally, the sequestration of carbon should begin much earlier to reduce the risks of breaching planetary tipping points.

It is evident that to stay below 1.5°C and distribute the global carbon space equitably, the world's three largest emitters need to increase their emissions reduction efforts significantly. Their current net-zero targets simply do not meet the bar for climate ambition and explicitly violate the principle of climate justice. The analysis highlights that merely advancing the net-zero year will not be enough. These nations need to aim for negative emissions in the long term to support the growth of the developing world. The global net-zero agenda should shift to a net-negative agenda for the developed world and China.

3 1 $GtCO_2$ per year for the EU and the US from 2050 onwards, and 2 $GtCO_2$ per year for China from 2060 onwards, given the much larger size of its economy

Annexure

Methodology

The analysis involved collecting historical emissions data, estimating future emission trajectories, and evaluating the share of carbon space consumed by the leading emitting nations. For this analysis, we have considered the following nations: China, the US, India, the EU, the Russian Federation, South Korea, Japan, Canada, Mexico, and Brazil. These countries were chosen based on their relatively high current share in total global emissions and the availability of explicit public information regarding their future vision and targets.

Historical data source

The emissions timeline considered in this analysis is 1850-2100. We considered total CO_2 emissions excluding forestry/ Land Use, Land-Use Change and Forestry (LULUCF). Historical emissions trajectories follow from 1850-2019. Our primary source of historical emissions was WRI's Climate Watch[4]; however, to complete the entire series, we also considered the World Bank's CO_2 emissions[5] trajectory. Notably, the consistency of the variable is maintained across sources. For the 1850-1899 period, we took emissions data from WRI Climate Watch's PIK database. For the 1990-2011 period, we considered data from WRI Climate Watch's CAIT database. For the 2012-2018 period, we considered data from the World Bank's emissions data repository. Finally, we use the rate of change of emissions between 2019-2021 from the Climate Action Tracker's database to estimate emissions for 2019, 2020 and 2021, based on 2018 World Bank data. For this analysis, we used the carbon budgets described in the IPCC's AR 6 report for 1.5 (400 $GtCO_2$) and 2.0 °C (1150 $GtCO_2$) targets for the 67th percentile (IPCC 2021).

Future emissions data source

For the future trajectory of emissions, we considered the countries' proposed pledges up to 2030. These included commitments under NDCs or any other mitigation efforts (See Table A1).

Table A1 Emissions reduction commitments and long-term carbon neutrality targets for selected nations

Region	2030 reduction target	Net-zero timeline
US	50-52% Below 2005 Levels by 2030	2050
EU	55% by 2030, compared with 1990 levels	2050
China	- Share of non-fossil energy consumption to around 20% by 2030	2060
	- Reduce carbon intensity by 60-65% below 2005 levels by 2030, and peak CO_2 emissions by 2030	
Russian Federation	25-30% below 1990 levels by 2030	No commitment
Japan	46% reduction by 2030 from 2013 levels	2050
India	- Reduce the emissions intensity of its GDP by 45% by 2030 from the 2005 level	2070
	- Non-fossil capacity to be 500 GW by 2030	
	- Achieve about 50% of the energy from renewable energy sources	
Canada	30% reduction by 2030 from 2005 levels	2050
Mexico	22% reduction by 2030 from 2000 levels	No commitment
South Korea	24.4 % compared to 2017 levels by 2030	2050
Brazil	37% by 2025 and 43% by 2030 from 2005 levels	2050

Sources: Spring and Paraguassu (2021); Governo do Brazil (2021); Government of Canada (2021); Hughes (2021); European Union (2020); BBC (2021); Climate Watch (2021a,b,c,d); Government of India (2018); McKinsey (2021); Takenaka, Takemoto and Obayashi (2021); Carbon Brief (2020); Climate Action Tracker (2021); Cha (2020); The White House (2021); IISD (2021)

4 Climate Watch is the platform hosted by World Resource Institute (WRI). The platform provides country-wise emissions timeseries and provides compilation from different sources. The Platform can be accessed here: https://www.wri.org/data/climate-watch-cait-country-greenhouse-gas-emissions-data

5 World Bank also provides the timeseries data for CO_2 emissions across countries. Their emission repository can be accessed from here: https://data.worldbank.org/indicator/EN.ATM.CO2E.KT

To incorporate the NDC pledges mentioned above, we considered a linear decline in emissions between the 2021 emission level and emission targets up to 2030. Further, we assumed a linear reduction in emissions from 2030 levels to the net-zero year. India recently announced 2070 net-zero, which is considered in this analysis. As described in Chaturvedi and Malyan (2021), for the 2070 net-zero scenario for India, 2040 is considered as a peak year. Mexico and the Russian Federation have not taken a position on net-zero targets. For the analysis, we assume 2060 as the net-zero year for these two countries. However, it should not be assumed Mexico, and the Russian Federation will actually adopt these timelines, or that we recommend that they do so.

To understand the implications of advancing the net-zero years of the world's three largest economies, we assume a 10-year advancement of the proposed net-zero years for the US, the EU, and China in our second scenario. We assume that the US and the EU target 2040 for achieving a net-zero economy while emissions decline starts immediately, and that China targets a 2050 net-zero year and advances its peaking year to 2025. However, other countries remain on the track considered in the current pledges scenario.

In the third scenario we considered, the US, the EU, and China countries not only advance their net-zero years but go on to achieve net-negative emissions. We assume that the US and the EU will sequester 1 $GtCO_2$ starting in 2050, and that China will sequester 2 $GtCO_2$ from 2060 onwards. We maintained the differentiation between the EU/the US and China is because of the massive size of the China's energy economy. Between the net-zero year and the net-negative plateauing year, we considered the linear change in emissions.

Image: iStock

References

BBC. 2021. *Climate change: EU to cut CO2 emissions by 55% by 2030*. 21 April. Accessed September 27, 2021. https://www.bbc.com/news/world-europe-56828383.

Carbon Brief. 2021. *The Carbon Brief profile: Mexico*. 04 June . Accessed September 27, 2021. https://www.carbonbrief.org/the-carbon-brief-profile-mexico.

Cha, Sangmi. 2020. *South Korea's Moon targets carbon neutrality by 2050*. 28 October. Accessed September 27, 2021. https://www.reuters.com/article/us-southkora-environment-greenewdeal-idUSKBN27D1DU.

Chaturvedi, Vaibhav, and Ankur Malyan. 2021. *Implications of a Net-Zero Target for India's Sectoral Energy Transitions and Climate Policy*. Working Paper, New Delhi: Council on Energy, Environment and Water (CEEW). https://www.ceew.in/publications/implications-of-net-zero-target-for-indias-sectoral-energy-transitions-and-climate-policy.

Climate Action Tracker. 2021. *Country Summary: Russian Federation*. 15 September. Accessed September 27, 2021. https://climateactiontracker.org/countries/russian-federation/.

Climate Watch. 2021a. *Climate Watch: India*. Accessed September 27, 2021. https://www.climatewatchdata.org/countries/IND.

Climate Watch. 2021b. *Climate Watch: Mexico*. Accessed September 27, 2021. https://www.climatewatchdata.org/countries/MEX.

Climate Watch. 2021c. *Climate Watch: Russia*. Accessed September 27, 2021. https://www.climatewatchdata.org/countries/RUS.

Climate Watch. 2021d. *Climate Watch: South Korea*. Accessed September 27, 2021. https://www.climatewatchdata.org/countries/KOR.

European Union. 2020. "Submission by Croatia and the European Commission on behalf of the European Union and its Member States." https://unfccc.int/sites/default/files/resource/HR-03-06-2020%20EU%20Submission%20on%20Long%20term%20strategy.pdf.

Government of Canada. 2021. *Net-Zero Emissions by 2050*. 13 August. Accessed September 27, 2021. https://www.canada.ca/en/services/environment/weather/climatechange/climate-plan/net-zero-emissions-2050.html.

Government of India. 2018. *India's intended nationally determined contribution: Working towards climate justice*. UNFCCC. https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/India%20First/INDIA%20INDC%20TO%20UNFCCC.pdf.

Governo do Brazil. 2021. *Brazil moves towards further reducing greenhouse gas emissions*. 22 April. Accessed September 27, 2021. https://www.gov.br/en/government-of-brazil/latest-news/2021/04/brazil-moves-towards-further-reducing-greenhouse-gas-emissions.

Hughes, Larry. 2021. *How Canada intends to achieve its 2030 emissions targets*. 19 July. Accessed September 27, 2021. https://policyoptions.irpp.org/magazines/july-2021/how-canada-intends-to-achieve-its-2030-emissions-targets/.

IISD. 2021. *US Sets Target to Reduce Emissions by 50-52% Below 2005 Levels in 2030*. 28 April. Accessed September 27, 2021. https://sdg.iisd.org/news/us-sets-target-to-reduce-emissions-by-50-52-below-2005-levels-in-2030/.

IPCC. 2021. *Summary for Policymakers. In: Climate Change 2021: The Physical Science Basis*. Cambridge University Press. https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_SPM.pdf.

Lewis, Joanna, and Laura Edwards. 2021. *Assessing China's Energy and Climate Goals*. 06 May. Accessed September 27, 2021. https://www.americanprogress.org/issues/security/reports/2021/05/06/499096/assessing-chinas-energy-climate-goals/.

Liu , Peiran R. , and Adrian E. Raftery. 2021. "Country-based rate of emissions reductions should increase by 80% beyond nationally determined contributions to meet the 2 °C target." *Nature: Communications Earth & Environment* 2. doi:10.1038/s43247-021-00097-8.

Marris, Emma. 2019. *Why young climate activists have captured the world's attention*. 18 September. Accessed September 28, 2021. https://www.cnbc.com/2020/11/19/wealthy-investors-get-serious-about-climate-change-without-politics.html.

McKinsey. 2021. "How Japan could reach carbon neutrality by 2050." https://www.mckinsey.com/business-functions/sustainability/our-insights/how-japan-could-reach-carbon-neutrality-by-2050.

Meidan, Michal. 2020. *Unpacking China's 2060 carbon neutrality pledge*. Oxford Energy Comment, Oxford Institute of Energy Studies. https://www.oxfordenergy.org/wpcms/wp-content/uploads/2020/12/Unpacking-Chinas-carbon-neutrality-pledge.pdf.

MoEFCC. 2021. *India: Third Biennial Update Report to the United Nations Framework Convention on Climate Change*. Ministry of Environment, Forest and Climate Change (MoEFCC), Government of India. https://unfccc.int/sites/default/files/resource/INDIA_%20BUR-3_20.02.2021_High.pdf.

MoP, GoI. 2021. *Power Sector at a Glance ALL INDIA*. 21 October. Accessed October 25, 2021. https://powermin.gov.in/en/content/power-sector-glance-all-india.

Prasad, Sumit, Spandan Pandey, and Shikha Bhasin. 2021. *Unpacking Pre-2020 Climate Commitments: Who Delivered, How Much, and How will the Gaps be Addressed?* New Delhi: Council on Energy, Environment, and Water.

Spring, Jake, and Lisandra Paraguassu. 2021. *Brazil's Bolsonaro, under U.S. pressure, vows climate neutrality by 2050*. 21 April. Accessed September 27, 2021. https://www.reuters.com/business/environment/bolsonaro-says-brazil-will-reach-climate-neutrality-by-2050-2021-04-22/.

Takenaka, Kiyoshi, Yoshifumi Takemoto, and Yuka Obayashi. 2021. *Japan vows deeper emission cuts as Biden holds climate summit*. 22 April. Accessed September 27, 2021. https://www.reuters.com/business/environment/japan-government-propose-new-target-cutting-greenhouse-gases-by-46-nikkei-2021-04-22/.

The White House. 2021. *FACT SHEET: President Biden Sets 2030 Greenhouse Gas Pollution Reduction Target Aimed at Creating Good-Paying Union Jobs and Securing U.S. Leadership on Clean Energy Technologies*. 22 April. Accessed September 27, 2021. https://www.whitehouse.gov/briefing-room/statements-releases/2021/04/22/fact-sheet-president-biden-sets-2030-greenhouse-gas-pollution-reduction-target-aimed-at-creating-good-paying-union-jobs-and-securing-u-s-leadership-on-clean-energy-technologies/.

UNEP. 2020. *Emissions Gap Report 2020*. Nairobi: United Nations Environment Programme (UNEP) and UNEP DTU Partnership (UDP).

UNEP. 2020. *Emissions Gap Report 2020*. United Nations Environment Programme, United Nations. https://www.unep.org/emissions-gap-report-2020.

UNFCCC. 2015. *The Paris Agreement*. United Nations Framework Convention on Climate Change. https://unfccc.int/sites/default/files/english_paris_agreement.pdf.

United Nations. 2021. *For a livable climate: Net-zero commitments must be backed by credible action*. September. Accessed September 28, 2021. https://www.un.org/en/climatechange/net-zero-coalition.

The authors

Ankur Malyan

ankur.malyan@ceew.in | @ankur_malyan

Ankur is a Programme Associate at CEEW in the Low-Carbon Pathways team. He is engaged in the analysis of the long-term aspects of decarbonisation pathways for India. Additionally, he analyses the state-level energy and climate policy using the integrated assessment modelling framework. Ankur is an alumnus of TERI School of Advanced Studies, Delhi. He also holds a post-graduate diploma from National Law University, Delhi and WWF-India.

Dr Vaibhav Chaturvedi

vaibhav.chaturvedi@ceew.in

Dr Chaturvedi, a Fellow at CEEW, leads the Low-Carbon Pathways focus area. His research on energy and climate change policy is positioned within the integrated assessment modelling framework of the Global Change Assessment Model. Dr Chaturvedi is an alumnus of the Indian Institute of Management Ahmedabad and Indian Institute of Forest Management, Bhopal.

Suggested citation: Malyan, Ankur, and Vaibhav Chaturvedi. 2021. *The Carbon Space Implications of Net Negative Targets.* New Delhi: Council on Energy, Environment and Water.

Disclaimer: The views expressed in this study is that of the author. They do not necessarily reflect the views and policies of the Council on Energy, Environment and Water

Peer reviewers: Dr Anindya Bhattacharya, Executive Director, The Celestial Earth and Dr Arunabha Ghosh, Chief Executive Officer, CEEW.

Acknowledgment: We would like to thank Dr Anindya Bhattacharya, Executive Director, The Celestial Earth, Dr Arunabha Ghosh, CEO, CEEW and Mihir Shah, Strategic Communications Lead, CEEW for providing their detailed comments and suggestions. Their valuable inputs shaped the research piece significantly. We assume full responsibility for any errors in the document.

Organisation: The **Council on Energy, Environment and Water (CEEW)** is one of Asia's leading not-for-profit policy research institutions. The Council uses data, integrated analysis, and strategic outreach to explain – and change – the use, reuse, and misuse of resources. It prides itself on the independence of its high-quality research, develops partnerships with public and private institutions, and engages with wider public. In 2021, CEEW once again featured extensively across ten categories in the *2020 Global Go To Think Tank Index Report*. The Council has also been consistently ranked among the world's top climate change think tanks. Follow us on Twitter @CEEWIndia for the latest updates.

Council on Energy, Environment And Water (CEEW)
Sanskrit Bhawan, A-10, Aruna Asaf Ali Marg Qutab Institutional Area New Delhi 110 067, India
T: +91 11 4073 3300
info@ceew.in | ceew.in | @CEEWIndia | ceewIndia