Energy&Climate
INTELLIGENCE UNIT

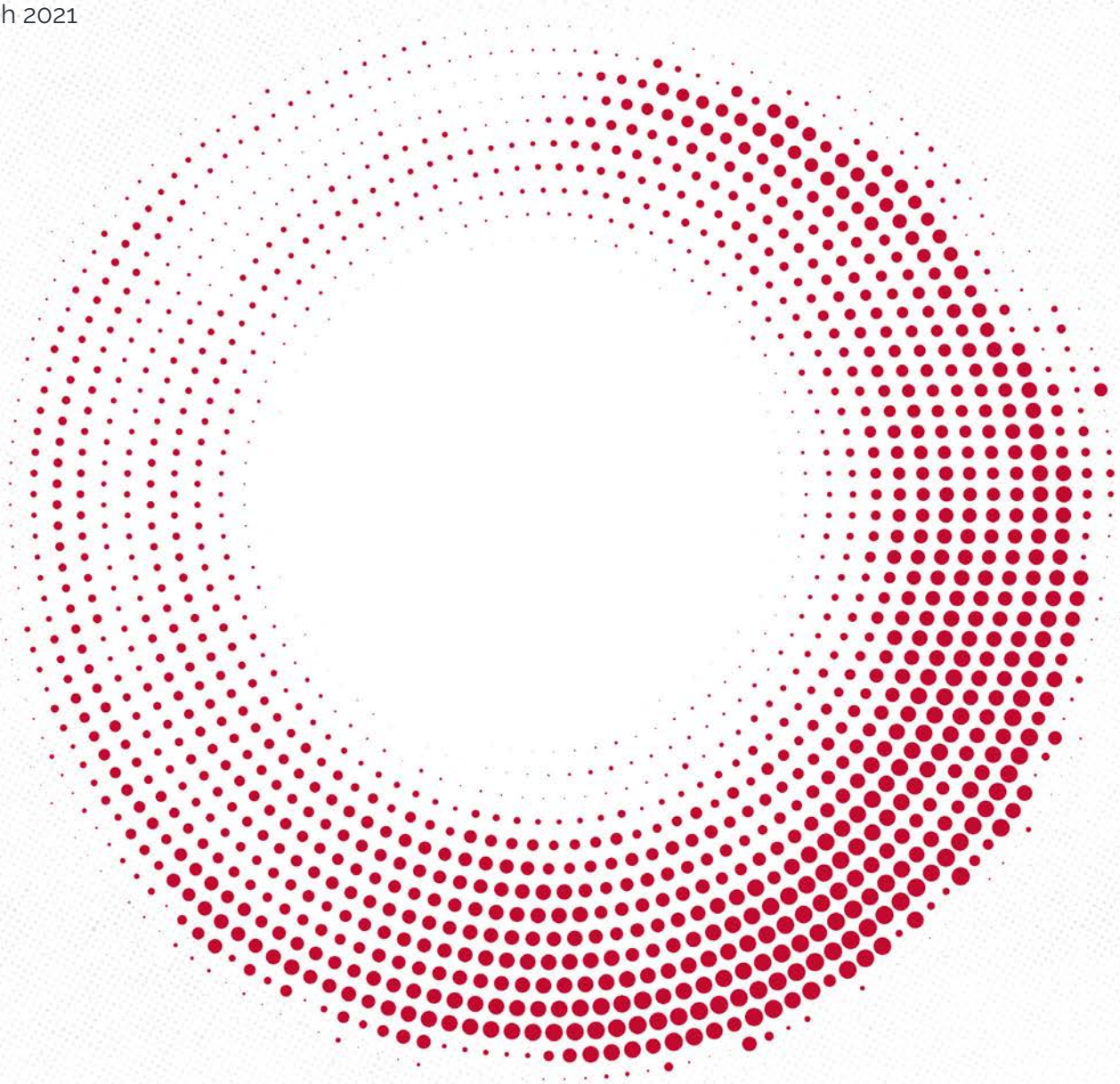
NET ZERO

UNIVERSITY OF OXFORD

# TAKING STOCK:
## A global assessment of net zero targets

Scrutinising countries, states and regions, cities and companies

March 2021



A report by:

**The Energy & Climate Intelligence Unit** and **Oxford Net Zero**

# About

**The Energy & Climate Intelligence Unit** (ECIU) is a non-profit organisation supporting informed debate on energy and climate change issues in the UK. Britain faces important choices on energy and on responding to climate change, and we believe it is vital that debates on these issues are underpinned by evidence and set in their proper context.

**Oxford Net Zero** is an interdisciplinary research initiative based at the University of Oxford, building on fifteen years of research on climate neutrality. As a network of leading researchers, we provide advice and expertise in the global race to net zero by national governments, global industry leaders and international organisations.

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# Executive Summary

In the last few years, the phrase 'net zero' has gone from being a somewhat obscure scientific concept to centre stage in discourse on halting climate change. Pledges to reach net zero emissions are everywhere – in governments' economic development plans, corporate strategies, investors' portfolio targets and the manifestos of regional governments and city councils. Net zero forms a major theme of this year's pivotal UN climate summit in Glasgow.

Keeping global warming to 1.5 degrees Celsius, the goal of the Paris Agreement, entails reaching net zero carbon dioxide emissions globally by 2050.[1] So the existence of net zero targets covering around two-thirds of the global economy represents a remarkable advance in climate ambition since the Paris summit of 2015.[2] Setting long-term goals aligned with science can be an important driver of action; but without immediate action, long-term goals will remain forever out of reach.

Robust net zero pledges, then, can play a central role in guiding the ongoing emissions reductions needed to deliver the Paris goals. There are examples of this in action: the EU outlined its 2050 net zero target in late 2019 and early 2020,[3] then in December 2020 upgraded its 2030 target to be in line with the longer-term goal.[4] This in turn is due to lead to new policy measures to get the bloc on track to both.[5] In June 2019 the UK government signed its 2050 net zero commitment into law: in December 2020 it upgraded its 2030 target to align,[6] and followed up by banning the sale of new petrol and diesel cars by 2030 as one measure among the many needed to get on track.[7] Robust net zero plans, with interim targets, commensurate policies and a governance mechanism, are not only essential for reducing emissions but can also create sustainable employment and prosperity via the unequivocal signals they send to businesses and investors.[8]

In the run-up to this year's UN climate summit, the spotlight is shining on what governments are pledging or intending to pledge in their Nationally Determined Contributions (NDCs), which generally set targets to 2030.[9] Many nations with mid-century net zero pledges currently have NDCs that do not match up in ambition.

An increasingly bright spotlight is also shining on corporate pledges, with investors, civil society and other observers scrutinising them for details that can show whether a company is serious about

1 https://eciu.net/analysis/briefings/net-zero/net-zero-why-1-5°c
2 https://unfccc.int/news/update-from-climate-champions-on-occasion-of-climate-ambition-summit
3 https://ec.europa.eu/clima/policies/strategies/2050_en
4 https://www.bbc.com/news/world-europe-55273004
5 https://www.europarl.europa.eu/legislative-train/theme-a-european-green-deal/package-fit-for-55
6 https://www.gov.uk/government/publications/the-uks-nationally-determined-contribution-communication-to-the-unfccc
7 https://www.gov.uk/government/news/government-takes-historic-step-towards-net-zero-with-end-of-sale-of-new-petrol-and-diesel-cars-by-2030
8 https://joebiden.com/climate-plan/
9 Governments were due under the Paris Agreement to submit NDCs before the end of 2020, but the Covid pandemic has effectively moved the timeline back for many. Governments were also invited to submit Long-Term Strategies at the same time.

delivering its net zero target. The existence of a plan (or evidence that the company is working to develop one), nearer-term targets to ensure action proceeds, commitment to publish annual progress reports, and clarity about the Scopes of activities and emissions covered are among the key details that can give credibility to a net zero target.[10] Another concern is 'offsetting' through carbon credits – the practice of paying for emission cuts or carbon removal (often, by implication, in developing countries) rather than cutting emissions. Studies show that offsets do not always provide fully additional effort, and reliance on them may present risks to effective mitigation. And while nature-based offsetting is becoming increasingly popular, there are limits on the natural resources available: a recent Greenpeace report found that just two companies, Eni and International Airlines Group, could 'exhaust up to 12% of the available total' of carbon dioxide offsetting through new forests.[11] Put simply, offsetting cannot be a substitute for significant emissions cuts.

In this report we present what is, we believe, the first systematic analysis of significant emitters, looking at the robustness of net zero pledges as well as their scope. We look for evidence that entities have components of a credible plan in place, such as interim targets, a reporting mechanism and clarity on use of offsets; we do not assess whether such plans are internally coherent nor compatible with a global trajectory to the 1.5˚C Paris Agreement target.[12] This report is an 'opening snapshot' that will allow the anticipated strengthening of net zero targets to be tracked over time.

We surveyed more than 4,000 significant entities:

- all nations
- all states and regions in the 25 highest-emitting countries
- all cities with a population above 500,000
- all companies in the Forbes Global 2000 list.

Just a couple of years after interest in net zero really took off, the analysis shows that already 769 of these (19%) have a net zero target in place.[13] Together, the commitments cover at least 61% of global greenhouse gas emissions, 68% of global GDP (assessed in purchasing power parity terms)[14] and 56% of the world's population.

Our analysis shows that these commitments vary hugely in their quality. Already, 20% of existing net zero targets meet a set of basic robustness criteria. The proportions of entities whose commitments encompass measures such as interim targets (60%), a reporting mechanism (62%) and a published plan (44%) are reasonably high given how recently many of them made their net zero pledges. Some commitments contain key details such as the greenhouse gases covered, clarity on use of offsets, and

10 https://www.carbontrust.com/resources/briefing-what-are-scope-3-emissions
11 https://www.greenpeace.org.uk/wp-content/uploads/2021/01/Net-Expectations-Greenpeace-CDR-briefing.pdf
12 See footnote 48 on page 19.
13 These numbers may differ from those in other analyses (eg, the UN's Race to Zero) because of different methodologies used - in particular, to define the scope of entities in the study.
14 See footnote 43 on page 16.

(for businesses) whether they cover emissions from the company's operations, value chain and/or products. However, many entities have not published these details as yet. The modest proportion that mandate near-term action also needs addressing.

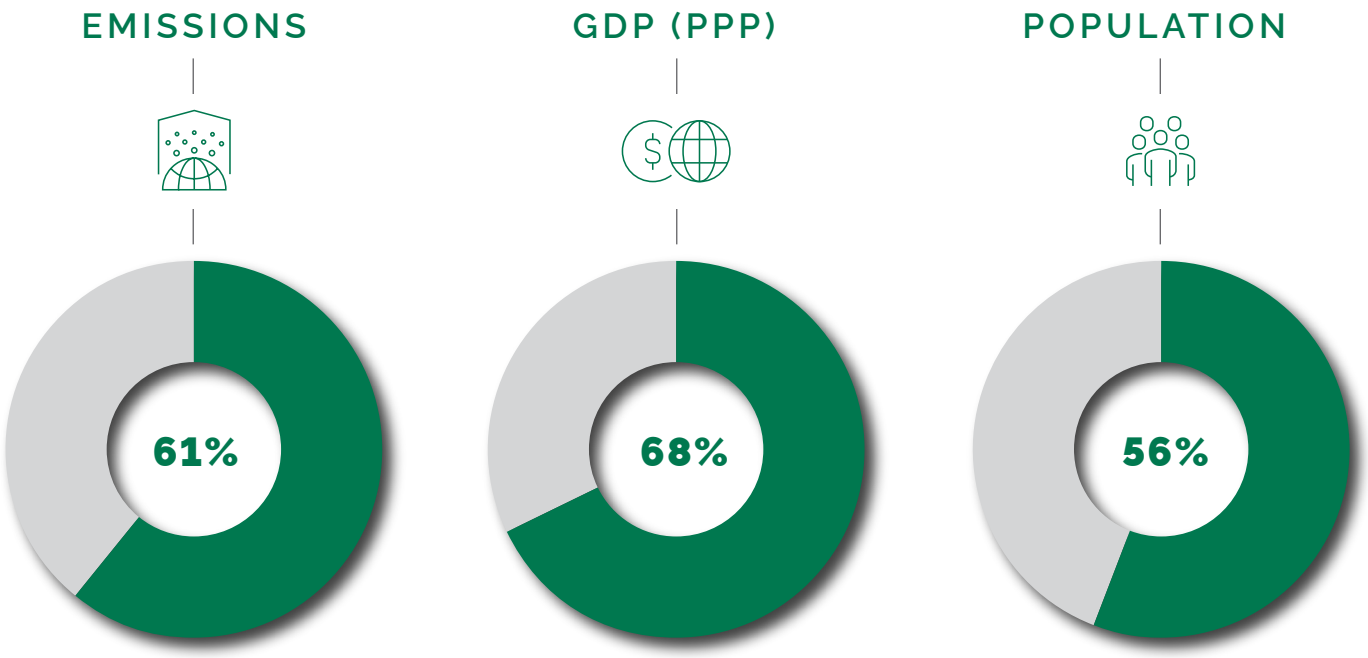


**Fig. 1**: Percentage of greenhouse gas emissions, GDP and population covered by national net zero pledges (the status of these pledges ranges widely, including proposed, in discussion, in policy document, in law and achieved. For more details, see Figure 5.). Population estimate also includes cities, states, and regions. GDP is assessed in purchasing power parity terms (see footnote 43 on page 16)

In the coming months countries, states & regions, cities and companies alike should ramp up their immediate action and provide greater clarity, with their intentions on offsetting a particular focus, to ensure their targets are seen as credible. Nations that have not yet set mid-century net zero targets, such as Australia, Russia and the Gulf states, should do so, including through publishing a net zero Long-Term Strategy as requested in the Paris Agreement. Those such as Japan that already have net zero targets must submit NDCs that are commensurate if they want their targets to have credibility. Entities that are members of the UN's 'Race to Zero' have pledged to meet a set of 'starting line' robustness criteria before COP26, and our analysis shows that most have work to do over the coming months.[15]

Net zero has come a long way in a very short time.[16] A priority for governments, local authorities, investors and civil society over this and following years lies in turning pledges into plans, showcasing

15 Comprising a pledge from a leader, a public plan detailing steps to be taken, an interim target, a commitment to publish progress reports at least annually, coverage of all emissions, and conditions on the use of offsetting - adopted from Race to Zero, https://unfccc.int/climate-action/race-to-zero-campaign

16 We include the US in this analysis as President Joe Biden made net zero by 2050 a central plank of his election manifesto. We include all EU nations except Poland which, at the time of data cut-off, was the only one objecting to the incoming bloc-wide net zero target.

successes, highlighting empty promises, and ensuring that racing to zero means a race to integrity rather than just intention.

### Standard setter: Sweden

Sweden enshrined a target of net zero by 2045 in law in 2017. After achieving it, Sweden's government plans to go to 'net negative emissions' – capturing more greenhouse gases than it emits.

Sweden's decarbonisation journey rests on three pillars: a Climate Act, climate targets and an independent climate policy council.[1] The Climate Act, which aims to 'provide the long-term conditions for business and society to implement the transition', mandates the Swedish government to: (1) present an annual climate report in its Budget Bill with details of policy implementation and progress towards its targets; (2) draw up a climate policy action plan every fourth year to describe how the climate targets are to be achieved; and (3) ensure that climate policy goals and budget policy goals work in unison.

Sweden lists interim emission targets in its Climate Policy Framework: 63% lower than 1990 by 2030 and 75% lower by 2040.[2] These cover all greenhouse gases. Short-term policy action has also followed target-setting. In 2019, the country banned sales of fossil fuel powered cars by 2030, and the following year phased out coal power.[3,4]

One area that sets Sweden apart from the net zero pack is its transparency around offsetting. The only nation in our dataset that does this, Sweden's net zero framework details maximum use of offsets that can be used to meet its interim goals: 8% by 2030 and 2% by 2040. By 2045, the overarching net zero goal can only be achieved using a maximum of 15% offsets. This stands in stark contrast to Norway, its net zero neighbour, which has ambitious net zero targets but does not provide clarity around the use of its offsets.[5]

1 Klimatpolitiska Radet, https://www.klimatpolitiskaradet.se/summary-in-english/
2 The Swedish Climate Policy Framework, Sweden's Ministry of the Environment and Energy, https://www.government.se/information-material/2018/03/the-swedish-climate-policy-framework/
3 https://www.government.se/press-releases/2019/12/inquiry-appointed-on-phasing-out-fossil-fuels-and-banning-sales-of-new-petrol-and-diesel-cars/
4 https://ieefa.org/sweden-becomes-third-european-country-to-complete-coal-plant-phaseout/
5 'Climate neutrality the Norwegian way: Carbon trading?', https://cicero.oslo.no/no/posts/nyheter/climate-neutrality-the-norwegian-way-carbon-trading

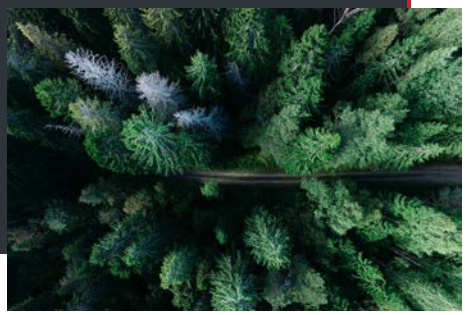

Image credit: Geran de Klerk, Unsplash

## Setting the scene

In 2015, at the pivotal UN climate summit in Paris, governments pledged to 'pursue efforts' to limit global warming to 1.5 degrees Celsius, recognising that warming above this limit would have serious consequences for many societies and for nature. Although grounded in the latest climate science, the idea that halting global warming at any level necessitated reaching net zero emissions was not yet widely recognised by policymakers or the public. Nevertheless, thanks to the efforts of vulnerable nations and activists, the concept was embedded in Article 2 of the Paris Agreement, which committed nations to achieving 'a balance between sources and sinks' of greenhouse gases.

Three years later the IPCC Special Report on Global Warming of 1.5˚C clarified the minimum action governments need to take in order to fulfil their pledge, in particular setting out the required timescale:

# FROM ZERO TO TWO-THIRDS

**2009**

Myles Allen, Dave Frame and other scientists publish a paper highlighting that **the eventual extent of global warming is largely determined by cumulative emissions of $CO_2$**

Susan Solomon and other scientists show that temperatures do not decline for many centuries even after a complete cessation of $CO_2$ emissions

**2010**

**2011**

Damon Matthews and other scientists propose that 'cumulative carbon emissions represent an alternative framework that is applicable both as a tool for climate mitigation and for the assessment of potential climate impacts'

**2012**

The IPCC Fifth Assessment Report states that limiting global temperature change means **limiting the cumulative (or stock) of $CO_2$ emissions in the atmosphere**. To eventually stop global warming, net anthropogenic additions of $CO_2$ into the atmosphere have to reach zero

**2013**

**2014**

Article 4.1 of the Paris Agreement stipulates 'Parties aim to reach global peaking of greenhouse gas emissions as soon as possible... so as to achieve a **balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases** in the second half of this century...'

President of the World Bank, Jim Yong Kim, says that a proposed global climate agreement should 'provide a clear pathway to zero net emissions before 2100'

**2015**

**2016**

Sweden becomes the first nation to enshrine a mid-century net zero target (2045) in law

**2017**

The IPCC Special Report on 1.5°C concludes that 'limiting temperature rise to around 1.5°C and preventing the worst impacts of climate change implies **reaching net zero emissions of $CO_2$ by mid-century** along with deep reductions in non-$CO_2$ emissions'

**2018**

The UK becomes the first G7 economy to legislate for net zero by 2050

**2019**

Net zero pledges cover almost one-sixth (16%) of the global economy

**2020**

China, the world's largest greenhouse gas emitter, commits to **carbon neutrality 'before 2060'** at the 75th UN General Assembly

**Net zero pledges cover over two-thirds (68%) of the global economy**

**2021**

- cut carbon dioxide emissions by 45% from 2010 levels by 2030 (which approximates to halving them over the decade from now)
- bring global $CO_2$ emissions to net zero by 2050
- reduce steeply emissions of other greenhouse gases.

Enacted globally, these actions would give a 50% chance of keeping global warming below 1.5˚C.[17]

## Gear change? China

In September 2020, President Xi Jinping told the UN General Assembly that his country would peak emissions by 2030 and achieve carbon neutrality 'before 2060'. China accounts for almost 30% of the world's $CO_2$ emissions and more than half of its coal use. If it were to achieve the 2060 goal, the world's biggest greenhouse gas emitter could on its own lower global warming projections by around 0.2 to 0.3˚C, the biggest reduction ever estimated from a single policy measure.[1]

Chinese officials have been quick to set their sights on implementation. Within a week of President Xi's announcement, Tsinghua University's Institute of Energy, Environment and Economy – which works closely with the Chinese Ministry of Ecology and Environment (MEE) – presented a roadmap for reaching net zero by 2060.[2] And within three weeks, 18 Chinese research institutes, including MEE, produced a decarbonisation scenario titled 'China Low-Carbon Development Strategy and Transformation Pathways'.[3] The IEA revealed it was working with China 'to design a roadmap and energy policies that simultaneously put it on a path towards its carbon neutrality goal while also supporting the country's continued economic development'.[4]

At the UN Climate Action Summit on 12 December 2020, President Xi announced updated climate targets for 2030, including more ambitious goals for emissions intensity, the share of non-fossil fuels in China's energy mix and wind and solar power generating capacity of at least 1,200GW by 2030.

But while these few details have emerged, there is still a lot to be clarified; and so far, short-term commitments and policies do not look commensurate with the 2060 net zero pledge. China's draft summary of its 14th Five-Year Plan (FYP14), for example, offers no planned reduction in the deployment of coal, no clarification on when peak emissions may occur nor even an economy-wide 'carbon cap'. In the absence of more details in its FYP14, China's new long-term climate targets risk being undermined by a conspicuous lack of short-term urgency. According to one recent analysis, China needs to get 25% of its energy from non-fossil sources by 2025 to be on a linear track to meeting its 2060 carbon neutrality goal.[5] Much attention now focuses on the NDC that China is due to release before COP26.

1 China reaching carbon neutrality before 2060 would lower warming projections by around 0.2 to 0.3˚ C, https://climateactiontracker.org/press/china-carbon-neutral-before-2060-would-lower-warming-projections-by-around-2-to-3-tenths-of-a-degree/
2 https://mp.weixin.qq.com/s?__biz=MzU5MzY5ODIwNQ%3D%3D&mid=2247489602&idx=1&sn=c6c6ee7b640539cb6f805817173a7990&chksm=fe0dd4b0c97a5da6b00836019650a2adee0075e1b53290703b5c8fdecbfed7081324a47d9a21#rd
3 https://mp.weixin.qq.com/s/S_8ajdq963YL7X3sRJSWGg
4 IEA holds talks with China on a roadmap for reaching its 2060 carbon-neutrality goal, https://www.iea.org/news/iea-holds-talks-with-china-on-a-roadmap-for-reaching-its-2060-carbon-neutrality-goal
5 https://energyandcleanair.org/how-to-tell-a-strong-chinese-five-year-plan-from-a-weak-one/

Image credit: Macau Photo Agency, Unsplash

The 'net zero' part of the formula rapidly caught attention. Sweden already had a target (for 2045) in national law, and in 2019 the UK and France followed suit. Many other nations pledged on similar timelines, with companies, cities and regions also issuing commitments. Between June 2019 and February 2020, the proportion of global GDP covered by net zero targets from nations, states and

17 https://eciu.net/analysis/briefings/net-zero/net-zero-why

regions and cities soared from 16% to 49%.[18,19] Now, 'net zero' has very clearly evolved from a technical formulation into a central organising principle for climate action. More than 120 nations have pledged to reach net zero around mid-century, complemented by more than 100 regional governments, 800 cities and 1,500 companies.[20] Many of these so-called 'non-state actors' are members of the 'Race to Zero', a UN initiative established to encourage more entities of all sorts (other than nations) to set net zero targets.[21]

In September 2020 came the most dramatic announcement of all, when President Xi Jinping pledged China to carbon neutrality by 2060.[22] Japan and South Korea swiftly followed suit, with 2050 target dates. Then came the December 2020 election of Joe Biden to the US Presidency on a manifesto pledging net zero by 2050 — within a week of Biden's inauguration, an Executive Order reiterated that pledge.[23] With the EU also setting a 2050 climate neutrality target, the world's three biggest emitters (accounting for about half of both global GDP and emissions) are all now signed up to hitting net zero emissions (either for $CO_2$ alone or for all greenhouse gases) around mid-century.

Entities other than national governments have continued to sign on too, in part stimulated by the launch of Race to Zero in June 2020. Cities, regional governments, universities, businesses, even wineries… the list continues to grow, with Race to Zero aiming to add still more signatories before COP26 in November.

The importance of these recent moves was demonstrated by analysis published in November. Climate Action Tracker calculated that prior to the spate of announcements, the world was heading for global warming by the end of the century of approximately 2.7˚C; however, if China, the US and other nations deliver their net zero promises, that could put the world on a path to 2.1˚C, approximately halving the gap to the Paris Agreement target of 1.5˚C.[24]

While this paints an optimistic picture, the growth in net zero target-setting has been matched by a growth in the volume of criticism, from civil society, academia and some businesses. A particular concern is offsetting – the practice of purchasing credits based on efforts elsewhere (often, by implication, in developing nations) to meet one's own target. Offsetting projects can either be emission reduction activities (eg funding renewable energy installation or clean cookstoves), emission avoidance (eg forest preservation) or removal of $CO_2$ from the atmosphere (eg planting more trees). Offset credits may play an important role in addressing emissions that cannot be cut by any other means; and doing so by restoring natural habitats, such as forests or peatlands, can play a crucial role in achieving this,

18 https://eciu.net/news-and-events/press-releases/2019/one-sixth-of-global-economy-under-net-zero-targets
19 https://eciu.net/news-and-events/press-releases/2020/almost-half-of-global-gdp-under-actual-or-intended-net-zero-emissions-targets
20 https://climateaction.unfccc.int/views/cooperative-initiative-details.html?id=94
21 https://unfccc.int/climate-action/race-to-zero-campaign
22 https://www.fmprc.gov.cn/mfa_eng/zxxx_662805/t1817098.shtml
23 https://www.whitehouse.gov/briefing-room/presidential-actions/2021/01/27/executive-order-on-tackling-the-climate-crisis-at-home-and-abroad/
24 https://climateactiontracker.org/publications/global-update-paris-agreement-turning-point/

## The science of net zero

The single largest driver of the currently-changing climate is $CO_2$. As long as human activities continue to add $CO_2$ to the atmosphere, the global temperature will keep rising. This means that stabilising global warming at any level requires us to end all $CO_2$ emissions, or balance out any residual emissions with removals: net zero.

In ratifying the Paris Agreement, countries agreed to 'pursue efforts' to limit the temperature rise to 1.5˚C. They also agreed to achieve a balance between sources and sinks of greenhouse gases from human activities in the second half of this century.

Tasked by countries with assessing what it will take to meet the 1.5˚C limit, the IPCC concluded in 2018 that global emissions of $CO_2$ must approximately halve by 2030, reach net zero by mid-century, and continue to fall beyond. Emissions of other greenhouse gases must also fall sharply. In these pathways, total emissions of all greenhouse gases (when measured in standard $CO_2$-equivalent terms) reach net zero around 2060-2070.

Although the IPCC stipulates that it is $CO_2$ emissions alone that reach net zero by mid-century, many targets include all major greenhouse gases in combination. A 2050 net zero target for all greenhouse gases, such as the UK's, is in practice more ambitious than a target of net zero $CO_2$ by 2050.

Use of carbon offset credits muddies the picture somewhat, not least because offsets encompass a range of different approaches spanning emission reduction (e.g. energy efficiency or renewables projects), emission avoidance (e.g. forest preservation) and removal from the air (e.g. tree planting or, at small scales, engineered $CO_2$ capture and storage). Crucially, the only form of net zero which stabilises global temperature is one in which any continued emissions of fossil $CO_2$ are balanced out by permanent removals of $CO_2$.[1]

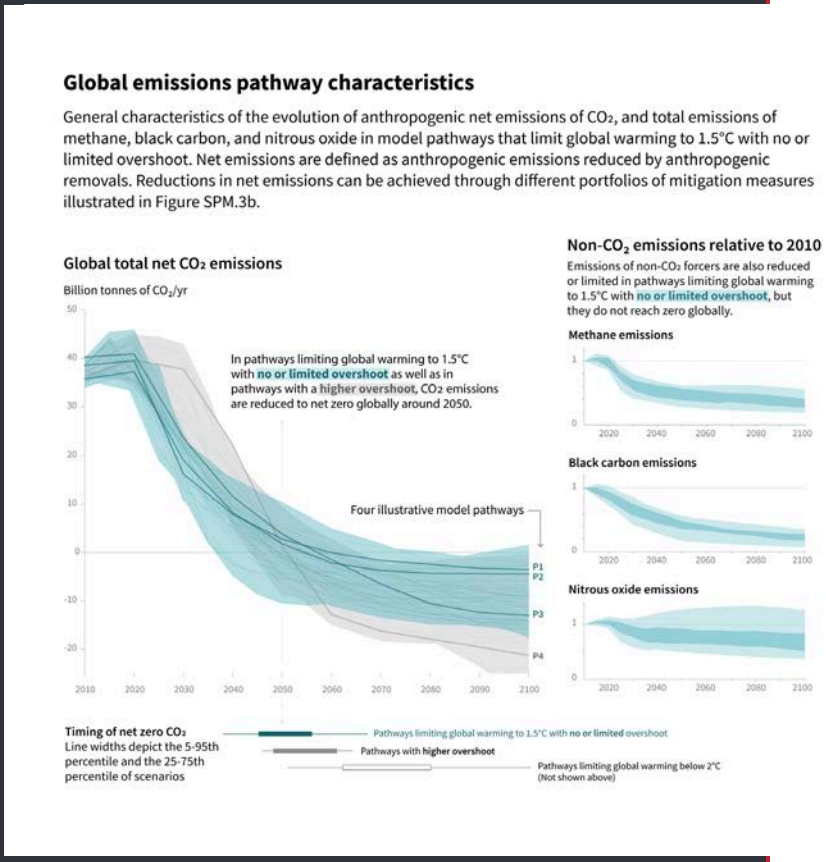


**Fig. 2**: From IPCC Special Report on 1.5˚C of Global Warming (https://www.ipcc.ch/sr15/chapter/spm/spm-c/spm3a/)

1 Allen et al. (2020) The Oxford Principles for Net Zero Aligned Carbon Offsetting https://www.smithschool.ox.ac.uk/publications/reports/Oxford-Offsetting-Principles-2020.pdf

with potentially important co-benefits for biodiversity. But there are multiple concerns: last month, for example, a Friends of the Earth report called offsetting 'chasing carbon unicorns,' saying that 'powerful actors are using net zero pledges to hide their climate inaction.'[25] In order to be truly consistent with stabilising the climate, any offsetting will eventually need to involve permanent $CO_2$ removal, for which very few projects currently exist.[26]

25 https://www.foei.org/resources/publications/chasing-carbon-unicorns-carbon-markets-net-zero-report
26 Allen et al. (2020) The Oxford Principles for Net Zero Aligned Carbon Offsetting https://www.smithschool.ox.ac.uk/publications/reports/Oxford-Offsetting-Principles-2020.pdf

**Fig. 3**: The Race to Zero 'starting line' criteria (https://unfccc.int/sites/default/files/resource/Minimum-criteria-for-participation-in-RTZ.pdf)

Other issues are that some net zero pledges do not specify which greenhouse gases are covered, contain no requirement to report progress, and may draw attention away from the need for immediate action to begin cutting emissions.

In parallel with this civil society criticism, academics and other experts have developed checklists of criteria that a credible net zero target needs to have. The NewClimate Institute and Data Driven EnviroLab proposed 'Ten basic criteria for net zero target transparency', including charting a decarbonisation pathway with interim targets, providing details on use of offsets and documenting a stakeholder consultation.[27] The World Resources Institute suggested that, to be credible, net zero

27 https://newclimate.org/2020/10/22/navigating-the-nuances-of-net-zero-targets/

targets should be reflected in investment decisions, that any offsetting should be undertaken in-country where possible, and entities should set separate targets for emission cuts and greenhouse gas removals.[28] A wide stakeholder consultation for the Race to Zero identified support across academics and practitioners for criteria including transparency through regular reporting and tracking, consideration of equity in setting a target date (for example, richer nations setting dates earlier than 2050), and coverage of all greenhouse gases (an updated set of Race to Zero criteria is expected in the coming months).[29] Several similar studies exist.[30,31,32,33]

As a result, entrants to the Race to Zero have to reach a certain minimum standard, or 'starting line' criteria, by the time of COP26.

In addition, Race to Zero requires the networks and initiatives[34] with which it collaborates to meet two substantive leadership practices on Scope and offsetting. The independent Expert Peer Review Group that reviews networks and initiatives seeking to join Race to Zero checks to make sure that the applicants' approach to these substantive elements matches best practice.

**Scope:** cover all emissions, including Scope 3[35] for businesses and investors where they are material to total emissions and where data availability allows them to be reliably measured, and all territorial emissions for cities and regions.

**Offsetting:** alongside immediate abatement measures, potentially including external opportunities,[36] transition to limiting offsets to neutralise 'residual' emissions. Offsets portfolios should transition to permanent removals by the time net zero is achieved. Ensure that all offsets meet robust standards for additionality, permanence, accounting, etc.

Networks or initiatives that fail to meet baseline criteria can lose their accreditation. The criteria will be reviewed and upgraded every year to reflect evolving science and practice around net zero. The most recent review took place January-March 2021 and the upgraded criteria will be published soon.

Precedents for setting a target and then working out how to meet it abound: for example, a bank joining the UN's Principles for Responsible Banking is not expected to have its portfolio immediately aligned with the Paris Agreement and Sustainable Development Goals, but is given a deadline by which to

28 https://www.wri.org/publication/designing-and-communicating-net-zero-targets
29 https://4bafc222-18ee-4db3-b866-67628513159f.filesusr.com/ugd/6d11e7_347e267a4a794cd586b1420404e11a57.pdf
30 https://www.c40knowledgehub.org/s/article/Defining-carbon-neutrality-for-cities-and-managing-residual-emissions-Cities-perspective-and-guidance?language=en_US
31 https://sciencebasedtargets.org/resources/legacy/2020/09/foundations-for-net-zero-full-paper.pdf
32 http://www.carbone4.com/wp-content/uploads/2020/04/Carbone-4-NZI-Guidelines-april-2020-2.pdf
33 https://carbonneutral.com/pdfs/The_CarbonNeutral_Protocol_Jan_2020.pdf
34 For a full list of the networks and initiatives that the Race to Zero collates net zero commitments from, see https://unfccc.int/climate-action/race-to-zero-campaign#eq-1
35 For more on emission scopes, refer to our methodology on page 15.
36 Such as immediate investments in nature-based solutions.

## Showing up: Costa Rica

Having advertised world leading climate ambition for at least a decade,[1] Costa Rica's plan for delivering on that ambition has caught up. For a middle-income country with little responsibility for causing global warming, Costa Rica is showing up many wealthier nations.

In its updated NDC submission delivered to the UN in December 2020, Costa Rica reaffirmed its 2019 pledge to achieve net zero greenhouse gas emissions by 2050.[2] The country has enhanced its 2030 target via a new NDC (as set out in the Paris Agreement), and justifies how its short-term ambition is consistent with a 2050 net zero trajectory.[3] Costa Rica's NDC is bolstered by a new legal and institutional framework for delivering climate action, including a 2018 National Adaptation Policy and 2019 National Decarbonization Plan — the latter of which doubles as the country's Long-Term Strategy.[4] According to an independent analysis, if Costa Rica were to implement all the policies outlined in its Decarbonization Plan, the country would achieve net zero emissions around 2050.[5]

A number of policies have been launched to facilitate carbon-cutting, including a National Energy Plan, a carbon neutral certification scheme for businesses and regions, Nationally Appropriate Mitigation Actions (or NAMAs), including for different agricultural sectors and investments in green infrastructure.[6,7]

This analysis found that while Costa Rica could provide details around the planned use of international offsets, it displays robust net zero governance: the country has published a detailed net zero plan and it reports on progress annually. Notably, Costa Rica's Decarbonization Plan references equity.[8]

1 Costa Rica aims to win "carbon neutral" race, 2007, Reuters, https://www.reuters.com/article/environment-climate-costarica-dc-idUSN2438974220070524
2 https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Costa%20Rica%20First/Contribucio%CC%81n%20Nacionalmente%20Determinada%20de%20Costa%20Rica%202020%20-%20Versio%CC%81n%20Completa.pdf
3 https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Costa%20Rica%20First/NDC%20Costa%20Rica%202020%20-%20Contribuci%C3%B3n%20Nacionalmente%20Determinada%20de%20Costa%20Rica%202020%20-%20Metas%20titulares.pdf
4 National Decarbonization Plan 2018-2050, https://unfccc.int/sites/default/files/resource/NationalDecarbonizationPlan.pdf
5 https://climateactiontracker.org/countries/costa-rica/pledges-and-targets/
6 http://www.namacafe.org/
7 https://www.globalconstructionreview.com/news/costa-rica-agrees-crucial-loan-13bn-san-jose-rail-/
8 National Decarbonization Plan 2018-2050

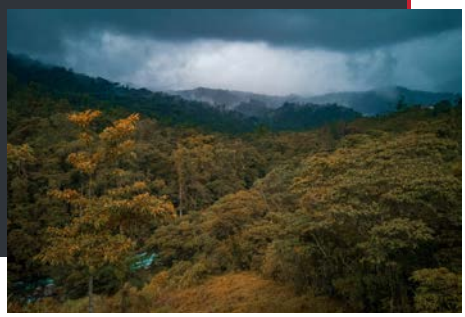

Image credit: Andrés Acuña, Unsplash

bring them in line.[37] More colloquially, President John F Kennedy set NASA the task of 'landing a man on the Moon and returning him safely to the Earth' within a decade without knowing how to do it, obliging engineers to work out the details.[38]

The value of the criteria lies in shining a light on the range of robustness across the net zero landscape. Identifying best practice sets a yardstick by which similar entities' commitments can be judged: highlighting those that are mere words allows scrutineers from citizens to investors and campaigners to call out the worst. Analysis across the range also allows entities to learn from each other.

But first, we have to analyse the spectrum and quantify existing commitments on the various criteria of robustness.

37 https://www.unepfi.org/banking/bankingprinciples/
38 https://www.nasa.gov/vision/space/features/jfk_speech_text.html

# Methodology

To make a global appraisal of net zero targets we reviewed:

- 202 countries
- all of the 806 states and regions in the world's 25 largest emitting countries
- all 1,170 cities with populations above 500,000
- the 2,000 largest publicly traded companies by sales.[39]

We looked for net zero commitments via a range of routes. First we surveyed the existing databases maintained by the UN Race to Zero and the Energy & Climate Intelligence's (ECIU) Net Zero Tracker.[40,41] We then ran two 'hackathons' with trained student volunteers at the University of Oxford fluent in a range of languages, who searched for online references to entities that had pledged net zero targets. All analysis draws only on publicly available documents, so may not reflect internal discussions.

## Noteworthy: New York State

In 2019, the State of New York enacted into law one of the most ambitious net zero emissions targets in the United States. The law mandates the state, home to over 19 million people, to reach an emissions-free electrical grid by 2040 and a net zero economy by 2050. Along the way, the state plans to reduce emissions 40% below 1990 levels by 2030.[1]

The state bill contains stringent conditions and limitations on offsetting; stipulations put into place during legislative negotiations in exchange for moving the bill from an absolute zero to net zero target.[2] In short, offsets are limited to 15% of economy-wide emission reductions and can only be used when a source has reduced its emissions to the 'maximum extent possible' and further reductions are 'not technologically feasible'.[3] The bill furthermore specifies that offsets be additional, permanent, maximise benefits to local ecosystems and public health and not result in a disproportionate environmental burden to disadvantaged communities.

Living up to its title, the Climate Leadership and Community Protection Act lays out clear mechanisms to ensure social equity and a just transition for New York communities. Between 35-40% of all state clean energy and climate spending, probably billions of dollars, is mandated to benefit disadvantaged communities, which are defined by a climate justice working group. A parallel just transition working group is mandated to report on job creation, workforce disruption and skill training needs resulting from the transition.[4]

Keeping up the momentum, a year after the Act was enacted, the New York State Pension Fund announced its goal to transition its portfolio, valued at an estimated $226 billion, to net zero greenhouse gas emissions by 2040.[5]

1 A.B. 6995. Climate leadership and community protection act. 2019 Reg. Sess. (New York 2019). https://legislation.nysenate.gov/pdf/bills/2019/S6599.
2 https://www.vox.com/energy-and-environment/2019/6/20/18691058/new-york-green-new-deal-climate-change-cuomo
3 A.B. 6995. Climate leadership and community protection act. 2019 Reg. Sess. (New York 2019). https://legislation.nysenate.gov/pdf/bills/2019/S6599
4 Ibid
5 https://osc.state.ny.us/press/releases/2020/12/new-york-state-pension-fund-sets-2040-net-zero-carbon-emissions-target

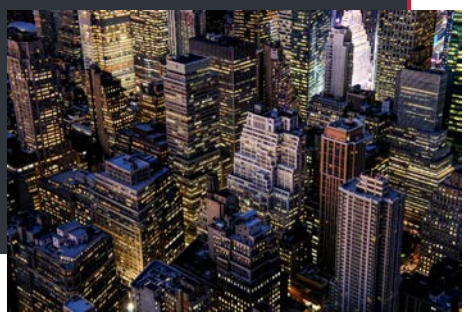

Image credit: Carlos Irineu da Costa, Unsplash

39 See Appendix for methodological details.
40 https://climateaction.unfccc.int/views/cooperative-initiative-details.html?id=94
41 https://eciu.net/netzerotracker/map

Our analysis encompassed commitments to net zero for $CO_2$ only, or for multiple greenhouse gases. We included those referring to 'net zero' emissions or to other related concepts that are widely used to denote net zero or net negative emissions such as 'carbon neutrality' and 'climate neutrality'. These terms each have different technical meanings but are often used loosely, even interchangeably, by entities making commitments.

All the data were entered in a master database according to a pre-existing protocol that allows for documenting of declared parameters (eg, '$CO_2$ only' or 'all greenhouse gases') but also allows us to note where no clarity is given, which is in itself a crucial parameter to quantify.

After surveying all 4,000+ entities, we calculated the fraction of global emissions, population and economic value covered by targets, and their robustness. Previous published figures for the share of GDP covered by net zero commitments have used the measure of nominal GDP:[42] here we used the alternative metric, purchasing power parity (PPP). This gives a truer reflection of a nation's greenhouse gas footprint; we advocate its use for all future analyses.[43]

In calculating the fraction of global emissions, population and GDP covered by targets, we avoided double-counting by leaving aside data for regions in nations that also had a net zero target, and those of cities in either nations or regions with a target. We did not include corporate entities in these calculations.

To assess the robustness of commitments, we drew on criteria identified as the 'starting line' and 'leadership practices' for participation in the Race To Zero Campaign.[44] Our benchmarks are as follows:

**Timing:** For each entity in our survey we collated the target year, interim targets where disclosed, and whether or not they refer to equity. We have not assessed their consistency with global temperature limits. Equity can be complex to quantify but as a common-sense starting point, those in prosperous parts of the world would be expected to reach net zero $CO_2$ emissions well before 2050.

**Status:** We documented the form commitments take, as this is a powerful marker of intent and affects the extent to which citizens or shareholders can hold entities to account. National targets may be announced by the government, published in an official policy document such as a Nationally Determined Contribution (NDC), in draft legislation, already in law or already achieved. The same applies to cities, states and regions, although many do not have power to draft legislation. Corporate targets range from simple promises through aspirational targets and inclusion in corporate strategies to

42 'Almost half of global GDP under actual or intended net zero emission targets', https://eciu.net/news-and-events/press-releases/2020/almost-half-of-global-gdp-under-actual-or-intended-net-zero-emissions-targets

43 PPP measures capture what goods and services a certain amount of money can buy domestically, while nominal GDP measures are better at comparing what a given amount of money can buy across countries. The former is more useful for assessing how much of the world economy is aligned to net zero because ultimately it is the share of goods and services aligned to net zero – or not – that determines climate outcomes.

44 https://4bafc222-18ee-4db3-b866-67628513159f.filesusr.com/ugd/6d11e7_347e267a4a794cd586b1420404e11a57.pdf

# SWEDEN 2045

## TARGET STATUS

- ACHIEVED
- IN LAW
- PROPOSED LAW
- IN POLICY DOCUMENT
- TARGET UNDER CONSIDERATION

## GOVERNANCE

**INTERIM TARGETS**
- 2030
- 2040

**PUBLISHED PLAN**
- YES
- NO

**ANNUAL REPORTING**
- YES
- NO

## USE OF OFFSETS

**OFFSETS ALLOWED?**
- YES
- NO

**CONDITIONS SET?**
- YES
- NO

**LIMITS ON OFFSETS?**
- YES
- NO

## COVERAGE

**TARGET GASES?**
- ALL GHGs
- $CO_2$ ONLY
- OTHER

**CONSUMPTION EMISSIONS?**
- YES
- NO

**INT. AVIATION AND SHIPPING?**
- YES
- NO

achievement. Some entities have already achieved targets, or already claim to be 'net negative' due to natural resources that absorb $CO_2$ from the air.[45]

**Coverage:** This includes several important questions. Firstly, which gases are covered? National reporting generally follows the international standard, covering all sources and sinks of a basket of gases ($CO_2$, N2O, CH4 and F-gases) within national territories. But this does not necessarily apply to targets set – for example, China's net zero pledge may cover $CO_2$ only; the government has yet to clarify. Commitments by states and regions, cities and corporates show much more variation. Another question for nations is whether the commitment includes emissions from international aviation and shipping. Finally, for businesses, a key issue is whether the pledge covers activities categorised as Scope 1 (covering sources and sinks directly managed by the entity), Scope 2 (indirect emissions from energy use) or Scope 3 (all other indirect emissions across the entity's value chain).

## Major match: Shell and BP

Major oil companies, including Shell and BP, made a splash in 2020 by announcing net zero targets. A healthy dose of scepticism followed these announcements on whether they will translate to the real world emissions reductions they claim. Taking a closer look, the Transition Pathway Initiative found none of the major oil companies' net zero targets align with a 1.5˚C future.[1]

Shell's target, which aims to reduce the carbon intensity of its operations and sold energy products by 100% by 2050,[2] is considered the most ambitious in the sector and closest to alignment with a 2˚C scenario.[3] Shell has also provided clarity on future use of large-scale CCS projects and investments in nature-based solutions (though the clarity has also generated concerns over the scale of the offsetting planned).[4,5] In contrast BP aims for a 50% reduction in the carbon intensity of its sold products by 2050.[6]

A common theme through oil companies' targets is a focus on $CO_2$ emissions reductions over those of other gases, leaving the door open for the expansion of methane (fossil gas) products even as carbon intensity is reduced.[7] Meanwhile a number of significant oil and gas giants, notably Sinopec, ExxonMobil and Saudi Aramco, have not made any net zero pledge at all.

1 https://www.transitionpathwayinitiative.org/tpi/publications/58.pdf?type=Publication
2 https://www.shell.com/energy-and-innovation/the-energy-future/our-climate-target.html#iframe=L3dlYmFwcHMvY2xpbWF0ZVghbWJpdGlvbi8
3 https://www.carbonbrief.org/analysis-shell-says-new-brazil-sized-forest-would-be-needed-to-meet-1-5c-climate-goal
4 https://www.ipieca.org/news/shell-announces-strategy-to-accelerate-net-zero-emissions-target/
5 https://www.carbonbrief.org/analysis-shell-says-new-brazil-sized-forest-would-be-needed-to-meet-1-5c-climate-goal
6 https://www.bp.com/en/global/corporate/news-and-insights/press-releases/bernard-looney-announces-new-ambition-for-bp.html
7 https://www.linkedin.com/pulse/bps-reimagining-energy-strategy-spring-hope-margriet-kuijper/

Image credit: Worksite Ltd, Unsplash

**Offsetting:** The difficulty of eliminating all emissions means that offsets feature in many net zero commitments, explicitly or by implication. While the details of future international credit markets under

45 Defined, for different countries, either as for $CO_2$ only or all greenhouse gases. We include in the 'Achieved' category countries with and without published net zero targets, but where their latest NDC submission lists a) their territory-wide emissions as a net carbon sink, net negative, or similar language, and b) an intent to maintain this emissions status, conditional or unconditional on international support.

the Paris Agreement are not yet finalised, existing markets may not provide fully additional effort and reliance on them may present risks to effective mitigation;[46,47] so this is a critical issue.

**Governance:** Poor governance increases the risk that targets are missed. We characterise governance using three features: whether the entity has published a plan for achieving the target, whether it has clear interim targets on timescales of planning cycles to assure accountability, and whether it has committed to report progress. We also looked for statements specifying that the entity had taken equity into account when setting its target.

We did not attempt to assess whether commitments are internally consistent – for example, whether interim targets provide a realistic pathway to the net zero target – only, whether they exist or not. Evaluating consistency is not a simple question and requires much closer scrutiny of individual targets than we can give.[48] We also did not attempt to measure the impact of meeting net zero targets on projections of global emissions or temperature rise.

Note that the robustness criteria we evaluate for are not a direct check of 'compliance' with the Race to Zero, which has its own defined compliance process.[49] Rather, we make an independent assessment of publicly available information regarding these entities' net zero targets, using our own criteria for robustness that draw on those of Race to Zero. For example, Race to Zero requires entities to have a plan in advance of COP26, while we record whether entities currently have a publicly available plan. Note as well that the Race to Zero does not include nation states, but does include many smaller entities that are not included in the sample of large non-state actors studied here.

We cut off entry to our database, to allow for analysis, on 12th December 2020.

# Findings

In total we find that 124 countries, 73 states & regions, 155 cities, and 417 companies in our sample have made some form of commitment to net zero. These figures differ from some previously published estimates because our sample focuses on the largest entities that produce the majority of global emissions.[50] These 769 entities represent 19%, by number of targets, of our total sample: 61% of nations, 9% of states & regions, 13% of cities and 21% of corporates.

46 https://ec.europa.eu/clima/sites/clima/files/ets/docs/clean_dev_mechanism_en.pdf
47 https://www.tandfonline.com/doi/full/10.1080/14693062.2018.1521332
48 Translating the scientific requirement of global net zero, or global temperature goals, to individual entities is complex. There are essentially two approaches. What we might call the 'microcosm approach' treats each actor as a world unto itself, requiring that all emissions attributable to that actor are either reduced or balanced with sinks. This approach is commonly used by countries, states and regions, and cities, but also by some companies. Alternatively, a 'scenario approach' is based on global scenarios that show what each sector needs to achieve to deliver global net zero for a given temperature goal. Each actor is then assigned a pathway of emissions reductions that corresponds to their share of a given scenario. This approach is used by the Science-based Targets Initiative (SBTI) for corporations and other entities, and is commonly used for corporations generally.
49 For the exact Race to Zero criteria, see: https://unfccc.int/sites/default/files/resource/Minimum-criteria-for-participation-in-RTZ.pdf
50 For example, https://newclimate.org/2020/09/21/accelerating-net-zero-exploring-cities-regions-and-companies-pledges-to-decarbonise/

Countries with net zero targets together represent 61% of global emissions, 68% of global Gross Domestic Product (in PPP terms) and 52% of the global population. Cities and regions whose net zero targets are not subsumed by a higher level of government add a further 4% to the total population covered. However, we were unable to add on estimates for the additional coverage given by states & regions and cities in terms of emissions or share of GDP, as it proved impossible to obtain sufficiently comprehensive and consistent data.

Companies with net zero commitments together represent sales of nearly $14 trillion – 33% of total sales across the top 2,000 public companies – with wide annual variations between sectors. For example, over two thirds of companies (by sales) in the Household & Personal Products sector have net zero targets. In contrast, the lowest coverage by sales is in the Semiconductors sector, at around 5%. Aerospace & Defence is little better, at just over 10%.

Assessing the results of this first 'global snapshot' against the five classes of criteria identified above, we find the following.

## Changing tack: Maersk

Shipping may be among the hardest industries to decarbonise, but that hasn't stopped Maersk throwing down the challenge to its competitors. The world's largest container ship company issued its 'net zero by 2050' pledge in December 2018. At the time, Maersk made it clear that because vessels have at least a 20-year lifetime, the first carbon-free ships would need to be operational at the latest by 2030. The pledge covers Scopes 1 and 2 but not yet 3, which may not be ideal, but on the other hand, the company is refreshingly clear about this.

Maersk recently announced that its first carbon-neutral container vessel will be on the water by 2023, seven years ahead of schedule.[1] Powered by carbon-neutral methanol, the Danish giant also promised that every new vessel will be 'dual-fuel', so capable of running on carbon-neutral substances such as methanol or ammonia as well as conventional petroleum-based fuels. According to CEO Soren Skou, what had seemed a 'moonshot' just two years ago was now a 'tough but achievable goal'.[2] Maersk is a founding member of Transform to Net Zero, a cross-sector initiative aiming to shift businesses from net zero ambition to net zero action.[3] Its stated objective is plucked straight from the IPCC's special report on 1.5˚C: 'halve global emissions this decade and get to net zero emissions no later than 2050.' Other members include Microsoft and Unilever.

Despite steering in a direction consistent with its net zero target, this analysis found that Maersk could improve the robustness of its navigations. Maersk has a decarbonisation plan and reports annually on progress (including to CDP),[4] but to enhance the credibility of its target, it could consider moving from an emissions efficiency target (of 60% relative reduction in $CO_2$ by 2030 from a 2008 baseline) to an absolute reduction target. Setting a Scope 3 target would also send a stronger signal that Maersk is serious about its promise to tackle supply chain emissions. Maersk, like most other companies we scrutinised, could also provide more clarity around how it plans to use and limit offsets.

1 https://www.maersk.com/news/articles/2021/02/17/maersk-first-carbon-neutral-liner-vessel-by-2023
2 https://www.ft.com/content/79bc2ed9-c0c4-4c29-a4bd-e3ec5f3a440e
3 https://transformtonetzero.org/
4 https://www.maersk.com/about/sustainability/reports

Image credit: Andrey Sharpilo, Unsplash

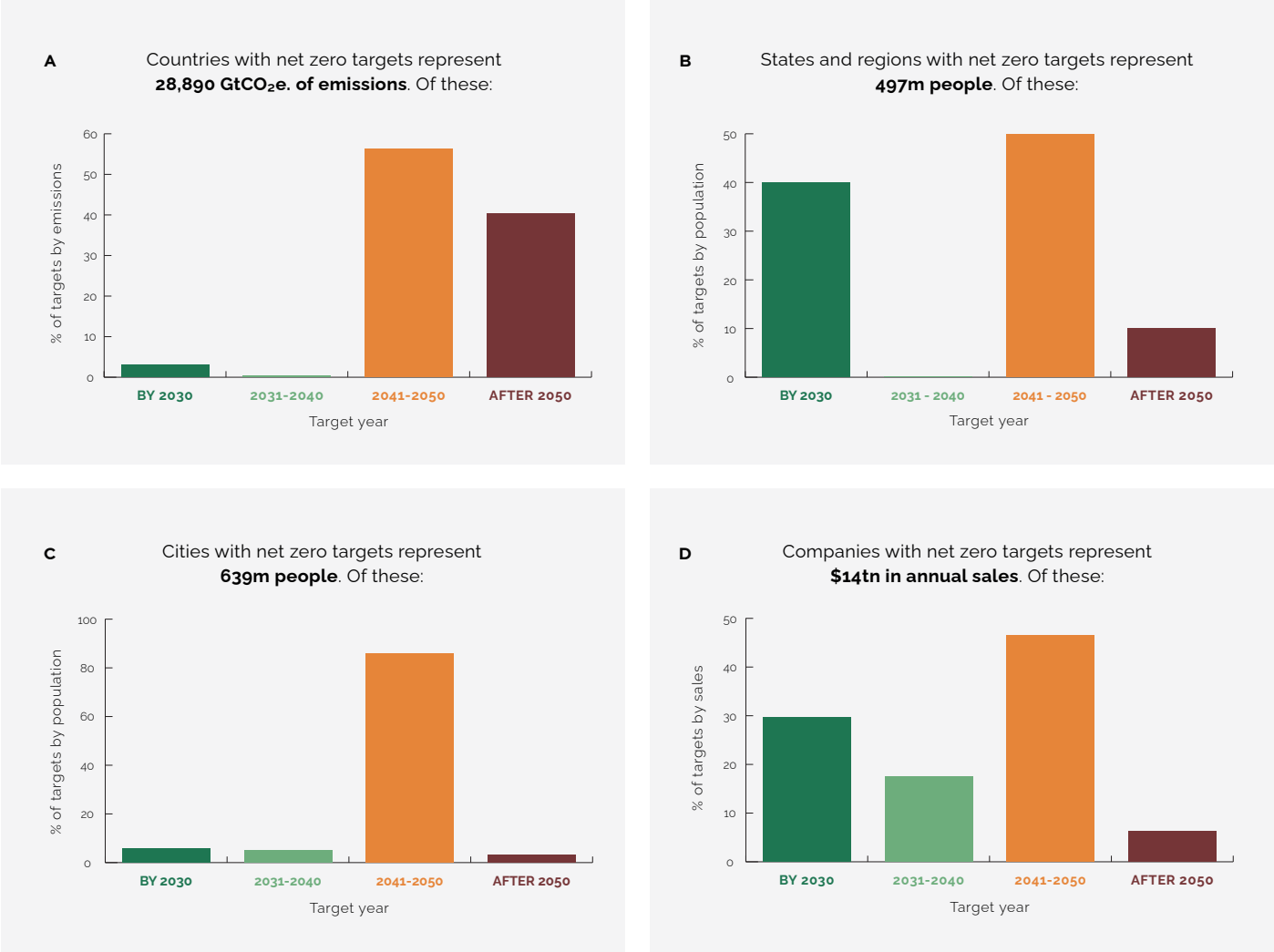


**Fig. 4**: Coverage and timing of net zero targets for (A) countries (B) states and regions, (C) cities, and (D) companies.

## Timing

- the majority of targets across all entities are 'by 2050'
- however, 212 entities have set a 'by 2030' target, three-quarters of them (153) companies
- China alone makes up the vast bulk of emissions covered by post-2050 commitments

## Status

- across all entities, the vast majority of targets are either proposed and aspirational, or in a policy or strategy document
- seven nations and four cities have enshrined their commitments in law
- 21 countries (17%) are net negative, while 44 companies (11%) have achieved their net zero targets

## Coverage

- across all entities, a significant fraction of targets (14% by number) do not specify $CO_2$ only or all greenhouse gases

- the remainder are split roughly equally between those covering all greenhouse gases and $CO_2$ only
- only five countries include a share of international aviation and only four include shipping
- the number of companies including emissions across all Scopes is 27% by number
- the number of states and cities with targets covering both territorial and consumption emissions is 9% by number

## Offsetting

- for all types of entity, the majority of commitments are unclear on whether they intend to use carbon offsets
- very few entities explicitly rule out the use of offsets (one country, eight regions, 11 cities and 33 companies)
- for those entities that indicate they will use offsets, only a few set conditions on their use (eight

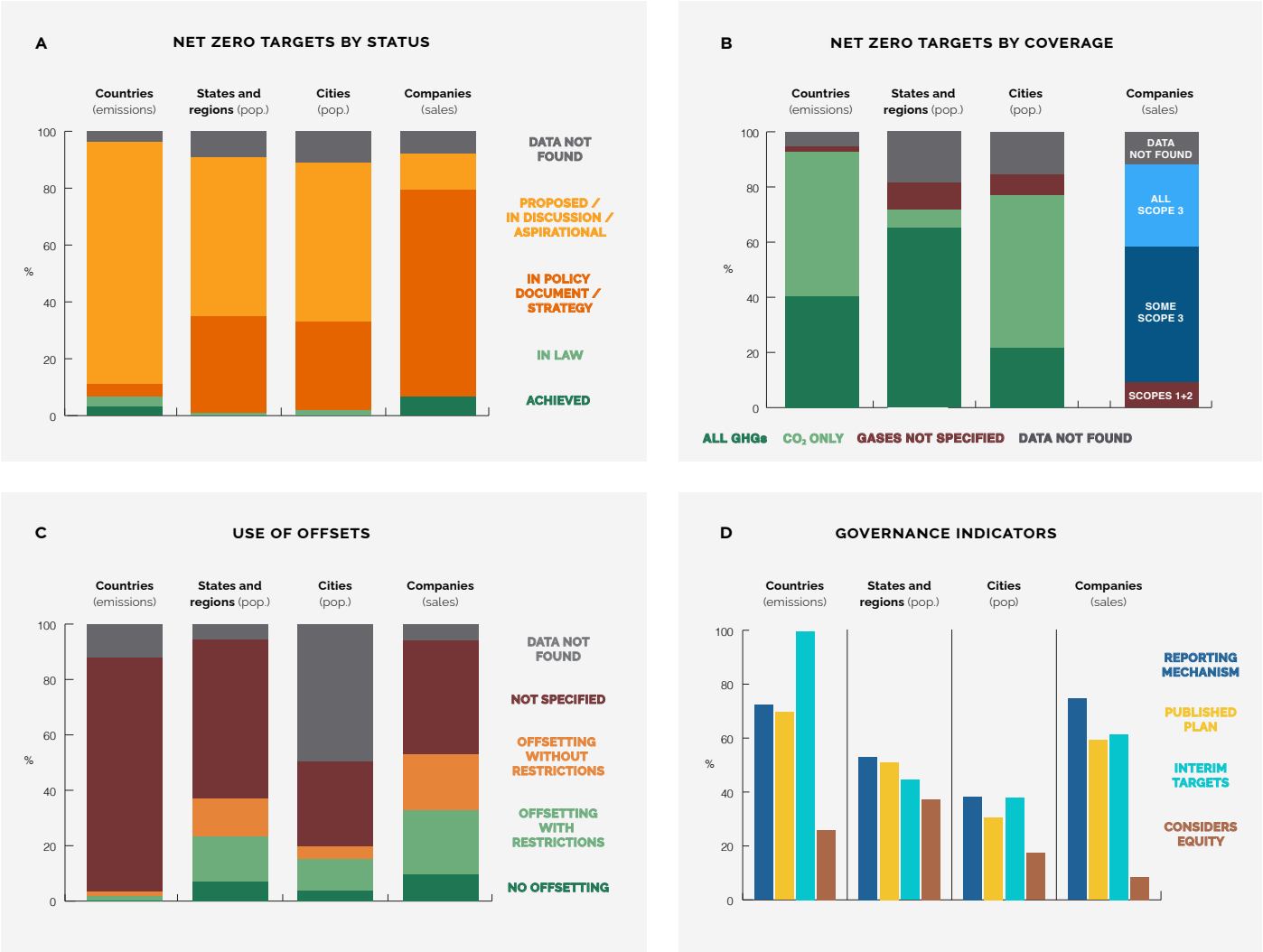


**Fig. 5**: Features of net zero targets assessed against criteria of (A) status, (B) coverage, (C) use of offsets, and (D) governance. As in Figure 4, countries are measured by emissions, regions and cities and states by population, and companies by sales. For coverage, company targets are shown by Scope of activities included, whereas other entities are shown by greenhouse gases included.

countries, 11 regions, 21 cities and 87 companies)

### Governance

- regular reporting of progress is widespread for national targets, which was anticipated as this is part of nations' commitments to the UN climate convention
- 86 nations, 42 states and regions, 68 cities and 277 companies have a reporting mechanism
- 25 nations, 41 states & regions, 65 cities and 210 companies have a published plan
- 115 nations, 35 states & regions, 71 cities and 244 companies have set interim targets[51]
- across all entities, 10% by number explicitly took equity into account when setting their net zero targets.

As outlined earlier, participating in the Race To Zero Campaign requires entities to commit to meeting a set of 'starting line' criteria before COP26 – Pledge, Plan, Proceed and Publish. Looking across our whole sample, we find that the number of entities with net zero targets currently meeting all these criteria is:

- 15 countries (5% by emissions)[52]
- 14 states and regions (85 million people)
- 8 cities (24 million people)
- 110 companies ($2.15 trillion by sales).

The Race to Zero campaign also highlights two 'leadership practices' that all members should move towards:

- states & regions and cities should include all emissions, and businesses Scope 3 emissions
- a commitment that offsetting will meet robust standards and that use of offsets will reduce over time to the minimum feasible.

But as yet only a handful of entities clear this higher bar:

- 5 countries
- 4 states & regions
- 4 cities
- 11 companies.

51 For nations, we included emission-constraining commitments within NDCs as 'interim targets'. We do not assess in this analysis whether interim targets are compatible with the net zero target.
52 As noted earlier, nations are not members of Race to Zero – nevertheless, the starting line criteria can be considered to indicate a reasonable 'floor' for robustness applicable to nations' net zero commitments.

# Conclusions

The rapid growth in net zero emission targets since the Paris Agreement, and especially since publication of the IPCC 1.5˚C report, shows that a significant proportion of political and business leaders now accept the case for reaching net zero by mid-century. The pace at which net zero targets have proliferated would almost certainly not have been predicted just three years ago – especially not the commitment of the world's three biggest emitters: China, the US and EU.

## Credibility test: Japan

In October 2020, Japan's Prime Minister Yoshihide Suga pledged to put his country on the path to net zero by 2050. Japanese lawmakers soon followed up the announcement with a climate emergency declaration.[1] Then, in December 2020, the country's trade ministry released a roadmap detailing how Japan could shepherd its economy away from fossil fuels towards low-carbon industries. The report named 14 industries where significant investment would be required to decarbonise over the next 30 years, including recommendations to invest in offshore wind, ammonia fuel and hydrogen, and even plans to revisit nuclear energy. In late 2020, the world's fifth largest emitter announced an investment of $19 billion to support hydrogen commercialisation and presented a plan to revise its policy on coal-fired power, which is projected to generate 26% of the nation's electricity in 2030.[2,3]

What is clear is that the flurry of net zero announcements in late 2020, particularly China's, pushed the Japanese government and some institutions into action. Just six months earlier it had published its NDC which was roundly condemned for lack of ambition. Now, in addition to producing a draft net zero roadmap, Japan's government is considering a ban on the sale of new fossil-fuel vehicles by 2035. The government-backed Development Bank of Japan's $509 million fund to help drive expansion of wind power offers another example of a change in direction.

However – like its high-emitting, big-promising Asian neighbour South Korea (which has also pledged net zero by 2050) – this year represents a test of Japan's credibility on the world stage. The country's net zero ambition and the consistency of its policies with the Paris Agreement rely on, at the least, an upgrade in 2030 ambition and a clear roadmap for decarbonisation – preferably coupled with a governance framework to deliver it. The net zero pledge has brought the paucity of short-term action into sharp focus, raising the prospects of accelerating decarbonisation in the coming decade including, perhaps, via an NDC upgrade before the Glasgow COP.[4]

1 https://www.reuters.com/article/us-climate-change-japan-resolution/japan-lawmakers-declare-climate-emergency-after-government-sets-zero-emissions-goal-idUSKBN27Z0GX
2 https://ieefa.org/japanese-government-to-invest-19-billion-to-support-2030-hydrogen-commercialization-goal-report/
3 Submission of Japan's NDC, 2020, https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Japan%20First/SUBMISSION%20OF%20JAPAN'S%20NATIONALLY%20DETERMINED%20CONTRIBUTION%20(NDC).PDF
4 https://www.env.go.jp/press/200330_Message.pdf Submission of Japan's NDC, 2020

Image credit: Jaison Lin, Unsplash

As such, the global momentum on net zero represents an exciting window through which to view decarbonisation. Setting a long-term science-based target and then working out how to meet it is a logical way to approach decarbonisation, for governments and business leaders alike.

However, net zero pledges will only deliver the 1.5˚C global warming target if plans are robust and enacted swiftly, so that emissions fall substantially over this decade and continue towards net zero by mid-century. Our analysis shows that in this area there is, unsurprisingly given these are early days,

work to be done.

This is the first quantitative analysis of the robustness of all types of net zero targets and provides a baseline against which progress can be assessed. And progress needs assessing. If nations, states & regions, cities and companies are serious about reaching their net zero targets it is entirely reasonable to expect them to enact measures that will help them get there; net zero is a land inaccessible to those without a plan.

Conceptually, three types of progress are needed – expanding, clarifying, and upgrading:

**Expanding:** Although net zero targets are now widespread, meeting the goals of the Paris Agreement requires all entities to align to mid-century decarbonisation (with those in more advanced states of development due to go earlier). Having signed the Paris Agreement and endorsed the IPCC Special Report which defined the target date, it logically follows that nations currently without a 1.5˚C-compatible net zero target should soon set one and work out how to meet it; and the logic is also compelling for for companies, whose business activities increasingly lie within net zero-committed countries.

**Clarifying:** Entities should be clear about what they are pledging – which greenhouse gases, on what timescale, with what use of offsets. An entity that has not published these essential details cannot reap any of the benefits of declaring a predictable path to net zero, such as sending an unequivocal signal to investors, nor can it expect every observer to take its commitment seriously.

**Upgrading:** Once it has made a clear commitment, an entity should welcome scrutiny from analysts, investors and civil society on whether its roadmap is adequate or needs upgrading.

The expectations on entities that have set net zero targets are likely to increase rapidly, with citizens, shareholders and other scrutineers demanding ever more clarity. Already, for example, criteria for membership of the Race to Zero are being tightened. It will be increasingly incumbent on entities to show they have a serious, credible plan; and in addition to looking at the existence of measures of robustness as we have done here, scrutiny will inevitably also focus on whether plans are compatible with a global path to 1.5˚C.

One logical first step for states & regions, cities and companies that have not yet done so would be to register for Race to Zero,[53] meet the starting line criteria by COP26 and then progressively enhance robustness using, where applicable, the various technical assistance mechanisms on offer. Multilateral Development Banks, expert bodies such as the International Energy Agency and philanthropy all have a role to play in helping entities solidify their plans, while companies have much to gain through

53 This will usually be via an established initiative such as the Net Zero Asset Owners' Alliance, the C40 network of cities or the Science-Based Targets Initiative. Full list at https://unfccc.int/climate-action/race-to-zero/who-s-in-race-to-zero#eq-3

## The 'golden triangle': China, the US and the EU

Together, China, the US and the EU account for over half of the world's economy and 46% of its greenhouse gas emissions. Their leaders have all now pledged to reach net zero emissions around mid-century. The history of previous cooperation on climate change (including the 2014 US-China Joint Announcement which set the stage for the Paris summit), plus the very obvious economic benefits to be gained by moving in step, is leading to hopes that the world's three largest economies will accelerate decarbonisation globally and lead an unstoppable journey to net zero.

In late 2020, the EU confirmed it would upgrade its carbon-cutting NDC from 40% to 55% by 2030 en route to becoming 'the world's first carbon-neutral continent' by 2050.[1] The EU and China have several joint projects in the low-carbon arena, and leaders of the two blocs spoke shortly before President Xi's September 2020 net zero announcement. In both the US and EU a discussion has started about border carbon adjustments - penalties levied on imports from nations without a credible decarbonisation plan - which is of obvious relevance to China as an exporter.

So the three biggest emitters' prospects are beginning to be linked officially - and are profoundly linked anyway given the importance of international trade in products that have to move from being high-carbon to low-carbon if the world is to reach net zero emissions, such as steel, cars, chemicals and plastics. The combined capacity to hasten other nations' decarbonisation via diplomacy and, especially, markets is huge.

The US-led high-emitting-nations' climate 'Leaders Summit' on April 22, aimed at lifting the ambition of heavy emitters, provides the three greenhouse gas giants with an opportunity to align. The US is expected to announce its NDC at that point, setting a marker for all governments that have not done so or have submitted one that is clearly inadequate. US-China-EU agreement before COP26, whether explicit or tacit, would send an unequivocal message to the rest of the world that net zero emissions by mid-century is the unimpeachable new political and economic reality.

1 https://ec.europa.eu/clima/policies/strategies/2050_en

Image credit: Susanne2688, Adobe Stock

setting best-in-class examples within their sectors. The logical pathway for nations, meanwhile, lies in publishing both a Long-Term Strategy containing a mid-century net zero target and an NDC before COP26, and making the second consistent with the first.

As noted earlier, huge potential for reducing near-term emissions lies in putting flesh on the bones of these long-term ambitions, in addition to garnering new net zero pledges from more entities. Setting a long-term goal with rigour, milestones and a compliance mechanism built in gives businesses and investors certainty as to the direction and speed of travel, reducing the costs of decarbonisation. For nations, setting the target in national law carries obvious benefits.

Some net zero targets are already accelerating short-term decarbonisation, and many more have the potential to do so as nations, states & regions, cities and companies develop and implement plans to reach those targets. If entities with net zero targets set robustness measures in place swiftly and those without come to the table equally quickly, net zero can be the window through which decarbonisation delivers the Paris Agreement.

# Appendix

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## Selection of entities

Countries: All UN-recognised countries and a number of self-governing territories and dependencies are analysed, comprising 202 entities in total. We do not include the EU as a separate entity. Country codes and names were sourced from the International Organization for Standardization (ISO) 3166-1 Alpha standard.[54] Country populations in 2019 were sourced from the United Nations (UN),[55] Gross Domestic Product (GDP) from the World Bank (2019, PPP using constant 2017 international USD)[56] and greenhouse gas (GHG) emissions from EDGAR (2018).[57]

### States & regions

We analyse the states, regions, and provinces (or other equivalent entities) of the top 25 emitting countries, which together account for over 80% of global greenhouse gas emissions. Specifically this comprises 806 states and regions from the United States, Australia, Canada, India, Russia, Japan, Germany, Iran, Saudi Arabia, South Korea, Mexico, Indonesia, Brazil, South Africa, France, Turkey, Italy, Thailand, Poland, Kazakhstan, United Kingdom, Spain, Taiwan, China, and Malaysia. As there are no

54 ISO 3166: Country Codes. International Organization for Standardization, Geneva, Switzerland. https://www.iso.org/iso-3166-country-codes.html [Accessed September 1, 2020]
55 United Nations, Department of Economic and Social Affairs, Population Division (2019) World Population Prospects 2019, Online Edition. Rev. 1. https://population.un.org/wpp/Download/Standard/Population/ [Accessed September 1, 2020]
56 The World Bank (2019) World Development Indicators. https://data.worldbank.org/indicator/NY.GDP.MKTP.CD [Accessed September 1, 2020]
57 Guizzardi, Diego; Muntean, Marilena; Schaaf, Edwin; Lo Vullo, Eleonora; Solazzo, Efisio; Monforti-Ferrario, Fabio; Olivier, Jos; Vignati, Elisabetta (2019) EDGAR v5.0 Greenhouse Gas Emissions. European Commission, Joint Research Centre (JRC). http://data.europa.eu/89h/488dc3de-f072-4810-ab83-47185158ce2a [Accessed September 1, 2020]

global datasets for names and population we compile them from a range of governmental and open-source repositories. We did not obtain comparable GHG or GDP data for all entities.

### Cities

All cities with populations over 500,000 are analysed, comprising 1,170 cities in total. City populations and names in 2018 were sourced from the UN.[58]

### Companies

We analyse all 2,000 publicly-traded companies included in the Forbes Global 2000 list. Company sales, names, industry and location of headquarters are sourced from Forbes.[59]

## Data acquisition

A team of trained data collectors systematically looked at each entity to ascertain whether it had a net zero target, and what characteristics that target exhibited. We rely on publicly available sources such as entities' websites or published documentation, press releases, or news articles. Data to complete the relevant template for each entity (detailed Section IV) was acquired using the following process:

1. Cross checking entity name against the Race to Zero[60] member master list (access provided by the UNFCCC Secretariat), and the Energy & Climate Intelligence Unit (ECIU) Net Zero Tracker[61] master list (access to data provided by ECIU);
2. Using Google Search to conduct the following internet searches in English and the entity's main language (if not English):
   a. [entity name] net zero climate target,
   b. [entity name] climate neutral,
   c. [entity name] carbon neutral,
   d. [entity name] zero emissions;
3. Reviewing relevant web pages relating to the entity's climate target; and
4. Using Google Search to conduct follow-on Internet searches as necessary.

The data acquisition activities were undertaken by volunteer coders from the University of Oxford and ECIU staff between August and December 2020. Before coding volunteers were given training material and walked through an hour-long induction and orientation. Members of the core research team were available to coders throughout the data collection process to answer questions and adjudicate ambiguities. Final acquisition and error checks on the target data were completed for non-state entities

58 United Nations, Department of Economic and Social Affairs (2019) Demographic Yearbook 2018. https://unstats.un.org/unsd/demographic-social/products/dyb/dyb_2018/ [Accessed September 1, 2020]
59 Forbes (2020) Global 2000: The world's largest public companies. https://www.forbes.com/global2000 [Accessed September 1, 2020]
60 Race To Zero Campaign. https://unfccc.int/climate-action/race-to-zero-campaign [Accessed November 15, 2020]
61 Energy & Climate Intelligence Unit (2020) Net Zero Tracker. https://eciu.net/netzerotracker [Accessed November 15, 2020]

on 23 November and countries on [11/12] December, so the results should be considered accurate as of that point in time.

## Error checking

Once the data acquisition for all entities was complete, ten percent of all entities in each category were randomly selected for 'double coding' to verify data accuracy. The data acquisition process outlined above was repeated for these entities, using different coders to those who had undertaken the process the first time around. Through this method, we found identical data acquisition results in 94% of cases. This high intercoder reliability rate builds confidence in the accuracy of the coding process. Spot checks were also undertaken to verify the accuracy of data entries for specific major actors, for example, 'Los Angeles' (in cities) or 'Amazon' (in companies). The purpose of spot-checking was to confirm that any subsequent, important updates pertaining to net zero targets had been accounted for. Alongside this, Google News searches were conducted for new net zero announcements until the data acquisition process was complete.

## Data limitations

Our dataset is limited by several factors. First, it is not globally comprehensive. While we have included all countries in our analysis, we limited ourselves to states, regions, and provinces of the top 25 emitting countries; cities with a population over 500,000; and companies the 2,000 largest by sales in 2020 which are publicly listed. Private companies are therefore excluded entirely, as are regions in lower-emitting countries, smaller cities and smaller public companies. Despite these exclusions, the data captures a globally significant range of actors that account for the vast bulk of global emissions.

Second, we only include data in the public domain. This may not reflect the most complete and current information held by individual entities.

Third, there are potential gaps in our analysis of net zero targets in some languages resulting from limits to translation. We mitigated this risk by assigning the coding for non-English actors to fluent speakers where possible, and then by translating non-English documents. For some languages however we were unable to enlist fluent speakers (including Thai, Turkish, Persian, and Russian). Key concepts that are used to describe net zero commitments (e.g. 'offsetting' and 'coverage') may not be discussed by non-English speakers in the same way or using the same terminology. Where languages do not use Roman script, we could not rely on accurate translation from algorithms such as Google Translate. Although many such actors are unlikely to have net zero targets at this point, certain gaps in the analysis may remain due to this constraint.

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