2020 THE CLIMATE TURNING POINT

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2020 THE CLIMATE TURNING POINT

OUR SHARED MISSION FOR 2020

PREFACE: WHY GLOBAL EMISSIONS MUST PEAK BY 2020

Authored by Stefan Rahmstorf and Anders Levermann
Potsdam Institute for Climate Impact Research

In the landmark Paris Climate Agreement, the world's nations have committed to "holding the increase in the global average temperature to well below 2 °C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5 °C above pre-industrial levels". This goal is deemed necessary to avoid incalculable risks to humanity, and it is feasible – but realistically only if global emissions peak by the year 2020 at the latest.

Let us first address the importance of remaining well below 2°C of global warming, and as close to 1.5°C as possible. The World Meteorological Organization climate report[1] for the past year has highlighted that global temperature and sea levels keep rising, reaching record highs once again in 2016. Global sea ice cover reached a record low, and mountain glaciers and the huge ice sheets in Greenland and Antarctica are on a trajectory of accelerating mass loss. More and more people are suffering from increasing and often unprecedented extreme weather events[2], both in terms of casualties and financial losses. This is the situation after about 1°C global warming since the late 19th Century.

Not only will these impacts get progressively worse as warming continues, but our planet also runs a growing risk of crossing critical tipping points where major and largely irreversible changes to the Earthsystem are triggered (see Fig. 1).

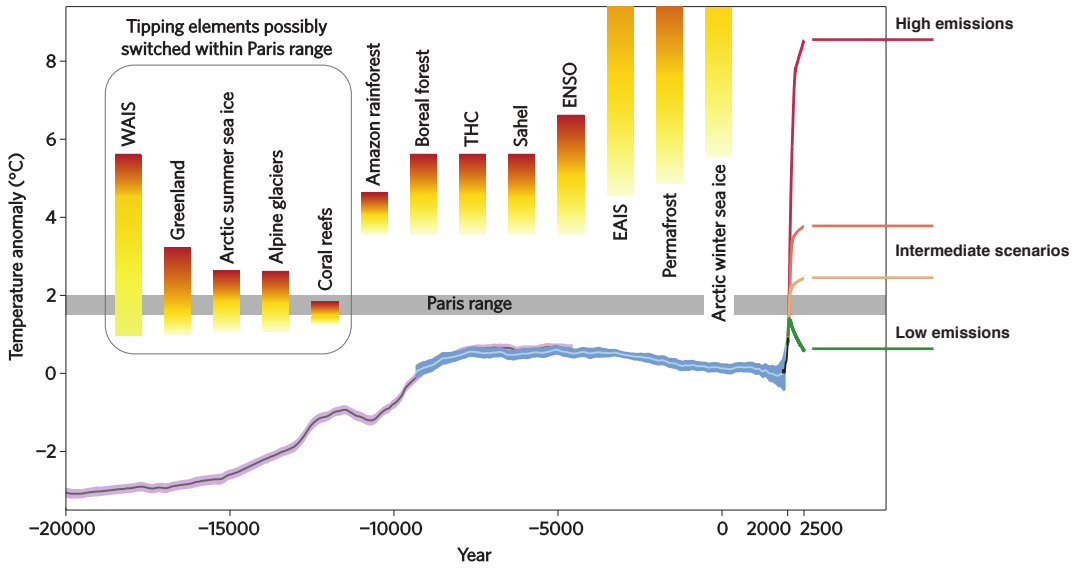

Fig. 1 *Tipping elements in the Earth system, in relation to past global temperature evolution since the last Ice Age 20,000 years ago as well as future warming scenarios[3]. The Paris range of 1.5 – 2 C warming is shown in grey; the bars show increasing risk of crossing tipping points from yellow to red. ENSO = El Niño Southern Oscillation. EAIS = East Antarctic Ice Sheet*

The West Antarctic Ice Sheet (WAIS in Fig. 1) has likely already been destabilised, committing the world to at least three meters of global sea-level rise in coming centuries[4] – an outcome that scientists have warned about since the 1970s[5]. The Greenland Ice Sheet – holding enough ice to eventually raise global sea levels by seven meters – may likewise be destabilised below 2°C[6]. Coral reefs have suffered pan-tropical mass bleaching in 2016 and are doing so again in 2017 as a result of warming oceans, and only if global temperature stays well below 2°C some remnants of the world's coral reefs can be saved[7]. The Gulf Stream system (THC in Fig. 1) appears to be already slowing[8] and recent research indicates it is far more unstable than previously thought.

Because overall global temperature rise depends on cumulative global CO2 emissions, the Paris temperature range can be translated, with some uncertainty, into a budget of CO2emissions that are still permissible. This is the overall budget for the century and it lies within the range of 150 to 1050 Gt of CO2, based on updated numbers from IPCC[9]. At the current global emission level of 39 GtCO2 per year, the lower limit of this range would be crossed in less than four years and is thus already unachievable without massive application of largely unproven and speculative carbon dioxide removal technologies. Even the CO2 budget corresponding to the mid-point of this uncertainty range, 600 GtCO2, is equivalent to only 15 years of current emissions. Fig. 2 illustrates three scenarios with this budget and different peaking years for global emissions. It makes clear that even if we peak in 2020 reducing emissions to zero within twenty years will be required. By assuming a more optimistic budget of 800 Gt this can be stretched to thirty years, but at a significant risk of exceeding 2°C warming.

It is still possible therefore to meet the Paris temperature goals if emissions peak by 2020 at the latest, and there are signs to show we are moving in that direction as global CO2 emissions have not increased for the past three years. We will need an enormous amount of action and scaled up ambition to harness the current momentum in order to travel down the decarbonisation curve at the necessary pace; the window to do that is still open[10].

In summary, declining carbon emissions after 2020 is a necessity for meeting the Paris temperature limit of "well below 2 degrees".

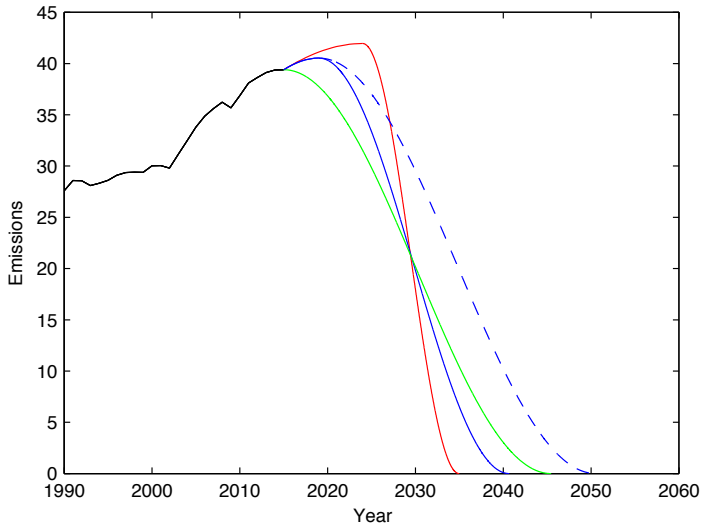

Fig. 2 *Three illustrative scenarios for spending the same budget of 600 Gt CO2, with emissions peaking in 2016 (green), 2020 (blue) and 2025 (red), and an alternative with 800 Gt (dashed).*

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INTRODUCTION

In 2015, more than 190 nations and many thousands of non-state actors jointly resolved to safeguard and strengthen the social, environmental and economic fabric of life on our shared planet. Together we committed to manifesting a more prosperous, resilient and equitable world in 2030, and set a 1.5-2°C temperature rise limit, which fundamentally underpins this better world.

We must now act with great urgency to fulfill our shared commitment. If we are to be successful, greenhouse gas emissions must begin their steady decline by 2020. Bending the curve of emissions any later will all but eliminate our chance to stay within 1.5°C and move the 2030 Sustainable Development Goals beyond our reach. Given the stakes, failure is simply not an option.

What this moment of history demands of us is not a burden; it is a tremendous opportunity. By rising to the challenge, we can create more resilient, secure and fulfilling livelihoods; enjoy access to cleaner air and water, vital to our health; live in better buildings and more livable cities; spur innovation and improve our resource efficiency, creating new jobs, economic opportunities and growth; and regenerate the extraordinary ecosystems that make our planet rich. The intrinsic value of these benefits extends beyond economic metrics but, by 2050, efforts to slow climate change could make us $19 trillion richer in that sense too[1].

The evidence that a 2020 climate turning point is within our grasp is growing every day. Global CO2 emissions have already plateaued, and are expected to remain flat over the coming years thanks, in no small part, to China's economic transformation, as well as the exponential growth in renewables worldwide. There are many signs that an irreversible direction of travel has been set: investment shifts, technology breakthroughs and cost reductions, a deepening understanding of eco-system services, resilient business and government leadership, as well as a staggering upsurge of citizen activism - all indicate that change is inevitable.

But when it comes to climate, timing is everything and we need to step-up the pace of change, accelerating a rapid drawdown in global emissions by 2020. Our shared mission is to ensure 6 critical milestones are met by 2020:

1. Renewables outcompete fossil fuels as new electricity sources worldwide

2. Zero emissions transport is the preferred form of all new mobility in the world's major cities and transport routes

3. Large-scale deforestation is replaced with large-scale land restoration, and agriculture shifts to earth-friendly practices

4. Heavy industry - including iron & steel, cement, chemicals and oil & gas - commits to being Paris compliant

5. Cities and states are implementing policies and regulations to fully decarbonize buildings and infrastructure by 2050

6. Investment in climate action is beyond USD $1 trillion per year and all financial institutions have a disclosed transition strategy

Just as the Paris Agreement was a deeply shared endeavor, so delivering on its promise must be too. Our success in Paris was not an accident; it was the result of us rallying behind a common strategy, and abandoning resignation for a can-do attitude that accepted this challenge as our own. In this next phase, we will need to come together once again. Meeting these 6 milestones will not be easy, and we will need to support each other along the way to ensure the transition is just and equitable. But just as we delivered success in Paris, so we can deliver the 2020 climate turning point too. This is our moment. This is our great opportunity.

"We need to bend the global curve of emissions no later than 2020 and reach a fossil-fuel free world economy by 2050. Yes, this is a grand transformation. Is it doable? Yes. Is it a sacrifice? No. The evidence grows day-by-day that a decarbonized world is a more attractive world."

PROF JOHAN ROCKSTRÖM, DIRECTOR, STOCKHOLM RESILIENCE CENTRE

1. OUR SHARED MISSION FOR 2020: RENEWABLES OUTCOMPETE FOSSIL FUELS AS NEW ELECTRICITY SOURCES WORLDWIDE

NECESSARY

Replacing fossil fuel powered electricity generation with renewables is key to global emissions peaking by 2020[2]. Already power generation emits 42% of energy-related CO2[3] (2014) and its relevance will only increase as other sectors, like transport, buildings and industry, become electrified. This is true even if accompanied with equally necessary and large improvements in energy efficiency performance.

Our electricity supply systems must undergo a radical transformation to ensure that global emissions peak in 2020 and move rapidly to zero by 2050. At the same time, this transformation can and must enhance energy security and ensure that the billions of citizens worldwide who today lack access to modern energy are not left behind. Decoupling global economic growth from power-related carbon emissions can deliver a new era of prosperity that does not destabilize the climate[4].

To deliver a 2020 climate turning point, our shared mission is to ensure that by then electricity generation from renewables outcompetes production from fossil fuels worldwide. This would see:

1. Renewables making up at least 30% of the world's electricity supply

2. No new coal-fired power plants being built, and all existing coal-fired power plants already in the process of being retired

DESIRABLE

Shifting to a clean power system will deliver meaningful benefits in and of itself, as well as limiting our human impact on the climate. Perhaps most importantly, shutting down fossil fuel power plants can reduce the number of early deaths from outdoor air pollution by up to ~500,000 globally each year. If polluting residential energy use is replaced with clean electricity, this could reduce the death toll by a further million[5].

There are also significant economic and security related benefits to be reaped. The development of domestic renewable energy sources will allow countries to decrease their energy import dependency, improve their trade balance[6] and reduce their vulnerability to international market volatility. Investing in renewable energy capacity will also create many new jobs[7], particularly in regions affected by high levels of unemployment, such as rural areas[8].

Finally, the distributed character of renewables, especially if combined with ever cheaper large and small-scale storage options[9], makes it possible to grant electricity access to people living off the main grid, as well as to the residents of small islands[10]. Improved energy access, in particular access to clean energy, also has health and economic benefits for the most vulnerable communities such as those who currently cook with coal, wood or dung in their homes, or have no reliable electricity[11].

ACHIEVABLE

Renewables make up at least 30% of the world's electricity supply

The transition toward an energy sector powered by renewables is already well underway. At the end of 2015, 23.7% of power was coming from renewable sources of energy[12], and investment in renewables continues to gather pace. In 2016, wind and solar PV constituted 78.4% of new capacity in the EU[13], in the US almost two-thirds of new capacity was renewable[14], and in China combined new capacity in wind and solar reached 52 GW and was roughly equal to the new capacity in coal and gas[15]. Even more positively, over the last seven years alone, solar PV costs have come down 85%, meaning it already outcompetes fossil fuel generation capacity in many regions of the world[16].

The International Energy Agency (IEA) calculates that renewables penetration could reach 26-27% globally by 2020, depending on what policies governments achieve between now and then[17]. But the world is moving to a low carbon power sector faster than anyone, including the IEA, thought possible[18]. With an extra push, we can ensure that by 2020, renewables make up 30% of the world's electricity supply[19].

To achieve this, many governments will need to eliminate policy and market barriers and create enabling environments, and the private sector will need to shift its investments to more decisively support renewable energy expansion. Adapting grids and energy markets, as well as eliminating fossil fuel subsidies will be critical for the expansion of renewable energy and the achievement of all the benefits this entails.

No new coal-fired power plants are built, and all existing coal-fired power plants are in the process of being retired

Already, more global capacity for renewable power is being added each year than coal, natural gas and oil combined, and in 2015 the sector overtook coal in terms of cumulative installed capacity[20]. The latest modeling indicates that by 2020, demand for coal and oil will have peaked[21]. The signs are already visible: at the end of 2016, the International Energy Agency (IEA) cut its forecast for future coal demand for the fifth year in a row[22], noting that "global coal demand growth has stalled". This is combined with a long-term coal price decline: between 2011 and 2015 prices have fallen by more than half[23].

Most governments and investors increasingly realize that there is no room for new coal-fired power plants in the emissions budget implied by the Paris Agreement temperature limits: emissions from existing power plants alone would exceed the cost-optimal carbon budget by 114%[24]. Most governments are also beginning to recognize that reliance on coal (and gas) exposes their economy to price volatility on the global coal markets and decreases their energy security. These considerations, combined with increasing cost competitiveness of renewables, means that investment in new fossil fuel generation capacity is slackening off.

Not only are new coal power plants struggling to secure investment, the retirement process for existing coal plants is also well underway: 249 US coal plants have been retired since 2010[25], and China has recently cancelled over 100 plants that were planned or under construction[26].

With concerted effort to accelerate these trends, we can ensure that no new coal plants are built beyond 2020 and that all existing plants are in the process of being retired. This is in line with what millions of citizens around the world want, as evidenced by the growing calls for better air quality, for example in Asian mega-cities.

2. OUR SHARED MISSION FOR 2020: ZERO EMISSIONS TRANSPORT IS THE PREFERRED FORM OF ALL NEW MOBILITY IN THE WORLD'S MAJOR CITIES AND TRANSPORT ROUTES

NECESSARY

Transportation is a major energy user, responsible for burning most of the world's petroleum and accounting for 14% of total global GHG emissions in 2010[27]. Moreover, without additional policy interventions, its emissions are projected to increase more quickly than other sectors, rising 80% from 2010 to 2050[28]. To ensure energy-related emissions are reduced to zero rapidly enough to hold warming to 1.5-2oC, the transport sector must begin to move quickly towards zero-emission options.

In order to make the 2020 turning point possible, our mission is to ensure that zero emissions transport becomes the preferred form of all new mobility in the world's major cities and transport routes. By 2020, this would mean:

1. Electric vehicles accounting for 15 to 20% of new car sales globally
2. Heavy-duty vehicle efficiency standards being 20% higher than today's across all major economies, and major cities decarbonizing transport fast
3. Public transport doubling its market share
4. The aviation sector reducing total emissions per kilometer travelled by 20% below 2013 levels
5. The shipping sector announcing plans for market measures or other instruments to eliminate emissions from their sector

DESIRABLE

Zero emission transport has multiple benefits above and beyond limiting climate change. Transport that runs on clean electricity reduces local air pollution, particularly in cities — a significant improvement over heavily polluting oil-powered transport systems, whose nitrous oxide emissions have negative impacts on health[29]. Public transport can significantly reduce the amount of time lost in congestion in cities, improving quality of life, as well as reducing car-oriented urban sprawl[30], which destroys natural habitats and agricultural land. Zero emission transport modes also reduce the demand for oil, increasing energy security for import dependent countries – as well as spurring innovation and creating skilled jobs in those countries that embrace the transition[31].

ACHIEVABLE

Electric vehicles account for 15-20% of new car sales globally

The world is at the precipice of a transport revolution, as electric vehicles (EVs) that connect to the grid will soon replace cars and trucks with internal combustion engines. In fact it has already begun. In 2015 there were 1.26 million EVs on the road, with global EV sales[32] standing at around 1%. The highest market shares of EVs in new car sales were in Norway (37% in January 2017)[33] and the Netherlands (10%)[34].

EV sales are already growing at 60% per annum. A 75% growth rate would deliver the intergovernmental Electric Vehicles Initiative's 20 million by 2020 target[35] – equivalent to 10% of new car sales. But to deliver a 2020 climate turning point, we must go even further. A 1.5°C compatible automobile sector requires that all new vehicles are electric by 2035/36. The Global manufacturing capacity for electric vehicles and their batteries is currently ramping up and is expected to pick up speed over the next decade. Given the potential

for faster than linear growth in the future once cost tipping points for manufacturing and ownership have been reached, our sense is that a non-linear path with a 15-20% target for 2020 is ambitious and achievable.

Costs for EV batteries continue to fall, with most studies seeing $150-300/kwh as the tipping point in their ability to compete with internal combustion engines[37]. General Motors states it achieved $145/kwh in 2015 and Tesla believes it will reach $100/kwh by 2020[38]. Research by Carbon Tracker and Imperial College, applying the latest EV battery costs, shows that EVs could become cost competitive by 2020 without subsidy, driving a faster rate of adoption than is foreseen by either the Bloomberg New Energy Finance New Energy Outlook or the IEA's 450 scenario (which is consistent with a 50% chance of limiting warming to 2°C)[39].

Prior to 2020, bulk purchasing agreements and lower cost / subsidized consumer vehicles will be needed to bolster demand and achieve economies of scale. Big developments can already be seen in this area too. The Chinese Government, for example, aims to have 5 million EVs on the road by 2020[40], while 30 US cities have asked manufacturers to quote for supplying 114,000 EVs[41]. The automobile industry is stepping up to meet demand – with Volkswagen, for example, stating it wants to be the world leader in EVs by 2025[42]. Further momentum would be added if all national and sub-national governments, plus major corporations, announced their commitment to purchase only zero emissions fleets from 2020 and automobile firms committed to meet this demand.

Heavy-duty vehicle efficiency standards are 20% higher across all major economies; transport routes in major cities are operated with zero-emission modes

Ramping up efficiency standards for heavy-duty vehicles will have a significant impact on emissions from transport. Technology for improving efficiency is there and quick wins can be made through improvements in aerodynamics and tire design, weight reduction, engine efficiency improvements and hybridization[43]. Tighter regulatory standards that force manufacturers and investors to take a longer-term view can make sure these gains are achieved[44].

Longer-term, electric heavy-duty vehicles can replace fossil fuel powered ones. In 2016, Tesla announced its plan to produce a battery-powered truck, and Mercedes-Benz has already released a prototype of its "eTruck", a fully electric heavy-duty model[45]. Take-up is already being incentivized through electrified traffic lanes, as underway in Sweden and Germany[46].

Incentivizing zero-emission modes is one strategy; another is the outright banning of high-emission modes. Several cities worldwide have already instated (and more are planning to instate) Low-Emission Zones in which old and inefficient vehicles are banned. The mayors of Mexico City, Athens, Madrid and Paris have stated their intention to ban diesel cars completely from their city centers by 2025[47].

Public transport doubles its market share

The current global share of private cars and motorcycles in total passenger transport is around 50%. It varies significantly between and within countries. In the USA, private transport dominates – accounting for 90%. In South Korea, the OECD country with lowest share of private transport, it is 40%. In developing countries, major shifts are underway: India and China increased the share of private transport from 27% and 10% respectively in 2000 to 35% and 30% in 2010[48].

The members of the International Association of Public Transport announced their intention to double the market share of public transport worldwide by 2025[49]. Encouraging signs can already be seen and our mission is to go even further. Bike-sharing schemes and bus rapid transit (BRT) systems have been growing quickly in recent years: already 850 cities have bike-sharing schemes encompassing more than a million bicycles, and 198 cities have BRT systems that carry nearly 33 million passengers every day[50]. Information and communication technology, ride-sharing and ride-pooling services are being integrated into the urban mobility ecosystem in many cities, helping to support the shift[51].

Given that the net benefits of enhanced public transit are likely to significantly outweigh the costs in the long term[52], there are good reasons to accelerate momentum by overcoming those barriers that stand in the way[53].

Aviation emissions per kilometer travelled are 20% below 2013 levels – limiting the sector's emissions growth to 29%[54]

After a long period of falling through regulatory cracks, aviation is finally moving towards managing its emissions. The International Civil Aviation Organization (ICAO) has announced a goal to improve global average fuel efficiency by 2% per year until 2020, stabilize net emissions from 2020 on, and reduce net carbon emissions 50% by 2050, relative to 2005 levels[55].

In order to achieve these goals, the ICAO has adopted proposals to set emission standards for new aircraft and for airlines to offset most of their CO2 emissions after 2020 (offsetting will be voluntary until 2027 and mandatory after that)[56]. Offset goals will cover an estimated 65% of emissions growth above 2020 levels in the first phase (2020–2027), and 80% in the second phase (2027–2035)[57].

The EU and China are also taking steps to curb emissions from aviation. The EU, which is responsible for 35% of global aviation emissions, has worked to include aviation into its Emissions Trading System, and China has built many high-speed train lines[58].

However, more needs to be done and several strategies can be employed to ramp up ambition. First, aviation's access to biofuels should be prioritized ahead of other sectors, since it currently has no alternative pathway to reach zero emissions[59]. Second, price signals and infrastructure improvements must be put in place to help support a modal shift from short-distance flights to fast trains. The EU's strategies demonstrate that taxing fuels, tickets or emissions can help shift consumer choices in favor of train travel. Third, retrofits, production updates, and new aircraft design can help increase aircraft fuel efficiency[60]. Many efficiency gains are still untapped, and just adopting new aircraft designs could reduce fuel consumption by approximately 25% by 2024[61].

The shipping sector announces plans for market measures or other instruments to eliminate emissions from their sector

The global marine shipping sector is responsible for approximately 1.5% of human-induced global greenhouse gas emissions today. Under business-as-usual conditions, the sector's emissions are expected to double by 2050[62].

However, shipping emissions could be significantly curtailed through changes in operational practices, improving the fuel efficiency of ships and burning lower-carbon fuels. Combined, these changes could reduce shipping emissions by 62% below business-as-usual projections in 2050, capping emissions at roughly today's levels despite very large increases in shipping volume by mid-century[63]. There is also an immediate opportunity to dramatically reduce the release of black carbon (a powerful short lived climate forcer) by 70%[64] through changing fuels, fitting scrubbers to exhaust systems and operating vessels more efficiently[65].

The cost savings that can be realized from reduced fuel use will, to some extent, accelerate the uptake of more efficient vessels[66]. But cost incentives alone will not drive sufficient change. Regulatory and policy instruments will be essential for aligning the shipping sector with a 2050 net zero emissions world.

The International Maritime Organization (IMO) has already committed to taking action in some areas. It has promised that by 2025, all new ships will be 30% more energy efficient than those built in 2014[67], and after years of debating definitions and potential measuring techniques for black carbon, it has now committed to initiating a process to regulate these emissions. Other measures, like carbon pricing, could accelerate investment in more fuel-efficient vessels and engines, and in alternative fuels[68] - the shipping sector should announce which measures it intends to use by 2020.

3. OUR SHARED MISSION FOR 2020: LARGE-SCALE DEFORESTATION IS REPLACED WITH LARGE-SCALE LAND RESTORATION, AND AGRICULTURE SHIFTS TO EARTH-FRIENDLY PRACTICES

NECESSARY

Land use and land cover changes affect local, regional, and global climate processes, with human activity influencing the exchange of greenhouse gases between terrestrial ecosystems and the atmosphere. Choices about land use and land cover patterns have and will affect the rate and degree of climate change and our vulnerability to its effects[69]. While net emissions from land use change over 2000–2005 were 5.5 GtCO2/yr (11% of global GHG), gross emissions (considering only sources of CO2) were almost three times this amount, reaching 15.8 GtCO2/yr[70]. About 70% of these emissions occur in the tropics, where 83% of new agricultural land is from forest conversion[71], pointing to a large mitigation potential in this region. Similarly, gross removals of CO2 through land-use change are large, estimated at over 10 GtCO2/yr (in 2000–2005).

Deforestation is the largest, and most visible, land use threat. Forests cover 31% of the global land area[72], providing vital ecosystem services and homes for people and wildlife. Our mission is to reduce emissions from deforestation to zero in the 2020s and to restore and conserve ecosystems, as well as to adopt sustainable agricultural practices, thus transforming the land-use sector into a growing carbon sink within the next two decades, while conserving the valuable biodiversity they house. This would involve:

1. The world's nations, civil society institutions and corporations acting to end deforestation by the 2020s, and mobilizing restoration, reforestation and afforestation to make the forestry sector a growing sink by 2030

2. Restoring and conserving at least 150 million hectares of degraded land, enhancing biodiversity and building ecosystem resilience

3. Ramping up the implementation of sustainable agricultural practices that improve the resilience of food production whilst reducing CO2 emissions, increasing CO2 removals, and halting the growth in non-CO2 emissions

DESIRABLE

Replacing deforestation with land restoration will have positive impacts on livelihoods, food and water security, health, ecosystems and biodiversity, in addition to reducing emissions and contributing to Sustainable Development Goal 15[73]. Coordinated approaches to landscape management can protect ecosystem services, build rural incomes and support rural economic development, while increasing resilience to the impacts of a changing climate[74]. Forest protection and reforestation will significantly improve the lives of around 1.6 billion people - including more than 2,000 indigenous communities – who depend on forests for their livelihood[75]. Anti-deforestation programs have shown positive outcomes in socio-economic indicators for the targeted populations – for example, finding alternatives to charcoal and biomass (which are used as fuels for cooking and heating by around 3 billion people and are some of the main forest degradation drivers) reduce the negative health impacts related to indoor air pollution and negative economic impacts related to time used for fuel collection instead of for income generating activities[76].

Integrated, earth-friendly agricultural systems also have numerous positive effects on local populations and ecosystems. They increase the productivity of cropland, reducing the pressure to expand into forests and other sensitive areas; they improve access to and distribution of food, facilitating the achievement of Sustainable Development Goal 2; and they preserve and enhance carbon stocks. Coalitions and alliances for the implementation of sustainable agricultural practices, which engage a range of sub-national actors, enhance local capacities and improve knowledge transfer whilst also encouraging continued research and development.

ACHIEVABLE

The world's nations, civil society institutions and corporations act to end deforestation by the 2020s, and mobilize restoration, reforestation and afforestation to make the forestry sector a growing sink by 2030

There is already strong political motivation to end deforestation. In 2014, world leaders endorsed the New York Declaration on Forests, which calls for natural forest loss to be cut in half by 2020, and to be ended altogether by 2030[77]. It also includes a goal to eliminate deforestation from the production of agricultural commodities by no later than 2020. More recently, the Sustainable Development Goals declaration included a target to 'by 2020, promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests and substantially increase afforestation and reforestation globally'. Companies have signaled their will to act in this area, with 54 big-brand companies committing to remove commodity-driven deforestation from supply chains by 2020 under the We Mean Business Coalition.

Deep and rapid reductions in emissions from deforestation are possible and have already been observed in countries like Brazil, where policies resulted in total land use and forestry emissions decreasing by 85% between 2005 and 2012[78]. Using mechanisms and technologies that are already available today, we can accelerate progress and significantly reduce global emissions by 2020.

Restore and conserve at least 150 million hectares of degraded land, enhancing biodiversity and building ecosystem resilience

There is already strong political consensus on the importance of restoring and conserving degraded ecosystems, which have been estimated to cover between 1 and 6 billion hectares worldwide[79].

In 2010, 168 countries — signatories of the Convention on Biological Diversity of the United Nations — set up biodiversity targets for 2020, including the 'restoration of at least 15% of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification'[80]. One year later, the Bonn Challenge was launched as an implementation strategy with the aim of restoring 150 million hectares of the world's deforested and degraded land by 2020 and 350 million hectares by 2030. To the date, this initiative has received 40 commitments, accounting for 148.38 million hectares that have been estimated to sequester around 15.1 GtCO2[81].

Land restoration can be accelerated substantially from now until 2020, as evidenced by the 20x20 Initiative in Latin America and the AFR100 Initiative in Africa, which have jointly committed to restore almost 80 million hectares of degraded land respectively across over 30 countries in just three years[82].

Ramp up the implementation of sustainable agricultural practices that reduce CO2 emissions, increase CO2 removals, and halt the growth in non-CO2 emissions

Improved land-use practices could substantially reduce GHG emissions from agriculture, while improving food security, rural incomes, and climate resilience. Estimates suggest that, by 2030, non-CO2 emissions could be reduced by 2.3-4.6 GtCO2eq/yr below a business-as-usual scenario; preventing them from rising above current levels[83]. In addition to this, increased soil carbon sequestration could make the agriculture sector a sink of CO2. The uncertainties in estimates of future removals are very high, particularly as sequestration in soils can be easily reversed, but there is the potential for about 1 GtCO2eq/yr[84].

Spurred by consumer demand for sustainably produced food, the importance of earth-friendly agricultural practices is increasingly recognized, and there is an effort to ensure regional and government policies are aligned with these aims. But there are many other opportunities to accelerate action and deliver a 2020 climate turning point.

Currently, about 30–40% of food is lost in the supply chain[85], revealing enormous potential to make food systems more efficient while improving food security. Reducing emissions from livestock could also deliver massive wins, as alone it accounts for up to half of the mitigation potential from the agriculture, forestry and

land-use sectors. Emissions could be significantly cut by: promoting dietary changes that reduce demand for livestock; sustainably intensifying production; promoting carbon sequestration in rangelands; and reducing emissions from manures[86]. Beyond this, innovative low-carbon agricultural practices and technologies, including using feed additives, improving feed digestibility, and improving the genetic potential of animals for production, are increasingly being developed – many of which are not yet included in future mitigation estimates[87].

4. OUR SHARED MISSION FOR 2020: HEAVY INDUSTRY – INCLUDING IRON & STEEL, CEMENT, CHEMICALS AND OIL & GAS COMMITS TO BEING PARIS COMPLIANT

NECESSARY

Global industrial processes, including the production of iron and steel, cement, chemicals, oil and gas, are highly energy intensive. The industrial sector accounted for 21% of total global greenhouse gas emissions in 2010, a number that rises to 32% if the sector's use of heat and electricity are also considered[88]. Iron, steel, and non-metallic materials (primarily cement) play an especially big role, and produced 44% of the CO2e emissions (direct, indirect, and process-related) generated by the industrial sector in 2010[89].

The energy consumption of industry per unit of value added has been dropping since the 1990s in developed countries, yet these improvements have been offset by an increase in total production – resulting in significant increases in both energy consumption and CO2 emissions. If these developments continue unchecked, the sector's total CO2 emissions risk increasing 90% by 2050 compared to 2007[90].

To get the sector on track for a 1.5-2°C pathway, industrial emissions must fall to more than half of their current level by 2050[91]. This means substituting high carbon materials like steel for low carbon alternatives, and increasing the levels of reuse and recycling wherever possible. It also means the heavy industry sector committing to be Paris compliant; ensuring that by 2020:

1. Firms have developed, published, and begun implementing roadmaps for their transition to a decarbonized economy in 2050

2. Heavy industries are increasing their energy, emission, and material efficiencies and are on a trajectory to halve emissions by 2050 using science-based targets

DESIRABLE

Enhancing emissions, energy, and material efficiencies in industrial operations is one of the most cost effective ways of reducing emissions – and doing so has positive effects that extend far beyond reducing climate impacts. Industrial efficiency measures enhance a firm's productivity, competitiveness, profitability, and may improve product quality, and working environment, while reducing the cost of operations, maintenance, and meeting environmental standards. Productivity and operational gains from industrial energy efficiency improvements can exceed the value of saved energy costs by up to 250%, further shortening their payback period[92]. Improving industrial efficiency has cascading macroeconomic effects: large-scale efficiency policies have been shown to boost national GDPs by more than 1%[93].

Enhancing industrial efficiency also reduces air, soil, and water pollution, improving health outcomes for millions and reducing environmental compliance and cleanup costs. Currently, more than 5.5 million people die from air pollution every year – in large part due to industrial emissions[94]. Pollution cleanup costs are huge: the US alone spends $4.3 billion per year to address freshwater pollution[95]. China recently released air, water, and soil pollution cleanup plans that will cost more than US $1 trillion to fully implement[96]. The case for reducing this pollution up front is clear.

ACHIEVABLE

By 2020, heavy industry firms have developed, published, and begun implementing roadmaps for their transition to a decarbonized economy in 2050[97]

There are several international collaborative efforts already underway, gathering data on heavy industry emissions, setting short-term goals, and laying the groundwork for longer-term sectorial planning. These include, but are not limited to, the IEA's Energy Management Action Network (EMAK), and the Low Carbon Technology Partnerships Initiative (LCTPi), which includes working groups focused on cement (the Cement Sustainability Initiative) and chemicals (Chemicals LCPTi). A consortium of 48 European companies and organizations in the Ultra-Low Carbon Dioxide Steelmaking (ULCOS) coalition aims to cut steel production CO2 emissions by at least 50%[98]. The Cement Sustainability Initiative's (CSI) members have set emission reduction targets that could cut 50-100 Mt CO2e in 2020; if the entire sector adopted similar goals, it could mitigate 120-540 Mt CO2e in 2020[99].

LCTPi groups are planning to ratchet up ambition in 2018, in concert with national revisions of emissions targets. This timing creates an ideal opportunity for firms to also create longer-term decarbonization roadmaps. Sharing knowledge and efforts among companies and across sectors and regions will accelerate learning around technology development and support the diffusion of best practices. This will enable more robust goal setting and the linking of short-term goals to a wider decarbonization strategy.

Heavy industries are increasing their energy, emission, and material efficiencies and are on a trajectory to halve emissions by 2050 using science-based targets[100]

Heavy industry emissions can be reduced markedly by improving material, energy and process efficiencies, and implementing best practice technologies (BPTs) that are already available today[101]. Deploying BPTs in chemicals and petrochemicals manufacturing, for instance, could reduce the sector's energy intensity by 40%, and lower its annual emissions by 1 Gt of CO2e by 2050. Operating Chinese cement plants with BPTs would reduce the sector's electricity consumption and emissions by 40%[102].

Governments and industry will also need to accelerate the development of carbon capture and storage (CCS) by supporting expanded research and development and commercial trials, building comprehensive policy frameworks to support CCS, and fostering international collaboration to advance CCS deployment[103]. Breakthroughs in carbon capture utilization and storage (CCU) technologies are already showing promise in industrial operations. The Tuticorin plant in India has developed a way to turn industrial carbon emissions into baking soda, a marketable commodity, in the first example of unsubsidized, industrial-scale CCU[104].

For these changes to happen, national governments in countries where industry is a significant emitter of GHGs will need to create incentives for the transition, for example by setting a national or sectorial carbon price, and facilitating research and development into new low-carbon technologies and CCS.

5. OUR SHARED MISSION FOR 2020: CITIES AND STATES ARE IMPLEMENTING POLICIES AND REGULATIONS WITH THE AIM TO FULLY DECARBONISE BUILDINGS AND INFRASTRUCTURE BY 2050

NECESSARY

Buildings alone are currently responsible for one-fifth of global greenhouse gas emissions[105]. Urban landscapes and their associated infrastructure are key to the 2020 climate turning point – by 2020 4.3 billion people are projected to reside in them[106], as 1.3 million people become new city dwellers every week[107]. Without concerted action, building the infrastructure needed by the world's growing and increasingly urban population would generate a total of 470 Gt of CO2 emissions by 2050 – nearly 10 times the total global CO2 emissions in 2012[108].

In order to align with a 1.5-2°C pathway, the building sector will need to reduce direct emissions by 70-80%[109] by 2050. These reductions will need to be paired with a complete phase-out of indirect emissions, primarily in the form of purchased electricity[110]. Our mission is clear: by 2020, cities and states will need to have a clear action plan and be starting to implement policies and regulations to fully decarbonize buildings and infrastructure by 2050, including:

1. Investing at least USD ~$300 billion annually to support infrastructure decarbonization, in addition to the necessary ~$6 trillion in annual business as usual infrastructure expenditures

2. Building all new buildings to meet zero or near-zero net energy standards

3. Upgrading at least 3% of the world's existing building stock annually to zero or near-zero emissions structures

DESIRABLE

Decarbonizing the world's buildings and infrastructure is desirable beyond its climate benefits. Doing so will benefit human health, boost city and state economies, help to address inequality and social exclusion, and improve the aesthetics of the built environment. Increasing energy efficiency in buildings has been shown to help reduce mortality and morbidity, while increasing productivity and concentration among workers and inhabitants[111]. Efficiency measures can also decrease waste and pollution, while increasing urban vegetation - for instance through the use of green roofs and walls[112]. Improved and more sustainable urban infrastructure can lower energy prices, increase savings, increase employment, decrease debt, improve energy security and power reliability, as well as reduce unforeseen costs for building owners, workers, and inhabitants. Smarter cities with low-carbon infrastructure also boast better social welfare, with enhanced safety, comfort, social inclusion and political stability, while improving social and physical resilience to environmental stresses, such as floods and water shortages[113].

ACHIEVABLE

At least USD ~$300 billion is invested annually to support infrastructure decarbonization, in addition to the necessary ~$6 trillion in annual business as usual infrastructure expenditures[114]

Delivering the necessary investment to decarbonize infrastructure is proving to be economically and technologically feasible, although coordinated policy-driven efforts are needed to further direct investment shifts. The latest research suggests that we will need $90 trillion in baseline infrastructure investments from 2015–2030[115]. Decarbonizing these investments would require an extra net $4 trillion[116] – a less than 5% increase in the upfront cost, which is more than offset by the consequent savings, which are estimated at US$5.1 trillion over the 2015-2030 period[117].

New buildings are built to zero or near-zero energy standards[118]

The feasibility of meeting zero energy building standards in developed countries is demonstrated by the EU's Energy Performance of Buildings Directive (EPBD), which stipulates that new buildings are to be nearly zero energy by 31 December 2020 (public buildings by 31 December 2018). Dozens of projects delivering zero and near-zero building renovations and new constructions have been already performed in many European countries including Austria, Bulgaria, Croatia, and Sweden[119]. We need to ensure that similar gains are made in developing countries, where the bulk of future infrastructure and urban growth is expected[120], where capacities are often limited, and at the same time where there is great opportunity to leap frog poor standards and apply high efficiency building and infrastructure practices for new structures[121].

At least 3% of the world's existing building stock, on average, is upgraded to zero or near-zero emissions structures annually[122]

Achieving an annual 3% retrofit rate worldwide is an ambitious goal. This aspiration is reflected in EU policies - the Energy Efficiency Directive (EED), the Energy Performance of Buildings Directive (EPBD), and the recent Winter Package (WP). The EED calls for at least 3% of central government-owned buildings to be retrofitted every year, while the EPBD and WP require EU countries to develop national plans for financing efficiency improvements in buildings. These policies could be adopted immediately by the US, Japan, and other developed countries.

A number of innovative programs are showing that change is feasible in middle income and developing countries too. China's 'Energy-efficiency retrofits of existing buildings' policy is perhaps the best example of a rapidly developing nation making headway. In Mexico, the Green Mortgage Program (Hipoteca Verde) provides "green mortgages" and has already improved the energy efficiency of millions of buildings[123]. This program could be reproduced in other developing nations[124]. Meanwhile the Caucasian nation of Georgia, working with the Covenant of Mayors, has set out to reduce building sector emissions by an average of 18% by 2020 in 10 of the country's largest cities.

Economic fundamentals already support robust retrofit policies: green retrofits typically reduce building operating costs by 10% annually. In the US, these projects are expected to pay for themselves in just 7 years, according to the U.S. Green Building Council[125]. However, upfront costs continue to act as a barrier, especially in developing countries, meaning that government measures and finance innovations remain key to accelerating delivery.

6. OUR SHARED MISSION FOR 2020: INVESTMENT IN CLIMATE ACTION IS BEYOND USD $1 TRILLION PER YEAR AND ALL FINANCIAL INSTITUTIONS HAVE A DISCLOSED TRANSITION STRATEGY

NECESSARY

Capital deployment is perhaps the most important factor for spurring the global transition to a decarbonized society, both in terms of financing concrete climate actions and ensuring that wider flows are climate-aligned.

There are many different estimates for how much is needed to squarely shift the world onto to a 1.5-2°C pathway. The International Energy Agency (IEA) estimates that ~$3.5 trillion must be invested on average every year from 2016 to 2050[126]. IRENA calculates that cumulative additional investment in low carbon technologies would need to amount to ~$29 trillion over the period until 2050[127]. The New Climate Economy Commission estimates that we need to invest an additional ~$4 trillion from 2015-2030 to make infrastructure compatible with 1.5-2°C[128, 129]. Our mission is to mobilize climate finance investments of well beyond $1 trillion per year for at least the next decade and a half. Given the ability of government backed finance to leverage private sector investment, we would expect the majority of this to be private resources seizing the opportunities of the low carbon transition.

This reallocation of investment needs to be accompanied by a curtailment of investment in carbon intensive activities. For this reason, our capital mobilization mission goes hand in hand with ensuring that, by 2020, all financial institutions have disclosed a decarbonization strategy[130], in order for portfolios to be well positioned to finance the necessary transition. This includes the huge assets managed by pension funds, sovereign wealth funds, and insurance companies[131]. In order to accomplish these twin missions, we will need to:

1. Invest at least $200 billion public and $800 billion private resources in climate action each year
2. Increase the amount of philanthropic funding for the climate movement by ten-fold from 2016 levels
3. Multiply the green bond market's annual issuance tenfold from 2016 levels

4. Ensure that institutions disclose climate-related financial risks and that credit ratings fully incorporate them

5. Eliminate fossil fuel subsidies

6. Cancel the capital expenditure for expanding coal, oil and gas production

7. Implement a carbon pricing mechanism within and across all major economies

DESIRABLE

The transition to a low-carbon economy is an enormous opportunity for financial innovation, and the creation of new business models and jobs, quite apart from its positive impact on climate. The later the financial sector becomes aligned with the Paris objectives, the more abrupt the adjustment will be, and the higher the risk of assets becoming stranded.

Investments in the low-carbon economy will not only make the planet safer and habitable, it will boost the economy: IRENA has recently estimated that efforts to slow climate change could make the world $ 19 trillion richer (0.8% of the global GDP by 2050), and investments in the clean energy sector only could create 6 million jobs[132]. The decoupling of economic growth from emissions is already being demonstrated in a number of markets, challenging the assumption that tackling climate change is a drag on the economy. The world is arriving at a sweet spot where investing in the energy transition makes both financial and climate sense.

ACHIEVABLE

At least $200 billion public and $800 billion private resources are invested in climate action each year

The political will demonstrated in Paris and elsewhere has already translated into significant real world economy actions. In 2014, the best figures available suggest there were already finance flows of at least $151bn from public sources and $241bn from private sources[133]. Investment in clean energy totaled $348.5bn[134] in 2015 while investment in energy efficiency topped $221bn[135]. Added to this, the costs of renewable technologies continues to drop rapidly, and more than expected since 2015. This will attract more investment and also increase emissions avoided per dollar spent[136]. Technological advances mean that the level and cost of policy measures required are falling. With recent divestment commitments coming from 688 institutions across 76 countries representing over $5.2 trillion in assets under management[137], the available resources to scale up investment in climate action will significantly increase.

Philanthropic funding for the climate movement increases by ten-fold from 2016 levels

The urgency of this transformation requires that funding dedicated to climate action expands way beyond the current 2% of overall philanthropic funding[138]. There are already major foundations driving an increased focus on climate, including Hewlett[139] and Packard[140] among many others, as well as calls for foundations to deploy their endowments now, rather than leaving them for later. Some foundations now see climate action as an impact investment opportunity that aligns with their mission. There is also an increasing awareness that failure to address climate could undermine grants in other social and environmental areas. Finally, there are an increasing number of examples of philanthropic funds being divested from fossil fuels.

The green bonds market annual issuance multiplies beyond tenfold from 2016 levels

Green bonds are no longer a niche market: going from $9 billion to $80 billion between 2013 and 2016, the investment has multiplied more than 8 times in three years. Estimates for 2017 issuances range from $120 billion (HSBC) to $200 billion (Moody's). This exponential growth trend is expected to continue into the near

future, and both the Climate Bonds Initiative and Citigroup have suggested the green bond market could reach $1trillion per year by 2020. The finance community must strive to come up with other innovative mechanisms to mobilize additional capital for climate action. For example, the World Bank has issued bonds that for the first time directly link returns to the performance of companies advancing global development priorities set out in the Sustainable Development Goals.

Corporates and financial institutions disclose climate-related financial risks and credit ratings fully incorporate them

Disclosure is the foundation that will allow for an allocation of capital that is Paris compliant. It is already well on the way to becoming mainstream. CDP, formerly the Carbon Disclosure Project, began asking for climate risk disclosure from companies in 2001 on behalf of 35 institutional investors. In 15 years, it has grown to represent over 800 investors with a combined $100 trillion in assets, generating climate-related disclosures from over 1,000 companies globally. In parallel, investors are directly requesting stronger climate risk disclosure from the companies of which they are shareholders. One prominent example is the campaign led by New York State and the Church of England, backed by investors worth US $4trn, to force US oil major EXXON to disclose climate risks[141]. Going forward, active ownership and engagement with companies on their governance, strategy, risk management and targets for the necessary transition to a net zero economy will be critical.

Significant progress is being made at a political and regulatory level too. The Task Force on Climate-related Financial Disclosures (TCFD) and G20 have been provided with a recommended framework that can be transposed into national requirements for financial regulators, and public and private financial institutions[142]. All members of the TCFD support and intend to adopt these recommendations in 2017[143]. By 2020 these should have filtered down to every company, with board directors expected to ensure the recommendations are appropriately applied as part of their fiduciary duty.

Cancel the capital expenditure for expanding coal, oil and gas production

To align with emissions targets and the changing energy system, a much smaller supply of fossil fuels will be needed. Carbon Tracker's analysis shows that over the next decade more than $2trillion of new investment needs to be cancelled[144]. For coal, this means no investment in new coal mines. For oil, some investment is needed just to maintain production, but if emissions are to peak in 2020, the oil sector needs to adopt plans that do not involve further growth. High cost, energy intensive gas supply options such as unconventional Liquefied Natural Gas (LNG) exports are also inconsistent with Paris targets, tempering growth expectations for gas too.

Avoiding investment in fossil fuel assets, whether that is for extraction or power generation, is essential to avoid perpetuating high carbon activities. Shifting this capital deployment will also improve corporate financial performance, avoiding investments in assets that do not have a place in a low carbon future. Recent IEA/IRENA analysis suggests that $1-2trillion of stranded assets could be created in a 2°C degree scenario, with the level increasing the longer action is delayed[145].

Fossil fuel subsidies are eliminated

According to the International Monetary Fund (IMF), fossil fuel subsidies currently cost the world $500 to $600 billion per annum, which rises to $5.3tn a year ($10m per minute) when the cost of damage from pollution and climate change is factored in. This is more than the total global spending on human health. A recently published study (February 2017) by the Overseas Development Institute (ODI) and the International Institute for Sustainable Development (IISD) found that: 'a complete removal of subsidies to fossil fuel production globally would reduce the world's emissions by 37 Gt of CO2 over 2017–2050[146]. This is roughly the amount of carbon dioxide that would result from burning all proven oil reserves in the United States and Norway.' Dedicating even a portion of these resources to clean investments would bring us very close to achieving our mission for the energy sector alone.

Voices calling for the phase out of fossil fuel subsidies are coming from all sectors of society. In February 2017, investors worth more than $2.8 trillion called for the G20 to phase out all fossil fuel subsidies by 2020,

starting with subsidies for fossil fuel exploration and coal production, and then moving on to public support for oil and gas. This followed on the heels of a 2016 open letter from over 200 civil society organizations to the G20 making the same demand. When investors and civil society are united and committed, governments will find fertile ground for reform[147].

Carbon pricing is implemented within and across all major economies

Already about 40 national jurisdictions and over 20 cities, states, and regions are putting a price on carbon, a move which comprises 13% of global emissions. A further 100 Parties (accounting for 58% of global GHG emissions) are planning or considering these instruments[148]. This momentum shows no sign of stopping: heads of state and business leaders have challenged the world to double the coverage of emissions subject to carbon pricing by 2020, and double it again within the next decade[149]. China's introduction of a nation-wide scheme in 2017 alone will deliver a doubling of the emissions covered.

CONCLUSION

The historic and legally binding Paris Agreement handed the world a roadmap to address climate change once and for all. 196 nations universally adopted this agreement, committing to limit global temperature rise to between 1.5-2oC above pre-industrial levels. What is less well known is how urgently we must act to honor this commitment. If we are to be successful, greenhouse gas emissions must begin their steady decline by 2020: our climate turning point.

The six sections of this report have demonstrated that the 2020 climate turning point is not only necessary – it is both desirable and achievable as well. Indeed, the evidence that this turning point is within our grasp is growing every day. Global CO2 emissions have already plateaued, and are expected to remain flat over the coming years. Across the six key areas of energy, transport, land use, industry, infrastructure, and finance, there are opportunities for breakthrough actions to unlock a radical increase in ambition over the coming years. This will make meeting the Paris Agreement's goals possible.

While managing climate change represents a huge challenge, it also represents a transformational opportunity. It offers an unprecedented – and exciting – chance for us to fast forward towards a highly desirable and more prosperous future. It is the 2020 turning point that will make this future possible. And it is radical collaboration and relentless optimism will make the 2020 climate turning point a reality.

#2020DontBeLate
#ClimateAction

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