

THE PARIS EFFECT - COP26 EDITION

**HOW TIPPING POINTS CAN ACCELERATE AND DELIVER
A PROSPEROUS NET ZERO ECONOMY**

November 2021

S Y S T E M I Q

ENDORSEMENTS



The race to a healthy, resilient zero-emissions economy is already underway in many sectors - and it's driven by the Paris Agreement's goals. Whether in the electrification of transport, the decarbonisation of heavy industry or the disruption in capital markets - we are breaking through in ways not even imaginable a few years ago. But, as the Paris Effect - COP26 edition shows, we must pick up the pace by halving emissions and building resilience within the 2020s."

Nigel Topping, UN High Level Climate Action Champion for COP26



The direction is set for this decisive decade - we will not step back from decarbonisation efforts to stay within the 1.5C limit. Substantial progress has been made since the Paris Agreement, and we will soon see the curve of emissions beginning to go downward. SYSTEMIQ's updated report, The Paris Effect - COP26 edition, shows us that the transformation of key sectors is happening, and that with increasing speed, we can create a virtuous cycle for policy, technology and finance."

Christiana Figueres, Co-founder of Global Optimism, former Executive Secretary of the UNFCCC (2010-2016)



The world is still not on track to limit global warming to 1.5°C and avoid devastating climate change. But we have the technologies to achieve far faster reductions, often at nil or low cost, giving us reasons to be optimistic. While we are accelerating on some fronts, we are not moving nearly fast enough in other sectors. The Paris Effect COP26 edition highlights how vital it is to accelerate our efforts towards market tipping points - two prime examples include the massive clean electrification of our global economy and the short-term reduction of methane emissions. By focusing on coordinated agreements and pledges, leading countries and companies can move forward to securing a net-zero economy."

Adair Turner, Chair, Energy Transitions Commission



In 2020 The Paris Effect made clear that weak or delayed action not only translates into potentially devastating climate risk, but also puts economies at risk of falling behind the next wave of the creation of prosperity. The Paris Effect - COP26 edition highlights that on multiple fronts rapid technological innovation is accelerating, supported by scaling investment and increased ambitions. It also makes clear that we need to do much more to mobilise capital for developing countries through creative combinations of international public finance designed to mobilise much larger flows of long-term private capital at much lower cost."

Pr. Nicholas Stern, Professor of Economics, Chair of the Grantham Research Institute on Climate Change and the Environment, London School of Economics



The Paris Effect report last year made it clear that we are in the midst of an unstoppable transition to a clean, lean, inclusive and circular economy. Corporates and investors are leading the charge, reinforcing feedback loops, mitigating portfolio risk and capturing new investment opportunities. One year on, the COP26 edition of the Paris Effect highlights that these feedback loops are accelerating, bringing tipping points closer to where markets will fundamentally shift."

Hubert Keller, CEO, Lombard Odier



As the old saying goes, if you want to lose a bet, bet against the future. Investing in high-carbon infrastructure now is that losing bet. For any infrastructure asset built today that serves a high-carbon value chain, the revenues from 10-years out should be seriously questioned. Infrastructure investors should also pay close attention to reinforcing downward spirals that will accelerate the decline of high-carbon assets."

Rachel Kyte, Dean, Fletcher School, Tufts University

ENDORSEMENTS



Science tells us that “business as usual” is driving negative ecosystem tipping points that are accelerating climate damage – from permafrost methane release to loss of sea ice. Our collective response must be to put in place transformational tipping points across key markets to radically cut emissions in this decade. This COP26 edition of the “Paris Effect” highlights how low-carbon solutions could scale rapidly in sectors representing 90% of emissions by 2030. A hugely strategic contribution to the “Race to Zero” which is well underway. With clear country commitments being made and finance starting to commit at scale, this gives a huge impetus to business who want to accelerate but still struggle with the How.”

Paul Polman, Business leader, Campaigner, Co-Author of *Net Positive*



As a global infrastructure investor, we have always seen sustainability as a core driver of value creation – we believe that values drive value. The Paris Effect – COP26 edition, highlights that this is the case now more than ever, as sustainable, low-carbon solutions are becoming even more competitive and set to see market tipping points in a multitude of sectors before 2030.”

Shami Nissan, Head of Sustainability at Actis



The transformation of our economy isn't just something we can imagine. In many sectors, progress is happening, propelled by the Paris Agreement which set in motion a wave of changes that wouldn't have been possible just a decade ago. The protection and restoration of our Global Commons is inextricably linked to how we engineer market tipping points across the global economy. The Paris Effect – COP26 edition tells us it is within reach, and the path is clear. We must all play our part in accelerating our journey towards a net-zero.”

Hubert Keller, CEO, Lombard Odier

REPORT HEADLINES

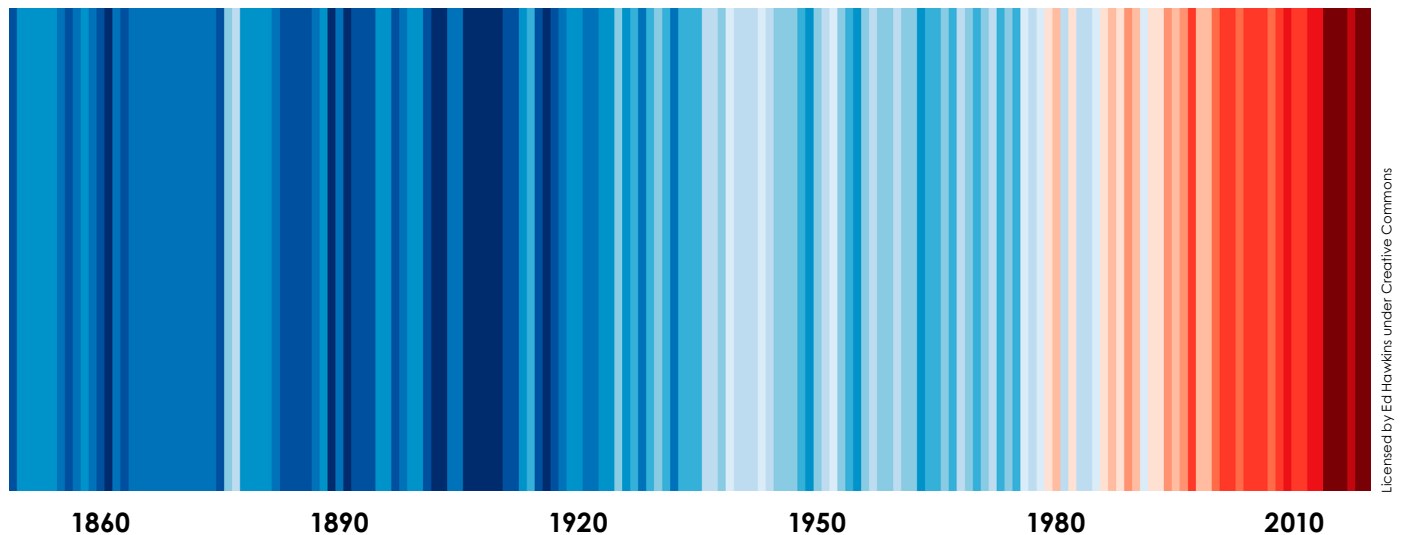
- To build a net zero prosperous economy, we **need to accelerate progress and engineer tipping points in six key systems:**
 1. **Decarbonise energy supply**, e.g.: renewable energy + storage; green hydrogen; sustainable shipping & aviation fuels
 2. **Transform energy demand**, e.g.: energy efficient buildings, planes, ships, industrial plants, etc.; green steel, cement and chemicals; well-designed cities; more circular business models
 3. **Recapitalise nature**, e.g.: restoring degraded land; alternative proteins to reduce pressure on land; regenerative agriculture; financing tropical forests and other key ecosystems
 4. **Finance net zero growth in developing countries**, e.g.: public finance to cut the cost of capital and attract \$1 trillion per year of private capital; stimulate early investments & trigger local market tipping points
 5. **Put methane back in the bottle**, e.g.: oil & gas fugitive methane emissions tracking & solutions; agriculture methane solutions; waste/landfill emissions solutions
 6. **Remove carbon dioxide:** combining nature-based and engineered solutions at the scale needed to deliver a possible 6GtCO₂e per year by 2030 and closer to 10GtCO₂e by 2040
- The good news is that we know how to do this and still have the option to build a prosperous net zero economy. **Not only that, the market dynamics set in train since the Paris Agreement created the conditions for dramatic progress in low-carbon solutions since 2015**, as demonstrated last year with the 'Paris Effect' report. This report assesses progress in the past year and dives further into how we can accelerate.
- By focusing on engineering tipping points, **low-carbon solutions could scale rapidly and push down emissions in sectors accounting for 90% of emissions by 2030**. We are **accelerating on some fronts** (e.g., solar/wind + storage; electric vehicles; plant-based meats; green steel) but **not moving nearly fast enough on others** (e.g., energy efficiency; heat pumps; developing country financing; nature-based/engineered CO₂ removals).
- **Accelerating action on the six key systems can deliver a host of benefits:** improved productivity & stable economic growth, jobs growth, more equitable wealth creation, more secure & resilient energy & food sources. The more that countries, companies and investors pull together and coordinate on this agenda, the faster we can move collectively to a prosperous net zero economy.

A RACE OF TIPPING POINTS

Emissions are not on track. To have a chance of staying under 1.5°C warming, we need to reduce emissions at 7% per year, every year. This year, global CO₂ emissions are expected to increase again by 5%, following a fall of only 6% in 2020 during the worst of the COVID pandemic.¹ The temperature continues to rise, with global average surface temperatures now 1.2 degree

Celsius above pre-industrial levels.² We are propelling towards **climate tipping points**: a series of one-way doors that will degrade and destabilize the world we live in, with the world's poorest communities likely to suffer the most. One need only look to the viral image of warming stripes (Exhibit 1) to appreciate how quickly this is moving.

Exhibit 1: Warming Strips - global temperature change 1850-2020³



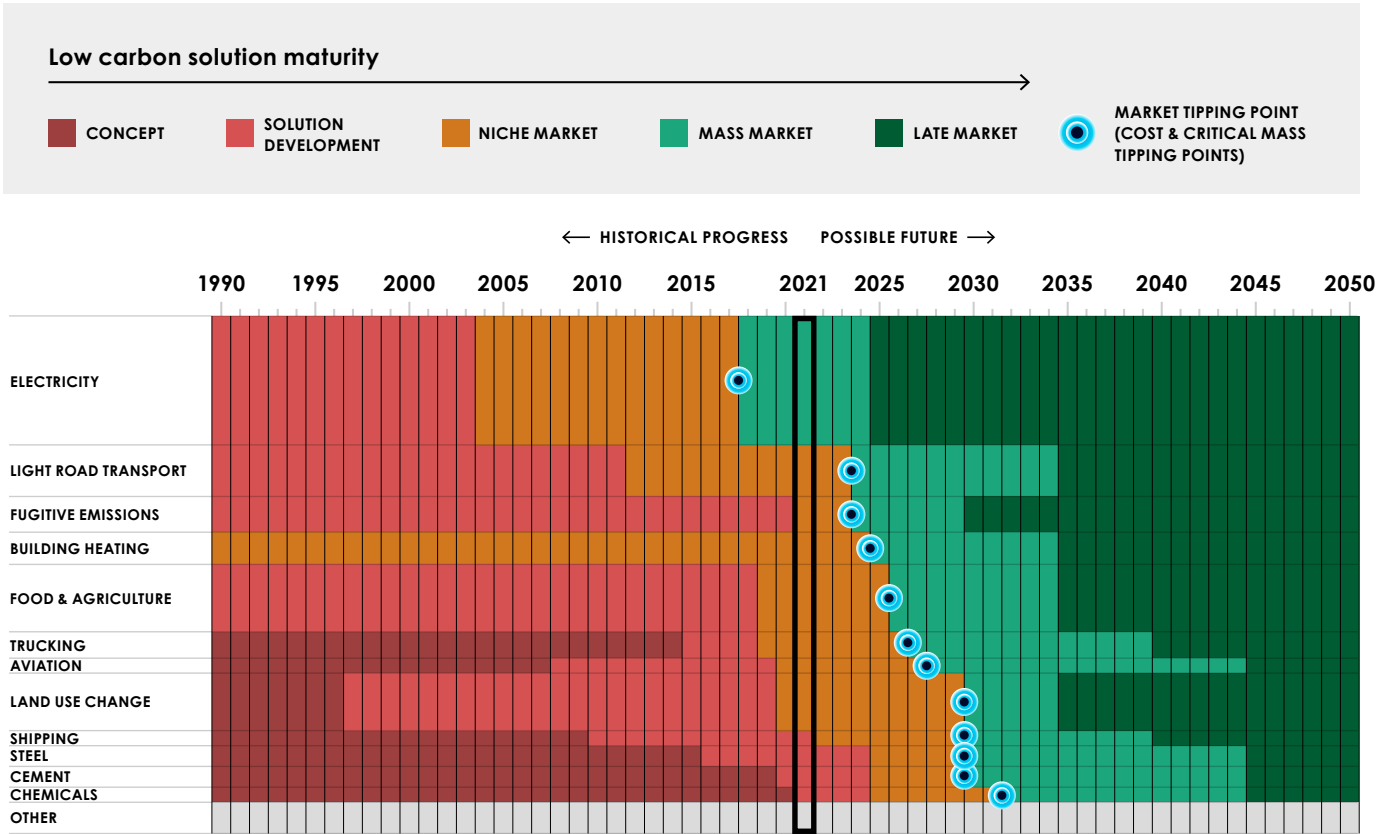
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But it is still within our reach to turn the tide if we can successfully harness the power of market S-curves. Last year with the 'Paris Effect' report, SYSTEMIQ showed how the market dynamics set in train since the Paris Agreement created the conditions for dramatic progress in low-carbon solutions. **This is leading to major market tipping points, where low-carbon solutions can out-compete legacy, high-carbon businesses.** When sectors cross these tipping points, the market dynamics shift in favour of low-carbon solutions, and they can proliferate far faster than anyone expected – as seen with the development of the solar PV industry – delivering adoption rates that follow an S-curve.

Today, low-carbon solutions are competitive in one critical sector: electricity. With investment now flowing into low-carbon solutions of all stripes, we could reach market tipping points in sectors representing 90% of emissions by 2030 (see Exhibit 2).[^] The key question, though, is **can we reach these market tipping points fast enough and then push remaining carbon out of the system**, before the climate tipping points set us on an uncontrollable path?

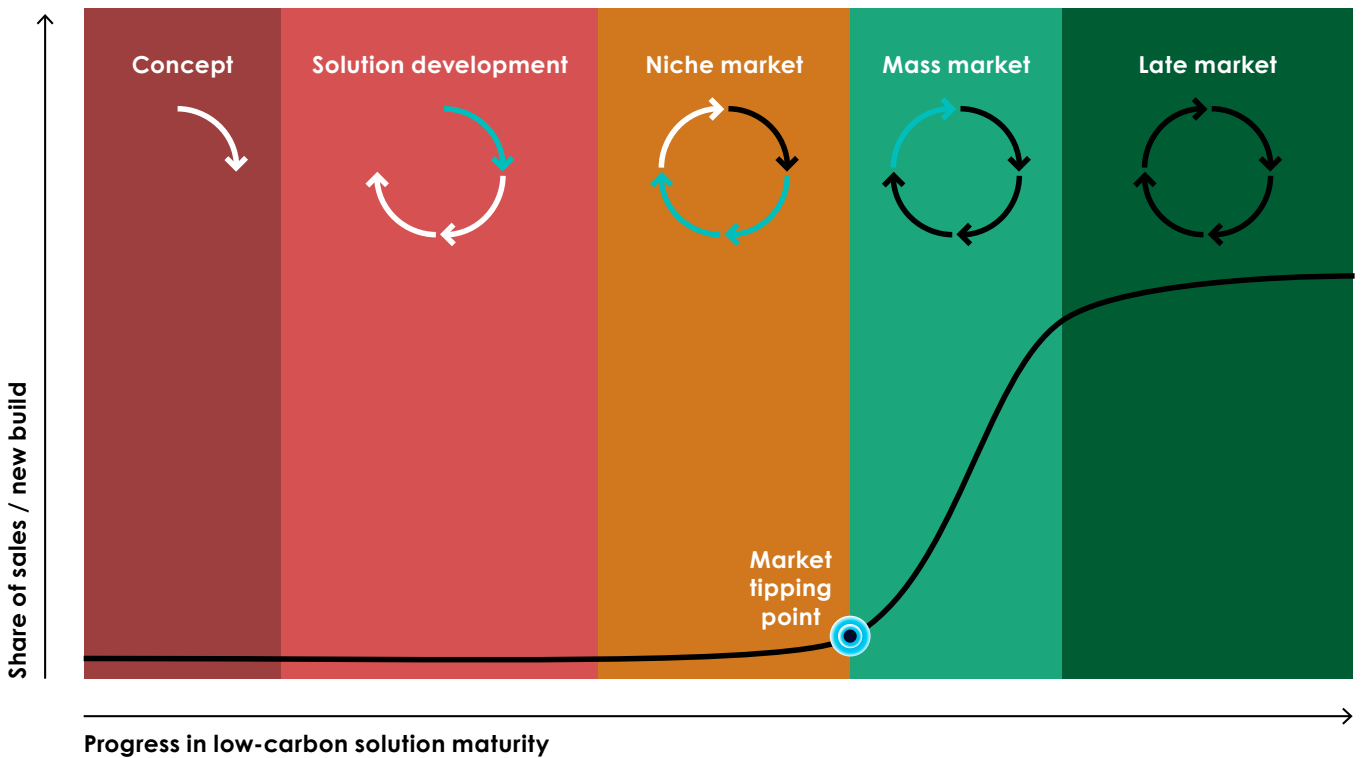
[^] Cost & critical mass tipping points; see Appendix A for details.

Exhibit 2: Low-carbon solution maturity by sector – progress since 1990 and possible future to 2050
 see details in Appendix A



Note: sectors sized according to 2019/20 emissions impact

Exhibit 3: Progress in low-carbon solution maturity leads to market tipping point which triggers an S-curve scale-up in share of new sales / new build



INDUSTRY ACCELERATION IN 2021, IN PART

How have low-carbon solutions fared in the most recent leg of this race, in 2021? Last year with the 'Paris Effect' report, we highlighted that progress on improving solutions 2015-2020 far exceed expectations. Across sectors, the advancement of solutions and level of activity in industry by 2020 was completely unforeseen back in 2015. These advancements in solutions were propelled by positive feedback loops: raised ambition > increased investment > solution improvement > market growth > raised ambition. The Paris Agreement set a clear direction and injected adrenaline into these feedback loops. Last year we highlighted that we were in a position to feasibly cross market tipping points before 2030 in sectors accounting for 70% of emissions. Has this picture improved or worsened given progress in the past year?

In the most advanced sectors – electricity generation and light road transport (i.e., cars) – we are already seeing real world outcomes show up surprisingly fast, as the S-curve upswing takes hold.

Renewable power generation from wind and solar has established itself as mass market technology than can outcompete fossil fuels. Over the last year, more than 80% of all new electricity capacity added was renewable, with 91% of this coming from new solar and wind installations.⁴ This radical acceleration has been driven by the relentless cost reductions seen over the last decade. Wind or solar PV has now become the cheapest form of new-build electricity generation in countries covering 77% of global GDP.⁵

Countries are now increasingly recognising the economic advantage of a zero-carbon power systems. Recent analysis found that a building a net zero energy system in the next 25 years would yield a net benefit of \$26 trillion for the global economy.⁶ In addition, it has now become clear that the renewables industry is considerably more jobs intensive than the fossil fuels industry, has at least twice as large of an impact on GDP⁷, can accelerate energy access, and can contribute to energy security, reducing dependency on volatile fossil fuel markets. Countries are accelerating the ramp up of renewable generation to reap economic and jobs benefits, with several systems today already operating with daily wind + solar percentages reaching 60% or more.⁸

Electric vehicles (EVs) are finally experiencing the surging demand across global markets that has long been anticipated. In 2020, the sales EVs jumped to 3 million, or 4% of the global market, with 330 full electric or hybrid models now available.⁹ Last month, the Tesla Model 3 became the first battery electric car to ever top Europe's monthly sales chart. This trend is expected to accelerate rapidly in coming years with EVs expected to reach sticker price parity with internal combustion engine (ICE) vehicles by 2024, as lithium-ion battery prices continue to fall.¹⁰ Car manufacturers are now increasingly seeing the writing on the wall, with 7 companies already set to phase out ICE vehicles completely by 2025-2035.¹¹

In many other sectors we do not yet have market share outcomes, but we are seeing advances in solutions accelerate and bring us closer to market tipping points.

In the food and agricultural sector, investment in alternative proteins (i.e., plant-based meats, cultured meat) is growing at exponential rates. Alternative proteins have seen rapid technical development and record investment growth with an estimated \$3 billion being raised by the sector in 2020, a 3-fold increase from 2019.¹² The sector is now widely expected to take off rapidly in the coming years, with predictions seeing the alternative



protein market reach an \$27 billion by 2027 and as much \$290 billion by 2035.¹³ As such, prices for alternative proteins are beginning to fall due to competitive pressure and economies of scale. It is estimated that plant-based meats could reach price parity between 2023 and 2025 and cultured meat by 2030–2032.^{14,15}

Large multinationals are encouraging and incentivizing their suppliers to take up regenerative agriculture.

Regenerative agriculture is seeing increasing interest from a range of actors hoping to produce agricultural goods that are nature positive. For example, Nestlé has committed to spending \$1.4 billion to help farmers transition to using regenerative agriculture practices while also planting 20 million trees.¹⁶ Similarly, PepsiCo aims to spread regenerative farming practices across 7 million acres, approximately equal to its entire agricultural footprint by 2030, eliminating at least 3 million tonnes of CO₂e by 2030.¹⁷ The Walmart Foundation has committed to help protect, manage or restore at least 50 million acres of land and one million square miles of ocean by 2030.¹⁸ Syngenta are aiming to enhance biodiversity and soil health on 3 million hectares of rural land every year, while investing \$2bn in sustainable agriculture breakthroughs by 2025.¹⁹

Hydrogen production costs are expected to fall rapidly as large-scale production ramps up. Green H₂ production costs have the potential to fall drastically in coming years, driven by rapidly decreasing renewable electricity prices and dramatic reductions in electrolyser costs. Companies have ramped up their ambitions on hydrogen as they seek to tap into the future growth in the market, with a project pipeline of over 50 GW of electrolyser capacity now announced. Over 30 countries have released hydrogen roadmaps, with 13 full national hydrogen strategies, including in major emerging economies such as India and South Africa. Industry initiatives, such as the Green Hydrogen Catapult and Reliance Industries' India strategy, are aiming to drive green H₂ costs down to below \$2/kg by 2025, which would unlock major breakthroughs for low-carbon solutions in other industries, including hard-to-abate sectors such as steel, cement, shipping, and aviation.²⁰

In the steel sector, low-carbon technologies have demonstrated their feasibility and are set to reach commercial scale production in the coming years. This August, the HYBRIT (Hydrogen Breakthrough Ironmaking Technology) project in Northern Sweden produced the world's first batch of "fossil free" steel from hydrogen, with Volvo as its first customer. Timelines for similar projects have since accelerated, with 11 hydrogen-

based steel projects now announced across Europe. ArcelorMittal's Sestau plant in Spain aims to become the world's first full-scale zero carbon steel plant by 2025.²¹ This has given increasing confidence to producers that decarbonisation is both feasible and economical, with more and more companies, especially outside Europe, now adopting net zero targets.²²

The HYBRIT project is a first step towards developing new supply chains based on cheap renewable electricity, which will see new industrial clusters emerge in areas with abundant resources. For example, another Swedish firm, Northvolt, is now developing Europe's first battery Gigafactory close to the Arctic Circle, utilising the plentiful local wind and hydro power for site's energy consumption. The BMW group will source batteries for EVs from this site by 2024, as well green steel produced at another plant in the region by 2025.²³

In the aviation sector, there has been a rapid acceleration in efforts to bring forward low-carbon solutions over the last year. In September 2021, 60 companies agreed to use a minimum of 10% of sustainable aviation fuel (SAF) by 2030 across their operations, with more than 20 companies having now already signed long-term purchase agreements with suppliers.²⁴ This is leading to a sharp increase in efforts to build out large-scale SAF production capacity. For example, in October this year, the world's first power-to-liquid jet fuel plant opened in Germany.²⁵ As with steel, these breakthroughs have allowed for more ambitious climate goals. Last month, the global trade body IATA announced its commitment to net zero aviation by 2050 globally, representing 290 airlines and 82% of total air traffic, a step that was unthinkable just a few years ago.

However, progress is faltering in a number of key sectors, with more coordinated action required for material progress to occur.

Energy efficiency is not improving at the levels required to align with a net zero trajectory. The Energy Transitions Commission finds that **maximising energy productivity could lead to an overall reduction in energy demand of 15% by 2050** relative to current levels. Improving material efficiency could cut emissions from harder-to-abate industrial sectors by 40% by 2050 and improving product/service efficiency could significantly cut building and mobility related energy use (by 5-10%).²⁶ Despite these opportunities, recent improvements in energy productivity have been disappointing, with annual improvement rates of only 1.5% in 2018 and 1.6% in 2019, falling to just 0.8%

in 2020. This disappointing performance reflects often-long lead times for retrofits, the need for collective action across a large group of actors, difficulties in accessing the right kind of financing (especially for retrofits) and lack of clear government plans.²⁷

In building heating, considerably more action is required to ramp up heat pump usage. Between 2020 and 2021, the global heat pumps market is expected to have grown only fractionally from \$112 billion to \$117 billion²⁸ and heat pumps serve only 5% of residential heat demand.²⁹ Heat pumps as a technology are relatively well developed but prices can only come down if incentives are provided and government regulations are introduced that stimulate mass adoption. Ambitions now seem to be ramping up with more government roll-out plans announced in the EU, UK, and US, though a considerable acceleration is still required.

The enabling conditions for alternative proteins to reach market tipping points and to then displace animal protein consumption are still not present. Despite the rapid development of the alternative proteins market, this is not yet translating into major changes in meat consumption patterns in most developed markets. Europe, for example, is still overconsuming meat by around 30%.³⁰ For meat consumption to fall and tipping points to be reached, this will require not just cost competitiveness of alternative proteins, but a range of measures to shift cultural norms, improving performance, accessibility and capability (the skills and knowledge of consumers and food service providers).³¹

There is still a major funding gap for nature-based solutions to help limit climate change. Nature continues to receive just a fraction of total climate financing, with ~3% of total funding, despite representing a much higher share of potential mitigation.³² FOLU estimates that the amount of finance for forest protection and restoration needs to be increased by \$65 billion a year.³³ Investment in nature-positive business models have been hard to scale, largely due to nascent business models, unusual counterparties (e.g. smallholders or indigenous communities), small scale and long-pay back periods. Fortunately, the market now finally appears to be starting to move in the right direction, with private finance into nature accelerating through company initiatives (e.g., the Bezos Earth Fund commitment together with other leading foundations of \$5bn for the restoration of nature and conversation and HSBC has launched a \$1bn natural capital investment fund)^{34,35}, and the voluntary carbon market, which is set to reach \$1 billion in transactions in 2021

(3x 2020 levels³⁶) with the potential to scale to \$50 billion by 2030.³⁷

Significant and rapid reductions in methane emissions are urgently required. Today, global methane emissions from oil and gas are estimated at around 80 million tonnes per year, or 6.7 billion metric tons of CO₂ equivalent (20-year horizon).³⁸ After largely being ignored for many years, countries are finally starting to take this seriously, with the EU and U.S. pledging to cut methane emissions by 2030 in September of this year.³⁹ However, progress remains far too slow, and many major emitters, China, India and Russia, have so far not joined the Global Methane Pledge. Low-cost solutions exist and could reduce emissions by 60% by 2030 at little extra cost, but global coordination and forceful action is now required.⁴⁰ Beyond oil and gas, agriculture contributes 45% of total methane emissions, with 80% of this from livestock production and the second-largest contributor is rice production⁴¹ Solutions to reduce are similarly coming forward however methane emissions have not received nearly sufficient focus to date; we need a step-change in attention & support to improve & scale solutions.

Carbon removal projects should be developed today to ensure they can play a role in reducing emissions before 2030, and at considerable scale by 2050. Negative emissions solutions will be required to achieve net zero to a) compensate before mid-century for a potential carbon budget overshoot resulting from not reducing emissions⁴² fast enough and early enough, as well as b) to compensate after mid-century for continual residual emissions. A potential ramp-up pathway for carbon dioxide removal (CDR) solutions could see removals of 6GtCO₂/year by 2030 almost entirely from nature-based forms of sequestration, rising to c.10 Gt/year in 2040 and nearly 16GtCO₂/year in 2050 with as much as 6GtCO₂/year of this from hybrid and engineered approaches (e.g., biochar, BECCS, DACCS)⁴³. It is possible to achieve 0.1 GtCO₂ carbon removal by 2030 via these hybrid and engineered solutions. These have so far been limited in scale, but there are encouraging signs of progress with, for example, the opening of the world's largest Direct Air Capture (DAC) facility by Climeworks in Iceland in September. This site will be able to store 4,000 tonnes of CO₂ per year, and has corporate clients including Microsoft, Stripe, Shopify, and Audi.⁴⁴ Developing early projects such as these in the 2020s are needed to ensure these technologies' costs fall and are available to deploy at scale beyond 2030.⁴⁵

See Appendix B for further information on meaningful indicators of change 2020-21 in each emissions sector.

ACCELERATING SHIFTS IN THE OPERATING ENVIRONMENT

The public, governments, corporates, and the financial community have stepped up pressure in the past year; this increases motivation across all sectors to accelerate the transition.

There has been a fundamental shift in public opinion in relation to climate change over recent years, translating into major political and legal shifts. As evidence of environmental damage becomes ever more apparent. Voters, consumers, and employees are becoming increasingly climate conscious. 73% of people in G20 countries now believe Earth is approaching potentially abrupt or irreversible tipping points because of human action.⁴⁶ In the US, 70% of voters believe corporations and industry should do more to address global warming and support transitioning the U.S. economy, uniting the electorate across party lines. The issue has already started to re-draw the political map. In Germany's 2021 general election, the Green Party became the country's third largest party and is highly likely to be part of the next government. This pressure is also translating into legal

impositions for both government and corporations. In the Netherlands, a landmark court ruling ordered Shell to reduce its greenhouse gas emissions by 45% from 2019 to 2030.⁴⁷ Overall, there has now been over 1,000 climate change related cases have been brought forward in the last six years. On the other side of influence, the oil sector's lobbying spend is now down 36% from the peak in 2009,⁴⁸ albeit still supporting fossil fuels with pre-tax subsidy regimes worth almost \$500bn in 2020.⁴⁹

The last year has seen a proliferation of net zero announcements from states, major corporations and investors. 131 countries have now committed to achieve net zero emissions, representing 73% of the world's emissions, up from 57% last year and just 6% in 2017. The recent net zero announcements from the UAE and Saudi Arabia demonstrate that even oil-rich states are increasingly taking the energy transition seriously, as the economics turn ever more in its favour. Momentum has also grown across industry, with over 3,000 major business and 173 of the world's largest investors adopting the same goal.⁵⁰

Governments have begun deploying policies with more teeth to support the transition, which can start to shift the economics in favour of low-carbon solutions. In the EU, the carbon price in the emissions trading system rose dramatically this year, after years of flatlining, breaching



60 EUR/ton for the first time in August 2021. With the addition of China's national ETS carbon pricing system in July 2021⁵¹, carbon pricing policies now cover 23% of the world's emissions.⁵² G20 countries – including critically China with their Belt and Road Initiative – committed to stop funding coal overseas by the end of the year, however commitments on curbing the use of coal domestically remain lacking.^{53,54} The launch of the European Green Deal, UK net zero plan, and U.S. Climate plan, are set to unlock trillions in investment to accelerate the transition. The introduction of concrete policies with clear timelines within these packages, such as the proposed SAF blending mandate for aviation in the EU, can radically accelerate the timelines for low-carbon technologies.⁵⁵

Many developing countries are showing leadership in climate policy, especially for the protection and restoration of nature. For example, Indonesia has managed to deliver a 75% reduction in primary deforestation and peatland degradation in 2020 (vs. 2019), with progress continuing this year.⁵⁶ Even more impressively, the country has succeeded in limiting forest fires to a minimum this year. In the fire season of July to October, Indonesia contributed less than 0.5% of global fire emissions.⁵⁷ In October, Indonesia established a landmark carbon trading system by 2025 that can support the development of a nature-based solutions industry, as shown by Colombia's implementation of a similar system.⁵⁸ The country also stepped-up commitments on energy generation, alongside Malaysia, by pledging to develop no new coal-fired plants.⁵⁹

Governments and the financial sector are mobilising more capital towards climate solutions. Global sustainable bond issuances are forecast to grow 60% over last year's record levels to reach \$850bn in 2021.⁶⁰ The EU and UK both issued their first ever green bonds in the last few months, with sales of €12bn and UK £10bn in debt respectively, attracting massive demand from investors.⁶¹ The UK green bond also has a unique social co-benefits requirement – demonstrating that even the financial community is waking up to the link between people and planet and the links between social inclusion, job creation and the Paris Agreement.⁶² Canada has created a national infrastructure bank aiming to deploy CAN\$6bn into areas like EV charging, renewables, and energy efficiency retrofits. In private markets, the pool of capital for climate solutions has also expanded considerably, with General Atlantic and TPG announcing plans to raise growth equity climate funds of a reported \$4bn and \$5bn, respectively. This is being reflected in greater deal activity in the sector, with climate tech start-ups raising

~\$16 bn across ~250 transactions in the first half of 2021, representing a ~50% increase in deal activity year-on-year.⁶³

However, much more effort is required from developed countries to provide climate finance for developing countries. Developed countries are still not meeting their pledge of providing \$100 bn in climate finance to developing countries, with only \$80 bn provided in 2019, in a mix of loans and grants.⁶⁴ If the \$100 bn target is met via grant-equivalent financing, it could unlock up to \$1 trillion in additional financing from the private sector, the estimated required amount to reach net zero in developing countries.⁶⁵ The \$100bn public support is crucial to de-risk investments, helping to lower costs of capital in developing countries for low-carbon solutions which are typically capital intensive (high CapEx, low OpEx). Lowering the cost of capital, and stimulating early investments in developing countries, is critical to ensure they too experience market tipping points where low-carbon solutions outcompete high-carbon. Significant investment and a lower cost of capital will also be critical in helping those developing countries most exposed to climate change to invest in adaptation measures. If designed well, adaptation efforts can be combined with both mitigation and wider development efforts. These three outcomes are all served by many of the same initiatives, e.g.: resilient clean energy grids, strengthened (and more local) agricultural value chains, improved public transport systems.



INVESTMENT IMPLICATIONS ARE HERE & NOW

The shift is inevitable. By mid-century, we could very feasibly have crossed tipping points in all sectors, and be into “late market” stage, i.e., have low-carbon solutions outcompeting high-carbon solutions, capturing nearly 100% share of new sales / build (see Exhibit 2). However, we may not get there fast enough for the climate. Stock and flow dynamics mean that legacy high-carbon assets could still be in the system by mid-century, even if no longer being built. The unavoidable point for investors and governments, though, is that the speed or progress and resulting S-curves adoption rates will reshape the global economy. Further, investors who invest ahead of the curve, and governments who create enabling environments to accelerate market tipping points, will reap economic benefits. Investments that ignore this understanding of the future stand to lose money, and governments who don't seize these opportunities will see their countries fall behind.

There is no longer any meaningful investment case for long-life high-carbon infrastructure assets – they are simply too risky from a commercial perspective. We have crossed tipping points in electricity, and can see them around the corner in road transport. Consequently, the European electricity sector wrote down \$150bn in the past decade, and with falling oil demand in the past two years North American & European oil companies had record write-downs of over \$150bn.⁶⁶ The spread in cost of capital for hydrocarbon vs. renewable developments has widened by 10 percentage points in the last 5 years.⁶⁷

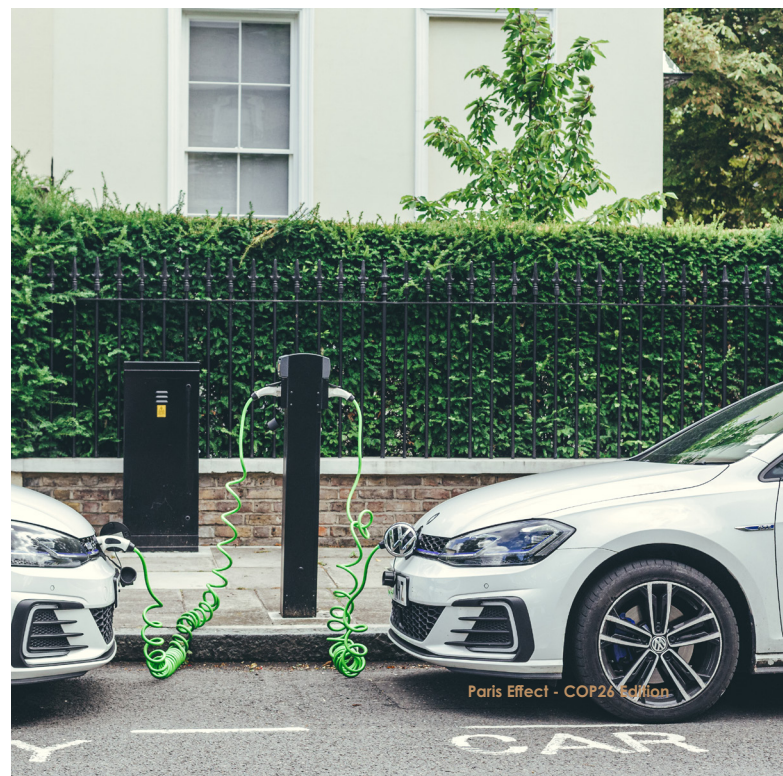
Borrowing costs for long-cycle oil developments are now over 20%, compared to 3-5% for renewable power investments; equivalent to a carbon tax of \$80/ton,⁶⁸ driving the start of a turning point in energy investment. The smart long-term capital is now well ahead of policymakers in most countries in terms of their de facto carbon pricing regime.

Consider that by 2040 we may have crossed market tipping points in all emissions sectors (see Exhibit 2), the demand for high-carbon products will be in rapid structural decline by then (and probably much earlier) and any returns for enabling infrastructure undercut. **For any infrastructure asset built today that serves a high-carbon value chain, the revenues from 10-years out should be seriously questioned.** Infrastructure investors should also pay close attention to reinforcing downward spirals that will accelerate the decline of high-carbon assets. Consider a gas pipeline with costs shared amongst

gas customers. As customers switch to low-carbon solutions (e.g., electric) the cost of the pipeline is spread amongst fewer customers, increasing their cost of gas, and pushing more customers to switch away.

The renewables sector is delivering greater returns for investors and attracting more talent, creating a positive virtuous cycle. This shift away from fossil fuels is reflected clearly in stock market returns, with listed oil and gas majors generating negative total shareholder return of -18% from 2017-2020, while leading renewables companies returned 30%, higher than those for big-tech stocks.⁶⁹ The same shift can be seen in new patent filings, with data showing that the number of patents for low carbon technologies has increased 50% in the last 10 years, while the number of fossil fuel patents have dropped by 18% since their peak in 2015, reflecting the technological exhaustion and brain drain from the sector.⁷⁰ As more engineers and capital continue to switch tracks in response to diminishing returns, the industry decline process will be further accelerated.

There are implications as well for how we avoid future energy supply crunches. Historically, tightness in fossil energy supply could only fundamentally be addressed with investments in new supply. Today, the situation is different. Market tipping points, and the resulting S-curve upswings are within reach for many sectors. We can invest to reach these tipping points sooner, and thereby push down fossil fuel demand in the coming years, instead of investing to increase supply. Or put differently, we invest to boost clean energy supply instead of fossil energy supply. Beyond climate, these investments will bring countries benefits in more resilient energy security, less reliance on energy imports and better trade balance.



WE CAN ENGINEER MARKET TIPPING POINTS

There is now no more time to waste. In order to avoid crossing dangerous climate tipping points, we must engineer market tipping points to happen sooner. The development and roll-out of vaccinations during the COVID pandemic shows that it is possible to dramatically reduce technological timelines when circumstances require it. There is no reason why the same cannot be achieved for low-carbon solutions. However, targeted actions will be required to speed up the transition. To engineer market tipping points and unleash S-curves, countries can focus on:

A. Supporting critical early niche markets and R&D:

Confident that early niche markets provide the circumstances to drive innovation, countries should focus support on growing these niche markets – e.g., through public procurement and mandates that create early markets – and enabling R&D investments. A well-recognised example of success is the UK offshore wind industry: it received targeted government support, saw rapid cost declines, and now offshore wind is at the centre of clean electrification plans for the UK.⁷¹ Taiwan recently achieved a similar feat with a now burgeoning offshore wind industry.⁷² Both examples highlight that country investments lead to country-benefits in a mature local industry & supply chain. There are a multitude of similar opportunities present today to support niche markets then reap the benefits of innovation. Examples include: cold climate reversible heat pumps (e.g., in U.S. north-east); long-haul hydrogen-electric trucks (e.g., in Canada, Chile); alternative proteins (e.g., in Europe/U.S. where cultural tipping points may be closer); green ammonia for fertiliser especially as it could outcompete grey once green hydrogen reaches \$1kg;⁷³ sustainable aviation fuels.

B. Investing ahead of the curve: With a proper appreciation of how fast the incline on the S-curve can move, countries should support large-scale investments in anticipation of these swings, and to enable these swings through de-risking (e.g., underwriting, enabling regulation, support for project development and pre-feasibility assessment), and with direct investments (e.g., PPPs and blended finance structures and products). Critical examples today include: electricity & charging network build-out in advance of electric vehicles rapidly scaling market share; investing in nature-based solutions now in advance of rapid expansion in markets that value & pay for nature; building fuel supply chains for e-fuels (e.g.,

ammonia, synfuel) including critical transport & storage infrastructure. Further, countries should be forecasting these S-curves within their modelling (e.g., energy system modelling, economic modelling). This is self-reinforcing: proper modelling of S-curves leads to proper investments which enable the S-curves outcomes to take place. This is particularly important in emerging markets, where well-informed policy combined with targeted use of development finance can unlock significant private investment by mitigating certain country- and sector-specific risks.

For the financial community, it is imperative to anticipate the inevitable policy response and re-allocate assets ahead of time. More action is needed today to write-down long-lived fossil fuel assets off balance sheets, while ramping up investment in climate solutions. Further, governments can help accelerate the retirement & write-down of long-lived fossil assets with subsidies & incentives, e.g., direct compensation to owners for foregone profits, subsidising investments into new clean energy (or other) industries at the same site. It is also often important to invest in human capital alongside, i.e., worker re-training & re-location support as appropriate. One example of accelerating fossil asset retirements includes the potential public international finance deals being negotiated between developed countries (e.g., US and others) and developing countries (e.g., South Africa, Indonesia) for compensation of increased costs to pursue an accelerated pivot from coal-based power systems to renewables-based power systems, i.e.: cost of early retirement of economic plants; retraining costs to support workers to benefit from the resulting growth in renewables jobs.

C. Send signals with confidence: Confident that industry can innovate at pace and markets can move on S-curves, countries can send a collection of signals forecasting the "late market" stage, including: sector-specific carbon prices that escalate in time; targets for share of market served by low-carbon; regulations; dates for bans on high-carbon options. These signals can shake industries out of stasis. The most evident example today is ICE bans. Other critical examples include: carbon price on steel & carbon border adjustments; target date for bans on deforestation-linked agricultural commodities, or new gas connections to buildings; target for upstream methane emission reduction in oil & gas. Additionally, it is imperative that countries shift public support and incentives away from carbon-intensive industries. There are still large amounts of subsidies, regulations, standards, and COVID-recovery packages that favour high-emissions products and industries. Transparency and metrics are required to ensure that these handbrakes on progress are lifted.



D. Establish international alignment, links & support: To help mobilise global industry players, multiple countries can set similar standards & targets (e.g., on certification of low upstream emissions oil & gas). To achieve the lowest-cost low-carbon solutions, countries can establish new global value chains (e.g., sourcing ultra-low-cost green ammonia from countries with very high solar & wind resource). To help developing countries be “fast followers” and capture the benefits of low-carbon solutions soon, developed countries can support with:

i. Enabling low-cost capital for low-carbon solutions,

confident that these solutions are competitive and provide attractive low-risk returns. This is critical since low-carbon solutions are typically more capital intensive (higher CapEx but much lower OpEx) and developing countries have a high cost of capital. Development Finance Institutions play a central role in taking on greater exposure to potential losses, to mobilise private capital flows at the scale required (\$1 trillion p.a. into developing countries⁷⁴). To reach this goal, developing countries must deliver on their pledge in the Paris Agreement of providing \$100 bn in climate finance to developing countries, and do so via grant-equivalent financing using mechanisms designed to mobilise private capital (e.g., guarantees).

ii. Technical advice on regulatory changes: An attractive regulatory environment is the single biggest lever to encourage private capital to flow into low-carbon solutions in developing countries. In 2016-2019, the top 47 countries with the best regulatory environments attracted 17-times as much investment into clean energy solutions as did the bottom 60 countries with ill-suited regulations.⁷⁵

iii. Funding a just transition: An accelerated transition creates more social dislocation. Fossil industry workers should be supported to benefit from the transition, including supporting local skills development and training. This will limit political objection and enable a more rapid transition.

iv. Finance for nature: Crucially, flows of finance from developed to developing countries are urgently needed to cover the short-term opportunity cost of preserving tropical forests rather than exploiting them for alternative activities such as feedstock crops or cattle rearing, and to support reforestation.

See Appendix B for select actions to accelerate market tipping points by sector.

CLOSE

We have just a few years to radically transform our economy and avert climate tipping points. The good news is that we already have most of the low-carbon solutions we need, and they are fast becoming competitive thanks to positive feedback loops that were triggered and boosted by the Paris Agreement. In some sectors, tipping points are now being reached that will unlock a rapid transformation to low-carbon systems. For the sectors that are still stuck in high-emissions technologies, we know it is possible to engineer market tipping points to accelerate the pace of change. Pressure from the public, governments, corporates & finance is accelerating.

This will fundamentally reshape the global economy. It presents an historic opportunity to improve livelihoods and generate more wealth, this time more equitably. For smart investors and companies, the potential returns are

massive. For those that do not move fast enough, they will miss this train and find themselves with the wrong investments when markets recognise this inexorable shift and reach the 'Minsky moment'. Countries who see the opportunity will benefit from more resilient energy & food supplies and create millions of good-paying jobs. Countries who delay will be left with economies reliant on increasingly volatile and risky old-economy industries.

The COVID crisis has shown us again that in moments of concentrated energy, new solutions can be found and deployed faster than anyone previously imagined. The same concentration is required for decarbonisation. We are starting to finally see that attention as companies & investors appreciate the crisis and appreciate the benefits of building low-carbon industries. It's way past time – let's speed up.



APPENDIX A: LOW-CARBON SOLUTIONS MATURITY BY SECTOR – HISTORICAL & EXPECTED YEAR OF SHIFT INTO A NEW STAGE OF MATURITY

Indicators informing categorisation of low-carbon solution maturity	Solution Development Year Investments are being made in solution, technologies and/or projects are being deployed even at commercial scale but limited to few instances. No consistent market as yet.	Niche Market Year Solutions have found a market to serve, even if early niche market, e.g., supported by public procurement or considerable minority of buyers willing to pay a premium.	Mass Market Year Solution is serving >5% of new sales / build (differs by sector, depending on sector dynamics), and a market tipping point has been crossed that is pulling the share served by low-carbon solution upward at an accelerating pace.	Late Market Solution Year Regulations are spreading in many countries that will drive the high-carbon incumbent solutions / activities towards 0% market share over time.
Electricity - Solar & Wind	<1990	2004 Germany launches feed-in-tariff system for solar & wind	2018 Solar & wind outcompete coal/gas on price in most countries; 2/3 new capacity	2025 Solar & wind + battery storage cheaper than fossil fuels in most countries
Light Road Transport - Electric Passenger Vehicles	<1990	2012 Tesla launches Model S, quickly reaches best-selling car in Norway	2024 EVs reach sticker price parity with ICE vehicles ⁷⁶	2035 EVs account for over 80% of new car sales globally
Fugitive Emissions - Tracking Methane from Oil & Gas, Premium Market	<1990 Methane certification is being explored with various initiatives appearing	2021 ~10% of US gas production signed up to methane certification initiatives	2024 Methane certification initiatives gain 30% market share, drive abatement	2030 Methane certification and resulting market prices drive abatement towards goal of 75% abatement, i.e., 5.7 GtCO ₂ e per year savings
Building Heating - Heat Pumps	<1990	<1990 First meaningful deployments in Sweden in 1970s (GSHPs) ⁷⁷	2025 Falling costs and incentives result in cost parity. note: in some geographies reversible heat pumps already at cost parity with vs. [gas boiler + AC]	2035 Ban on sale of new gas boilers. Higher taxes on gas
Food & Agriculture - Plant Based Alternative Proteins	<1990 First commercially available alternative protein burgers	2019 Fast food restaurants begin to serve alternative protein burgers ⁷⁸	2026 Price begins to compete with existing proteins	2035 Alternative proteins become a staple in most diets, meat is more heavily taxed
Trucking - Electric Trucks	2015 R&D efforts begin	2019 BYD electric trucks commercially available in China	2027 TCOs for electric trucks becomes competitive with ICE vehicles ⁷⁹	2040 Electric trucks over 50% new sales in some markets
Aviation - Sustainable Aviation Fuels	2008 First flight with blended biofuels	2020 20+ SAF offtake agreements signed, first large-scale deliveries	2028 SAFs account for 10% fuel consumption on most major airlines	2045 SAFs account for >50% fuel consumption in major developed economies
Land Use Change - NBS Revenue Stream through Value for Nature	1997 REDD first tabled at Kyoto protocol negotiations	2020 Major corporations and governments back NBS	2030 Voluntary carbon market reaches \$50 billion per year ⁸⁰	2035 Majority of companies set NZ nature-positive SBTs or carbon removal targets
Shipping - Sustainable Shipping Fuel	2010 R&D efforts begin	2022 First zero-carbon ships hit the water ⁸¹	2030 Zero-emissions fuels make up 5% of total consumption globally ⁸²	2040 Carbon tax makes zero-carbon fuels cost competitive
Steel - H2 Reduction	2016 Launch of first major H2-based Steel project ⁸³	2025 First large-scale green steel production. Industry plants in clean heat generation and low-carbon chemistry ⁸⁴	2030 Green steel accounts for 5% of global market with carbon price at approx. \$70/t. ⁸⁵	2045 Majority of virgin steel produced from low-carbon methods
Cement - Carbon Capture	2020 First zero carbon cement projects using CCS get approved	2025 Low carbon cement starts being produce using CCS	2030 Over 10% of the cement market is zero carbon	2045 Regulations and taxes lead to majority of cement being zero carbon
Chemicals	2021 Decarbonisation targets announced to increase use of renewables, electric steam cracker pilot and other solutions	2025 Zero carbon chemicals start being produce using large-scale electrolysis and CCS. Mechanical recycling accounts for <14% total, chemical recycling accounts for <0.1%.	2032 40% of plastics recycled and/or reused. CCS introduced to cover 10% sectoral emissions. Large-scale use of electrolysis for chemicals.	2045 >75% of emissions eliminated or stored including CCS

Note: Many dates informed by industry expert views based on market analysis and industry movements seen to date. Low-carbon solution maturity dates are directional and may potentially occur over a range of years.

APPENDIX B: MEANINGFUL INDICATORS OF CHANGE 2020-2021, AND SELECT ACTIONS TO ACCELERATE

Sector	Meaningful Indicators of Change 2020-2021	Select Action to Accelerate Market Tipping Points
Electricity - Solar & Wind	<ul style="list-style-type: none"> Renewable power projects expected to become the largest area of spending for the energy industry in 2021, for the first time ever.⁸⁶ More than 80% of all new electricity capacity added was renewable, with 91% of this coming from new solar and wind installations.⁸⁷ Wind or solar PV has now become the cheapest form of new-build electricity generation in countries covering 77% of global GDP, and two-thirds of the world's population.⁸⁸ 	Mass Market → Late Market <ul style="list-style-type: none"> Commit to a global coal phase out by 2040, to provide clear target to the market. Increase carbon prices and end fossil fuel subsidies, to create proper incentives. Upgrade transmission and distribution networks, extending to regions with high sun/wind, to de-risk & reduce costs for developers. Reduce borrowing costs in EMs for large-scale renewables projects (e.g., through DFI/ MDB guarantees), and targeted financial support for early coal retirement.
Light Road Transport - Electric Passenger Vehicles	<ul style="list-style-type: none"> Sales EVs jumped to 3.1 million in 2020, accounting for 4% of the global market, with 330 full electric or hybrid models now available on the market.⁸⁹ In September, the Tesla Model 3 Europe's monthly sales chart becoming the first EV to ever do so a trend expected accelerate in the coming years.⁹⁰ 	Niche Market → Mass Market <ul style="list-style-type: none"> Roll-out charging infrastructure and upgrade networks ahead of imminent EV demand upswing. Expand low-emissions zones in cities. Provide subsidies to close sticker-price gap in next 2 years to stimulate "early majority" to start to go electric faster. Ban new sales of ICE vehicles by 2035 (or earlier), and introduce strict regulatory standards (i.e., mandates or CO₂ emissions standards) to push manufacturers to move more swiftly to ramp EV sales.
Fugitive Emissions - Tracking Methane from Oil & Gas, Premium Market	<ul style="list-style-type: none"> Range of initiatives developed to address methane, including the EU's 2020 Methane Strategy, state-level targets set by New York and California, and industry-led efforts such as upstream oil and gas methane intensity targets from the OGCI. The U.S., EU, and several other countries jointly pledged to cut methane emissions by at least 30% by 2030. However, several large methane emitters did not sign-up, including China, India, Russia, and Brazil.⁹¹ Growth in the sector is starting, such as MiQ, a methane emissions certifier, which will certify almost 2% of global gas production (including Exxon) by the end 2021, up from zero in 2020.⁹² 	Niche Market → Mass Market <ul style="list-style-type: none"> Target 40+% methane reduction by 2030 (entirely economic). Strong national regulations, starting in the top emitting countries, specifying maximum acceptable leak rates (well below 1%) and applying large fines for excess leaks. Commit to standardised international satellite monitoring programmes for methane emissions measurement R&D funding for methane detection and prevention technologies. Provide financial support and incentives for low-income countries to detect and reduce/capture fugitive methane emissions.
Building Heating - Heat Pumps	<ul style="list-style-type: none"> Global heat pumps market is expected to have grown only fractionally from \$112 billion to \$117 billion from 2020-2021.⁹³ Heat pumps expected to be a significant lever in the EU's 2050 climate ambitions over the coming years, as mentioned in its Strategy for Energy System Integration.⁹⁴ The UK government set out plans in 2021 to provide ~\$600 million over the next 3 years in the form of ~\$7,000 subsidy scheme for heat pumps.⁹⁵ The UK is aiming to install 600,000 heat pumps per year by 2028.⁹⁶ The Biden administration announced the launch of the E3 Initiative, putting only \$10 million toward accelerating the research and adoption of heat pump technologies.⁹⁷ 	Niche Market → Mass Market <ul style="list-style-type: none"> Subsidise heat pump installations to build up the market. Support R&D to further improve Coefficient of Performance, particularly in cold climate performance. Increase building standards for insulation and energy efficiency & support with retrofit subsidies to upgrade any building stock not yet well suited to heat pump solution.
Food & Agriculture - Plant Based Alternative Proteins	<ul style="list-style-type: none"> Alternative proteins saw record investment growth with an estimated \$3 billion being raised by the sector in 2020, a 3-fold increase from 2019.⁹⁸ This has resulted in large predictions of growth in the coming years potentially driving the alternative protein market to reach \$27 billion by 2027 and \$290 billion by 2035.⁹⁹ Plant & Bean a contract manufacturer opened Europe's largest 'plant-based meat' factory in the UK with an initial capacity of 55,000 tonnes.¹⁰⁰ 	Niche Market → Mass Market <ul style="list-style-type: none"> Policymakers to create supportive conditions for behavioural shifts, performance, accessibility and capability.¹⁰¹ National dietary guidelines, education targets and advertising & marketing regulation. Public procurement and behavioural nudges. Support investment and R&D spending in alternative proteins.
Trucking - Electric Trucks	<ul style="list-style-type: none"> Daimler Truck, Traton Group and Volvo announced plans to invest \$600 million to install and operate 1,700 public charging stations for electric heavy-duty trucks in Europe.¹⁰² Volvo plans half of all global truck deliveries to be electric by 2030, it also received an order of 100 Electric trucks from DFDS to be delivered in 2022.¹⁰³ Zero-emissions freight vehicle expected to increase from over 70 models to 85 and from 24 manufacturers to 30 in the U.S. and Canada alone during 2021.¹⁰⁴ 	Niche Market → Mass Market <ul style="list-style-type: none"> Financial incentives for fleet operators and manufacturers, e.g.: tax exemptions, purchase rebates, allow network connection cost to be rolled - into network asset base (not born by truck depot). Redirect R&D spending from ICE efficiency to zero-emissions trucks . Invest in charging infrastructure and supporting distribution networks, starting with high-volume trucking corridors.

APPENDIX B: MEANINGFUL INDICATORS OF CHANGE 2020-2021, AND SELECT ACTIONS TO ACCELERATE

Sector	Meaningful Indicators of Change 2020-2021	Select Action to Accelerate Market Tipping Points
Aviation - Sustainable Aviation Fuels	<ul style="list-style-type: none"> • IATA commits to net zero by 2050, representing 290 airlines and 82% of total air traffic.¹⁰⁵ • 60 companies sign commitment to use 10% SAFs by 2030 via the WEF Clean Skies for Tomorrow coalition.¹⁰⁶ • World's first power-to-liquid SAF plant opens in Germany.¹⁰⁷ • The U.S. Government announces actions to reduce aviation emissions by 20% by 2030, with \$4.3 bn committed in support.¹⁰⁸ • European Commission proposes SAF blending mandate to reach 5% fuel consumption by 2030.¹⁰⁹ 	Niche Market → Mass Market <ul style="list-style-type: none"> - Implement increasing SAF blending mandates, to grow niche market allowing solutions to mature - Boost SAF demand via long-term offtake agreements, encourage voluntary corporate demand - De-risk investment in large-scale SAF plants (e.g., underwrite off-take) - Support roll out of electric charging and hydrogen re-fuelling infrastructure at airports for short- & medium-haul.
Land Use Change - NBS Revenue Stream through Value for Nature	<ul style="list-style-type: none"> • New York Declaration on Forests: 500 companies committed to curb forest destruction in forest-risk commodities, 270% increase in corporate commitment from 2012.¹¹⁰ • Amsterdam Declaration: 9 European Countries committed to eliminate deforestation in relation to agricultural commodities by 2025.¹¹¹ • Voluntary Carbon Markets to hit \$1 bn for first time in 2021, set to scale 15x by 2030.¹¹² • Apple, Goldman Sachs & Conservation International: launched \$200M Restore Fund for nature carbon removal.¹¹³ • AXA invests \$11 million USD for wetland restoration projects in Indonesia: bond structure shows that the sector is (slowly) maturing.¹¹⁴ 	Niche Market → Mass Market <ul style="list-style-type: none"> - Agree to deforestation free commodities by 2025. Countries commit to halt and reverse deforestation by 2030. - Coordinate and agree on international standards of Nature-Based Solutions, to help secure credibility & integrity to market. - Establish long-term financing structures to secure large-scale capital in nature-based solutions - Ramp up investment in nature-based solutions in tropical countries to provide healthy & high-integrity supply to NBS market
Shipping - Sustainable Shipping Fuel	<ul style="list-style-type: none"> • Maersk announcing order of 8 large zero-emission capable container ships to hit water by 2023.¹¹⁵ • Fortescue announcing intention to convert and run 8 iron ore carriers on green ammonia in the coming years.¹¹⁶ • Group of international companies including Amazon, Ikea and Unilever committed to using only zero-emission ships to transport their cargo by 2040.¹¹⁷ 	Solution Development → Niche Market <ul style="list-style-type: none"> - Provide public funding to achieve cost reductions in green shipping fuels - Introduce sectoral carbon pricing to cover remaining 'green premium' - Support roll-out of enabling infrastructure (e.g., ammonia bunkering), via guarantees & PPP investments
Steel - H2 Reduction	<ul style="list-style-type: none"> • First batch of green steel produced from hydrogen at HYRBIT project in Sweden.¹¹⁸ • ArcelorMittal announced plans to open full-scale zero-carbon steel plant in Spain in 2025.¹¹⁹ • 25 publicly announced green steel projects globally, with 11 hydrogen-based green steel projects planned in Europe.¹²⁰ • New wave of commitments brings 20% of global steel production under net zero commitment, including largest steelmakers in China, Japan, South Korea and Europe.¹²¹ 	Solution Development → Niche Market <ul style="list-style-type: none"> - Industry aligns behind ambitious, universally adopted definitions of 'green' steel - Introduce sectoral carbon pricing mechanisms & carbon border adjustment mechanisms, in particular for major steel importers - Leverage public procurement to create market for green steel, e.g., in government-linked construction (schools, hospitals, etc.) - Collaborate with industry actors to provide start-up capital and subsidise early projects, to help advance solutions
Cement - Carbon capture	<ul style="list-style-type: none"> • HeidelbergCement announced that it intends to upgrade a cement facility in Sweden to become the world's first large-scale carbon-neutral cement plant by 2030 through capturing ~1.8 Mt of CO₂ using CCS.¹²² • The European Commission also published a proposal for a carbon border adjustment mechanism (CBAM), which would impose a levy on imports of carbon cement.¹²³ • Revision of the EU's ETS (2021-2030), will also see the phase out of free CO₂ allowances to cement plants, it will see EU cement industry paying for at least half its allowances by 2030. This could cost as much as ~\$5.5 billion in 2030.¹²⁴ • The 12 months leading up to July 2021 saw over \$100m in venture funding going to low-carbon cement start-ups.¹²⁵ • Forty of the world's leading cement and concrete manufacturers (representing 80% of total production outside China) pledged to cut CO₂ emissions by a 25% by 2030 preventing 5 billion tonnes of CO₂ and committed to net zero concrete by 2050.¹²⁶ 	Solution Development → Niche Market <ul style="list-style-type: none"> - Introduce sectoral carbon pricing mechanisms, to signal long-term market demand - Collaborate with industry actors to provide start-up capital and subsidise early projects, to help advance solutions.
Chemicals	<ul style="list-style-type: none"> • BASF set new targets to cut its worldwide greenhouse gas emissions by 25% by 2030 and anticipates investing up to \$4.7 billion to reach its goal, developing large-scale pilot electric stream cracker plant by 2030.¹²⁷ • Bayer committed to cut the emissions by 42% by the end of 2029 and plans to invest ~\$580 in renewables and efficiency improvements.^{128,129} • ShareAction, an NGO, convened a \$3tn group of investors to step up shareholder engagement to reduce emissions in the chemicals sector.¹³⁰ • Solvay has pledged \$2 bn to reach carbon neutrality by 2050 and raised its internal carbon price for investment decisions to €100/tonne CO₂.¹³¹ 	Solution Development → Niche Market <ul style="list-style-type: none"> - Set industry-wide decarbonisation targets, to motivate players to begin investing in low-carbon solutions - R&D support to identify the most critical technologies for chemicals to decarbonise scope 1 emissions - Introduce sectoral carbon pricing mechanisms (e.g., on heavily traded chemicals) & carbon border adjustment mechanisms to signal long-term market demand - Collaborate with industry actors to provide start-up capital and subsidies to focus on large scale pilots for the most critical technologies

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ABOUT THIS REPORT

Developed by SYSTEMIQ, *The Paris Effect – COP26 edition: How Tipping Points Can Accelerate and Deliver a Prosperous Net Zero Economy*, builds on *The Paris Effect* report published in December 2020. In *The Paris Effect*, we examined how progress towards a zero-carbon economy has accelerated in the past five years since the Paris Agreement, and the opportunities that this creates for governments and businesses that join this transition. With the COP26 edition we examine the progress in the past year and dive further into how to harness the Paris Effect to create market tipping points and accelerate the transition to a net zero economy.

The new assessment shows that by focusing on engineering market tipping points, low-carbon solutions could scale rapidly and push down emissions in sectors accounting for 90% of emissions by 2030. We are accelerating on some fronts (e.g., solar/wind + storage; electric vehicles; plant-based meats; green steel) but not moving nearly fast enough on others (e.g., energy efficiency; heat pumps; developing country financing; nature-based/engineered CO₂ removals).

The Paris Effect – COP26 edition draws on research and analysis from hundreds of sources to highlight economic, social and political trends. Countries, companies and investors who accelerate action to reach market tipping points stand to capture outsized returns while also delivering a host of benefits: improved productivity & stable economic growth, jobs growth, more equitable wealth creation, more secure and resilient energy as well as food sources. The more that countries, companies and investors pull together and coordinate on this agenda, the faster we can move collectively to a prosperous net zero economy.

About SYSTEMIQ

SYSTEMIQ was founded in 2016 to drive the achievement of the Paris Agreement and the UN Sustainable Development Goals by transforming markets and business models in four key economic systems: regenerative land use, circular materials, clean energy and sustainable finance. A certified B-Corp, SYSTEMIQ combines purpose-driven consultancy with high-impact, on-the-ground work, and partners with business, finance, policy-makers and civil society to deliver transformative change. SYSTEMIQ has offices in Brazil, Germany, Indonesia, the Netherlands and the United Kingdom.

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