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Planetary turnaround: an investment banker's perspective on climate change action

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Earth 4All

Two planetary challenges threaten the wellbeing of most people on Earth. The first is environmental: global warming, biodiversity loss and resource scarcity are now clear and present dangers. The second is socio-economic: technological advances are increasing unemployment, inequity and polarisation of wealth, while poverty and hunger remain endemic across significant parts of the world, creating an ever-growing risk of radical societal disruption.

The risk of climate change was first identified by the French mathematician Joseph Fourier in the early 1800s, and both challenges have been understood in detail for 50 years, since the publication of *The Limits to Growth* in 1972. Intergovernmental agreements and corporate promises have followed, though still relatively little action has been taken.

The solutions are also well understood. Five extraordinary turnarounds are needed: phasing out fossil fuels; making agriculture sustainable; employing new development models; redistributing income (just enough that the investment required is made only by the richest people and nations in the world); and ensuring everyone has access to good-quality education, healthcare and contraception.

We have already developed many of the technologies we need, including renewable energy generation, electric vehicles and battery storage. Unit prices have fallen substantially, shifting the economic balance in favour of these sustainable solutions and accelerating private-sector investment.

Sustainable investing has grown dramatically over the last few years. With cost of capital at all-time lows in the rich world and a global surplus of capital, these initiatives also represent a solution to the pension fund manager problem of where to place customers' retirement savings, as at least part of the required investment will generate attractive long-term returns.

Despite this, existing modelling shows that current and planned policy initiatives and private-sector investments will not address the dual challenges sufficiently in the next 30 years. Known solutions have not been implemented as many have not been perceived as profitable by investors, in part due to high discount rates. In addition, incumbent workers and businesses owners in the sectors to be phased out have understandably resisted changes that would affect their jobs and investments respectively.

Thus, governments must introduce new policies urgently. These should include subsidies to accelerate the shift to new technologies as well as a guaranteed income for displaced workers until they are retrained for new jobs in the green sector. Governments should also ban new investment in fossil fuels, end subsidies to the sector, announce sunset dates for the sale of fossil fuel vehicles, and set near-term targets for domestic power systems to achieve "grid zero".

These turnarounds can be financed with investment of around 1–3% of gross domestic product (GDP) per year, a relatively modest figure given the scale of the threats that we face. More importantly, the investment required to drive the shift to renewables and the adoption of regenerative agricultural practices can help to create new well-paid jobs, thus helping in part to address the socio-economic issues too. Countries whose governments act in a timely and effective manner will benefit significantly, through healthier economic growth, reduced societal tension, reduced environmental and ecological risks and a cleaner environment.

Our evolutionary choice

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Humanity stands at an evolutionary fork in the road. Either we must learn to live in harmony with the planet and each other, or we must suffer the cost and pain of adapting to a much more hostile environment. The former implies collaborative evolution towards financial and ecological sustainability and broad economic inclusion. The latter implies purposeful rejection of evidence and reason in favour of adversarial ignorance, as the few pursue power at the expense of the many.

Either way, unlike previous crises – plagues, famines or volcanic eruptions, for example – this time the consequences of our choices will affect almost every living person, not just those in our own immediate society or region. Humanity's destiny is in our collective hands.

In choosing a path to follow, the test we face is one of both intellect and character. Are we smart enough to see through the noise and distraction of weaponised consumerism to identify the best way forward? Are we bold enough to learn the lessons of the last few hundred years and embrace a new paradigm for decision-making? And are we far-sighted enough to understand that the challenges we face today might also form the crucible from which the next phase of human development can be forged? If we fail and continue on our current path of endless consumption, the environmental, ecological and societal declines we are already seeing will accelerate. Our world will rapidly become an inhospitable one, even for the people and countries at the top of the economic pyramid.

The environmental and ecological threat

The most immediate challenge is climate change. As explained in detail in the documentary *Breaking Boundaries: The Science of Our Planet*, narrated by David Attenborough, the development of our species since the beginnings of modern civilisation in around 10,000 BC has benefited dramatically from exceptionally stable global temperatures. We have already seen the severe impacts that are possible in recent fires, floods, droughts and storms. With global heating set to continue for decades to come, these are only a mild indicator of what lies ahead. As Mark Carney said in a speech to the Lloyd's of London insurance market in 2015, "The catastrophic norms of the future can be seen in the tail risks of today."

The greenhouse effect causing this change is not new science. In the early 1800s, Fourier identified that the Earth's atmosphere provided insulation and that changes in the composition of its gases created by human activity could thus change global temperatures. With carbon dioxide (CO_2) levels now approaching 420 parts per million, 40% higher (yes, really) than at any other time in the last 800,000 years, humankind's actions are now extremely close to destroying the historical balance.

Beyond changing our planet's climate, humanity's footprint on the Earth has become enormous. *Homo sapiens* first began migrating from the African continent between 70,000–100,000 years ago, reaching the Australian continent between 35,000–65,000 years ago, and finally entering the Americas around 13,000 years ago, as the last ice age was ending. Everywhere that *Homo sapiens* expanded, the mammalian population declined (Harari, 2014), which might make you wonder whether the agricultural revolution was less about inspirational invention and more a response to the existential challenge posed by humankind's having eaten most of the meat available in the wild.

Today, livestock bred for human consumption accounts for around 60% of the body weight of all mammals on the planet. Humans account for almost all the rest, with the other *ca*. 6,500 species of wild mammals making up just 4%. In short, life on Earth is more and more the story of *humankind* on Earth, and the stresses on our planet's ecosystem are growing by the year. These translate into ever-greater conflict between humans and nature, and an increasing risk of new zoonotic diseases such as COVID-19 jumping from animals to humans.

As every child learns, 70% of the Earth's surface is covered by water. So we should be alarmed that our critical freshwater and marine ecosystems are under threat too. We reached the ocean's capacity to supply us with fish in the mid-1990s, and we've been filling the seas with waste for decades. According to a recent World Wildlife Fund study, the world has produced as much plastic since the year 2000 as in all previous years combined. Of this, roughly a third ends up in nature – equivalent to about 100 million tonnes of plastic waste in 2016. On the current trajectory, our ocean will contain one tonne of plastic for every three tonnes of fish by 2025, and by 2050, the weight of plastic will overtake that of fish. And this pollution isn't just swirling around the ocean: it's on your dining table too. A recent study by the University of Newcastle, Australia, suggests that an average person could be ingesting approximately 5g of plastic every week through microparticles contained in the water they drink.

The above should surely be a dramatic wake-up call. *Homo sapiens* are no longer simply passengers on Spaceship Earth. Rather, our species is both captain and chief purser, responsible for our planet's entire cargo and the provisions we need to survive. Indeed, the impact of humans on our planet is now so significant that scientists have proposed that we are entering a new geological epoch called the Anthropocene, reflecting the significance of humankind's impact on the Earth's entire geology and ecosystems.

The socio-economic threat

The other fundamental threat to the wellbeing of most of the planet is socio-economic. The dark side of the extraordinary technological advances made over the last few decades has been a dramatic increase in the polarisation of wealth in many countries. In large economies such as the United States, virtually all the financial benefits of technological advances and the associated increases in productivity have flowed to the top 10% of society, while median earnings have barely changed in real terms since 1980. Indeed, most of the modest apparent real growth in US median wages since the 1970s is accounted for by increases in pay[1] for both women and people of colour, as they slowly move towards parity with white male workers.

These effects continue today, as employers such as Google propose to cut pay for remote workers by as much as 25% so that shareholders, rather than employees, will capture the productivity benefits of remote working. Meanwhile, though the United States perceives itself as a world-leading nation, it provides very little in the way of tertiary education, social welfare or public healthcare for its population, and many cities have limited transport infrastructure. These failings accentuate the disparity in quality of life between the median citizen and the top 10%.

In 2019, as the pre-pandemic US economy boomed and unemployment rates were at the lowest level in five decades, a US Federal Reserve study reported that 40% of Americans would struggle to afford a US$400 emergency expense. The same study reported that a quarter of the population skipped necessary medical care because they could not afford the cost, and one sixth were unable to pay all their bills in full every month. It *ought* to be unthinkable that one of the world's largest and richest economies should have so many people living under so much financial stress, but that is the reality of the modern United States. Globally, a handful of the world's richest billionaires have sufficient personal financial resources to end world hunger, yet extensive famines persist. In short, we must face and solve our societal challenges as well as our environmental ones, and we must act with urgency.

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Elsewhere around the world, huge progress has been made in eliminating extreme poverty, particularly in countries such as China, where the poverty rate fell from over 60% in 1990 to just 3.2% in 2018, according to World Bank data.[2] Nevertheless, despite these successes, 800 million people still go hungry each day, and the effects of climate change may well add to this total. Globally, around one third of all the food we produce is wasted, so we certainly have the *capacity* to feed every person.

In addition, low- and middle-income economies have workforces whose inherent capabilities are significantly underutilised. As a result, many people in those nations continue to live in poverty – an international equivalent of the exclusion from productivity gains that has affected US workers. According to UN data, by the end of 2020, over 1% of the world's population was forcibly displaced due to factors such as persecution, conflict and violence. As these numbers continue to increase, richer nations will surely be confronted by ever-growing inbound refugee numbers too.

The economic and political elite ignore these disparities and risks at their peril. History shows us that declining living standards and extreme polarisation of wealth can materially increase the likelihood of revolutionary change, creating significant risks for all of society. As we write, anti-science anti-reason rhetoric is growing in many parts of the high-income world. As stated in the cover note to *Twilight of Democracy*, "From the United States and Britain to continental Europe and beyond, liberal democracy is under siege, while authoritarianism is on the rise" (Applebaum, 2020). Recent events in several countries have shown that social tensions are indeed rising, including the unprecedented storming of the US Capitol on 6 January 2021.

The solution: five extraordinary turnarounds

The environmental and ecological catastrophe that now stares us in the face was one of the scenarios shown in the early 1970s, by a team at the Massachusetts Institute of Technology who had been commissioned by The Club of Rome to create the first computer model of the world. That model, and the accompanying book *The Limits to Growth*,[3] clearly laid out the factors that would lead inexorably towards a slow-moving societal train wreck if decision-makers failed to acknowledge and understand the dangers of unconstrained extraction and consumption within a finite ecosystem. Fifty years on, the original business-as-usual environmental, ecological and social scenario remains alarmingly consistent with reality.

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The good news is that these challenges can be solved by five extraordinary turnarounds – the smallest and simplest set of global actions to slay the two-headed monster we face. These five solutions were first laid out in "Transformation is feasible", which shows how the twin ecological and social catastrophes can indeed be avoided while providing for greater economic inclusion around the world.

As we mentioned earlier, the five turnarounds involve phasing out fossil fuels, transitioning to regenerative agricultural practices, and employing new development models to support the development of low- and middle-income nations. They also include some redistribution of income (of only the richest people and nations in the world) and ensuring that everyone has access to good-quality education, affordable healthcare and effective contraception.

The even better news is that the solutions to deliver these turnarounds are already well understood and, indeed, have already been deployed with great success in some localities.

As an example, renewable energy is now cheaper than energy from fossil fuels in many locations. Combined with the right storage solutions, renewable energy can reduce the scale and complexity of required power networks, lessen associated risks (such as bushfires created by power networks in very hot/dry weather) and improve overall resilience. This transition is also creating jobs that are better paid and less vulnerable to redundancies during oil price cycles and economic downturns. Further, companies are attracted to purchasing renewable energy, as

they can lock in reduced costs over long time frames through power purchase agreements with renewable energy generators, who themselves have near-certain operating costs and are not exposed to commodity price fluctuations. (In contrast, coal- and gas-fired power stations face considerable input price risk.) Meanwhile, once those long-term power purchase agreements are in place, infrastructure investors (among others) are highly attracted to these projects and are deploying substantial capital to acquire them. Thus, investment in the energy transition can prospectively deliver on our objectives to improve society too – it's good for the planet, it's good for your community and it's good for your pension too.

Similar dynamics are beginning to emerge in the transport sector, thanks to the rise of electric vehicles. Users already benefit from significantly lower operating costs for two reasons. First, electrical energy is typically cheaper to purchase on a comparable mile-for-mile basis than petrol. Second, electric vehicles have virtually no moving parts, making for significantly lower servicing costs. As manufacturing volumes increase and electric vehicle manufacturing works its way along the scale-efficiency curves, electric vehicles offer the prospect of competitive whole-of-life costs, particularly as battery lifetimes are extended and battery materials are increasingly and cost-efficiently recycled.

In addition, although the transition to electric vehicles will require some new investment in renewable energy generation, these vehicles can play a critical role in helping our energy transmission and distribution networks adapt to a fossil fuel–free world. Typically, electric vehicles have batteries that store something in the range of 50–85 kWh of energy, equivalent to 2–4 days of electricity usage in a US household. These batteries can already be configured and managed en masse (as so-called virtual power plants) to provide power back into the grid at times of particularly high demand, thus reducing the need for energy storage in distribution networks themselves. They can then recharge in the small hours when demand for energy is low, or at times when sun is abundant. Of course, this means that both car manufacturers and motor fleet operators will need to embrace a new vision for the role of passenger vehicles as an integral part of our energy system.

It is also important to understand that both renewable energy and electric vehicles will create substantial new demand for a variety of minerals and rare earth metals that are essential to the manufacture of some types of solar panels, electric motors and batteries. From what we have seen, most leading companies are increasingly aware of these constraints and are beginning to address the need for substitutes and to ensure complete and cost-efficient recycling of relevant materials as equipment comes to the end of its effective working life. In addition, new battery technologies that use more abundantly available materials are emerging.

In the agricultural sector, we are now seeing the adoption of regenerative agriculture, where a more sustainable approach is creating higher-quality products, greater yields, improved environmental outcomes and greater profit. Meanwhile, the rapid emergence of alternative sources of protein, including plant-based sources, cellular fermentation and biomimicry offers paths to healthier diets with dramatically lower – or even net positive – environmental footprints. More broadly, consumers are shifting away from animal-based proteins and adopting flexitarian, more Earth-friendly diets.

New technologies are emerging in other critical areas too, such as the LEILAC kiln, which can capture CO2 from lime and cement production at a very low marginal cost. Among these and other innovations, we already have much of the technological capacity we need to meet the challenges we face.

All this should come as no surprise, as the report card for humanity is not all bad. Over the last several decades, phenomenal developments in technology have put mobile communications, extraordinary computing power and a modern-day Great Library of Alexandria in the hands of billions of people. These developments have been matched by dramatic advances in healthcare, helping life expectancies to increase by two to three months every year in many low-, middle- and high-income countries, and allowing worn-out knees and hips to be replaced in routine operations. Hearing can be restored with cochlear implants, wheelchairs can be controlled with brainwaves and prosthetics can be economically personalised and 3D-printed. In contrast to these extraordinary innovations, most of the solutions we need to enact are much simpler from both technological and implementation perspectives.

Though the private sector is now financing the deployment of many new technologies – and consumers are happily paying to use them – much of the original hardcore science, as well as the years of research and development required to turn theories and laboratory experiments into practice and products, has historically been paid for by governments. As examples, the development of GPS navigation, touch screens, voice recognition and search algorithms were all funded by the US government (Mazzucato, 2018). Governments have built critical infrastructure too, including the massive interstate highway network that connects the United States. Though the popular belief in the United States may be that the nation's success has been driven by private enterprise stimulated by low tax rates, the exact opposite is true. Government spending was critical, and the top marginal rate of personal tax in the United States was at least 70% from 1936–1980.

Financial opportunity in environmental adversity

With an investment banker's hat on, it is encouraging to see substantial investment activity. By the end of 2021, total investment in sustainable funds globally reached US$2,744 billion, including some US$2,231 billion in Europe and US$357 billion in the United States. Nevertheless, we must remember that much of this is being invested into rich-world, existing companies, not in the new projects that are so sorely needed. More helpfully, around US$755 billion flowed into "energy transition investment" in 2021, according to data compiled by BloombergNEF. This included $273 billion invested in the electrification of transport, an increase of 77% over the previous year.

At a qualitative level, we also continue to see exceptional levels of investment by both specialist infrastructure investors and large-scale energy companies into renewable energy generation projects and associated storage solutions. These include "utility-scale" projects that connect to national distribution networks as well as smaller-scale "behind-the-meter" projects designed to meet the direct needs of commercial, industrial and agricultural energy users.

Despite the severity of the threats we face, lurking behind them is the prospect of great financial opportunity, as the economics of human evolution undergo profound changes.

Despite the severity of the threats we face, lurking behind them is the prospect of great financial opportunity, as the economics of human evolution undergo profound changes. In a widely cited 2017 speech, the Bank of England's chief economist Andy Haldane noted that interest rates had fallen to the lowest levels seen in 5,000 years – 0.25% in the United Kingdom at the time Haldane spoke, and 0.5% at the time of this writing. Overnight interest rates on the euro have been consistently below zero since early 2015 and now average around –0.5%. Meanwhile, Japanese interest rates fell below 0.5% in the mid-1990s and entered negative territory in early 2016. In the United States, overnight rates are currently just 0.07%, and despite rapid growth and significant concerns about inflation, even 30-year rates are just 2.21% (as of 2 March 2022). Importantly, these are all *nominal* interest rates – in more and more cases, real rates of interest are now negative.

Similar dynamics are unfolding in equity markets too. Despite the significant economic contraction caused by the COVID-19 outbreak, several major stock markets boomed. In the United States, companies are raising more money prior to initial public offering (IPO) than ever before. Meanwhile, US$594 billion was raised globally in IPOs in 2021, up from US$331 billion in 2020 and setting a new record high. Almost one third of this activity related to special-purpose acquisition companies (or SPACs), cash shell businesses created with the sole purpose of acquiring or merging with other businesses at a later date, surely an indicator of surplus capital desperately seeking a home. Looking through another lens, the risk premia available for investing in equities have contracted too – and these reductions have been dramatic in the high-growth Asian region. For example, at the time of writing, the equity risk premia calculated by NYU Stern's Professor Aswath Damodaran are now almost the same for China (4.94%) as for the United Kingdom (4.84%).

Arguably, these are clear signs that there is more capital available in the world than there are attractive opportunities to invest that capital. In considering this proposition, remember that these low interest rates come at a time when government debt has increased dramatically due to fiscal measures implemented to respond to the COVID-19 crisis. In other words, governments themselves are absorbing significant amounts of investment, yet interest rates remain at all-time lows. Similarly, traditional listed equity markets are booming despite progressive reallocation of capital by major investment managers away from this asset class into other areas such as infrastructure.

One reason for this ultra-low interest rate/return environment may be that the ongoing robot revolution[4] requires relatively little capital investment: the underlying industrial shifts are largely driven by software that is used to automate decision-making and, hence, to replace many administrative, clerical and other roles. This dynamic is also reflected in low real-wage growth in several major economies, despite relatively strong economic growth and low unemployment. Similar trends were seen in the United Kingdom during the industrial revolution in the 19th century and in the United States over the last 50 years, as jobs in each "new economy" did not emerge rapidly enough to offset jobs lost to automation.

For people seeking work in rich economies today, the erosion of opportunity in many blue- and white-collar roles highlights the social challenges that the next round of automation will bring. For individuals and businesses seeking investments, finding attractive places to deploy their capital is becoming more challenging than ever.

Rethinking investment priorities

Where does this leave us? Global warming already represents an immediate threat, evidenced by the rapid increase in extreme weather events. Socio-economic tension is rising in many countries and approaching crisis proportions in some. On the other hand, at a local level in areas such as renewable energy, electric vehicles and sustainable agriculture, we can see that substantial private-sector investment is already beginning to flow in the right direction. We can also see that it is possible to tackle the environmental problems we now face in a manner that provides a powerful mechanism for addressing social issues while also providing an attractive long-term home for surplus investment capital. In other words, though the risks are growing, the solutions we need to overcome them are within our grasp, so long as we stay focused on the right long-term objectives.

Nevertheless, although the solutions are well understood, existing modelling shows that current and planned policy initiatives and private-sector investments will not address these challenges sufficiently in the next 30 years. Some progress *has* been made over the last 50 years in developing and deploying the new technologies we need, but it is insufficient to avert the ecological and social catastrophes we face. Indeed, we have scarcely slowed our headlong rush towards the abyss – we are just not accelerating quite as rapidly as might otherwise have been the case. As a result, unless we make dramatic changes, we will experience significant and widespread social and environmental problems before the middle of the current century.

How in the world did we get here? After 12,000 years of extraordinarily rapid development of our species, and truly amazing advances in science, technology, thinking and communication, why do governments, investors, business and, indeed, many people continue to follow paths that create a danger both to our society and for the planet on which we live? Are we just repeatedly making bad choices, and if so, why? Are we asking ourselves the wrong questions? As a species that appeared to have mastered change and uncertainty, are these challenges coming at us too quickly for us to adapt our philosophies and epistemologies accordingly? Further, given that the risks have been well understood for so long, why has so little action been taken to address them? What barriers stand in our way, and how do we overcome them?

First, yes, we *have* been asking the wrong questions. Faced with such dramatic changes and new risks, every investor should now be putting a new challenge to their investment managers: “How can I invest my capital to generate sound risk-adjusted returns over the long to very long term, while simultaneously reducing environmental and ecological risks and creating a stronger, fairer society?” Moreover, note that these investments need not generate any cash return in the near term, as this would just add to the pile of surplus capital. In theory, answering this question will require a fundamental change in both mindset and methods, as traditional investment appraisal

methods artificially emphasise short-term returns and ignore both longer-term risk and reward. In practice, interest rates and equity risk premia are now so low for high-income-country investors that this inherent bias is significantly reduced, at least for infrastructure-style assets whose performance is largely decoupled from economic performance.

In parallel, leaders in government and civil society, philanthropists, and environmental and social activists should be asking: "Is there a way to apply the extensive available financial capital to enable humankind to transition towards planetary sustainability, while addressing social injustices and economic exclusion?" If the answer is yes, this implies we can find pathways towards an entirely new societal paradigm of healthy growth, where humankind's evolution benefits everyone in society and our pursuit of health, wealth and happiness improves our environment.

Even so, we still must answer a critical global-scale question: "Does the above logic apply across the entire set of challenges we face, implying that smart private-sector investment could generate adequate returns while reversing environmental and ecological degradation and ensuring much greater economic inclusion?"

The answer, almost certainly, will be no.

As a result, we need robust predictive tools to quantify and prioritise the investments that are needed and must be tackled by the public sector. We must also identify countries and communities that will need public or philanthropic aid and assistance to adapt, and assess what policy measures will be the most beneficial to them over the long term. Critically, politicians, bureaucrats and economists everywhere will want to know what impact these decisions will have on our economies and financial systems and, indeed, on our society and Spaceship Earth itself.

The Club of Rome's Earth4All initiative will provide detailed quantitative analysis to address these questions and to demonstrate the effectiveness of the solutions we propose in this paper. It will also deliver powerful predictive models as well as new perspectives on transformational economics and investment decision-making. Together, these tools will shine yet more light on the interlinked choices we must make and how best to implement them, though the window to act is closing rapidly.

The barriers we must overcome

Why are we moving so slowly when the challenges are so obvious and becoming clearer every day, including the pain of economic exclusion, losses and unnecessary deaths caused by bush fires, cyclones, droughts, floods and more? This seems especially foolish in the current environment, with an abundance of capital available at very cheap rates for both governments and private projects, and a surplus workforce of underutilised or unemployed labour. Surely we have learned from the response to COVID-19 that collective action is possible and effective, even if the short-term return on investment is negative?

We are moving slowly for two main reasons.

First, the necessary projects are not profitable from a private-sector investor's point of view, at least not until the state has paid for the original development of the necessary technology and, in many cases, subsidised its initial deployment. As an example, solar cells have been under development in publicly funded laboratories around the world since the late 19th century, and early commercial deployment of solar-energy generation has been subsidised by numerous governments and incentivised by generous feed-in tariffs for surplus generation of power. But only in recent years and in locations with high solar radiation has this form of generation become cheaper than the fossil fuel alternatives.

Thus, government support is essential, as it can take 20 years or more for a new "exponential" or "disruptive" technology to advance enough to become commercially viable. Significant unit volumes are usually required to reach true economies of manufacturing scale. Eventually, this inflection point will be reached, as we have seen with both wind turbines and solar panels, and the powerful forces of competitive markets and private-sector investment can then be harnessed to drive mass market rollout. Similar dynamics are emerging with electric vehicles, again thanks to widespread government subsidy of scientific innovation, research and development, as well as subsidies and incentives for early vehicle sales in countries such as Norway, where sales of new plug-in electric vehicles achieved a market share of 85% in June 2021[5] and 65% for the year 2021.

Second, both owners and workers in incumbent businesses in the fossil fuel sector (and the many businesses in their supply chains) will naturally resist the rapid elimination of their jobs and profit streams, irrespective of other economic, environmental or social logic. This is fully understandable and underscores the importance of governments investing to retrain the workforce, providing unemployment benefits that make the transition bearable and stimulating the creation of new businesses and new-economy employment opportunities. With the right approach, these communities will then be able to look forward to a thriving future, rather than a slow and painful decline.

Our environmental, ecological and socio-economic problems cannot be solved through voluntary action by individuals or the unregulated market alone.

In short, our environmental, ecological and socio-economic problems cannot be solved through voluntary action by individuals or the unregulated market alone. Collective (i.e. governmental) action is essential; although, in practice it remains impossible to reach democratic agreement on the necessary state action in many countries.

Urgent government policy actions

So, what actions *must* governments take, given the remaining few years available to avert the crisis? There are several areas where direct policy measures should be urgently implemented:

1. Subsidise or provide incentives so that the industries of the future become increasingly attractive, including accelerating the adoption of new technologies.
2. Make damaging activities increasingly unprofitable, including banning new investment in fossil fuels and ending subsidies to the fossil fuel sector (now some US$500 billion per year).
3. Set dates for energy systems to reach net zero and to end the sale of fossil fuel vehicles. As an example, the United States is targeting grid zero by 2035 and aiming for sales of electric vehicles to comprise 50% of all new vehicle sales by 2030.
4. Provide a decent guaranteed income for displaced workers until they are retrained for new jobs in the green sector.
5. Undertake the required investments with public money where private-sector investment proves impossible.
6. Learn from the COVID-19 experience that the state (at least well-organised states) can finance catastrophe-bashing investment with freshly printed money (i.e. loans from the central bank to the parliament).[6] Over the last 18 months we have seen that this can be undertaken without negative implications for either interest rates or inflation, so long as the amounts are not too large.

In addition, we must describe clearly how, when and why these actions will improve financial security and quality of life for most of society. The Earth4All initiative is designed to address precisely these questions in a robust and quantitative manner, thus enabling the implications for a broad improvement in general wellbeing to be effectively communicated. This should help to build public enthusiasm for the project and garner support from the political majority.

Globally, where individual countries lack the financial or economic capacity to fund the required investments, rich nations must provide funding (as envisaged by Article 9 of the Paris Agreement) to address the shortfall. To address this need, the Green Climate Fund was established under the Cancun Agreements in 2010. Nevertheless, although US$100 billion of funding support was promised at a 2009 UN climate summit in Copenhagen, to date contributions have fallen far short of this target. Indeed, much of the support has been provided in the form of loans, and a 2020 Oxfam report estimated public climate financing at just US$19–22.5 billion in 2017–2018.

In some emerging countries, government guarantees may be sufficient to encourage private-sector investment.[7] For example, microgrids[8] could be built in low-income countries – creating well-paid jobs in the process – with the capital cost repaid in, say, 30 years' time, once those countries have industrialised based on very low-cost energy. Operational costs will be very low and will be determined largely by local labour costs. Microgrids could thus be locally delivered and paid for during the life of the project. The state would remain the long-run owner of the solar farms, as is the case with many public-private partnerships in Australia and elsewhere around the world.

Collaborative evolution or adversarial ignorance?

We estimate that these turnarounds can be financed with investment of around 1–3% of GDP per year, relatively modest given the scale of the threats that we face. As context, the US government recently approved a US$1,000 billion infrastructure bill, and further infrastructure investment of up to around $3,500 billion is under consideration, equivalent to roughly 2% of US GDP per year for a decade. More importantly, we have seen that the investment required to drive the shift to renewables and adoption of regenerative agricultural practices can help to create new well-paid jobs, thus helping in part to address socio-economic issues too, so long as the right approach is taken.

If we are successful, humanity will enter a new phase of collaborative evolution, where quality of life and access to opportunity are no longer limited by a resource-constrained world.

To navigate the crisis and make the most of the opportunities it presents, deep systems-thinking and effective collaboration will be essential, two features that have repeatedly defined the dramatic evolution of *Homo sapiens* over the last 12,000 years (Harari, 2014). If we are successful, humanity will enter a new phase of collaborative evolution, where quality of life and access to opportunity are no longer limited by a resource-constrained world.

If we fail, the path ahead will grow rapidly more dangerous for both environmental and social reasons. Though we have the technological solutions and the capital to implement them, the chance of failure remains dangerously high. Around the world, we have seen an explosion in anti-science rhetoric, in- versus out-group animosity and exploitation of social conflict by leaders of mainstream political parties. Extremist elements in the traditional media sector have profited greatly from stirring division and animosity, and their impact has been leveraged by sophisticated manipulation of social media platforms. If these forces prevail, we risk succumbing to a new "Great Dark Age", where politics is ruled by adversarial ignorance, to the detriment of us all.

We stand, as a species, at a critical fork in our evolutionary road. With a typhoon approaching on one side and wildfires sparking on the other, we cannot afford to sit back, close our eyes and minds, and ignore the perils we face. Whether in our own lives, in our businesses or as investors, we each have the power to make wise choices that will help to secure our collective future and will offer a path to a stronger, more resilient and more inclusive society. Now is the time for action – and to urge your peers and political representatives to act too.

Footnotes

[1] US Census data, table P-5 *People by median income and sex*

[2] Global poverty reduction is slowing, regional trends help understanding why, Marta Schoch and Christoph Lakner, 5 November 2020 on the World Bank blog

[3] See for example the original ABC Australia documentary *Computer predicts the end of civilisation*, available on YouTube in 2018 at https://www.youtube.com/watch?v=cCxPOqwCr1I&feature=youtu.be

[4] I.e. the widespread use of computers and artificial intelligence to automate decision-making

[5] Year to date share was 57.3% for plug-in EVs and 25.4% for hybrid EVs, for a combined share of 83%

[6] For a detailed enunciation of Modern Monetary Theory, see *The Deficit Myth*, Stephanie Kelton

[7] In some cases, a guarantee from a major government of interest and principal repayments will be sufficient to secure private-sector financing, particularly for larger-scale projects in more stable countries

[8] E.g. community-scale projects with solar- and wind-powered generation, coupled battery storage and a small-scale local distribution network

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