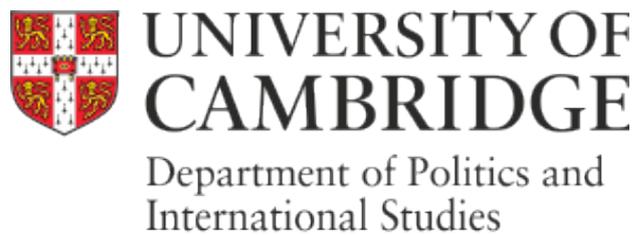
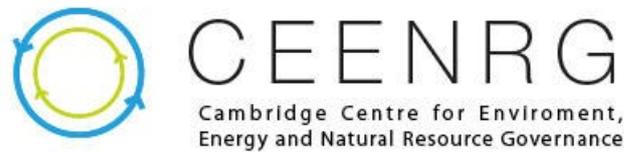


What Now?

Climate Change and Energy After Paris

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A Policy Briefing Based on the Conference Proceedings

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0.1 Executive Summary

What now?

This was the central question framing the post-Paris energy and climate change conference in Cambridge on Friday, January 22nd, 2016. Distinguished scientists, social scientists, and policy leaders gathered to reflect candidly on the outcomes of the landmark 2015 Paris Agreement on climate change. Participants included academics, lawyers, government officials, private sector advisers, community groups, and leaders of NGOs. To encourage frank, uninhibited discussion, the entire event was conducted under the Chatham House Rule, stipulating that “participants are free to use the information received, but neither the identity nor the affiliation of the speaker(s), nor that of any other participant, may be revealed”. This official Policy Briefing therefore adheres to the same rule. While the identity of the speakers espousing particular views shall not be revealed, what follows should be taken as a faithful account of views expressed at the conference, with particular consideration of the implications for national climate policy moving forward.



Although the Paris Agreement was widely celebrated in the press as an unequivocal success, at the post-Paris conference in Cambridge it was described as everything from "historic" and "ambitious" to "toothless" and "inadequate", depending on who one asks.

A central goal of post-Copenhagen global climate negotiations was inclusivity, and as a consequence, as one participant put it, the Paris Agreement was "broad and therefore necessarily shallow". All previous meetings of the United Nations Framework Convention on Climate Change (UNFCCC) were premised on a distinction between Annex I and non-Annex parties with differing levels of legal responsibility, but "the firewall is now dead". There are,

of course, still very different expectations for different countries, and the language of "developed" and "developing" countries has not disappeared. But to avoid the prolongment of stifling division, negotiators opted for a "bottom-up" approach of national self-determination and near-universal participation, abandoning failed "top-down" methods of international diplomacy. It was an "evolutionary solution", albeit a profoundly imperfect one.

The Paris Agreement recognizes and encourages "joint efforts" from diverse "coalitions and clubs" of countries that are expected to take on increasing levels of ambition in the coming years. These clubs were described as "webs of governmental and sub-governmental networks"; so if the United States Congress, for example, continues its intransigent isolation from the rest of the world on the issue of climate change, then the growing World Bank Carbon Pricing Leadership coalition, to use just one example, will deal with sub-national, climate-serious states like California, or "*whoever* can deliver".

The Paris Agreement "exceeded the expectations of many progressive observers" regarding what was previously deemed politically possible. The best estimate of the future rise in global mean temperature resulting from national pledges in the Paris Agreement is, based on the latest study from Climate Action Tracker, indeed lower than before Paris. However, current pledges still overshoot 2 degrees Celsius, let alone 1.5 degree Celsius, by a wide margin. At the post-Paris conference in Cambridge, it was noted that the Intended Nationally Determined Contributions (INDCs) of many countries were "conservative" and might be "*over-achieved*", except perhaps the INDC submitted by the United States which was thought to be notably ambitious. But INDCs are "just on paper"; "they need to be implemented *now*, not in 5 years", and "ambition must increase *now*, not later".

The most exuberant of assessments declared the Paris outcome "a miracle" in terms of the smoothness of the process, one that "will put to rest forever doubts that parties can ever negotiate an agreement line by line". The Paris Climate Change Conference brought together the largest number of Heads of State *ever* under one roof. Over 28,000 delegates from over 190 countries attended the conference. The ostensible success of the agreement was attributed to a shift in "underlying economic realities", a "strong, palpable determination" to reach an agreement by leaders who were personally involved, and the role of France, "the honest broker", in the negotiation process. From this "euphoric" standpoint, "it is now clear to everyone that the era of fossil fuels is ending", in light of "a new sustainable development path that will create a virtuous circle".

This unrestrained delight about the Paris Agreement was always unequivocally the first-cut view, quickly tempered thereafter by one or another inter-

pretation of scientific and political realism. Idealism made only brief cameo appearances, typically, although not always, expressed with the most sustained confidence by those nearest political power. As one participant put it, "from the lens of politicians and politicized expectations", the Paris Agreement is "a triumph"; from the investment perspective, "it is great" insofar as "it changed expectations"; but from the science lens, Paris is "nowhere close", from a justice lens "not good either", and for future generations "inadequate".

The most important aspects of the Paris Agreement were identified and assessed based on the extent to which they bring humankind closer to the goal of avoiding dangerous climate change. It was unanimously understood that the Paris Agreement will come to naught if its aspirations are overcome by "business as usual" and "politics as usual"—a great deal of hope is invested in the outgrowth of new "transformational coalitions" of government and private sector actors. It was generally agreed that the scale of financial flows to low-carbon technologies in the energy sector insufficiently lives up to the rhetoric of global commitment to keeping warming "well below" 2 degrees Celsius. A unanimity of pessimistic opinion regarding humankind's long-term ill preparedness to pay for and adapt to the ominous impacts of climate change was strikingly palpable.

To concisely and straightforwardly convey the most important, policy-relevant aspects of the post-Paris discussions that ensued in Cambridge, the following section will articulate central points made by participants, followed by dissenting counterpoints that were also expressed.



Point: *The Paris Agreement successfully avoided acrimonious division by allowing for “flexibility, reflecting national realities”. The previous top-down approach was abandoned in favor of one rooted firmly in national-level, bottom-up action. Over 190 countries submitted mitigation pledges through Intended National Determined Contributions (INDCs). The sum total value of all emissions reductions in the national pledges greatly surpasses the ambition of national pledges prior to the Paris agreement. In order to circumvent disagreement and achieve this feat, it was understood that Venezuela, Saudi Arabia, Indonesia, Malaysia and other countries extremely dependent upon fossil fuels will have “a very different [policy] path”.*

Counterpoint: Within the next 5 to 10 years, "every country needs to decelerate emissions". It will take considerable effort to avoid pre-Paris divisions. “Intended” nationally determined “contributions” reflect a watering-down of the previous legal language on “commitments”.

Participants at the post-Paris conference in Cambridge voiced many related concerns about the sufficiency of the INDCs: "the INDCs rely entirely on good faith—they are statements of good intentions"; "national pledges to reduce emissions are not guarantees of what is going to happen"; "developing countries won't deliver on their INDCs if doing so is perceived to constrain their economic development"; "the INDCs will not be implemented if they are not funded"; "India's INDC is not that ambitious, just business as usual"; "China's pledge is also basically business as usual". While many pledges were conservative and may actually be overachieved, it is possible that many of the pledges will fall short. The text of the Paris Agreement "notes with concern" that even if all national pledges are achieved, this would not prevent warming well beyond 2 degrees Celsius, let alone 1.5 degrees [...] "much greater emission reduction efforts will be required than those associated with the [INDCs]".

Participants noted that "it would be a disaster" if INDCs sit idle and are implemented in a tardy or restricted way.

Point: *The strength of the Paris Agreement resides in its basis in consent and procedure. It effectively promotes transparency, and serves as a legal basis for ramping up national-level action. Article 4.3 of the Paris Agreement stipulates that each successive iteration of INDCs should become progressively stronger and not weaker—known as the "no-backsliding clause". An absolutely essential element of the Paris Agreement is that it calls for a "global stock-take" of collective progress, including a review process for INDCs every five years. Peer pressure not only from other countries but from non-governmental environmental groups was crucial in the lead-up to Paris and will be essential moving forward.*

Counterpoint: This is true, but there is no guarantee that peer pressure will be sufficient. The Paris Agreement enshrines "obligations of conduct, rather than obligations of outcomes". "The UNFCCC *can't* be the center to confirm implementation" of INDCs, but simply has a duty to encourage "joint efforts". While the perception of good faith and conduct might prevail at the international level, most participants found analysis of domestic political struggles to be sobering. What appears to be "peer pressure" at the international level could, in some cases, be accurately described as sanctimonious posturing, subsequently contradicted by political realities at home.

Prime Minister Cameron's speech to the international audience in Paris was "fantastic", but it was "something he would never say domestically". Within the first week after the Paris conference, the government of the United

Kingdom drastically cut solar energy subsidies, capping them at 30 million pounds; although this might seem like plenty, the country's single most polluting coal plant alone receives 27 million pounds in subsidies per year. Lending further credence to doubts about the government's seriousness on climate change mitigation, the United Kingdom Secretary of State for Energy and Climate Change said the country will only phase out coal-fired power plants if they are replaced with new gas pipelines.

Germany, a pioneer in the low-carbon energy transition, donated \$100 billion for global renewable energy investments—"a great service to the world". One participant credited Chancellor Merkel for "[playing] an outstanding role" at the climate negotiations. But Germany's *Energiewende*—"energy transformation"—is under threat domestically. The country has committed to long run targets of reducing CO₂ emissions by at least 80 percent by 2050, while simultaneously committing to phase-out all remaining nuclear reactors by 2022. Regulations are in place to cap coal emissions and increase renewable energy generation in the power and heat sectors. Eco-taxes have also put downward pressure on consumption and emissions. But the German parliament has recently significantly watered down one of the most successful cornerstones of its energy transformation: the Renewable Energy Sources Act, first enacted in 2000 under a coalition between the Social Democratic and Green parties. Under Merkel's leadership, the government has reduced the surcharge paid for renewable energy sources, capped future growth in renewable energy generation, and created a market to keep coal-fired power plants running to ensure baseload power. This was not only at the urging of Merkel's own party, but was met with support from the more centrist, and increasingly dominant, wing of the Social Democrats. Native coal, gas, utilities, chemicals, and automobile companies and unions, as well as market-liberal think tanks and pressure groups, have stepped up lobbying efforts in recent years to delay the energy transition. Despite the sustained popularity of the *Energiewende* among the German public—consistently above 75 percent approval—German residential consumers of electricity are paying the highest rate in Europe, while Germany's heavy, polluting industries pay among the lowest rates. It is anyone's guess how the *Energiewende* will fare in light of these developments.

Despite President Obama's key role in Paris and his maneuvering to enforce the domestic Clean Air Act and limit emissions from coal-fired plants, an "elephant in the room" was and remains the intransigence of the United States Republican party. The United States INDC was fairly ambitious given its domestic political circumstances, but the country could experience a complete reversal of policy if the Republicans take control of the White House

later this year. Every single Republican presidential contender is either a climate denier or a climate "skeptic" who thinks government action on the issue is inappropriate. Even if a Democrat wins, they will for the foreseeable future face steadfast opposition to any legislative action on climate change from Republicans in Congress. At least one participant noted that the Paris Agreement was intentionally structured throughout the negotiations to enable United States ratification; the agreement was worded in such a way that it could be ratified under U.S. law through a "presidential-executive agreement", without the approval usually required from Congress (under Article 2 of the U.S. Constitution, treaty ratification requires a two-thirds "super-majority" vote from the U.S. Senate). However, as the same participant noted, the drawback of relying on a presidential-executive agreement to ratify the Paris Agreement is that future presidents could repeal it. Meanwhile, the two-thirds supermajority rule in the U.S. Senate applies not only to any future-proof treaty ratification, but increasingly to any major, comprehensive domestic law that goes through Congress. This is why national cap-and-trade legislation failed in Congress in 2010. Polarization in Congress is pervasive, menacing, and "here to stay", while public trust in the institution is nearly at an all-time low.

President Jinping has announced that China's "new normal" will involve the pursuit of "ecological civilization". As one participant attested, this new slogan is "more than rhetorical". China has become the world's largest emitter, but as far back as 2004 it announced medium and long-term plans (up to 2020) to reduce the energy intensity of its economy. Much of China's climate policy has centered around an extremely bold and expansive renewable energy industrial policy, first enacted in 2005, largely in order to "chase demand" from countries enacting legislation to boost generation of renewable energy, such as Germany and Spain. This has created economies of scale in the solar and wind industries and contributed to considerable cost reductions witnessed in recent years. Nevertheless, coal comprises 70 percent of China's energy mix. Approximately 80 percent of the country's indigenous coal must be left in the ground to be compatible with keeping warming "well below" 2 degrees Celsius. Even while coastal areas of China have seen an enormous growth in renewable energy generation, there is strong resistance from the coal dependent provinces further inland. The 13th Five-Year Plan vows to use more market mechanisms to achieve its energy and climate targets, but recent capricious movements in the stock market "should make [observers] uncomfortable with market mechanisms". There is also the additional issue that China effectively "exports" much of its emissions, by building carbon-intensive roads, canals, and infrastructure in countries abroad.

Suffice it to say that, every country—including world leaders on climate policy—has encountered considerable domestic political resistance of one form or another. While it was politically expedient at the international level for the Paris Agreement to remain flexible in light of "national realities", it is understandable why some claim it is nevertheless "toothless", unable to decisively override the vicissitudes of domestic politics.

Point: *Half of all new energy investment worldwide is in low-carbon technologies. In the OECD, low-carbon sources comprise approximately 75 percent of total energy investment. In light of these proportions, we should be cautiously optimistic about the future of low-carbon investment flows.*

Conterpoint: Overall investment in the global energy system from 2010-2050 is projected by the International Energy Agency to be over \$100 trillion, and much of this is currently destined for fossil fuel infrastructure. This could lock-in emissions for years to come. Additionally, keeping warming "well below" 2 degrees Celcius requires generating an estimated "\$3 trillion per year in low-carbon investments", or nearly 10 times current investment levels (\$330 billion in 2015, a record high year). As one participant put it, "the sums of money that need to shift direction of travel are mind-boggling". It was noted that an estimated "60 percent of the built environment in 2050 is *yet to be built*". At the same time, political levers have not sufficiently mobilized capital flows to clean energy. There is in Europe alone more than *\$3 trillion* in private sector savings—a huge stock of potential capital for the clean energy transition that is simply stationary and untapped.

The additional consideration of the ever-fluctuating oil market was emphasized. Energy R&D spending swings closely in line with changes in the price of oil—the higher the price has been historically, the greater the R&D investments in both fossil-based and alternative energy sources. But the price of oil and gas has been stubbornly low recently, and there are strong geopolitical interests to keep the oil price low. It is true that this has choked off investment in new fossil fuel developments deemed unprofitable at low prices. But low prices also deter and delay investment in clean energy; they also tend to result in greater subsidies to oil producers, as producer interests take over national politics. This is why effective carbon pricing, no matter *how* it is pursued in the policy realm, has long been deemed absolutely essential. In the words of one of the participants, such a carbon price would need to be "eye-wateringly high" for long enough (i.e. at least 30 euros per tonne, to spur more than just the precocious, "charismatic" business executives to undergo stringent decarbonization). Other participants felt that carbon pricing of this

quality remains improbable in most countries and that we should therefore be focusing more on regulatory measures.

Point: *The Paris Agreement incorporated the aim of keeping the rise in global mean temperature to “well below” 2 degrees Celsius. It also emphasized the importance of “[pursuing] efforts to limit the temperature increase to 1.5 degrees Celsius”. Including 1.5 degrees in this way was one of the major surprises of the Paris Agreement. It was a product of diplomatic efforts in the days leading up to the Paris conference, particularly at the Malta Commonwealth Heads of State meeting in late November 2015. Its importance was also implicitly understood by those who attended the France-Oceania Summit that same week prior to the Paris conference. When President Obama met with leaders from five island countries, he was “visibly moved” by their plight and struggle for a decent chance of survival. It was decided that there needed to be an explicit show of solidarity with the island countries. The Paris Agreement’s 1.5 degree ambition is crucial in its implicit acknowledgement that what is at stake is nothing less than survival for many of the world’s vulnerable low-lying countries, such as the Marshall Islands.*

Counterpoint: Aspirations are important in politics, but aspiring cannot amount to “just sitting back and hoping”. Both MIT and Climate Action Tracker did separate analyses of current national emissions pledges. It was determined that the gap between current “intended contributions” and the emissions reductions required for 1.5 degrees Celsius is “huge”. At least one participant said, and numerous others implied, that the ambition to keep warming below 1.5 degrees is “unrealistic”.

Crucial for containing the rise in global mean temperature under 1.5 degrees Celsius, and also 2 degrees Celsius, is the growth of negative emissions technologies. These technologies are designed to result in the net removal of CO₂ and greenhouse gases from the atmosphere. Net negative emissions are “absolutely necessary” because it appears that humankind will very likely peak global emissions “too late”. To achieve net negative emissions—given that there will still be positive emissions even at the end of the current century—negative emissions will have to be *5 times the size of world oil production* (4.2 Gt per year). Strategies to reach negative emissions include afforestation, agricultural land management, biochar, bioenergy with carbon capture and storage, and others. Studies on these techniques hitherto show that the verdict is still out as to whether achieving net negative emissions is possible.

Some participants were more pessimistic. It was noted that approximately

one-third of all anthropogenic climate change arises from deforestation, and that one widely touted "solution" to climate change, namely biomass for electricity, is actually counterproductive because it could result in the net loss of forests. Much of the biomass used for electricity comes from wood imported from other countries. Some studies have promoted the idea of incorporating carbon capture and storage (CCS) with biomass, but even if this could theoretically result in negative emissions in some places, CCS is not yet commercially viable on a large-scale. On the other hand, it was noted that a great deal of climate warming could be averted "if everyone becomes vegan", due to the fact that current farming practices cause much of the vexatious deforestation. But it was also noted that the chances of such a revolution in dietary practices becoming sufficiently widespread are practically infinitesimal.

The complexity of earth system processes was repeatedly emphasized by the climate scientists in attendance, but not in any way that appreciably allayed fears about the most extreme risks. Global mean surface temperature is a reasonable measure of the effects of climate change, but it is an imperfect one. A large fraction of anthropogenic change to the climate is irreversible on multi-century to millennial time scales, unless CO₂ is removed from the atmosphere. One of the studies cited, Feldmann and Levermann (2015), found that the complete melting of the West Antarctic ice sheet might be irreversible, in which case the world would experience an additional 3 meter rise in sea level. The best estimate of the temperature threshold beyond which the complete melting of the Greenland ice sheet would be irreversible is 1.6 degrees Celsius (which is still "well below" the 2 degree Celsius aspiration). The timescale of the melting will depend largely on the rapidity of global surface temperature warming, particularly in the regions where the ice sheets are located. We do not know if the most extreme effects will be experienced within the next 100 years, or if it will take closer to 1,000 years. Suffice it to say that climate change could severely inundate coastal regions even if all current national greenhouse gas pledges are achieved. Taken together, sea level rise resulting from West Antarctic, Greenland, and Arctic ice melt would mean that the Netherlands would no longer exist, and the coast of East England would recede as far West as Cambridge. Looking further ahead, Arnell et al (2015) found that a 4 degree Celsius mean temperature rise would mean that over 25 percent of mammals and 50 percent of plant species would lose 50 percent of their climatically-suitable habitat area.

Point: *The Paris Agreement includes provisions for addressing "Loss and Damage" from the impacts of climate change that cannot be avoided or adapted to. This was a major point of contestation initially. Many countries did not*

want anything about Loss and Damage included at all in the agreement. But given the reality of the risks, especially to low-lying countries, a deal was struck in the end to include Loss and Damage in the legal language.

Counterpoint: The legal language used in Article 8 on Loss and Damage is "addressing" loss and damage. But as one participant rebuked, "what does that mean?" It is not clear, leaving ample room for inaction. The trade-off in the Loss and Damage provisions is that island countries gave up a potential set of legal rights. Paragraph 52 of the decision that accompanies the Paris Agreement stipulates that it "does not involve or provide a basis for any liability or compensation". The legal language of "liability" and "compensation" was for rich countries and other large emitters deemed beyond the pale. They did not want to discuss the financial implications of 2 degrees or 3 degrees Celsius.

Point: *Paragraph 21 of the decision adopting the Paris Agreement "invites" the Intergovernmental Panel on Climate Change (IPCC) to provide a Special Report in 2018 on the impacts of 1.5 degrees Celsius versus 2 degrees Celsius warming. This report could be a catalyst for further mitigation efforts, adding to the urgency of keeping warming below 1.5 degrees.*

Counterpoint: This task for "attribution research" in climate science is no small feat. At the moment, the academic community simply does not have detailed modeling that would calculate the difference between 1.5 and 2 degrees Celsius. There are many complications in determining this sort of difference. Considering, for example, the food-water-energy nexus, the academic community knows individual areas quite well, but one participant conceded "we don't know causal linkages very well". Another participant presented evidence pointing to the fact that mean surface temperature warming does not always increase precipitation. These are just some among many areas of uncertainty in attribution research.

With respect to the upcoming 2018 Special Report of the IPCC, "the academic community has been caught sleeping", as another participant conceded. "It's embarrassing, but that's where we're at". It appears that climate scientists will be in a rush to publish evidence relating to attribution up until the 2017 article deadline for the IPCC Special Report. Observers may reasonably wonder whether it is simply a matter of scientists having "not figured this out yet", or if in fact the challenges of attribution research are insoluble. This is unfortunate for many reasons, among them the fact that drafting the IPCC report is very important for issues relating to *liability* in the future. Looking

ahead to 2040 or 2050, it will matter whether or not national governments "knew", based on the latest peer-reviewed science, that 2 degrees of warming, as opposed to just 1.5 degrees, would result in additional loss and damage.

Point: *"Paris has happened about 20 years too late". "The last 15 years demonstrate that 1.5 degrees is incompatible with democracy". This is fundamentally a "political problem", related to "the connectedness between consumer and voter interests". What we have seen is that "governments care more about voters than 1.5 degrees". If we want a serious chance of averting dangerous climate change, we must recognize that "1.5 degrees implies geoengineering".*

Counterpoint: The Paris Agreement is better late than never. The outcome is *far* better than if the UNFCCC simply collapsed. That was, after all, a real possibility. More governments than ever before have expressed intentions to ramp up mitigation efforts in the coming years. Paris was no panacea—that much is clear. But this is an evolving process, and it would be naive to expect Paris to be anything more than a modest step forward in the global struggle to avert dangerous climate change.

It is true that governments care more about voters than 1.5 degrees Celsius, but it is far from clear that this implies the need to abandon democracy. Autocracies do not outperform democracies on climate and environmental policy metrics. The verdict is still out as to whether fully technocratic management of climate policy would be publically acceptable, or even effective. It is scarcely imaginable that civil servants and scientists could usurp power from both voters and carbon-intensive industry. It is far more plausible that a mass social movement *of voters* is required to empower well-meaning politicians or force laggard ones to act in the interests of sound climate policy. This does not imply the abandonment of democracy but the strengthening of currently nominal democracies to forms of democracy that function far better, with greater foresight and risk aversity. Participants at the post-Paris conference in Cambridge did not at all discuss challenges with regard to public opinion. Moving forward, this has to change. We should not rely on "transformational coalitions" of experts alone. It will require a cross-party consensus, the whole body politic.

It is crucially important not to underestimate the progress that has been made, and the harbingers of positive things to come. The United Kingdom is home to over 11,500 companies and 460,000 people in the low-carbon economy; the industry's annual turnover is approximately \$120 billion, twice that of the automobile manufacturing sector. These are the fastest grow-

ing sectors not only in the United Kingdom, but in the United States and many other countries. Presidents Obama and Hollande and Prime Ministers Modi and Cameron launched "Mission Innovation" to finance and deploy the next generation of low-carbon technologies; shortly thereafter, Bill Gates signed on with 27 wealthy friends. There is a real possibility that there could be breakthroughs in energy storage and transmission, the missing links in the renewable energy revolution; already, companies in Germany are making remarkable progress with underground energy storage techniques, but "it's anyone's guess" as to which ideas will win in the market. We should also be encouraged by "Swanson's Law", which states that for every doubling of cumulative solar installations, the price of solar tends to drop 20 percent. Hence, we should be confident that new renewable energy commitments by governments can create "huge growth in markets". In the solar industry, "everything is still based on silicon PV", but "in Cambridge we know that plastic solar cells are a fraction of the cost".

Although the Paris Agreement excluded shipping and aviation emissions from regulation (a point that several participants criticized adamantly), there is nevertheless some promising momentum in the transportation sector. Variolift Airship, a British company, has created a 12-story-high, low-carbon "airship". The airship is huge—170 meters long and 70 meters wide. It carries 1,500 tonnes of freight and travels at 340km per hour. It is covered in aluminum and propelled by helium bags and compressors. In road transport, there are also encouraging signs: 17 percent of new registered cars in Norway are electric, and Oslo plans to become car-free by 2019. China is also investing heavily in electric vehicles. This could be the beginning of a transformational coalition in transport.

There are also other encouraging developments to keep an eye out for. The New York Forests Declaration commits to creating new carbon "sinks" through afforestation of land mass the size of India, as well as eliminating deforestation by 2040. There are also real prospects for providing electrification to those who do not currently have it without increasing emissions. The United States and United Kingdom have jointly agreed to "Energy Africa/Power Africa", which assists African governments in deploying clean energy off-grid to every African village that does not currently have electricity, "reaching 620 million people by 2030".

If these encouraging developments are insufficient to quell disappointment with global climate change mitigation efforts thus far, it is because it is indeed quite possible that they will be too little, too late. Whatever lies ahead, geoengineering "should not be a fig leaf". The danger of geoengineering, aside from its many uncertainties, is that it presents a moral hazard, intimating

misleadingly that a technological solution is just on the horizon, and that mitigation action is no longer needed. Either way, mitigation action will be imperative. Moving forward, governments need to make every concerted effort, at every political opportunity, to advance the low-carbon transition as expeditiously as possible. Failing to do so, and failing to continue to pressure laggard governments and businesses to do so, will not only very likely produce a global economy in shambles, but will be a major disservice to the spirit of the Paris Agreement, which, for all its blatant imperfections, is the single greatest statement of the fact that, collectively, we know and can do better.