THE GEOPOLITICS OF CLIMATE CHANGE

# ENVIRONMENTAL AFFAIRS

SPRING 2021

**General David Petraeus**
A Framework for the Geopolitical Risks of Climate Change

**Hon Malcolm Turnbull AC**
Australia's Need to put Climate at the Heart of its Geostrategy

**Rt Hon Lord Hague of Richmond**
The Convergence of British Foreign Policy with Climate Policy

**Erin Sikorsky and Sherri Goodman**
NATO's Mission in an Age of Climate Change

Policy Exchange

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# THE GEOPOLITICS OF CLIMATE CHANGE

**Environmental Policy increasingly reaches the heart of all policy areas, starting with questions of the global balance of power**

At some point in the last few years, environmental policy became a strategic priority of nations. Protecting access to key resources has always been at the centre of geopolitics, but now the definition of 'resources' has expanded to include a safe planetary environment. This is driving a deep shift in the economics that underwrite the global balance of power.

In this vast geopolitical swerve, some commentators seem to foresee a form of the 'end of history' all over again, as the oil wars of the past come to an end and petrostates stabilise. As **Bruno Maçães** points out in his article, this is a flawed view. While a more sustainable and equitable world economy is a worthy end goal, there will be upheavals in the meantime. We must access new types of resources, which opens up new national vulnerabilities, as highlighted by **Nadia Schadlow**. Energy security policy will have to modernise, as the focus shifts away from oil fields in far-off lands and onto local power grids, as **Ed Birkett** sets out.

These upheavals will be harder because, as the world attempts this shift to prevent a catastrophe, that catastrophe has already begun to unfold. The waters are churning more and more, even as we try to rebuild the ship. Extreme weather events and disrupted ecosystems already exert severe pressures on societies, and the weakest states are the most exposed. All of which is driving the convergence of environmental and foreign policy, as Britain's former Foreign Secretary **William Hague** lays out in his essay.

If we are lucky, bold and careful all at once, these pressures can be manageable. But they are already taking effect and we need institutional innovations to cope, updating existing bodies and creating new capacities. As **Erin Sikorsky** and **Sherri Goodman** argue, NATO's founding mission should be seen to encompass the effects of climate-induced destabilisation, though this means its strategy must change to stay ahead. Other cross-border issues will need wholly new approaches. In their article, **Benjamin Pohl**, **Sabine Blumstein** and **Susanne Schmeier** set out the need for water policy to move beyond technical fixes and into the political sphere. Finally, we must explore every tool available to us, including more controversial approaches like solar geoengineering. However, this will need a framework of research and governance to avoid abuses and maximise value, say **David Keith** and **Peter Irvine**.

Not all of this is new: the world has had to build a new critical resource supply chain every few generations since the 18th century. Each industrial revolution creates new energy dependencies, with instability along the way. We are experiencing the latest version of that process. However, we should note that such changes in the past have allowed nations to rise and fall – Britain and America should know this well, because it was they who benefitted most. The climate geopolitics of the 21st century will set up a competition in which the stakes are just as high. In such a field, the liberal democratic model must prove that it can respond to long-term, international challenges whilst maintaining freedom and prosperity.

With a more assertive China seeking to build its own spheres of influence, liberal democracy faces a credible challenger. An effective and collaborative response to climate change would help liberal democracies to underscore their soft power, forge new alliances and protect against China's authoritarian model. As its former Prime Minister **Malcolm Turnbull** notes, nations like Australia must prioritise climate policy in order to resist this competitive pressure in the all-important Indo-Pacific. Others in that region, not least India, are looking to richer democratic powers to help them. In his article, **Mihir S Sharma** makes the compelling case that New Delhi is proactively building Indian self-identity around leadership on climate, but it needs support – particularly access to private capital – in order to do so.

In thinking through these complexities, it helps to have some clarity of the risks. Our lead essay, co-authored by **David Petraeus**, sets out a high-level framework for viewing such risks in the geopolitical context. None of our contributors believe that climate change is the single dominant force in geopolitics. Several specifically point to the complex interplay of risk factors, with climate change acting as an increasingly relevant 'threat multiplier'. Yet the vague language of 'threat multiplier' becomes less helpful as these phenomena manifest more clearly over time. It becomes harder to generalise and more necessary to test policy solutions in the real world.

As we have increasingly discovered at Policy Exchange, environmental questions now sit at the heart of traditionally more dominant areas of policy, from economics to foreign affairs, security, health, industrial policy and social issues. These overlaps will be the focus of Environmental Affairs.

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# CLIMATE CHANGE AS A GROWING FORCE IN GEOPOLITICS

**The world requires a new framework for thinking about the geopolitical risks of climate change, argue David Petraeus and Benedict McAleenan**

***By General David Petraeus and Benedict McAleenan***

In 1815, two months before Napoleon's troops met Wellington's at the Battle of Waterloo, a volcano erupted in what we now know as Indonesia.

Mount Tambora, which lies on the north coast of that country's southern archipelago, gave way with such violence that its explosions were mistaken for local cannon fire over a thousand miles away. British colonial officers despatched troops and ships in the assumption that their comrades were under attack.[1]

Tambora's eruption devastated the region, leaving 120,000 dead over the following days and months. The resulting famine and disease were terrible, with the ash blocking out the sun for an extended period.

As frightening and as tragic as the initial effects were, no one at the time could have predicted the distant and long-lasting implications they would have on 19th century geopolitics. Today, pulling together several academic analyses, we can plausibly link that volcano to events across the world that were both acute and long-lasting.[2]

Take, for instance, Napoleon's fate. The effects of the sulphur dioxide and ash that spread from Tambora caused well-documented, dramatic changes to weather systems globally, creating what Victor Hugo described in Les Misérables as "an unseasonably clouded sky" over Belgium in June 1815. Beneath that sky, Wellington desperately waited for his Prussian allies to arrive. Napoleon, having planned to strike early on June 18th, delayed slightly due to the heavy rains over the preceding night, knowing that cannon balls are designed to skip along the ground for the last few meters of their trajectories, and they would have been less effective in ankle-deep mud. Importantly, his delay allowed the Prussians time to arrive and unite with the British. The rain also may have undermined the effectiveness of Napoleon's infantry, whose muskets and rifles would have become damp as he sent them across fields of wet rye grass.[3]

Given Wellington's description of the Battle of Waterloo as "the nearest run thing you ever saw in your life," it is entirely possible that an Indonesian volcano gave the Iron Duke the edge he needed to change the course of history. The ensuing victory removed the British Empire's leading rival and laid

***The links between climate change, national security, and the wellbeing of societies are undeniable and becoming increasingly pronounced.***

the base for the hegemony it enjoyed for a full century after.

At the other end of Eurasia, the presence of sulphates in the stratosphere cooled the land. This disrupted the Monsoon season, leading to devastating floods in Yunnan Province and along the Yangtze River Valley, creating famines and social unrest. In fact, the reigning Qing dynasty's inability to manage the subsequent unrest has been suggested as one reason for China's decline in the 19th century.[4] Thus began China's 'century of humiliation' – a term that was coined a hundred years later in 1915, but one that still informs Chinese foreign policy today.

The wet weather and failed harvests also pushed up grain prices and caused hunger across the world. The resulting riots in Europe led to severe clampdowns and a wave of authoritarianism that lasted for decades. Meanwhile, American farmers surged West across the Appalachian Mountains to find and cultivate new, highly productive land to make up for the lost supply. But, when European grain markets recovered and demand for US grain declined, the banks financing the American agricultural expansion collapsed, and the US experienced its first credit crunch.[5]

Finally, the volcanic eruption may also have helped create the world's first cholera pandemic, as the disruption of the Monsoon in Bengal allowed a new and more infectious strain of cholera to emerge and spread across the world.[6]

All of this occurred, at least in part, because of a single environmental event that changed the average temperature at the time by about 0.5 to 1 degree centigrade.

It affected the course of a decisive battle, created social unrest and refugees in wealthy nations, sent food prices soaring, and even led to financial instability. Now consider the effects of a change in temperature of more than double that seen in 1815. In such a case, long-term climate change could bring about very similar effects; indeed, the unseasonable weather of the years following 1815 should be expected repeatedly in the 21st century. The effects of the eruption in 1815 changed events then, and a similar rise in temperature will do so in the foreseeable future. We are, in fact, already seeing results of climate change around the world in the increased severity of storms, significant changes in weather patterns, rising temperatures, expanding desertification, rising sea levels, intensification of fire seasons, and a host of other climate-related developments.

As examination of the consequences of Tambora and of the many other analyses of shifts in the climate have shown us, the links between climate change, national security, and the wellbeing of societies are undeniable and becoming increasingly pronounced.

It is thus very clear, again, that changes in our climate hold significant implications for geopolitics and security policy. And, for that reason, my co-author and I are very grateful to Policy Exchange for inviting us to examine these implications.

## From Black Swan to Gray Rhino

A key issue we have examined has to do with the categorisation and management of the broad range of risks associated with climate change. And we want to use this opportunity to propose a broad taxonomy with which to consider climate risks in the geopolitical context.

We believe this taxonomy enables us to think through the conceptual challenges more clearly, requiring a set of policy responses upon which we will touch, but which will certainly require further development.

To be sure, the international community has come a long

way in policy development regarding climate change. And this year presents what many see as a potential inflection point for the issue, with the arrival of President Biden in the White House serving as a catalyst for action. The United States' return to the Paris Agreement comes at a pivotal time, amid commitments by several other major economies, led by the UK, to a 'Net Zero' emissions policy.

The UK's presidency of the COP26 climate summit alongside Italy, with both of these partners also hosting the G7 and the G20, provides a rare confluence of opportunities to galvanise and increase momentum. This will generate additional focus in security and foreign affairs communities, which have seen steadily more widespread acceptance that climate change presents numerous major challenge for strategists and those assessing risks.

This is not a partisan political shift: senior security officials under successive US administrations with differing views on climate-related issues have stated their concerns and placed steadily increasing priority on climate-related security risks. Under President Trump, for example, my long-time comrade General Jim Mattis highlighted the significant effects that climate change was having on "stability in areas of the world where our troops [were] operating."[7] President Biden's National Security Advisor describes the need to address climate change as an "urgent national security priority."[8] And the just-released Global Trends report by the US Director of National Intelligence assesses that, "During the next 20 years, the physical effects from climate change of higher temperatures, sea level rise, and extreme weather events will impact every country," with the "costs and challenges" falling disproportionately "on the developing world, intersecting with environmental degradation to intensify risks to food, water, health, and energy security." That is a very stern analytical assessment, with none of the normal caveats of such findings by intelligence communities.

The problem is, in short, real and grave. Nonetheless, we have so far struggled to define it adequately and to propose a sufficient response. This reality is implicit in the rhetoric surrounding climate security. For some years, for example, the foreign affairs and security establishment has described climate change merely as a 'threat multiplier.'[9] And, indeed it is: climate change clearly exacerbates familiar pressures such as poverty, corruption, resource scarcity, and authoritarianism. Yet this descriptor is just not enough; it is too vague and too limited in its ability to prescribe a policy response. Simply stating that climate change will make every threat more intense is not very helpful in practical terms. It merely implies that the only policy response is to reinforce our defences and batten down the hatches.

## A taxonomy of risk

To improve on the conceptual framework used to discuss these issues, we propose borrowing from a taxonomy used by the financial community given that even more than the security community, financial institutions are fluent in the language of risk.

Their aim is, of course, to commoditise risk, to price it into products and services. It should be no surprise, then, that they are, in certain respects, some years ahead of the pack in analysing the risks of climate change.

Financial analysts have identified three broad areas of climate-related risk for their own investments, and we believe they can be useful for our purposes as well. These are: physical risks, transitional risks, and liability risks. With some adjustments for context, these terms provide a structure, or construct, for analysing the geopolitical stressors that climate change creates.

*Tunisian protestors chanted for "bread, freedom, social justice". Early Syrian protestors counted among their numbers farmers ruined by regional drought and the state's divestment from agriculture. And demonstrators in Jordan and Yemen waved baguettes as a symbol of protest.*

## Physical risks

Physical risks are those created by an increasingly uncertain physical environment. The list is extensive and includes, for example: sea level rises and resultant flooding, desertification, crop failures, disrupted monsoons, species displacement, and the emergence of new pathogens. As we saw with the Mount Tambora example, the effects of climate change can be manifested locally and globally, acutely and chronically, in easily predictable and complex ways.

In 2015, a study by Lloyd's of London found that a strong warm-phase El Niño southern oscillation, combined with a surge in a wheat blight, both of which are highly plausible, could have devastating effects on a global scale. The resultant flooding and drought in crucial agricultural regions could cause grain and soybean prices to soar. The Lloyd's model indicated that particularly vulnerable regions, such as the Middle East and the Sahel, could experience food riots, with potentially terminal consequences for the governing regimes.[10]

The scenario is not based on fiction. There has long been an awareness that the Arab Spring, from its first sparks on a Tunisian roadside to the ongoing conflagration in Syria, has had a significant climate-related element. Our argument does not assume that climate events form a linear causal chain. Clearly, the world is more complicated than that. Nonetheless, it is wrong to assume that human societies operate on a plane apart from their physical environments.

There is a tendency among some in the West, perhaps influenced by the term 'Arab Spring' and the events associated with it, to think of those events as driven by democratic aspirations. While there may be some merit to that, it may be more appropriate to consider that they were driven by hunger. Indeed, the countries involved are still some of the largest wheat importers in the world, with Egypt being the largest. The US Ambassador to Algeria had, in fact, reported on weekly food protests in Algiers as early as 2008. Similarly, Tunisian protestors chanted for "bread, freedom, social justice". Early Syrian protestors counted among their numbers farmers ruined by regional drought and the state's divestment from agriculture. And demonstrators in Jordan and Yemen waved baguettes as a symbol of protest.

It is thus relevant to note that 2010 to 2011 saw a near-doubling of global wheat prices due to droughts in China, Russia, and Ukraine, as well as unseasonable rain in Canada and Australia.

China's drought led it to import substantial quantities of wheat to shore up its domestic supplies, and that created market shifts with profound consequences for brittle regimes on the other side of the world.[11]

Nor was this a freak event. In rural Nigeria, farmers and herders have engaged in increasing conflict over fertile land and water supplies, creating a huge increase in casualties between 2010 and 2016.[12] This has been, in part, driven by the desertification of sizeable swathes of farmland each year. And, needless to say, increasing scarcity of farm and grazing land creates competitive pressures that feed destabilisation, migration, and support for armed non-state groups such as Boko Haram and Daesh.

The effects of these phenomena ripple out of course: in recent years, for example, Europe has seen the consequences of a northwards migratory surge from the Sahel and a westwards push from Syria. The resulting tsunami of refugees created enormous domestic political challenges for European countries, in many cases the biggest domestic challenges since the end of the Cold War.

To be sure, there were other factors at work in the Arab Spring, from the arrival of social media to the effects of a global financial downturn. Nonetheless, we contend that environmental change should have a prominent place in geostrategic analysis of such events and of such possibilities..

In two studies, researchers at Stanford University have sought to quantify the correlation between conflict and changes in temperature and precipitation. Their analyses conclude that, at the interpersonal, inter-group, state, and civilisational levels, deviations from the norms in temperature and rainfall present seriously destabilising factors. In fact, their study found that a single deviation point change in temperature and rainfall (which is less than half the predicted change for some geographical regions by 2050) led to a rise of 14% in inter-group conflict. That represents, needless to say, a sizeable increase in potential civil wars and revolutions.[13]

Physical risks will also complicate our understanding of various theatres of military deployments. Western military forces, for example, have made extensive use of naval and air bases on islands dotted around the globe. Many of these low-lying bases are vulnerable to rising sea levels – which already are some 20cm higher than they were in 1900. Clearly, we cannot replace each such location with an aircraft carrier, amphib, or submarine, and it is clear that each nation has to assess its own vulnerabilities closely and plan for changes that may be required by further rises in sea levels.

Such an assessment should also include the increasing potential of new bases emerging in the High North, where melting ice caps are creating a flurry of activity between

competing Arctic and near-Arctic states, and where waters that were inaccessible in the past are increasingly becoming open for longer periods each year. With that, let us turn to our second category of risk: Transitional.

## Transition risks

'Transition risk' refers to those risks associated with preparation of societies and their economies for the challenge ahead, such as the shift from fossil fuels to renewables.

We clearly must, as a species, move our economic model to an increasingly sustainable footing through increased reliance on new energy sources and adoption of new technologies.

Transition risks highlight likely shifts away from the trade patterns and, in some cases, relationships that have shaped the 20th century.

This will create an inevitable period of flux within which there will be much to gain in a variety of respects. Indeed, we in the West should not see climate change as pure risk: our strategic competitors certainly do not. They see the opportunities to be exploited and we need to do the same. For states like China, the ongoing transitions associated with adoption of sustainable energy sources and ecosystems have presented numerous opportunities, and China, in particular, has sought to capitalise on those opportunities in a variety of ways. As a former Portuguese minister, argues, "China is not so much announcing a retreat from a technological model as the beginning of a new one."[14] He notes that, in the past, England gained the upper hand by pioneering the first fossil fuel technologies, and the USA very much followed suit. We must now recognise the new transition and shift swiftly to become leaders in it.

China sees climate change through two prisms: the first is domestic order, the second is international influence. Climate change is properly seen by authorities in Beijing as a challenge to domestic stability, a central objective for the Chinese state. Remember, if you will, that the destabilising effects of the Tambora eruption had a devastating effect on China and the Chinese regime at the time. China's dependence on fossil fuel energy imports, high consumption of coal, rural environmental degradation, and unhealthy air quality over major cities are all factors of considerable concern for Chinese authorities, whose political legitimacy rests in no small measure on the ability not just to deliver economic growth, but also to improve quality of life, including air, water, and soil quality.

In turn, this has contributed to identifying new ways to meet energy consumption needs that reduce domestic vulnerabilities.

***Simply stating that climate change will make every threat more intense is not very helpful in practical terms.***

Beijing also sees significant opportunities in the transitions in global energy sources and the resources required for sustainability initiatives. Consequently, China has become the leading investor in renewable energy and clean technologies – reportedly investing more in these areas than the US and EU combined. It has also aggressively sought the resources must needed for new technologies, with a special focus on the rare earth minerals that are vital for a host of advanced products. It has also declared itself a 'Near Arctic State', invested in icebreaker ships, developed relations with Greenland to achieve Arctic mineral access, and invested heavily in new energy supply chains.

The Belt and Road Initiative has facilitated many of China's initiatives in this area in developing countries. In so doing, China brought many resource-rich and strategically-located states into its economic orbit and enabled the establishment of extensive supply chain relationships.

For all of the world, moving from fossil fuel dependence means more than a welcome shift to cleaner energy production as well as increasingly capable storage and transmission systems. But solar panels, wind turbines, batteries, and the other elements of sustainable energy require a range of materials as well as engineering that will introduce new industrial approaches.

In energy security terms, this will not be a replacement of like for like. The anticipated shift will not be as simple as a move from petrostates to electrostates, not least because many petrostates have huge potential for solar and wind resources that could turn them into regional hubs of electricity exports and hydrogen or ammonia production. In sum, the permutations and developments of the new way forward are certain to have substantial effects on geopolitics, trading relationships, economic development, and security issues,

## Liability risks

Finally, the financial community increasingly considers the growing role of liability risks associated with climate-related developments. For financial analysts, this is primarily a question of ensuring adequate due diligence to understand the potential liabilities, how to mitigate of the risks identified, and thereby how to reduce the potential for costly developments and complex litigation.

Liability risks have grown considerably in recent years. Pension funds and oil companies, for example, have found themselves in court as legal and fiduciary expectations have changed in response to climate change – and have thus worked hard to reduce the likelihood of such legal challenges.[15]

We suggest modifying this category for the geopolitical context, in essence to be a question of rights and responsibilities. Scarce resources have always been a chief concern of economics and geopolitics, and they will be long after the transition to low-carbon energy production has advanced, meaning that this is not a 'transitional' question per se. That is why it deserves a separate category of risk.

Yet environmental change does bring a new set of questions around scarcity and the liabilities associated with it. Water management is perhaps the most obvious. Clean water, free of pollutants and in adequate supply, is a basic

requirement for life and functioning societies. But, in many cases, a river can course through multiple jurisdictions, making its wellbeing the concern of multiple states and multiple industries and livelihoods.

Ethiopia's development of the Grand Ethiopian Renaissance Dam is a high-profile case in point. The Nile River basin is expected to support one billion people by 2050. A study by researchers at MIT indicates that climate change could increase rainfall in the Ethiopian Highlands, which supply 80% of the river's source water. This would increase its flow, but also its variability, which means that droughts and floods will become more common throughout Ethiopia, Sudan and Egypt. The authors note that this pattern is already in evidence; it is not an abstract projection.[16]

The Renaissance Dam arrives in this context, placing a new strain on shared resources. Ethiopia has, for example, been unwilling, at times, to allow water to flow through the generating station at the dam in order to supply Egypt in times of drought. The resulting issues have become ones not just of national pride on both sides, but of economic survival for those downstream. Ethiopians across the political spectrum see the dam as a ticket to the developed world and regional influence. Egyptians see the Nile's waters as its life blood, a birth right synonymous with Egypt's very identity, and Cairo has been invoking old treaties to protect what they see as their entitlements.

*Droughts in California, have not led to civil war; however, they have at least contributed to civil war in places like Syria. The difference is governance.*

Yet the controversy is also symptom as well as cause: as the MIT authors note, the basin faces a much broader challenge than one controversial dam. Coping with a far more variable Nile River flow requires regional cooperation from Lake Victoria to the Mediterranean in order to create the necessary water storage and management infrastructure. It also requires individual nations to consider their efficiency of resource use, especially that of water. The Nile issue thus is ultimately a question of arbitration, cooperation, rights, and responsibilities.

While the parties in this dispute have not yet resorted to the use of force, such an outcome has not been explicitly ruled out. But the Nile is not just a one-off; rather, similar conflicts are on the rise elsewhere: the Pacific Institute, which maintains a database on water-related conflicts, shows a steady, indeed alarming, acceleration of both internal and cross-border disputes since the late 1990s.[17] Thus, despite many warnings, efforts to prevent water wars appear to be faltering.

Another challenge in this question of rights and responsibilities concerns our respective atmospheric emissions. Britain began the industrial revolution – and the pollution associated with it. The US then became the largest polluter in the last century. And now China holds the crown. Various developing countries hold the view that the developed world created the problem and should provide the lion's share of solutions, as they experience their own challenges as they expand their industrial activities.

Questions of responsibility and redress will be a central one during the UK's presidency of COP26 later this year. Who, for example, is to tell others that they cannot develop as they wish? At what point will the first sanction be levied for polluting the world's atmosphere? And how should geoengineering be introduced if the world proves unable to manage its climate through emissions controls alone?

These are not simple questions, and they pose enormous questions and significant risks that will affect the balance of duties between nations.

Very often, the solutions to the challenges accompanying climate change will lie in governance. Droughts in California, for example, have not led to civil war; however, they have at least contributed to civil war in places like Syria. The difference is governance.

Liability risks thus create a challenge that requires governance across borders – diplomatic, economic, and potentially military. Where governance fails in such contexts, the results may lead to an increase in "fait accompli strategies" to achieve resource objectives and, in some cases, this could lead to the use of force.

In an era of persistent competition, the character of conflict has changed, with the distinctions between peace and war blurred in some respects. Combat in cyberspace, the newest domain of warfare, is ongoing every day, as are significant activities in social media intended to undermine our cohesion, to inflame ongoing debates, and influence decision making. Climate change will present additional developments that will undoubtedly precipitate disputes and actions that will result in challenges to existing institutions and norms.

To deal with these developments, democratic nations will need to enhance their abilities to offer comprehensive responses, mobilise public and private stakeholders and civil society and to foster coordinated approaches with like-minded nations.

## The implications for the liberal democratic alliance

For the liberal democracies of the world, these three risk factors will present a complex range of challenges. At the least, they will require reallocation of resources. However, a more fundamental challenge may emerge to the democratic, liberal economic model, and this will likely bring new strains and stresses on existing relationships, alliances, and partnerships.

As nations large and small grapple with the physical, transitional, and liability risks of climate change, they naturally will experience new pressures. These will manifest themselves in political, economic, and fiscal spheres often related to infrastructure and resources. In some cases, they may even be existential, as threats of sea level raise increase to several low-lying island states.

Such pressures may make states and societies more vulnerable to opportunism and the temptations of extreme political answers. At the state level, there could be a higher risk of authoritarianism. As Europe saw after the eruption of Tambora and as the Arab world saw after 2011, authoritarian rule often emerges in stressed societies. At the sub-national level, where states or local resources fail to provide a stable economy with sufficient rewards for licit activities, the attractions of joining non-state armed groups such as Daesh and Boko Haram can be enhanced. These groups will hold out the promise of (though rarely deliver) order, income, and privileged access to resources. In practice, however, they often destabilise already fragile societies and drive migration in response to a downward economic spiral and oppressive, sometimes extreme rule.

At the international level, such pressures can lead countries into the sphere of influence of larger actors. China's Belt and Road Initiative, for example, is a vast programme of investment in infrastructure and assets, welcomed in many countries and regions. And demand for such improvements is, in part, a function of the climate change transition, helping to meet the need for preventive measures such as low-carbon energy and adaptive measures such as air conditioning. China's domination of some key markets and credit lines helps it to exert considerable influence over its 'partners' in the Belt and Road. That is understandably sounding a cautionary note for many in the security community, leading to calls for

corresponding initiatives by the world's democracies.

Where there is risk, though, there is also opportunity, not only for authoritarian regimes but also the liberal democratic world. Indeed, the latter is well suited to respond to all of the growing risks, if managed properly. Liberal democratic systems that function effectively offer not just freedoms and degrees of prosperity, but also an enhanced ability to adapt and develop new solutions to the pressures they face.

## Building anti-fragile systems requires liberal democracy

In developing a strategic response to the array of new and intensifying risks associated with climate change, there should be two objectives. First: minimise climate change. Second: enable creation of adaptive systems.

The first objective must be to minimise to the extent possible major climate change. Evidence suggests that we may already be too late with this effort, but it is possible to slow and, over time with breakthrough technolgies halt the process and, indeed, reverse it to varying degrees.

Such strategies and initiatives will require global efforts, and indeed there is obviously much of that underway and being reinvigorated by the new administration in Washington. We will discuss some additional initiatives in a moment.

The second objective should be to build adaptive systems. As most observers in this arene will be familiar, the philosopher Nassim Nicholas Taleb has pioneered the concept of "anti-fragility," which attempts to describe a distinct form of responsiveness to systemic shocks. It is highly relevant in facing a new set of stressors such as those presented by climate change.

The concept of anti-fragility is often misunderstood. 'Anti-fragile' explicitly does not mean merely resilient. Rather, the term describes the ability of a system to strengthen and actually develop in the face of volatility. To explain, there are three categories of systems: firstly, those that are fragile and crumble under stress. Secondly, those that are resilient and can withstand shocks and carry on as before. But these first two categories of systems will struggle nonetheless over the long term. So, thirdly, there are systems which actually get stronger and learn from the experience of stress – the anti-fragile.

Now, a socio-economic system such as China's could be said to be resilient. By sheer scale of its population, its economic trajectory, and its central control, it is able to endure through many challenges. But as Darren Acemoglu and James Robinson have argued, the inability of China's model fully to mobilise societal capacity can place a limit on the capacity of the state.[18] For full mobilisation of both state and society, liberal markets and democratic scrutiny appear particularly well-suited for attracting innovation and self-perpetuating investment.

The writer C.S. Lewis claimed to be a democrat not because he trusted in the wisdom of individual men, but because he believed in the opposite; he saw the need for political systems to correct themselves constantly in the face of flaws and volatility. This is exactly what we mean by the anti-fragility of the liberal democratic model. It is not perfectly anti-fragile by any means – no system can be – and various democratic states have demonstrated shortcomings in recent years. Nonetheless, liberal democratic systems are, in our view, more dynamic than authoritarian systems.

Some observers offer that China's response to the COVID crisis is a case in point, as it restricted internal discussion and aggressively pushed back against reasonable inquiries about the pandemic's origins, reflecting possible limitations in learning from missteps and setbacks. A system's inability to scrutinise itself makes that system more fragile, not less.

For a system to be anti-fragile, it must as far as is possible, eliminate or at least reduce downside risks and open itself to potential upsides. A dynamic and healthy democracy, with a liberal market system backed by a capable, vibrant state, can explore, examine, and debate new ideas. It can challenge bad ideas through intense debate and public scrutiny. And, through democratic freedoms, property rights, and market incentives, with new technologies and business models brought forward by innovation, it can capitalise on the 'upside' opportunities.

> ***The inability of China's model fully to mobilise societal capacity can place a limit on the capacity of the state***

As set out in the previous sections, climate change is likely to deliver increased volatility on a global scale. Democratic features such as transparency, open debate, and regular course-correction will be essential tools in responding to its many challenges. The liberal democracies of the world must thus double down on their values systems, because they provide what has been termed the 'social technology' needed to combat this problem.[19] The UK is therefore right, in our view, to promote a new 'D10' or Democratic 10 forum, by expanding the G7. The values-based systems of the major democracies, despite their challenges, provide a real-world advantage in fighting climate change and the risks it generates, in addition to addressing other geopolitical developments.

## Steps to addressing climate-related geopolitical risks

Having identified three areas of risk and understanding that we must build and strengthen adaptive, anti-fragile systems, what are the practical steps we should take?

First, we must develop a more sophisticated understanding of the three risk areas. To help us with this effort, advanced modelling and monitoring tools are increasingly available, using AI and advanced data science, and these capabilities will help advance considerably our understanding of the physical and transitional risks. Many of these capabilities have been developed by the private sector, meaning that states should work more broadly across societies than they have before – just as our competitors do in their pursuit of their initiatives.

An example of the public-private partnerships that can

be particularly productive is that of the UK's Spatial Finance Initiative, which is aiming to develop sophisticated satellite-based mapping programmes to understand the real economic effects of climate and environmental change.[20]

This should, in truth, be an international effort, and developed nations should share advanced capacities to create early warning systems across multiple domains and risk categories. This monitoring should be focused especially on areas of known climate risk, where environmental factors are seen to be increasingly variable and where they combine with governance fragility and resource scarcity.

Militaries around the world are already considering the implications of climate change for their permanent and forward operating bases and for how they will provide power for them. These bases may find themselves limited by new physical risks (such as flooding or extreme desert temperatures), or conversely required to scale up their operations (such as in the Arctic) to take advantage of new opportunities and also to meet new challenges presented by adversaries. A comprehensive assessment of these bases must be high on the list of allied military planning. Building on this, adequate funding for a clear High North strategy should be an increasing priority for the UK, Canada, EU (especially Denmark), Norway, and the USA.

For some time, multi-factor scenario modelling, war games, and stress tests have included an element of climate change in their scenarios. This should continue and be enhanced, given the increasing implications of climate-related challenges. There should be more climate-specific factors within such exercises, explicitly considering extreme weather conditions and human responses (physical risks), changes in energy and trade systems (transition risks), as well as heightened tensions between key participants (liability risks).

These exercises should reflect the growing body of evidence that raises climate-related security concerns as an increasingly important element of military, intelligence, and diplomatic planning.

To this end, we applaud the UK government's plan for an Office for Net Assessment and Challenge, echoing the recommendations of Policy Exchange.[21]

A complex operating environment requires a sophisticated response, and that office rightly will include cybersecurity and other thematic threats; it also should include climate change as an essential layer. In the US, the Climate and Security Advisory Group has recommended a Watch Center in the office of the Director of National Intelligence, focused on climate-related risks, which would also be an appropriate development and augment the already growing expertise on climate issues and threats in the US intelligence community.

*Absent major wars, climate-related risks will rank with the leading threats to stability and will require greater attention in HADR planning*

Second, the West and its allies should invest in reducing downside risks appearing in vulnerable states. This would constitute a first step towards fostering anti-fragile systems. Modern energy and transport infrastructure, as well as coastal defences and resilient agriculture, will be needed increasingly by developing economies around the world. China has offered a ready supply of finance, albeit with some reductions in activity in recent months.[22]

The D10 and its partners should also ensure that development funds, including green finance, are readily available as a competitive alternative, based on liberal market principles. Coordinating the deployment of the funds available from the US International Development Finance Corporation, Agency for International Development, and Millennium Challenge Corporation with the funds of counterpart institutions in the D10 countries and beyond would enable this approach very impressively and also help pursue important geopolitical objectives. These measures could help developing nations protect themselves from some of the risks we have described.

*The West and its allies should invest in reducing downside risks appearing in vulnerable states*

Protective measures should also include regional capacity building and coordination in Humanitarian Assistance and Disaster Relief (HADR). Absent major wars, climate-related risks will rank with the leading threats to stability and will require greater attention in HADR planning. Here, again, the D10 countries should take the lead and welcome the contributions of other possible partners around the world. The risks we have described thus offer opportunities to reinforce important partnerships and to coordinate agendas. In some cases, this may mean emphasising deployment of development aid over traditional security activities. As militaries have learned, the holy grail of alliances often comes down to issues as simple as doctrinal standardisation and equipment interoperability. Sharing such lessons from the military with aid organisations could contribute to building capacity. And such missions are very worthy of our investment: when developed strategically, they build military and non-military capacities for both the recipients and the benefactors and help to reduce the casualties and costs of disasters.

Finally, we should seek to augment the capacity of nations to build their own anti-fragile systems and take advantage of the upsides of change. This is where the transition risks – those that involve shifting trade systems and dependencies – become opportunities if managed well.

These actions can take two forms: the access to affordable green finance mentioned above is one; the other is the institutional capacity needed for states to foster development of liberal, open markets that attract capital to their shores and adapt dynamically to new challenges. Advanced governments such as the USA, UK, EU, and Japan should offer the expertise

of their institutions to enhance the ability of countries to manage their own transitions. This could include energy and financial regulators and advisory bodies such as the UK's Climate Change Committee. It could be done as part of a development aid package, or in a commercialised setting as per the UK's Met Office and Ordnance Survey – both previously state functions that have been turned to commercial value. Providing our own institutions as models for other nations also creates invaluable channels for trade, diplomacy and shared values, as well as laying the foundations for more effective risk management systems.

## Conclusion

Global climate change and its associated regional phenomena will inevitably prove complex and imperfectly predictable, but a clearer approach to the risks can help us to structure our analyses and policy responses. By adapting the three-risk taxonomy borrowed from the financial world – physical, transitional, and liability – we have a way to structure dialogue and debate, and to focus efforts to manage, to the extent possible, the risks we have described. The objective should be to develop systems that can help minimise downsides while adapting to shocks and volatility, using the concept of anti-fragility as a guide. This will help promote policy actions that will support a stable geopolitical environment, even as the world is buffeted increasingly by the manifestations of climate change and other global developments.

Climate change is, of course, a global challenge – and a particularly pressing one – not just in its origins, but in its implications. It thus requires a sophisticated solution that mobilises the resources of all societies and nation states, even those that compete in other respects, as well as the strongest-possible multilateralism. We look forward to the development of this approach, building on the strength of the UN system and existing agreements, especially now that the US has re-joined the Paris Climate Accord and sought to galvanise further action to accomplish the aims that we have described in this paper. Responses should certainly include innovations developed by like-minded states, such as the D10; nonetheless, the global response necessarily should include all states, business entities, and stakeholders.

As with many security and geopolitical challenges of the past, climate change need not define our fates if the leading countries of the world, representing all systems, recognise the magnitude of the threats and make way together.

General David Petraeus *(US Army, Ret.) served in the US Army between 1974 and 2011, rising to the roles of Commander of US Central Command and Commander of the International Security Assistance Force respectively. Between 2011 and 2012, he served as Director of the Central Intelligence Service. He is currently a Partner at the investment firm KKR and Chair of the KKR Global Institute.*

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# IT'S TIME FOR AUSTRALIA TO LEAD ON CLIMATE

**Australia should match the commitments and ambition of its allies, says its former Prime Minister Malcolm Turnbull.**

***By Hon Malcolm Turnbull AC***

For more than a decade now, framing and maintaining an effective response to global warming has been trapped in a political stalemate, brutally toxic even by Australian standards.

As in the United States, global warming has become for too many a matter of belief or identity, instead of simply a matter of physics. While this reality denialism, for that is what is, has been more consequential in the United States, the causes are very similar.

A combination of vested fossil fuel interests, right wing media, largely owned by Rupert Murdoch, and the populist right of politics have served to block effective action.

It is, perhaps, one of the British Conservative Party's greatest achievements that it did not fall prey to this madness. As a consequence, action to address climate change has been more or less bipartisan in the UK.

Having lost my job as Australia's Liberal Party leader twice over this issue, I am perhaps more keenly aware than most of the local political tensions. Murdoch's dominant media presence in Australia remains the single largest obstacle to any coherent national policy that integrates climate and energy policy.

***The application of the laws of physics are not subject to the will of parties or parliaments.***

Of course, consigning responses to global warming to the craziness of culture wars may work out in terms of domestic politics. But it overlooks the fact that the application of the laws of physics are not subject to the will of parties or parliaments.

The lack of coherence or ambition in Australia's climate policy does not just puzzle Australians. The massive bushfires of 2019-20 burned out an area about the size of England – over 12 million hectares. Billions of animals were killed. For days our capitals had the worst air quality in the world, and thousands of Australians huddled in midday darkness on beaches while they waited for the navy to evacuate them from the infernos that surrounded seaside holiday towns.

It looked like the end of the world. It was, perhaps, a preview of how it will end.

Of course the fires were quickly overtaken by the COVID pandemic. And once again the same people who denied the reality of global warming were quick to dismiss COVID as no worse than the flu, masks an assault on human rights and social distancing orders the harbinger of a new totalitarianism. As it turned out, biology is no more susceptible to Fox News hectoring than is physics.

The management of the pandemic has been a test for all of us; of character, competence and capability. At any given time, most countries are grappling with similar issues. But it is very rare that every nation in the world is faced with the same problem and at the same time. It has been rather like an old-fashioned examination where the rows of anxious students

wait, pens poised, for the invigilator to check her watch and say "You have three hours, start writing."

In this global COVID exam it is very clear which nations did best. They were the ones who trusted and acted upon the science and whose citizens trusted their governments when they did so. Those who politicised the response did worst – the United States and Brazil. Those who waited to impose, or inconsistently enforced, quarantines and mask wearing similarly did badly – the United Kingdom and most of Europe.

Australia handled the pandemic relatively well, but it must be noted that the heavy lifting in terms of quarantine, social distancing and testing was done by the State and Territory Governments. The federal Government took a back seat on public health and its principal contribution was a massive financial stimulus to offset the widespread job and business losses from lockdowns and the disruption that followed.

But now, while we hope that by relying on medical science we are turning the corner on COVID, there is no sign that this has resulted in any change to the approach to global warming in Australia, at least at the national level.

A year after the bushfires, and nine months into the pandemic, the Australian Government refused to increase its nationally defined contribution ("NDC") towards reduce greenhouse gas emissions. This resulted in Australia being refused a speaking role at a climate summit at which other nations presented higher ambitions. At the last COP in Madrid in 2020, Australia joined with Saudi Arabia and Bolsonaro's Brazil to block greater action.

With President Biden in the White House and John Kerry, the architect of the Paris Climate Treaty, as his Climate Envoy, Australia now finds itself out of step not just with Boris Johnson's Britain, or the Europeans but with its great and powerful American ally.

Just as culture war debates must yield to the realities of biology and physics, so must domestic political battles yield to the reality of geopolitics.

***Australia offers a potential solution, with resources supplied by a stable, democratic nation.***

With Trump in the White House, there was at least another climate change denier at the G7, somebody you could rely on to call out the joys of coal and the warmist follies of wind turbines and solar panels.

But it's not just the vibe that is different. The EU buys $20 billion of goods and services from Australia each year and the bloc is developing plans for a Carbon Border Adjustment Mechanism which would unilaterally impose a tax on imports from countries that do not have a commitment to reach net zero emissions by 2050. The US Democrats are also considering carbon taxes at the frontier. While these appear novel in trade terms, they are extremely appealing to politicians. They can be justified by saving the planet – so much more idealistic than old-fashioned protectionist arguments of defending local jobs and businesses.

Two thirds of Australian exports are bought by nations with mid-century 'net zero' emissions targets, including 62% of our coal and iron ore exports,[1]. If we do not convincingly raise our climate ambitions, we will be particularly vulnerable to these carbon tariffs.

While Australia has suffered, and will continue to suffer, the consequences of a hotter drier climate, the harshest toll will be paid by developing countries including many in our own region. One of the most bitter injustices of the climate crisis is that the countries which have contributed the least to the problem will suffer the most. None more so than the island nations of the Pacific. These are Australia's neighbours, developing countries to whom we have been the largest aid

***With President Biden in the White House and John Kerry, the architect of the Paris Climate Treaty, as his Climate Envoy, Australia now finds itself out of step not just with Boris Johnson's Britain, or the Europeans but with its great and powerful American ally.***

donor and closest economic partner for many years. But right now, our relationships are being tested by competition from China. Pacific leaders, such as Fiji's PM Bainimarama, are asking how they can trust Australia if it does so little to stop the global warming that threatens the existence of so many island nations.

While Australia is a big producer, consumer and exporter of coal and gas, it is also blessed with vast solar and wind resources. As renewables replace coal-fired power we are not only seeing emissions reduce, but electricity prices decline. Storage projects, like the huge Snowy Hydro 2.0 commenced by my Government, will make these renewables reliable.

In fact, Australia has the capacity to move to zero emissions and lower cost electricity, with less difficulty than many other countries, like the UK, that are further advanced in, and far more committed to, decarbonisation.

So what is to be done?

First we must commit to reaching net zero emissions by 2050 at the latest and ideally earlier. Technological advances mean this can be achieved with cheaper electricity, higher levels of energy security and stronger economic growth. Our energy policies should be guided by engineering and economics rather than ideology and idiocy.

Second, we should seek to lead in every relevant technology. Whether it is solar panels, batteries, pumped storage or green hydrogen, Australian scientists have made world-leading contributions. A spirit of innovation and science must be restored and led with enthusiasm. Rather than lamenting the demise of coal, we should be ensuring that cheap, renewable energy replaces fossil fuels and provides well paid jobs in energy-intensive industries. We have the best solar radiation and highest capacity onshore wind in the world. The only barrier to harnessing it is a lack of imagination and confidence.

I have been helping Andrew Forrest, the founder of iron ore giant Fortescue Metals Group, in his efforts to build the world's largest green hydrogen energy company. Hydrogen is the fuel of the future. If it is produced by using renewable electricity to split water, then it is "green hydrogen". When it is burned and recombined with oxygen to produce energy, the only by-product is water.

Hydrogen offers the prospect of zero-emission fuel for transport, for energy storage, even for making steel without coal. But it needs vast amounts of cheap renewable energy and Australia's north is ideally suited to provide it.

Equally, Australia is endowed with all of the cobalt, nickel, lithium and other metals required for batteries. President Biden has demanded a review of the USA's supply chains in these sectors, worried that China is already dominant. Australia offers a potential solution, with resources supplied by a stable, democratic nation. That places us in a key geostrategic position for future global prosperity, but we must invest and work with our allies to make it happen.

Third we should review and increase our NDC for 2030. Our commitment made in Paris in 2015 is now embarrassingly easy to achieve. The challenge is not to set the lowest possible bar so that surmounting it is a breeze, but rather to reach to a higher goal and set an example. Lead the pack rather than be a grumbling laggard lurking in the slipstream of other nations who take their responsibilities more seriously.

Fourth, and above all, Australia must lead. Whatever Murdoch's editors may say, we should match our ingenuity and our national endowment with the 'can do' enthusiasm that allows us to support, emulate and surpass our friends, not just in North America and Europe, but in our own region. This is no time to dawdle disagreeably, as Trumpian exiles in the Antipodes.

Hon Malcolm Turnbull *served as Australia's Prime Minister between 2015 and 2018.*

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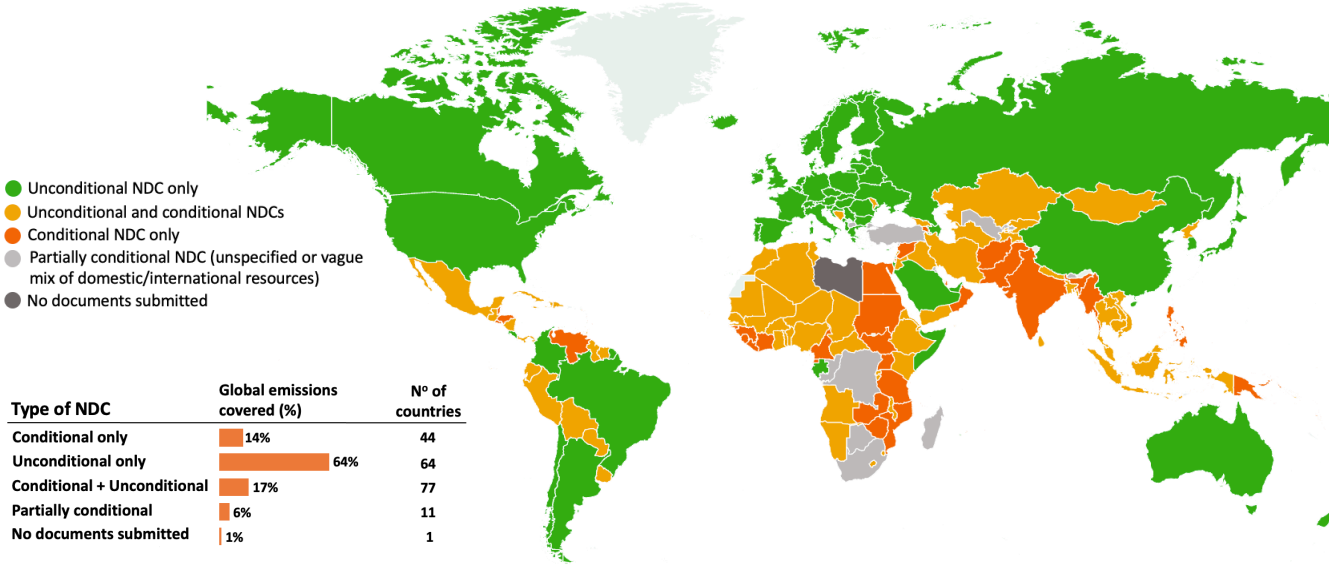
# The Geopolitics of Nationally Determined Contributions (NDCs)




| Type of NDC | Global emissions covered (%) | Nº of countries |
|---|---|---|
| Conditional only | 14% | 44 |
| Unconditional only | 64% | 64 |
| Conditional + Unconditional | 17% | 77 |
| Partially conditional | 6% | 11 |
| No documents submitted | 1% | 1 |

In 2015, agreeing a global framework for decarbonisation in Paris was a triumph, overcoming the 'gridlock' character of previous global climate negotiations.[1] By shifting the emphasis from top-down to bottom-up targets created by individual nations, known as Nationally Determined Contributions (NDCs), the summit achieved a major breakthrough. However, relying on the bottom-up approach has two important geopolitical dimensions.

The first is based on the fact that the whole system is voluntary. As the name suggests, NDCs are centred around the concept of sovereignty; they are nationally determined. This, together with a lack of penalties to incentivise nations to stick to their promises, means that NDCs rely on the domestic stability and desire of governments to meet their promises. Progressing under this framework requires a lot of trust between nations and it can be vulnerable to unforeseen consequences.

Secondly, on top of the fact NDCs are voluntary, many have conditions attached to them. As shown in the graphic above, around a third of global emissions covered by an NDC are subject to some form of condition, particularly NDCs produced by the countries in the global South. These conditions take the form of requests for monetary or technical capacity in support of decarbonisation. If these conditions are not met, conditional NDCs are unlikely to be delivered. NDCs therefore create a situation where decarbonisation hinges on wider asks for financial and technological transfer from the global North to the global South.

For example, conflicts can undermine the ability of some nation-states to meet their emission reduction targets, through reducing their physical capacity to decarbonise as well as changing their domestic priorities. Some countries even specified this in their initial NDCs; the Central Africa Republic emphasised that meeting its decarbonisation targets depended on the "consolidation of peace and security", and Somalia pointed out that its civil war destroyed its renewable energy generation capacity.[2]

The conditionality of NDCs could turn out to be the Achilles' heel of the Paris Agreement. As rich countries miss increasingly demanding conditions, poorer countries have valid reasons to delay decarbonisation. For instance, the mobilisation of climate finance to date has been slow, with reports that the target for $100bn of 'new and additional' climate finance will be missed.[3] Such finance can be seen as a 'quid pro quo', making decarbonisation by poorer nations dependent on the commitments of richer ones.

As a consequence, NDCs will increasingly act as a medium through which geopolitical agendas play out. Already, the divide between the Global North and Global South is reflected in the distributions of who has conditional and unconditional NDCs, as shown in the graphic above.

The gap between current NDCs and the amount of decarbonisation needed to keep warming "well below" 2°C (the language of the Paris Agreement) is about 12 gigatons of $CO_2$ equivalent, equal to around 20% of current global emissions. If this gap widens further, it's likely that the conditions attached to NDCs will get more demanding, increasing the extent to which they reflect the geopolitics of decarbonisation.

**Will Nicolle** *is a Research Fellow, Energy and Environment, at Policy Exchange.*

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# THE GREAT CONVERGENCE

**The UK's Integrated Review shows the convergence of British geostrategy with environmental policy, writes William Hague**

***By Rt Hon Lord Hague of Richmond***

In 2010, during one of my first speeches as Foreign Secretary, I warned that "as the world becomes more networked, the impacts of climate change in one country or region will affect the prosperity and security of others around the world."[1]

Eleven years later, this has regrettably come to pass. In Iraq, farmers were driven to join ISIS once opportunities to provide for their families dried up along with local water sources.[2] In Somalia, jihadists have cut off water supplies to punish areas of the country outside of their control.[3] And in Syria, social unrest, exacerbated by droughts driving Syrian farmers into cities, spilled over into civil war just a few short months after my remarks, leaving hundreds of thousands dead and millions scattered across the world.[4]

Something less easily predicted, however, is the speed and scale in which not just the impacts of climate change, but the prevention of climate change has become intertwined with our prosperity and security. This is a result of two crucial trends.

> ***The Commons Science and Technology Committee have rightly recommended that ARIA focus on just one or two strategic missions***

First, as action to protect our planet has become more pressing, so too has the need for governments to bring greater coherence to the full range of their policies. The recent controversy over the Cumbrian coal mine is a good example of this. A decade ago, perhaps the UK could have reopened a coal mine in the same year as we hosted a crucial global conference on climate change, without this action undermining our efforts to secure meaningful international decarbonisation targets. But not today. As the international community gears up for the race to Net Zero, Global Britain cannot get away with talking the talk without walking the walk.

Second, the issue of China is looming larger and larger in UK politics, drawing a growing number of previously unrelated policy issues into its orbit. A decade ago, there might have been little problem with the UK relying solely on Chinese batteries to power our electric cars. Indeed, if it were not for our political differences, China, with their strong industrial capacity, would still be an ideal country to manufacture the renewable technology the UK needs to reach Net Zero. But the last ten years have seen China become a strategic rival of the West, and it is now impossible for us to remain dependent on them in such a critical area. As a result, our policies towards China and climate change have become unavoidably linked.

As a result of these trends, it will become increasingly difficult for the UK Government to pursue a foreign policy that is not centred around the twin threats of climate change

and China. And as the race to Net Zero and the West's rivalry with China accelerate, policy coherence in this area will only become more essential.

## The convergence between climate and foreign policies

Some commentators have expressed a great deal of optimism regarding the impact that this transition could have on global peace and stability. Fossil fuels can exacerbate competition and conflict, both through their location in existing international flashpoints, such as the Eastern Mediterranean, and in their transport through strategic chokepoints, such as the Straits of Hormuz. Similarly, many of the petrostates reliant on fossil fuel revenues, such as Saudi Arabia and Russia, have chequered histories on human rights. It can be argued that a move to renewables, allowing countries to produce more of their own energy domestically, could reduce conflict and weaken many authoritarian regimes.

But this optimism is almost certainly misplaced. Anyone who thinks that the transition to renewables will usher in a more peaceful world might well be in for a nasty shock. There are three reasons for this.

The first is that the transition to renewables is unlikely to weaken many of the world's authoritarian regimes. In the short-term many petrostates could benefit from the transition. As Jason Bordoff, a former adviser to President Obama has pointed out, if the race to Net Zero leads to a rapid decline in new capital investment for drilling, oil supply will drop faster than demand, driving up prices.[5] In the longer term, many established petrostates will be able to use their strong fossil fuel revenues to invest in renewables. For example, last year Saudi Arabia announced a $5 billion green hydrogen plant.[6]

Instead, the petrostates most likely to lose out from the transition to renewables are countries, such as Nigeria and Libya, where governance is weak. Further destabilisation of such states will overlap with the growing impact of climate change and could easily lead to new waves of mass migration, conflict, and terrorism rippling through neighbouring countries and towards the shores of Europe.

Secondly, the transition to renewables will likely shift strategic competition from fossil fuels to different natural resources, rather than end it altogether. Already competition over the supply of critical minerals required for green technology has become part of the wider rivalry between China and the West. For example, China has established a powerful hold over the supply of cobalt, a crucial material for producing the batteries that will power the electric cars of the future, while the nations of the West are playing catch up and seeking to wean themselves off Chinese supply chains.

> ***Multilateralism is indispensable in dealing with climate change.***

This race to control the critical minerals on which the transition to renewable energy depends will create new flashpoints. As the North Pole melts, the rush to exploit deposits of rare earth minerals in the Arctic Sea and Greenland, exposed by the receding ice, will heat up. Moreover, today's science fiction of commercial mining in space could yet become

science reality. Further in the future, China and the United States could be racing to extract the vast stores of nickel and cobalt on asteroids, adding extra friction to the already tense issue of space exploration.

The third factor is that, leaving aside the impact of the transition on petrostates, the technology of renewable energy itself could create a whole host of security problems. Renewable electricity trading through integrated grids might open up vulnerabilities for terrorists and hostile states to exploit weaknesses in these grids and wreak havoc on countries' electricity supplies. There is evidence that a Chinese cyber campaign was responsible for substantial power outages in Mumbai last year.[7] Likewise, the spread of nuclear power raises the risk of proliferation to hostile states or terrorist attacks on plants.

With both climate change and the transition to renewables likely to make our world a much less stable place, governments will need to align their domestic and international policies if they are to thrive in these dangerous waters.

## Putting climate change at the heart of domestic and international policy

Climate change is no longer a discrete issue that can be separated out from other policy considerations. From now on, preventing climate change and mitigating its impact must be central priorities running through UK policies. In domestic terms, this means creating a strong home base from which to lead the world on responding to climate change. Globally, this means prioritising climate change in our international relationships.

## Creating a strong home base

As noted in the Government's recent Integrated Review, "our foreign policy rests on strong domestic foundations".[8] This is particularly true of our approach to climate change, with what we do here in the UK directly affecting our influence on this issue on the world stage.

A landmark report by the International Renewable Energy Agency (IRENA) argues that three types of countries have the potential to emerge as global leaders on renewable energy - countries with sufficient renewable energy capacity to become significant exporters of it; countries rich in the critical minerals required for renewable technologies; and countries that lead in technological innovation, who are "positioned to gain the most from the global energy transformation."[9]

It is in this third category that Global Britain should aspire to be a leader. The UK is already renowned as a global hub for research, enjoying many of the ingredients so crucial for innovation, from world leading universities to our culture of entrepreneurialism. With these existing strengths, we can leverage the talent that our country possesses towards spurring advances in green technology. Such an approach would also fit seamlessly into the first strand of the Strategic Framework set out in the Integrated Review, which proposes "sustaining strategic advantage through science and technology" by making science and technology "an integral element of our ... international policy".[10]

In recent months, the Government has taken a number of steps that will go a long way to establish the UK as a green tech leader. These include commitments to support research into difficult-to-decarbonise sectors like aviation, new funding for developing floating offshore wind technology, and new visa reforms which will ensure the UK continues to attract and retain the international talent we need to spur technological advances.[11]

But more could still be done to steer the talent of UK innovators towards renewable technology. The UK's new Advanced Research and Invention Agency (ARIA), set to become fully operational next year, is an opportunity to drive forward high risk, high reward research in critical sectors.[12] The Commons Science and Technology Committee have rightly

recommended that ARIA focus on just one or two strategic missions.[13] There is a strong argument that the technologies arising from combating climate change should be one of these. After all, the Government itself has acknowledged that, after Covid, "the greatest challenge facing the UK and the world is that of decarbonising our economies."[14]

## Prioritising climate change in our international relationships

There are a myriad of factors that influence our relationships with other countries around the world, from ties that bind us together, such as trade, investment, and shared culture, to issues that drive us apart, such as security concerns and human rights violations.

As action to alleviate climate change becomes more pressing, environmental issues are likely to become a more influential factor in our international relationships. In the past, the UK has been willing to use all of our firepower, both military and diplomatic, to secure and extract fossil fuels. But in the future, the UK will need to use all of its diplomatic capacity to ensure that these resources are not used and that natural environments are protected.

This could result in uncomfortable situations where the need to coordinate international action on climate change runs against our other foreign policy priorities. Trade policy might present difficult choices, with the UK ambitious to strike as many new trade agreements as possible to maximise the opportunities of our departure from the European Union.

Take for example, Brazil. The ninth largest economy in the world with a population of 211 million, Brazil is exactly the sort of growth market with which the UK should be seeking to build a strong trading relationship. But as climate change climbs the hierarchy of important political issues, it will be increasingly difficult to square our climate change policy with agreeing a free trade deal with a country that clears a football pitch-sized area of the Amazon rainforest every minute.[15] In such cases, realpolitik will leave the UK with a dilemma: ease up the pressure on climate change delinquents like Brazil or forget about your trade deal.

We are not yet at the place where the UK has to choose between stronger trade ties and protecting our planet. For example, in December, the Chancellor of the Exchequer skillfully negotiated a deal with Brazil to help develop a green finance market in Brazil, supporting action to tackle climate change in that country while providing opportunities for the City.[16]

But such a dilemma could soon be upon us. For example, climate concerns loom ever larger in the relationship between the United States and Brazil, with President Biden warning during his election campaign that the latter would face "economic consequences" if it doesn't "stop tearing down the rainforest".[17] And in January, a coalition of former US cabinet secretaries and chief climate change negotiators produced an "Amazon Protection Plan", which called on Biden to ensure that "future trade agreements strengthen tropical forest governance". The Plan went on to argue that deforestation should be taken "into account when considering U.S. policies relating to Brazil, including ... new trade agreements".[18]

Such an outcome is not inevitable, however. One way to avoid the trade-climate dilemma would be to introduce new mandatory labelling schemes for products with risks of high environmental damage, such as food and clothing, to clearly demonstrate environmental standards. Such a system, as is being considered for animal welfare standards in the EU, if mandatory, would allow consumers in the UK to snub products that damage our environment while enabling the UK to deepen trade ties in other sectors.[19] With the Government already committed to consulting on what can be done through labelling to promote high standards, they should give this proposal consideration.[20]

If such a workaround is not forthcoming, we will soon face the day when our legitimate desire to deepen trade ties conflicts with our responsibility to protect our planet. If it does, we must choose to prioritise the environment over exports, for the economic costs of climate change and the destruction of biodiversity far outweigh the short-term benefits of a trade deal with any one country.

## Developing a network of innovative partnerships

Multilateralism is indispensable in dealing with climate change. All of humanity shares this planet, and we cannot hope to cap rising global temperatures without each major emitter steadily reducing their emissions. It is for this reason that the forthcoming COP26 being held in Glasgow and the biodiversity conference being held in China later this year are so vital.

At the same time, the world is moving on from the assumption that international relations will mainly consist of the manoeuvring of powerful blocs. I argued in 2010 that we are witnessing an increasingly networked world, with new alliances and bilateral partnerships.[21] In the last decade, this trend has only accelerated, as the world's rapid digital revolution has made it easier for new innovative partnerships to be established.

These new alliances offer the opportunity to go beyond existing multilateral forums and drive progress towards Net Zero even faster. For example, last year the thaw in relations between Israel and the UAE, announced in the recent Abraham Accords, has resulted in the two countries working together on food and water security, both threatened by climate change.[22] Even more recently, the UK and the UAE have launched a £1 billion investment partnership to support innovation in life sciences.[23]

The UK should seek to develop a latticework of

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criss-crossing new bilateral partnerships and "coalitions of the willing" to buttress the existing pillars of our international rules-based system and their work on climate change.

## Partnerships to prevent climate change

The most important area in which the UK can spur action on climate change is tackling deforestation, responsible for around 11% of global greenhouse gas emissions. Quite apart from addressing climate change, deforestation is one of the key trends driving the rise of zoonotic diseases, as Policy Exchange noted in a recent report.[24] While Covid-19 is thought to have begun in the wetmarkets of Wuhan, it is just as conceivable that Covid-29 could begin on the palm oil plantations of Indonesia.

To his credit, International Environment Minister Lord Goldsmith recognises this and has announced legislation to prohibit larger businesses operating in the UK from using products grown on land that was harvested illegally.[25] It is widely expected that encouraging similar commitments from other countries will be a key aspect of the UK's agenda for COP26. Earlier this year, the Government launched a Forest, Agriculture and Commodity Trade Dialogue with 17 other countries ahead of the COP, to "agree principles for collaborative action" on protecting forests at the same time as promoting development and trade.[26]

But due diligence laws on their own are not enough. We also need to boost supply chain traceability, to ensure companies impacted by these laws cannot hide behind ignorance. As the Global Resource Initiative taskforce has recommended, the Government should provide further financial support for researching and commercialising technologies to support more traceable supply chains.[27] One such technology ripe for further innovation is blockchain - a distributed ledger technology which securely records all transactions in a way that is resistant to modification. The Government should explore the potential for new research partnerships on blockchain between leaders in the technology here at home, such as University College Oxford and the University of Edinburgh, and those overseas, such as Cornell and Kyoto universities.[28]

Carbon taxation is another issue that has to be on the national and international agenda. In an ideal world, the forthcoming COP26 would see the UK and other countries agree sufficiently ambitious Nationally Determined Contributions (NDCs) to keep temperature rises below 1.5 degrees Celsius, leaving carbon taxation unnecessary.

However, as a last resort, the UK should be prepared to work towards an internationally agreed tax on specific high-carbon products. At present, many Western countries have driven down their carbon footprint at home through taxation, only to offshore their emissions by purchasing cheaper goods, produced in a high-carbon way from overseas. Levying tariffs on high-carbon products would level the playing field between domestic and international producers, and encourage overseas countries to reduce their carbon emissions.

## Partnerships to respond to climate change

Innovative new partnerships will be just as important for responding to the impacts of climate change as they are to trying to prevent these impacts, with climate change exacerbating a whole host of existing problems and creating new ones.

One of the most thorny problems that will be created by climate change is the future of the Arctic. As Secretary General of NATO Jens Stoltenberg has recently warned, global warming risks a new cold war to the North, as melting ice "will increase the economic interest in the area for oil and gas activities and it will of course also make it easier to move

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military capabilities around."[29] Part of this competition will include a race to extract renewable energy resources, such as uranium, found in the region. The growing risk to stability in the Arctic is underscored by China's recently released 14th five year plan which commits to further developing their "Polar Silk Road" in the Arctic Ocean and pursuing greater engagement in the region.

The commitment in the UK's Integrated Review to ensuring that greater access to the Arctic region is managed responsibly reveals an increased emphasis on the High North within UK foreign policy.[30] There is a danger that increased tensions in the area could drain attention away from other priorities, including the Indo-Pacific region.

The Government should prepare to join other Western nations in countering Chinese and Russian activity in the region, by increasing our own presence. China's success in expanding control of the South China Sea has been made easier by the lack of a local, sustained presence by the United States. A similar situation in the Arctic would prove extremely problematic for the West.

The UK should press for an overarching NATO strategy for the region. If that is not possible, the UK should push for greater military cooperation outside of NATO, through a coalition of Northern Atlantic countries. Recently, the UK led a task force of warships from the United States, Denmark and Norway into the area to underscore our commitment to freedom of navigation in the Arctic Circle.[31] We could seek to expand this makeshift alliance into an "Arctic Quad", to mimic the Indo-Pacific Quad's work to protect freedom in the Pacific Ocean.

While only an observer state on the Arctic Council, the UK could also push for reform of this institution, to open up the Council to greater cooperation to Near Arctic powers, such as ourselves, as the Council on Foreign Relations has proposed.[32] Doing so would help to give China a stake in Arctic governance and make it more likely to engage with the international frameworks in place, rather than bypass them.

Cyber security is another security policy concern which will become more complicated as a result of climate change, with the integrated electricity grids required for decarbonisation providing an attractive target for terrorists and hostile states. It is worth noting that the Chinese-controlled State Grid company has announced ambitions to create a global supergrid - the 'Global Energy Interconnection' - to link each continent's grids with transmission cables.[33] In order to mitigate security risks, the global community will need to develop common cybersecurity norms and rules, and the UK would be well placed to lead on this issue. As Foreign Secretary, I launched the first in a series of biennial Global Conferences on CyberSpace regulation, which the Government should consider relaunching after the pandemic.[34]

By creating this network of new relationships, the UK will place itself at the forefront of global efforts to both prevent and respond to climate change. This will also leave us well placed to join with other nations to create the right framework for dealing with the other issue looming larger in Western policy priorities - relations with China.

## The convergence between China and climate policies

There has been widespread criticism of the Integrated Review's approach to China, with commentators struggling to accept that we can work with China on key issues, at the same time as standing up to its human rights abuses. Of course there is tension between these two simultaneous approaches, but a realistic foreign policy often requires managing such tensions, however difficult that might be.

The Government is right about both aspects of its proposed approach to China. The Integrated Review rightly acknowledges that China poses "a systematic challenge ... to our security, prosperity and values" but that the UK must also "cooperate with China in tackling transnational challenges such as climate change."[35] Indeed, there are many global issues, from nuclear proliferation to cooperation on pandemics such as Covid-19, where we should seek to work with China. While it might be possible to live with the consequences of a lack of cooperation with China on some of these issues, this is not true of climate change. We cannot solve climate change without China.

All of humanity, from the Americans in the West to the Chinese in the East, call the same planet home. The negative impacts of climate change upon our planet affect us all, and every country on Earth has a shared interest and shared responsibility to work together to mitigate it. No one country or bloc can solve climate change. The West cannot solve climate change without China, nor can China solve climate change without the West.

## Working to reduce our dependence on China

Of course, working with China on climate change does not mean that the UK should be neutral in the growing rivalry between the United States and China. The UK will always be aligned with our American friends when it comes to foreign and security policy, and we must continue to oppose Chinese human rights abuses. The coordinated sanctions announced in March by the UK, US, Canada and the EU in response to the oppression of the Uighurs should be welcomed.[36]

The race to Net Zero is fast becoming a central front in the West's strategic rivalry with China, with each side seeking to gain the upper hand in the green tech race. By investing in huge cobalt mining operations in the Democratic Republic of Congo and shipping these minerals back home for manufacturing,

China has made itself indispensable to the supply of batteries that will power the renewable revolution. Dependence on your rivals is a deeply uncomfortable position to be in, and it is right that the West is at last waking up to this threat and seeking to end our reliance on China.

The most important action that the UK should take to achieve this is announcing a review of our critical mineral supply chains, to inform a dedicated resilience strategy. Australia already has such a strategy, while earlier this year President Biden issued an Executive Order announcing that the United States would also prepare "a report identifying risks in the supply chain for critical minerals".[37] Aside from seeking to build critical mineral supply chains with our existing close allies, the UK's new strategy should also explore the potential for new partnerships on critical minerals. For example, the Polar Research and Policy Initiative has proposed greater links with Greenland, rich in deposits of crucial minerals from cobalt and nickel for battery production to uranium for nuclear power.[38]

Another approach to mitigate China's early lead in the supply of electric car batteries would be to spur innovation in the design of batteries in a way that would reduce, or eliminate, the need for cobalt. The Government has already committed £274 million to the Faraday Battery Challenge project, which seeks to support battery research, including research to reduce our dependence on raw minerals.[39] More remains to be done, however, and the Government should consider making battery technology one of ARIA's key areas of research. The UK should also explore the potential for new innovative research partnerships between ARIA and universities specialising in battery technology, from the University of Birmingham here at home, to the University of Technology Sydney and Berkley.[40]

## Working with China to prevent and respond to climate change

With the UK hosting COP26 and China hosting the UN conference on biodiversity, 2021 will be an extraordinarily important year for the UK and China to work together on climate change. If we are to meet our target of keeping rising temperatures below 1.5 degrees Celsius, it is essential that China agrees to ambitious NDCs at COP26. There are grounds for optimism, given President Xi Jinping's recent commitment that China will reach Net Zero before 2060, and given that China is keen to make a success of its biodiversity conference later this year, which will be the first time that the country leads negotiations on a major international agreement on the environment.[41] However, China's commitments have been undermined by a lack of concrete steps towards Net Zero, with its recent Five Year Plan likely to accelerate the country's emissions rather than reduce them.[42]

International standards for mining are another area in which it would be helpful for greater cooperation between the West and China. This is an issue which will become increasingly febrile during the renewables revolution. Fossil fuel extraction in the South China Sea has exacerbated problems there, and the race to exploit critical minerals for renewable technology, first in the Arctic, and potentially, in due course, in space, will likely lead to additional tensions. The UK should therefore redouble efforts to engage with China and agree new international standards for deep sea mining through the International Seabed Authority, and new international standards for future commercial exploitation of space, which remains a grey area under the Outer Space Treaty 1967.[43]

The race to Net Zero is also incentivising nuclear power, creating additional risks which China and the West should work together to ameliorate. As the United Nations Institute for Disarmament Research warned in 2009, "the revival of interest in nuclear power could result in the worldwide dissemination of uranium enrichment" with "obvious risks of proliferation."[44] Potentially even more concerning is the risk of terrorist activity towards nuclear plants, with the UN warning that "the nightmare scenario of a hack on a nuclear power plant causing uncontrolled release of ionizing radiation is growing."[45] With the popularity of nuclear power likely to grow as we transition to Net Zero, the UK should lead on reforming

international frameworks and standards on nuclear power, to both prevent proliferation and protect plants from attack.

Working to reduce our reliance on China at the same time as working with China against climate change will be no simple task. It will require us to dispense with simplistic, two-dimensional descriptions of our relations with China, abandon the monikers of "Sinophile" and "Sinosceptic", and become clear-eyed Sino-Realists. But if we could work with the Soviet Union over nuclear arms limits at the height of the Cold War, we can most certainly work with China to protect our planet, and they with us.

## Conclusion

When the G7 - or the G8 as it then was - last met in the United Kingdom back in 2013, climate change was nowhere near the top of the agenda. Today, with months still to go before the Summit, the UK Government is already making excellent progress in pushing forward ideas for preventing climate change. That alone is commendable.

But the race to Net Zero will be a marathon, not a sprint, and the UK will need to retain focus on this issue in the years and decades ahead, all the while recognising that climate change policy is now closely linked both to domestic policy here in the UK and our international policies, not least of all China.

By putting climate change at the heart of our policies, creating a strong home base that leads in renewable technology and innovation and prioritising climate change in our international relationships, the UK can establish itself as a world leader in decarbonisation.

By developing a network of innovative partnerships, in policy areas from deforestation and carbon taxation to the Arctic and cyber security, the UK can both support the rest of the world to decarbonise and respond to the risks climate change pose to UK security.

And by pursuing a realistic approach to China of smart competition, that sees the UK work with our rivals to decarbonise, while working with our allies to diversify our supply chains of the critical minerals required to do so, we can combat climate change at the same time as reducing our dependence on China.

If the Government commits to pursue each of these three objectives, they will ensure that by the time the G7 next meets in the UK we will be well on our way to saving the natural world and, just maybe, ourselves.

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# HOW OUR NEW CLIMATE POLICIES COULD LEAD TO INCREASED RELIANCE ON CHINA

## Each step of the battery supply chain exposes Western nations to geostrategic competition, warns Nadia Schadlow

*By Nadia Schadlow.*

Key climate goals of the administration, such as reducing greenhouse gas emissions for the energy and transportation sectors, may be held hostage by China. This is because a shift away from fossil fuels depends on lithium ion batteries. Since China dominates that industry, the administration will need its strategy to mitigate the leverage. While climate envoy John Kerry hopes to approach climate as a "standalone issue," the fact is geopolitics will shape the environmental choices of the administration, and it will not be able to separate domestic climate policies from China.

Energy storage is the glue within a low carbon economy, which enables greater use of intermittent power sources like wind and solar. The World Economic Forum argues that batteries mark a critical factor to reach the Paris Climate Accord goal of limiting rising temperatures to two degrees celsius. China of course dominates the four stages of the battery supply chain. This is mining, processing, assembly, and recycling.

First, China has now solidified control over the critical minerals of lithium, graphite, cobalt, and nickel. Chinese firms account for about 80 percent of the total global output for raw materials for advanced batteries. Using favorable deals with companies in South America and Australia, Chinese firms control around half of the global lithium production.

> *In the eyes of the Communist Party, the United States and China are in a battery race.*

China is also the largest source for natural graphite, supplying more than 60 percent over recent years. More than half of the cobalt reserves in the world are in the Democratic Republic of the Congo, while China controls over half of the production in that country. While nickel denotes less of a bottleneck, China is tightening its grip on nickel exports from Indonesia, which carries 30 percent of nickel production in the world.

Second, China has the largest minerals processing industry in the world, an unfriendly process from any environmental standpoints. According to Benchmark Mineral Intelligence, China controls the processing of almost 60 percent of lithium, 65 percent of nickel, and more than 80 percent of cobalt. China also refines 100 percent of spherical graphite.

Third, China leads in battery assembly gigafactories that turn processed minerals into battery packs. Over 130 of the more than 180 gigafactories planned or operational in the world are or will be in China. Just 10 will be in the United States. General Motors said it will build the second battery factory in the United States for a step in the right direction.

Fourth, China dominates battery recycling because it has built up critical infrastructure to recycle lithium ion batteries from consumer electronics. About 70 percent of the lithium ion

***Biden could make progress on his goals, but will take a dose of climate realism and pledge to competitive policies to achieve our independence in battery technology***

batteries in the world are recycled in China and South Korea. In less than one decade, 11 million metric tons of lithium ion batteries will reach the end of their service lives.

Indeed, the dominance of China across this supply chain should come as no surprise. China has been strong with identifying and controlling some foundational technology sectors and platforms. Like financial technology or broadband cellular networks, advanced energy technology will be the critical platform. China has a global plan that includes "new energy" as a key area of focus and will not easily watch its advantages melt away. It is also ahistorical to think that China will not use this leverage.

China enacted a law last year allowing the Communist Party to control the exports of products that fall under the broad category of national security. China threatened to cut off the United States from access to supplies with processing rare minerals, as it continues to punish Australia by restricting imports unless Canberra submits to some political demands.

As President Biden himself has said, fresh efforts to position the United States as the "global leader" for manufacturing electric vehicles cannot involve dependence on our most determined competitor. In the eyes of the Communist Party, the United States and China are in a battery race. American efforts could be contested even if there are low global carbon emissions. The United States should treat clean energy technology as a competitive space to avoid such dire dependence on China.

As it starts its supply chain review, the administration should adopt the work done by its predecessor, which identified government investment priorities. The administration faces hard choices. To increase domestic industry, it should address the environmental challenges of processing facilities. Tradeoffs will be necessary. Biden could make progress on his goals, but will take a dose of climate realism and pledge to competitive policies to achieve our independence in battery technology.

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# A CLIMATE SECURITY PLAN FOR NATO: COLLECTIVE DEFENCE FOR THE 21ST CENTURY

**Erin Sikorsky and Sherri Goodman highlight the relevance of a changing climate on NATO's founding mission, and how the Alliance must respond**

***By Erin Sikorsky and Sherri Goodman***

## Introduction

Since its founding in 1949, the core organising principle of NATO has remained the same: collective defence. An attack against one is an attack against all. Article 5, which articulates this principle, has famously only been invoked once, in the wake of 9/11. Today, however, some of the biggest security risks facing the Alliance do not come from states or organisations alone, but instead from transnational, actorless threats like climate change and pandemics. What does collective defence mean in the face of increased extreme weather events, rising temperatures, and surging sea levels? More importantly, how do these climate change effects exacerbate or contribute to other security risks facing NATO, whether the rise of geopolitics in the Arctic, political instability in the Middle East and North Africa, or the increasing need for humanitarian assistance and disaster relief within Alliance members themselves?

These questions are not completely new to NATO. In fact, NATO has long been a leader amongst global security institutions in addressing the climate-security nexus, integrating the risks posed by climate change and environmental stress into its 2010 Strategic Concept. Since Jens Stoltenberg took the helm as NATO's Secretary General in 2014, the Alliance has accelerated its efforts to address these risks. Stoltenberg has rightly pushed for the adoption of a NATO-wide climate security strategy, arguing that, "Climate change is one of the biggest challenges of our time. As the planet heats up, our weather becomes wilder, warmer, windier and wetter, putting communities under pressure as sources of food, fresh water and energy are threatened ... It is essential that we adapt to this new reality."[1] To that end, in March 2021 at a NATO ministerial meeting the Alliance agreed to pursue a strategy aimed at increasing NATO's ability to "understand, adapt and mitigate the security impact of climate change."[2]

The task now is to take this high-level strategic push and translate it into sustained, long-term action. Doing so will require steady leadership toward building political consensus, as well as a concrete demonstration for NATO member states that tackling the issue together will not only mitigate climate security risks but also complement action to address other threats, saving money and resources in the long run. As the economic strains from the COVID-19 pandemic endure, questions of burden-sharing within the Alliance are likely to remain contentious.[3] Some also warn that NATO should not become an "all-purpose alliance"[4] that loses its focus. Given these dynamics, any proposals perceived as expanding the Alliance's core mission without justification, or as not benefiting all member states, may face opposition from some Allies.

Alas, making the case that climate change poses serious security risks relevant to NATO's mission is not hard to do. This article begins by examining four areas of particularly acute risks: first, climate change-induced increases in demand for humanitarian assistance and disaster recovery missions


(HA/DR); second, the impacts of climate change on military readiness and operations; third, how climate change effects can exacerbate state fragility; and finally, how it contributes to geopolitical competition. Given this landscape, the next section of the article discusses what a climate security plan for NATO should include. We detail concrete steps NATO should take in the areas of building climate domain awareness, prioritising climate resilient infrastructure, and leading by example towards reducing carbon emissions.

## Climate Security Risks Facing NATO

### Increase in Demand for Humanitarian Assistance/Disaster Relief Missions

NATO's long-standing commitment to protection of populations and civil defence have led to its important role in HA/DR missions both within NATO member states as well as other countries, in partnership with the UN and non-governmental organisations. NATO conducted a disaster relief mission in the United States in the wake of Hurricane Katrina, and has contributed to numerous efforts to respond to flooding across Europe, including in Ukraine, Romania and Hungary.

Looking ahead, demand for such support is likely to expand as climate change-induced extreme weather events like intense floods, storms, droughts, and heatwaves increase in the coming years. Overlaying these events with socio-political developments, including increased population density in urban areas, often along coasts, as well as governments strained by complex crises like the COVID-19 pandemic, it is unsurprising that the human and financial cost of these disasters continues to grow. In the period 2000 to 2019, there were 7,348 major recorded disaster events claiming 1.23 million lives, affecting 4.2 billion people (many on more than one occasion) resulting in approximately US$2.97 trillion in global economic losses. This is a sharp increase over the previous twenty years; between 1980 and 1999, 4,212 disasters were linked to natural hazards worldwide resulting in approximately US$1.63 trillion in economic losses. Much of the difference is explained by a rise in climate-related disasters including extreme weather events: from 3,656 climate-related events between 1980 and 1999, to 6,681 climate-related disasters between 2000 and 2019.[5]

These costs are not relegated to the developing world. Insurance company MunichRe has found that mortality risk related to heatwaves is rising in Europe, as heatwave frequency, duration, and intensity increase, and resistance decreases due to aging societies.[6] Climate disasters within Europe are also contributing to displacement and internal migration. Bosnia Herzogovina, Spain, France and Germany have seen the highest numbers of internal displacement due to climate hazards in recent years.[7] Meanwhile, the United States faces myriad climate-linked disasters. According to the National Oceanic and Atmospheric Association, there were 22 separate billion-dollar weather and climate disasters across the United States in 2020, with a combined cost of $95 billion. The previous annual record was 16 such events.[8]

### Challenges to Military Readiness and Infrastructure

Climate change effects such as extreme heat, extreme weather, and sea level rise will increasingly impact NATO military bases and infrastructure, while also straining NATO troops and equipment when operating abroad. NATO installations along the Mediterranean and Atlantic are particularly vulnerable, while missions in Afghanistan, Iraq, and sub-Saharan Africa already face climate security risks regularly.

Sea level rise and extreme weather events are some

of the most concerning – and potentially most expensive – climate risks threatening naval bases and coastal NATO military infrastructure. For example, Hampton Roads in the US State of Virginia, named "the greatest concentration of military might in the world," by former US Secretary of Defense Leon Panetta and home to NATO's Allied Command Transformation, already suffers from regular flooding. Given the low-lying nature of the site, multiple scenarios for the years 2035-2100 find the area will be regularly inundated. A 2018 Military Expert Panel report found this development would be a significant impediment to force deployments for critical Atlantic, Mediterranean and Pacific war-fighting and humanitarian operations.[9] Major European ports like Rotterdam, Antwerp and Hamburg face similar challenges. Even more concerning, increasingly sophisticated modeling suggests previous models have underestimated likely sea level rise, suggesting a need to rapidly scale up preparations to deal with what were once considered "worst case" scenarios.[10]

Extreme heat is also an escalating risk for NATO troops and equipment, particularly those deployed in operations and training missions in Afghanistan, Iraq, and sub-Saharan Africa. Already, the average number of 'hot' days per year in Afghanistan increased by 25 days between 1960 and 2003, and scientists assess warming in Iraq is far above the global average, with temperatures 2.3°C warmer in the past five years than at the end of the 19th century –about double the amount of warming seen on Earth as a whole in the same time period. A US Army War College study in 2019 found the simple need for water in these increasingly arid environments poses a logistical challenge, noting that in the 2000s in Iraq, over 864,000 bottles of water were consumed each month at one Forward Operating Base, with that number doubling during hotter months.[11] Even more concerning are the risks posed by the need to resupply – more than 3,000 U.S. soldiers were killed or wounded from 2003-2007 in attacks on fuel and water convoys in Afghanistan and Iraq.[12]

### Exacerbating Instability in Fragile States

Climate change effects already strain weak governments in fragile states, as rising temperatures and changing weather patterns (e.g. drought and/or flooding) contribute to irregular migration, public discontent with government services, or contestation over increasingly scarce food and water resources. These challenges are most pronounced in states and regions already suffering from poor governance practices and environmental degradation – rarely does climate change alone cause instability. In the most serious cases, this instability can spill over into armed conflict or spur external migration – both of which have consequences for NATO's mission.

The situation in Basra, Iraq, exemplifies these complex dynamics. This city of approximately four million people sits on the Shatt al-Arab River, created by the confluence of the Tigris and Euphrates rivers before emptying into the Persian Gulf. Due to a combination of climate change effects, upstream infrastructure development, and poor governance practices, the Iraqi government in 2018 estimated that the water flow in the Tigris and Euphrates had been reduced by 30 percent since the 1980s.[13] Meanwhile, due to the combination of less fresh water flow, sea level rise and environmental degradation, saltwater intrusion into the region has increased, negatively impacting agriculture and fish farming.[14][15] The lack of clean water in the city has led to periodic outbreaks of waterborne disease, as well as the eruption of anti-government protests. As of January 2019, an estimated 15,000 people had been displaced in the region due to water shortages.[16] Developments in Basra have contributed to broader instability and political challenges in an already fragile country, with the potential to undermine NATO missions elsewhere in Iraq. Climate change-induced sea level rise will only make water problems more acute in the coming years.

Elsewhere in the Middle East, Sub-Saharan Africa, and Asia, climate-induced migration continues to grow. While

migration is largely a positive adaptation strategy for stressed communities, when climate effects force large numbers of people to move quickly or in irregular patterns, it can contribute to political instability within states and lead to external migration. According to a report from the International Federation of Red Cross and Red Crescent societies, in the six month period between September 2020 to February 2021, around 10 million people worldwide were displaced due to natural hazards, including climate change-induced flooding and droughts.[17] Given climate trajectories, these dynamics are also likely to intensify in coming years.

### Contributions to Geopolitical Competition

In addition to shaping dynamics within states, climate change also affects security relationships between states. As countries look to navigate a warming world, it is no surprise that competition and contestation over constrained resources may increasingly occur. The changing climate has the potential to shift regional and global power dynamics or inflame already tense inter-state relations.

Of particular concern to NATO is the intersection of climate change with the growing militarisation in the Arctic. The Arctic has emerged as a region of potential geostrategic competition, primarily because rising temperatures, melting sea ice, and collapsing permafrost now grant access to a region previously locked in ice most of year. The Arctic is warming at twice the rate of the rest of the globe, and by some estimates could be largely ice free in the summers by 2035.[18] While the Arctic has historically been a region characterised by cooperation and diplomacy, it has more recently become a zone of increased tensions over valuable energy and mineral resources, and access to shipping routes. The rapid melting of the old growth sea ice has given rise to a significant expansion in military and economic activities, including shipping, resource extraction, and other commerce.

Changes in the Arctic are feeding into China's and Russia's strategic ambitions, both regionally and globally. As US Secretary of Defense Lloyd Austin said in response to questions in his confirmation hearing in early 2021, "Climate change is drastically altering the natural environment of the Arctic – and the strategic balance. This is fast becoming a region of geopolitical competition, and I have serious concerns about the Russian military build-up and aggressive behaviour in the Arctic – and around the world. Likewise, I am deeply concerned about Chinese intentions in the region."

## A Climate Security Plan for NATO

Though NATO is not new to the climate security conversation, as it begins to fill in the details of its climate security strategy, it must consider some key questions. How should it stitch the disparate existing climate security elements across the organisation into an Alliance-wide approach? What approach should it take to climate security analysis and warning, and how can it ensure risk assessments translate into action? Where can it look for best practices in climate resilience and how should these practices be integrated into mission and infrastructure planning? What role should energy resilience and decarbonisation play in a climate security plan? The steps we outline below – building climate domain awareness, prioritising climate-resilient infrastructure, and leading by example to reduce carbon emissions – begin to answer these questions and will help "climate-proof" the Alliance for the 21st century.

### Building Climate Domain Awareness

The first steps include creating more granular knowledge about the nexus of climate change and security risks, and ensuring that knowledge is accessible and actionable for all NATO programmes and allies. As analysts and scholars continue to build out risk assessments and early warning methodologies on this topic, NATO should develop robust pathways to both learn from and deepen this analysis. The Alliance has included climate security risks in its foresight analysis, and other efforts are ongoing through the Crisis Management and Disaster Response Centre of Excellence (CMDR COE) based in Sofia, Bulgaria. The CMDR COE has sponsored research, workshops and training courses focused on climate security effects in the Balkans and elsewhere. As discussed earlier in this article, however, climate security risks are broader than an increase in HA/DR missions, and will touch on nearly every aspect of

> ***As the Alliance better understands the climate security threat, it must also take action to build the resilience of NATO bases and operations***

NATO's work going forward. Therefore, we support the NATO 2030 recommendation to create a standalone Climate Security Centre of Excellence designed to bring together outside experts and NATO members to study the topic. Such a COE could help centralise NATO's climate-related meteorological and oceanographic data collection, and could develop best practices that can be integrated across Allied countries as well as other COEs, including those focused on maritime security, civil-military cooperation, energy security and modeling and simulation.

The good news for establishing such a COE is that the world possesses unprecedented foresight capabilities that can inform sophisticated climate security risk assessments. Technological and scientific advances have led to the development of complex models with a strong record of accurate predictions of the rate and scale of global climatic changes under various emissions scenarios, and these models are continually being refined. Use of these models as well as data in security assessments provides a decisive advantage that is not available when examining other security risks posed by state actors where future developments are much more difficult to predict. A NATO Climate Security COE could leverage such tools to produce a common risk assessment, for use in both planning existing missions as well as forecasting

potential hot spots or instability risks that may threaten NATO, whether in the Arctic, the Middle East, sub-Saharan Africa or even within NATO countries in future high emissions scenarios. Such a centre could also conduct modeling, simulations and wargames to support NATO strategy and planning.

### Prioritising Climate-Resilient Infrastructure

As the Alliance better understands the climate security threat, it must also take action to build the resilience of NATO bases and operations, and launch initiatives designed to help member states adapt their military, security, and critical civilian infrastructure to withstand the climate change effects that are coming in the near term, regardless of future emissions trajectories. These initiatives could include low-carbon projects designed to significantly lower the scale and scope of climate change, bolstering security and creating long-lasting employment opportunities. In the face of increasing threats from sea level rise, extreme weather events and wildfires, it should involve a comprehensive programme to repair, construct, fortify, and responsibly site the nation's interconnected military, energy, transportation, agriculture, water, and commerce infrastructure in a climate-resilient fashion.

*Green procurement can contribute to advantages on the battlefield, such as reducing supply chain risks to fueling forward operating bases or eliminating the use of noisy generators by clandestine teams*

This is an area in which there are best practices to be shared amongst Alliance members. For example, NATO could adapt tools developed by the United States such as its US Army Climate Assessment Tool which was designed to help U.S. military installation leaders and personnel evaluate risks to bases and facilities. Similarly, the new UK Ministry of Defense Climate Change and Sustainability Strategic Approach includes recommendations the Alliance can draw on, including for operational self-sufficiency and new forms of military training.[19] Another model for best practice is Norway and its innovation and leadership on Arctic climate security and resilience.[20] NATO should also consider partnerships or exchanges with states who have taken action toward building more climate-resilient security forces and critical civilian infrastructure, such as Sweden and Finland in Europe, or Japan and South Korea in Asia.

NATO should also leverage its expertise to help developing countries outside the alliance build resilience and adapt to climate risks. This could be incorporated into training missions and other engagements, with the goal of promoting regular military-to-military and civil-military international engagement on climate change preparation. Not only would this enhance the resilience of these countries and potentially prevent climate security risks that could spill over as threats to NATO, it could also enhance NATO influence in strategic locales.

### Leading by Example Towards Reducing Carbon Emissions

NATO has spent decades working on making its military systems interoperable for more seamless conduct of NATO operations. Now the alliance needs to expand and update its plans for energy interoperability in a decarbonising future. Greening defence forces is a small but important piece of the broader all-hands-on-deck effort needed globally to reduce greenhouse gas emissions at a scale that's meaningful for security. NATO is

already leading by example in reducing the carbon footprint of its activities through such initiatives like its environmentally friendly NATO Headquarters building, and other "Smart Energy" efforts. To bolster these initiatives, the alliance should revisit and implement some of the recommendations in the 2015 final report of the Smart Energy team, such as naming a "Smart Energy" champion and country-level focal points.[21] These types of integrated leadership positions can help ensure programmes move from the lab to the field more quickly.

Similarly, NATO's Green Defence effort is due for a boost. The NATO 2030 report called for the Alliance to, "reinvigorate, reassess, and revise its 2014 Green Defence framework in light of evolving challenges and emerging green technologies." There is an opportunity to look for synergies across member states as many pursue "green recoveries" from the COVID-19 pandemic, and explore potential partnerships with the private sector as well. Critically, NATO should prioritise demonstrating to member states that green procurement does not compromise mission performance, and in fact can contribute to decisive advantages on the battlefield, such as reducing supply chain risks to fueling forward operating bases or eliminating the use of noisy generators by clandestine teams.[22] [23]

## Conclusion

NATO is not alone as it charts a course toward "climate proofing" its security strategy. Militaries and security institutions around the globe are grappling with how best to shift their posture in the face of a new and different security landscape due to climate change. The expansion of the International Military Council on Climate Security, a group of senior military leaders and security experts from more than 38 countries dedicated to anticipating, analysing and addressing the security risks of climate change, is one indication of the growing recognition that militaries need to adapt to meet climate risks head on. Another indication is the centrality of the US Department of Defense (DoD) in President Joe Biden's January 2021 Executive Order (EO) on Tackling the Climate Crisis at Home and Abroad. The EO tasks DoD with not only evaluating direct climate security risks but also a strategic-level analysis of climate security risks to be incorporated into the US National Defense Strategy, wargaming, and other high-level planning efforts.

Preparing a collective defence for the 21st century requires a broader definition of security risks. It is clear that climate change effects both directly threaten the lives and livelihoods of the citizens of NATO member states, and also increase the likelihood of risks posed by state instability and conflict as well as geopolitical competition. NATO will only live up to its mission if it redoubles its efforts to both prepare for the climate change risks already on the way and do its part to prevent catastrophic climate change effects in the latter half of the century. As a report from the NATO 2030 Young Leaders Group concluded in early 2021, the Alliance must adopt, "a more comprehensive, holistic, and inclusive understanding of security towards the 2030s," and climate change must feature more prominently on NATO's agenda because, "it has deeply destabilising effects on international peace and security and, more crucially, on the mere existence of life on earth."[24]

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# THE U.S. CAN'T GO IT ALONE ON SOLAR GEOENGINEERING

**Smaller democracies should take a role in shaping solar geoengineering research and governance, say David Keith and Peter Irvine. Without them the challenges that solar geoengineering poses will be harder to tackle and the risks of mistrust and misuse will be greater.**

***By Peter Irvine and David Keith***

The world must do more to tackle climate change. Rich nations who are responsible for most historical emissions must go farther and work faster than poor nations who will suffer the most. In this respect, the UK is a world-leader. It signed the first nationally binding emissions cuts into law in 2008 and is now half-way to achieving its net zero target, with greenhouse gas emissions down 50% since 1990.[1] The UK also made heavy investments in climate science over decades, supporting world-leading work at the Met Office and universities, and has supported clean energy and carbon removal research. It has also developed official capacity such as the independent Committee on Climate Change that advises the government on how to meet its climate pledges and holds the government to account.

However, the UK has abandoned its early leadership on a novel and potentially revolutionary climate policy option: solar geoengineering. It is past time for the UK and mid-sized democracies like it to re-engage.

Solar geoengineering describes a set of methods (see the box below for details) that could offset the heat-trapping effect of greenhouses gasses by reflecting away some sunlight or, in the case of cirrus thining, by making it a bit easier for heat to escape into space.This idea is also called solar climate intervention, and solar radiation modification. Whatever it's called, it's perhaps best defined in relation to other ways of managing climate risk. It is one of four toolboxes:

- Decarbonisation: transitioning to carbon-free energy to eliminate the greenhouse gas emissions that drive climate change;
- Carbon removal: actively removing $CO_2$ from the atmosphere to manage the burden of historical emissons and to offset hard to eliminate emissions;
- Adaptation: preparing societies and ecosystems, where possible, to better cope with the hazards of a changing climate;
- Solar geoengineering: actively modifying the Earth's energy budget with the goal of ameliorating climate hazards due to long-lived greenhouse gases.

Climate change poses two challenges: tackling the accumulation of long-lived greenhouse gases that drive climate change and coping with the consequences of the changing climate. Decarbonisation is essential, but even when emissions are eliminated humanity will only have prevented the problem getting worse. Carbon removal complements and extends this effort, making it possible for future generations to reverse the build-up of $CO_2$, returning the climate towards its pre-industrial state. To meet the second challenge, adaptation will be essential but many of the impacts of climate change will be beyond the adaptive capacity of some societies and ecosystems meaning there will be a significant amount of

loss and damage. Solar geoengineering is no substitute for decarbonisation and carbon removal; instead it offers the possibility of reducing the amount of climate change during the period when greenhouse gases are highest, reducing the amount of human suffering and ecological damage.

Solar geoengineering may sound implausible, and an uncertain and risky response to climate change. Yet a growing number of climate scientists and environmentalists now take this prospect seriously. This is, in part, because even if countries follow through on their pledges for emissions cuts made in Paris in 2015, we seem on track to blow through both the aspirational 1.5 and 2.0 °C temperature targets before mid-century.[2]

While solar geoengineering might enable the world to avoid passing the 1.5 °C threshold this is not a sound reason for considering it. Despite some of the rhetoric, there is no scientific consensus that there is a sharp threshold at 1.5 or 2.0°C, below which climate risks are manageable and beyond which they are not. Instead, what the science tells us is that the risks of climate change grow with temperatures. The more carbon we emit, the warmer the planet gets, and the worse the risks.

## The case for responsible research into solar geoengineering

The more sound basis for considering solar geoengineering is simply that there is a growing body of evidence that strongly suggests some solar geoengineering technologies could, if used appropriately, substantially reduce important climate hazards over most of the world, with physical harms or risks that are small compared to the aggregated benefits of reduced climate impacts.[3] While over a hundred scientific studies into solar geoengineering have been published so far, it is too early to decide to develop and deploy it or to rule it out. The uncertainty is far too large. However, the evidence of solar geoengineering's potential to reduce human and ecological impacts is sufficiently strong to justify launching a substantial research effort and sustained policy attention.

In 2009, the UK's Royal Society published the world's first report to address solar geoengineering.[4] The Royal Society concluded that this approach might offer an opportunity to reduce climate risks, though warned of substantial uncertainties, including that it might pose a considerable threat to the international order as individual nations could have the power to change the global climate. The Royal Society recommended £100 million be spent over ten years researching solar geoengineering and carbon removal (which was equally novel at the time), and in response the UK launched a much more modest but still world-first state-funded research effort into the topic. However, by 2014 the UK had abandoned all research into solar geoengineering, around the same time that it also abandoned its carbon capture competition amid severe fiscal constraints (the latter has since been re-adopted as a strategic priority).

The UK recently published an official view that addresses solar geoengineering, also called "Solar Radiation Management" (SRM), that states: "The UK Government has commissioned research into the effects of SRM on climate,

> ***Despite some of the rhetoric, there is no scientific consensus that there is a sharp threshold at 1.5 or 2.0°C, below which climate risks are manageable and beyond which they are not.***

and monitors research in this area."[5] No rationale is provided for abandoning research, however the previous version of the document said: "The UK Government has commissioned research into the effects of SRM on climate, which showed that SRM deployment would produce changes in rainfall patterns and amounts. This would be likely to lead to 'winners' and 'losers', with some regions suffering detrimental impacts."

Why was this reasoning dropped from the latest version? Perhaps because it is a poor argument against research. What important policies have only winners? Or perhaps, it is because the claim that SRM will necessarily produce sharp inequalities looks weaker as the science develops. Our 2019[6] and 2020[7] papers showed that if deployed alongside emissions cuts to halve future warming, solar geoengineering could substantially reduce the effects of climate change where they are greatest and only slightly worsen some of the effects in the least-affected regions. Furthermore, it is not just a couple of papers that come to these conclusions. Hundreds of climate model studies all point to the same conclusions: solar geoengineering is feasible and if used in moderation as a complement to emissions cuts could substantially reduce the overall risks of climate change.[8]

## The need for responsible research and governance

Research on solar geoengineering is at an early stage. We may be wrong about its potential and impacts. Deploying solar geoengineering hastily and in ignorance could very well have disastrous environmental impacts. Despite these uncertainties and risks, the unique potential of solar geoengineering to immediately halt or even reverse global warming will be a temptation to world leaders facing growing demands for immediate relief from the impacts of climate change. Kim Stanley Robinson's, Ministry for the Future, paints a compelling picture of such a scenario. After a deadly heatwave in India the Indian government unilaterally deploys stratospheric aerosol geoengineering. If such an unbearable climate disaster occurs in a powerful nation and worse is expected, it may be hard to dissuade them from taking matters into their own hands.

Robust scientific scrutiny, multilateral collaboration, and transparent deliberations about how to govern solar geoengineering are needed to forestall the risk of desperate, ill-informed, unilateral deployment. These same actions are also what is needed to determine whether solar geoengineering could be developed and done so in a way that furthers the global public interest. While tentative research efforts into solar geoengineering have been made by the UK, China, US and across Europe in the past decade and we have seen the very beginnings of a discussion of this issue in international fora, there is a leadership vacuum on this topic.

With the release of the National Academy of Sciences (NAS) report that recommends $100 - $200 million be spent on a major research effort into solar geoengineering, the US is set to fill this leadership vacuum. The NAS report distils the science, social science, and governance discussion on solar geoengineering to make a set of research and governance recommendations that the new US administration would be wise to follow.[9]

***Solar geoengineering might pose a considerable threat to the international order as individual nations could have the power to change the global climate.***

First, the NAS report makes clear that while solar geoengineering potentially offers a novel strategy for reducing climate risks, it is not a substitute for reducing greenhouse gas emissions. The research agenda that the NAS lays out strikes a balance by not only addressing the impacts and technical dimensions of solar geoengineering, but also giving equal weight to considering the context and goals for research, and to the social dimensions. The report recognises that solar geoengineering, even at the research stage, raises serious public and governance concerns, hence it recommends that 20% of funds be spent on promoting the development of robust national and international governance for research and for conducting public engagement exercises.

The NAS also recommends a set of research governance principles be integrated into the research effort from its inception, including, for example, making sure all results are publicly available, maintaining a public registry of research and ensuring that off-ramps are in place to end research if needed. While the report advises against developing the technology required for deployment, it recommends field experiments for advancing understanding that cannot be achieved by other means. It also provides some recommendations to ensure that such activities do not have adverse environmental impacts.

The central problems of solar geoengineering are not developing the technology itself. Rather they are the problems of building trust in scientific predictions of benefits and risks, and in building an international system of governance that has sufficient political legitimacy so that decisions about deployment are stable in the face of inevitable international disagreements.

The central problems are, in short, geopolitics and international governance. And it is implausible that a US-dominated effort will succeed in resolving them. The USA's history of unilateral, or near-unilateral, military action and its hegemonic position will generate fears that it will develop and deploy solar geoengineering in its own interests and to the potential detriment of others. The instability of US politics, made all too evident under the Trump presidency, has further weakened US credibility.

It would be better if research and the development of governance regimes were internationalised from the start. We suggest that smaller developed democracies, with strong records on climate action, work together with demoncracies in developing economies that are most vulnerable to climate change. Such a coalition, with a strong commitment to emissions cuts and just climate outcomes, would have the

scientific capacity to assess solar geoengineering and the legitimacy to develop an equitable framework for making decisions about potential deployment. As an internationally respected leader on climate action with world-leading climate research, and outsized political influence, the UK is well-positioned to take a leading role in such a coalition. Its position at the heart of climate diplomacy in 2021 also lends the UK the ability to make faster progress than most.

## Three key challenges of solar geoengineering

Some will argue that solar geoengineering is too risky, that we already know enough about it to ban it forever and abandon research.[10] Before making our policy recommendations we address three concerns about solar geoengineering that some believe justify abandoning research: moral hazard, termination, and unilateralism.

Emissions reductions are essential to bringing climate change to a halt. Nothing about solar geoengineering changes that essential fact. But societies and ecosystems are already facing serious risks which will worsen substantially before emissions are brought to zero. Furthermore, eliminating emissions just stops the problem getting worse. To reduce climate hazards, it will be necessary to actively remove carbon from the atmosphere, a process that will be slow and expensive. The threat posed by future climate-related risks motivates us to cut emissions cut as well as to explore solar geoengineering.

## 1. An excuse for inaction?

Whether or not to bring solar geoengineering into climate policy poses something of a catch-22. If solar geoengineering becomes recognised as an effective means of reducing the risks of climate change then it may sap the willingness of societies to make the difficult transition to a zero-carbon world as these risks motivate the need for emissions cuts in the first place. If that happens then we may end up with greater emissions and in turn greater risks of climate change. The more effective and convenient that solar geoengineering is seen to be, the greater the potential threat.

For those who have been following the climate debate for some time this may sound familiar. The climate community faced a similar challenge with adaptation back in the 90s.[11] To discuss ideas to minimise the impacts of climate change through adaptation, e.g., building seawalls, adopting new agricultural practices and improving the built environment, seemed to be to downplay the risks of climate change, and there were worries it would sap the willingness for difficult emissions cuts. However, adaptation is now a core part of climate policy and developing policies for adapting to the inevitable impacts of climate change did not derail climate policy, it made it serve the most vulnerable better.

If the research on solar geoengineering's potential consequences holds up, then it could play an important role in managing the otherwise unavoidable near-term climate risks that will occur on the way to net zero $CO_2$ emissions and peak temperatures. To have the greatest positive impact,

solar geoengineering would need to be understood as a complementary, additive measure to be incorporated alongside emissions cuts, carbon removal, and adaptation, rather than an alternative to these measures.

However, we should not be naïve about how solar geoengineering could shift the debate on climate change. There will be a temptation to relax efforts to cut emissions, or not to strengthen them as much, if the costs of emissions cuts are deemed too high or politically costly (see, for example, the 'Gilet Jaunes' movement in France). Furthermore, there will be actors, in the fossil fuel industry and elsewhere, who have a vested interest in the status quo and may promote solar geoengineering as a substitute for strengthened emissions policies.

This concern about solar geoengineering, often referred to as moral hazard or mitigation deterrence, is the most widely cited and discussed concern about the idea. There is some evidence from public perception studies that when the public is presented with the idea of solar geoengineering, it raises their concern about climate change and their willingness to support emissions cuts, i.e., it has the opposite effect from the one feared.[12] However, such tests may not give a good indication of how the idea will be viewed if and when powerful industry, media and political interests begin pushing a narrative that presents solar geoengineering as a technological get-out-of-jail-free card.

Is concern about moral hazard sufficient reason to abandon research? Our answer is no, but we agree that some research should be restricted. Economic decision analyses that assume rational actors find that research is never bad (assuming the costs are negligible), because the decision-maker can simply decide not to use whatever new knowledge is generated. In a world with irrational decision-makers in frequent conflict—the world we live in—some things are better left unknown, such as a recipe for easily synthesizing smallpox.[13] But the bar for ending research should be high and given the evidence that some forms of solar geoengineering could have enormous benefits for the world's poorest,[14] and the lack of plausible pathways for weaponisation, we don't see how concerns about moral hazard come close to justifying a moratorium on research. However, concern about moral hazard is a good reason to develop governance structures that can counter efforts by self-interested actors (e.g. fossil fuel interests) to promote solar geoengineering as an alternative to emissions cuts.

## 2. The risk of unilateral action

Stratospheric aerosol geoengineering is a proposal to create a global aerosol layer to scatter light and cool the Earth and is arguably the leading solar geoengineering proposal. Research indicates that stratospheric aerosol geoengineering would be feasible and cheap to implement with new high-flying jets, with the latest estimates placing it as low as $10-30 Billion per year per degree-celsius avoided.[15] The barrier to entry is therefore low enough that several countries could afford to develop and deploy it, raising the prospect of one nation pursuing a unilateral policy of climate intervention.

While it is perfectly possible for one nation to deploy stratospheric aerosol geoengineering in their narrow self-interest, there are good reasons to believe this scenario is unlikely. Firstly, stratospheric aerosol geoengineering is an inherently global intervention. The stratospheric circulation quickly spreads any injected particles across all longitudes and then towards the poles, allowing only a limited degree of control over the resultant pattern of cooling, mostly limited to determining whether the tropics or high latitudes are cooled more. While it is possible to only deploy stratospheric aerosol geoengineering over a single hemisphere, doing so would radically alter tropical hydrology with potentially disastrous consequences for the region.[16] The benefits of pursuing such a selfish hemispheric strategy would be trivial (it would halve the relatively small direct costs of deployment), whereas the

resistance to be expected from affected nations, in the form of political pressure, sanctions or military action, would seem certain to be overwhelming even for a superpower.

Given the potential push-back, even the most self-interested nation would have an incentive to pursue a stratospheric aerosol geoengineering strategy that avoided clear harms to other nations. Secondly, even if a nation committed to deploying stratospheric aerosol geoengineering, there is little reason to do so unilaterally. All nations are affected by climate change and all have agreed to limit warming, and so, assuming the science continues to suggest that stratospheric aerosol geoengineering could reduce the overall risks of climate change, it seems likely that a nation that wished to pursue deployment could gather a coalition to support this. Given the mutual interests in limiting global warming, and the limited degrees of freedom afforded to the deployer, there seems little to be lost by involving others in the choice of how to deploy and much to be gained by building a coalition, in terms of legitimacy and reduced push-back from other nations.

## 3. Termination shock and the long-term commitment to deployment

Another prominent concern about solar geoengineering is that as it only masks the warming effects of greenhouse gases, if deployment were suddenly stopped, temperatures would rapidly recover to where they would have been without solar geoengineering. This would lead to a rate of warming in the following years that would be greater than what would have been seen under climate change. Some have argued that this implies that once solar geoengineering is started, we would be locked into deploying it indefinitely, given the millennia it would take for atmospheric $CO_2$ concentrations to return to pre-industrial conditions.[17]

However, there are two possible off-ramps. First, solar geoengineering need not be deployed to keep temperatures constant indefinitely, it could be deployed to only slow the rate of warming, buying time for adaptation.[18] Alternatively, once deployed, it could be phased out gradually over the course of decades. Second, carbon dioxide removal (such as bioenergy and carbon capture and storage, which is championed by the British Government, among others) offers a means of driving $CO_2$ concentrations down such that the warming that solar geoengineering is offsetting is gradually eliminated. The two could be calibrated as complementary solutions.

If solar geoengineering is to make a substantial contribution to limiting global warming it will need to be deployed for many decades. This is not, however, a unique requirement. Humanity is not even more sharply dependent on maintaining a range of technologies, from electric power to the production of nitrogen fertilisers. Tackling anthropogenic climate change will take a long time: it will take decades to reach net zero emissions and for temperatures to peak, millennia for the carbon cycle to recover naturally or at least a century with the help of carbon dioxide removal, and sea-level rise is expected to only keep accelerating for the next few centuries. Anthropogenic greenhouse gas emissions will leave a legacy that future generations will be managing for centuries to come. The question is: could solar geoengineering play a useful role alongside other climate policies in managing this troubling legacy?

Solar geoengineering only masks the warming effect of greenhouse gases and so if something unexpectedly prevented its deployment then a rapid warming would follow, a risk known as 'termination shock'. Some argue that it would be dangerous to develop a global system that must be maintained for decades, pointing to the turmoil of the 20th century. However, it seems relatively easy to forestall all but the most apocalyptic threats to maintaining this system.[19]

> ***The priorities today are to understand, collaborate and debate so that a foundation of knowledge and trust can support later decisions on whether to develop and deploy solar geoengineering.***

First, the stratospheric aerosol geoengineering deployment system is inherently robust: tens of aircraft operating from multiple airbases would be hard to disrupt and any disruption must persist for many months before it would have a noticeable climate impact given the fact that the aerosols persist in the stratosphere for a year or more before falling out. Those aircraft need not operate globally to spread aerosols; atmospheric circulation will do that for them. With appropriate back-ups and defences, it would take a global superpower or world-shaking calamity to interrupt deployment.

Second, all nations would have a vested interest in avoiding termination shock and so even if some superpower or coalition demanded solar geoengineering end, they would be much more likely to demand a slow phase-out rather than a sudden termination of activities. Those who want to see dams taken down do not want them dynamited when full, they want them drained and dismantled. The potential for a termination shock can be relatively easily avoided but it places a burden of long-term management on future generations.

## A path forward

The geopolitics of solar geoengineering are not yet apparent. While discussions have reached heads of state and preparatory meetings at the UN Security Council, nations have not articulated clear positions. When the topic is discussed at meetings under the UN Framework Convention on Climate Change (UNFCCC), the discussions are generally kept out of the public spotlight.

The behind-the-scenes interest combined with the current lack of clear positions from the major powers provides

an opportunity for a loose coalition of small democracies to shape the agenda for research and governance.

What would this leadership look like? The priorities today are to understand, collaborate and debate so that a foundation of knowledge and trust can support later decisions on whether to develop and deploy solar geoengineering. For the UK this means making significant investments in research at home, perhaps through the forthcoming Advanced Research and Invention Agency (ARIA); supporting international research collaborations, especially with developing world, perhaps through the Global Challenges Research Fund; and leading efforts to develop an international governance framework for solar geoengineering. Without strong leadership on solar geoengineering, there is a chance that we may either miss a great opportunity to reduce the risks of climate change or see risky, unilateral actions that lead to catastrophic outcomes.

The scientific research and technological development required to improve understanding of solar geoengineering's benefits and risks is not inherently expensive. This means that comparatively small or poor countries could, in principle, play a significant role.

The scale of funds required is very different than the scale of funds required to develop technologies for emissions reductions, let alone to deploy them. As a rough guide the total amount the world now spends on clean energy deployment is roughly $300 billion per year, and it needs to be spending over $1 trillion per year (roughly 1% of GDP) to reduce carbon emissions at a reasonable pace. The cost of clean energy R&D is hard to estimate, but one could possibly argue that it should be several percent of the cost of energy deployment, so many tens of billions of dollars per year.[20] In contrast, the total funding required for a serious solar geoengineering R&D effort might never exceed a few hundred million dollars per year globally, and it would start much smaller.

This means, that at least in principle, a coalition of smaller democracies including a mixture of high-income and low-income countries could play an important role in shaping geoengineering research and the development of international governance. This could start with developing a broad collaborative research programme managed by memoranda of understanding between science funding agencies, articulating principles for research governance such as data sharing, a registry of research and experiments, and principles of open access, transparency, and non-commerciality.

Developing non-binding principles for collaborative research on a non-commercial technology is a small and comparatively easy step. But it is not insignificant, as it could build a network of government officials and civil society that could begin to work on the hard problems: developing the foundation of international governance of deployment—including decisions not to deploy—that could be widely respected as legitimate.

No such loose arrangement can avoid the geopolitical realties. If China and the US, for example, develop clearly aligned interests they could, no doubt, impose their decision. But given the great powers have yet to develop hard positions on this issue there is space for a governance structure to be advanced by a representative set of small democracies that could define the terms of engagement.

The UK led the world on solar geoengineering but then abdicated its leadership perhaps out fear of controversy. This is a mistake. Decisions about challenging technologies are best made with knowledge and broad engagement, not ignorance and secrecy. It is time for the UK to end its silence on this topic and to lead a responsible international debate on solar geoengineering.

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# Examples of Potential Solar Geoengineering Technologies

All of the below techniques have potential advantages and drawbacks, making research and governance development essential before considering responsible deployment at scale.

## Stratospheric aerosol injection

Powerful volcanic eruptions, such as the eruption of Mt. Tambora in 1815 or Mt. Pinatubo in 1991, add millions of tons of highly reflective sulphate particles into the upper atmosphere (the stratosphere) which spread across the world and cooled the climate substantially for a few years. Using high-altitude jets to distribute particles into the stratosphere this cooling effect could be replicated. Research suggests this idea is feasible, relatively cheap and potentially highly effective at ameliorating climate hazards.[1] However, depending on the particle introduced, it would have a number of side-effects, including a potentially significant delay in the recovery of the ozone hole.

## Marine cloud brightening

Marine cloud brightening would involve using specialist ships or aircraft to spray fine dropplets of seawater into low-lying marine clouds.[2] There, the salt particles would promote the formation of clouds with a greater concentration of smaller cloud droplets. Clouds with more and smaller droplets reflect more light and so this would have a cooling effect. However, clouds are complex and there remains significant uncertainty around how effective marine cloud brightening could be. Unlike stratospheric aerosol injection which is global in its effects, marine cloud brightening is a local or regional-scale intervention.

## Cirrus cloud thinning

Cirrus clouds are high, thin, wispy clouds made of ice crystals, which reflect relatively little sunlight but trap a lot of the thermal energy leaving the Earth. Cirrus clouds therefore have a net warming effect, which cirrus cloud thinning aims to reduce.[3] By dispersing particles which can act as seeds for the growth of ice crystrals, it is hoped that larger, heavier ice cystals can be formed, producing cirrus clouds that trap less heat and dissipate more quickly. Cirrus clouds are even less well understood than other cloud types and so there are deep uncertainties regarding this proposal. Like marine cloud brightening cirrus cloud thinning would be a local or regional-scale intervention.

## Space-based reflectors

Perhaps the simplest but most expensive option would be to place a constellation of reflective satellites between the Earth and the Sun. This would slightly reduce the amount of sunlight that reaches Earth. The practicalities of implementing this idea are daunting but it offers the advantage of being the cleanest intervention into the Earth system. While this idea is likely impractical in the coming decades, if there is significant economic development in space, this idea may become practical in the later parts of the 21st century.

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# STRENGTHENING WATER DIPLOMACY

**With growing competition for water resources, foreign policy should engage with political realities rather than technical solutions alone, argue Benjamin Pohl, Sabine Blumstein and Susanne Schmeier**

***By Benjamin Pohl, Sabine Blumstein and Susanne Schmeier***

> *"For years and generations, wars have been fought over oil. In a short matter of time, they will be fought over water."*
>
> Kamala Harris, US Vice President, April 7, 2021[1]

Water is critical for survival – not only literally, but also through its impacts on economies and societies. As global water demand has soared over the past decades, water crises have consistently featured among the World Economic Forum's top global impact risks.[2] The lack of access to water, at appropriate quantity and quality, for basic human needs and socio-economic development undermines billions of livelihoods. By impairing human security, thwarting development and fuelling displacement, water insecurity also poses significant risks for peace and prosperity.

Does that mean that Vice President Harris' prediction that wars will soon be fought over water (rather than oil) will necessarily be true? History suggests otherwise: most scholars agree that water wars between nation states have been most notable through their absence.[3] One key explanation for this finding is the relatively low value of water (per unit of weight), which makes it hard to capture and carry it off. Moreover, water is relatively plentiful – albeit distributed very unevenly around the world.

Yet the Vice President still has a point: access to water has been a major issue in many (violent) conflicts, notably in the Middle East. Moreover, a focus on international wars easily loses sight of far more frequent conflict over water resources at the subnational level, such as in the Sahel and Horn of Africa regions. Most importantly, the political economy of conflict over water might be changing: not only is demand increasing precipitously due to demographic and economic growth, the power over controlling water is dispersing as more and more countries become able to build huge dams – a function of the loss of de facto veto powers of financing that the World Bank (and its major shareholder) once held. Such major infrastructure projects, and the changes in the balance of benefits and power that they entail in many basins, are potential harbingers of conflict. And they are fuelled by the changes that climate change brings about – whether by altering water flows, increasing demand (notably for storage and irrigation) or incentivising 'green' hydropower production.

These changes imply that policymakers might be facing a prevention dilemma with respect to 'water wars': predicting the catastrophe in order to prevent it might carry a price in terms of political capital and legitimacy because the predicted catastrophe is subsequently prevented, exposing policymakers to the charge of misplaced alarmism. However, perhaps an even bigger problem is that the discussion over (the absence of) 'water wars' between nation states masks more mundane and structural violence over water, whose consequences for human security can, however, add to local, national, regional and international insecurity.

Water insecurity adds to humanitarian pressures by undermining health, food security and employment, and limiting economic opportunities. Losses in livelihood security may drive migration and fuel grievances in host communities. More generally, water insecurity can also undermine

governmental legitimacy, which has been linked to water management since the dawn of written history in irrigation-focused kingdoms in the Middle East, Egypt and China.[4]

Today, such impacts are often transboundary. Last year, New York Times Magazine produced a long, modelling-supported (and nicely animated) piece titled 'The Great Climate Migration Has Begun'.[5] It focuses in particular on northward migration pressures from Central America's 'Northern Triangle' fuelled by drought and sudden flooding, but it underlined that, whereas "[t]oday, 1% of the world is a barely livable hot zone. By 2070, that portion could go up to 19%." To be sure, the relationship between climate change, migration and conflict is neither deterministic nor monocausal. Decisions to migrate (or protest, or fight) are motivated by many contextual factors, making it difficult to attribute them to climate change or water scarcity.

The relationship between water, climate and security is influenced by a host of governance factors. While bedeviling academic debates, this murky and indirect relationship also has a positive upshot: there are many governance levers that can be employed to prevent or limit the most socially and politically destructive outcomes of water- and climate-related risks.

Nowhere is the complex nature of the challenge clearer

***As global water demand has soared over the past decades, water crises have consistently featured among the World Economic Forum's top global impact risks***

than in transboundary basins. This is not so much a question of water wars, but of the fragility and lost development opportunities that non-cooperation entails. Consider the Nile: even though the great majority of its riparian states have collaborated in the framework of the Nile Basin Initiative for more than 20 years (and made significant progress), a permanent institution for cooperation has proven elusive. In recent years, tensions have risen around Blue Nile flows (by far the most important contributor to the Nile) between downstream Egypt and upstream Ethiopia in particular, with midstream Sudan seeking to mediate and realigning as relations with both neighbours shift. At issue was initially the construction and now the filling and operation of the Grand Ethiopian Renaissance Dam (GERD) on the Blue Nile. Although the heads of state or government of the three countries eventually reached agreement on a Declaration of Principles between Egypt, Ethiopia and Sudan on the GERD in 2015,[6] negotiations have since repeatedly failed to put that cooperative intention into practice, most recently at a meeting on 6th April 2021, in Kinshasa, seat of the current African Union president.[7]

Similar difficulties between upstream and downstream countries are typical in contested basins such as the Indus (India/Pakistan), Brahmaputra (China/India), Amu Darya (Tajikistan/Uzbekistan), Helmand (Afghanistan/Iran) or Euphrates/Tigris (Turkey/Iran/Iraq/Syria) – to name but a few of the most disputed transboundary rivers and the main contestants.[8] This is despite significant opportunities that transboundary water cooperation can offer for both upstream and downstream countries: dams constructed for hydropower production in upstream countries can, for example, simultaneously help control floods and increase the potential for downstream hydropower, flood protection and irrigation by stabilising water flows. They may also offer downstream countries opportunities for cheap electricity imports (as the

GERD's planners foresee for Sudan). In reality, however, such plans often lead to conflict with downstream neighbours, as these fear the consequences of flow changes and/or the potential political lever against them.

In some cases, including the GERD, there have even been threats of military action. Yet the biggest risk is not that such conflicts escalate into international wars, but that they undermine stability, with incalculable consequences. This threatens both upstream and downstream countries. Ethiopia's internal strife, and in particular the government's ongoing conflict with the Tigrayan elites that dominated its predecessors, could appear to offer leverage to downstream countries. This risk intensifies in the context of an ongoing border conflict between Sudan and Ethiopia, and Sudan's history of serving as a base for Ethiopian rebellions. Just the perception of such threats can easily harden conflict. Vice versa, the impacts of uncoordinated water releases either in the form of floods in Sudan or drought in Egypt could potentially undermine stability in these countries. Such developments could bring about significant regional instability – something that all governments should wish to avoid, but that they could fear their neighbours might be willing to consider. Yet even if such escalation is avoided and tensions can be contained, the mere continuation of political conflict implies significant opportunity costs in other sectors, hampering economic development as well as sustainable and equitable water use.[9]

Most governments are well aware of the risks of playing with fire and will avoid it. Yet some might see themselves existentially threatened, and the mere perception of being unfairly pressed by rival riparians creates incentives to showcase efforts of defending national positions and red lines (rather than enlightened national interests). Cooperation thus often founders on the perceived political risks of water cooperation, rather than the lack of economic incentives (think Brexit and its aftermath).[10]

The GERD illustrates this dilemma. Technically, there is significant potential for having all countries benefit.[11] The politics of reaching a mutually agreeable solution have been difficult, however. As the dam's name ever so subtly indicates, the Ethiopian government has invested a lot of political capital into making this a successful nation-building project, which is particularly critical now that the country is acutely threatened by violent conflict and political tensions with ethno-sectarian roots. The high political stakes that the dam has come to embody should not surprise Egyptians: Abdel Halim Hafez, one of its most famous musicians, once intoned with respect to Egypt's own dam "we said we will build, and we built the high dam... O coloniser, we built it with our own hands."[12]

Yet rather than using shared sentiments to construct a common narrative of jointly building a bright future, distrust among the governments is probably stronger now than in a long time. This is despite considerable progress in negotiating, for many years, over the nitty-gritty technical details of a possible agreement (including dam filling, provisions for managing drought situations and dispute resolution mechanisms). Although the technical teams achieved several breakthroughs and found solutions to a number of contested issues, the three countries today seem to be further away from reaching an agreement than they have ever been before.

This state of play highlights a lesson that goes beyond the specifics of the GERD and the complex politics in the Horn of Africa. For many years, both basin governments and many international donors have sought to depoliticise questions of water cooperation, in the hope of finding technical solutions that leave all governments better off. In many basins and contexts, that is a good idea. However, it tends to run aground in those contexts where cooperation is most difficult because trust is elusive and technical efforts repeatedly fail or do not get off the ground at all. Where domestic national(istic) narratives clash, negotiating technical aspects and water-centered

***The biggest risk is not that such conflicts escalate into international wars, but that they undermine stability.***

management solutions are unlikely to suffice because no contract is ever complete: there will always be instances of unforeseen events where efficient cooperation requires trust that the other side will not leverage every change in circumstances for unfair advantage.

In the Horn, that trust has so far proven elusive because national narratives are conflicting. Egypt's dependence on the Nile and past dominance of the basin have prevented it from reshaping a rights-based narrative into one of mutually beneficial collaboration. Ironically, given Hafez' poetry, it is colonial-era informed treaties from 1929 and 1959 that are the main source of this rights narrative. Ethiopia, by contrast, above all resents the (perceived) historical injustices of these treaties to which it was not part and which allocated practically all the Nile's water to Egypt and Sudan. Overcoming this fundamental contradiction cannot be achieved through a technical agreement on water release – although such an agreement could be a step towards building a shared new narrative of mutually beneficial collaboration.

As this analysis shows, any outside support trying to mediate in the dispute requires careful diplomatic and political engagement that addresses political realities. This is also true of the other high-pitched water conflicts around the world. In our opinion, this demonstrates the need for foreign policymakers to engage on the issue and not leave it to the water and development communities alone to handle.[13] That is by no means a call for the water community to disengage – on the contrary, their technical expertise is more necessary than ever. Yet given the interdependencies of water management with energy and food security, livelihoods, social stability and national identities, solutions must transcend the water sector.[14] They must rely on a legitimacy of representing broader, enlightened national interests rather than more narrow, distributive sectoral interests – and defining those is the role of foreign policymakers (even if they do not always live up to that ideal).

Successful water diplomacy requires an integrated approach across technical and political divides, jointly undertaken by technical experts and diplomats and adapted to each basin's specific needs. To support such processes, the World Bank has assembled a broad toolbox, from facilitating private discussions between decision-shapers to identifying mutually beneficial development paths and narratives, to reducing risks by offering guarantees or joint assessments.[15] However, it often needs the political impetus and diplomatic skillset that foreign policy can provide.

Ultimately, transforming conflict over resources into expectations of mutually acceptable and, where possible, beneficial patterns of interaction is what diplomacy has always been about. Realising this potential for water resources is particularly important now that competition over water is rising in many regions around the world. To foil Vice President Harris' predictions, water diplomacy needs empowerment – and thus greater constructive engagement from foreign policy actors.

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4. See for example S.Solomon (2010), "Water. The Epic Struggle for Wealth, Power and Civilization", New York: HarperCollins.
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# ENERGY SECURITY GETS LOCAL

**The move to 'electrify everything' will reduce reliance on global oil and gas markets but brings new risks in energy security, writes Ed Birkett**

***By Ed Birkett***

Conventional wisdom holds that a globalised economy means highly interdependent trade, long supply chains and globalised risks to security, including energy security. To make matters worse, climate change will exacerbate these risks through extreme weather, conflicts over scarce resources and climate refugees. The coronavirus pandemic exposed the downsides of how a globalised economy reacts to crises, whether through bans on the export of personal protective equipment or accusations of vaccine nationalism. The recent saga of the Ever Given cargo ship stuck in the Suez Canal adds to a sense that the globalised economy is brittle. This brittleness could particularly affect global energy security, given the reliance of energy trade on shipping pinch points in the Strait of Hormuz, Strait of Malacca and the Suez and Panama canals.

However, the imperative to reduce greenhouse gas emissions to 'Net Zero' means structural changes in the type of energy that we use; in particular, we will use more electricity and less oil and gas.[1] This structural shift means that if the lights go out, it's as likely to be caused by problems within national borders or in neighbouring countries as by conflicts in oil- and gas-producing nations or due to disruptions to global trade. Unless countries shift the focus of their energy security policy to their electricity sector and neighbouring markets, countries risk sleepwalking into the types of failures that have recently crippled the electrical grids in Texas and California.

## In a Net Zero world, electricity is the key to energy security

Today, energy security is predominantly ensured through secure supplies of oil and gas, and to a lesser extent coal, backed by strategic reserves that can be released at times of national or international crises. The UK's Statutory Security of Supply Report details how diverse international supply of oil and gas is a key component of the UK's energy security, with pipeline supplies complemented by global shipments of oil and Liquified Natural Gas (LNG).[2]

Even when international oil and gas markets are functioning well, domestic disruptions can still threaten energy security. In the UK, the Government maintains access to a reserve fleet of oil trucks and tanker drivers to counter the risk of extreme events, including any repeat of the industrial action proposed by tanker drivers in 2012.[3,4] In the United States earlier this year, blackouts in Texas were caused by a large-scale failure of the gas system and the knock-on reduction in electricity supplied by gas-fired power stations.[5] These incidents both suggest that short-term risks to energy security are indeed likely to be caused by oil and gas shortages. However, rapid changes in countries' energy mixes, driven by the Net Zero agenda, will lead to a new set of risks for the energy sector predominantly focused on the electricity sector itself.

To hit Net Zero by 2050, the Climate Change Committee

forecasts that the UK must use 85% less oil and two-thirds less natural gas, whilst electricity consumption will more than double.[6] This additional electricity demand will be met predominantly through low-carbon sources such as wind, solar and nuclear. By 2050, electric vehicles will largely replace petrol and diesel vehicles, and electric heating systems will largely replace natural gas boilers. This shift means that the UK will rely less on global markets for oil and gas, and more on electricity, which is predominantly traded domestically and regionally due to the cost and technical difficulties of transmitting electricity across continents.

## Risks to electricity supplies are different to those for oil and gas

Electricity systems can only operate if supply and demand is balanced at all times and, in contrast to oil and gas, large-scale electricity storage is expensive and therefore not yet widespread. Whereas oil and gas can be transported through a mix of physical pipelines and ships, electricity must be transmitted through physical cables between and within countries. This reliance on fixed links means that countries can only trade electricity with their neighbours rather than accessing a global market; in the case of the UK, the country is only connected to electricity systems in EU Member States and in Norway. Physical links are vulnerable to failures, be they caused by technical faults or collisions with ship anchors.[7,8] Undersea cables are also vulnerable to foreign interference, as highlighted by now-Chancellor Rishi Sunak MP in a 2017 report for Policy Exchange, **Undersea Cables: Indispensable, insecure.**[9]

Electricity supply and demand is highly dependent on weather conditions, particularly as countries rely on weather-dependent wind and solar for more of their electricity. Electricity systems must be robust to long periods of low wind output, like those experienced in the UK,[10] and fast drops in solar output as the sun goes down. To date, grid operators have dealt admirably with a rising share of intermittent generation, relying on innovative solutions like fast-acting batteries to smooth out second-by-second fluctuations in output.[11] However, grid operators still rely on conventional gas-fired power stations to meet the inevitable lulls in wind and solar output; gas-fired power stations that the Climate Change Committee says the UK should close by the mid-2030s.[12]

*Climate change will pose new challenges for electrical grids, already seen in California's programme of rolling blackouts*

Climate change will pose new challenges for electrical grids, already seen in California's programme of rolling blackouts, known as **Public Safety Power Shutoffs,** that aims to reduce the risk of wildfires started by fallen electrical lines. As droughts become more common in certain regions, the impact of falling electrical lines, which is not uncommon, becomes more severe.[13] Similarly, more extreme or unpredictable weather would make it more difficult for network operators and power station owners to plan when they can schedule maintenance without jeopardising energy security, one factor cited in this year's blackouts in Texas.[14]

## A three-point plan to manage new risks to energy security

The growing reliance on electricity means that governments need new plans to ensure energy security. Here, I propose a three-point plan to analyse and prepare for the local and

regional risks to electricity supplies.

Firstly, governments must improve their preparedness for disruptions to electricity supply, adopting military techniques like 'red teaming' to war game how governments and the electricity system would respond to extreme events. For example, in a UK context, how would the Government respond to a coordinated military offensive disabling subsea electricity cables? Similarly, how would the UK's electricity system, with its increasing imports of electricity from the EU, respond to mass outages of the French nuclear power fleet due to the discovery of faults common to several reactors, as happened in 2016?[15]

In addition, governments must prepare for how climate change will alter the risks to the electricity system. For example, how will demand for air conditioning rise as the number of hot days increases? Could demand for electricity in Northern European countries like the UK peak in summer, driven by air conditioning, rather than in winter, driven by heating?

Conventional probabilistic approaches to assessing energy security may no longer be fit for purpose, with the key variables like extreme heat and precipitation uncertain and changing due to climate change. In 2019, the UK Government's Panel of Technical Experts raised exactly this issue, noting that, although it would be difficult to model, changing market circumstances mean that the Government and grid operator must pay extra attention to "Black Swan" events and combined failures of generators that would threaten the security of the electricity system.[16]

*The coronavirus pandemic has served as a reminder that, in situations of extreme duress, national interests may trump regional or global considerations*

Secondly, governments must assess whether they can really rely on electricity supplies from neighbouring countries in an emergency situation. The coronavirus pandemic has served as a reminder that, in situations of extreme duress, national interests may trump regional or global considerations, whether for vaccines, medical supplies or protective equipment for healthcare professionals. For energy security, this means considering scenarios where whole regions are short of electricity, be that due to low rainfall levels reducing output from hydropower dams, weeks-long lulls in wind power, or lack of fuel for power stations.

The technical properties of electricity systems lead to interesting and perhaps unexpected dynamics for energy security. For example, the continental European electricity grid is a single "synchronous area", which means that electricity supplies must be balanced across the whole region, else the lights will go out for everyone. The impact of this regional interdependence can be seen in a Kosovo-Serbia dispute that led to more electricity consumption than supply in the region, slowing electrical timers (clocks) across Europe. More seriously, earlier this year the failure of several transmission lines in Romania caused a serious disturbance to the continental European grid, requiring grid operators to disconnect customers in France and Italy to keep the system secure.[17] This security of continental European electricity supplies is therefore significantly more interdependent than for oil and gas.

The UK's electricity grid, however, has a very different relationship with neighbouring markets. Whilst the UK is connected to the continent via four subsea electricity cables, it is not part of the continental "synchronous area". This means that the electricity grids in the UK and on the continent can operate independently; potentially allowing one party to cut off the other in the event of an energy security crisis. The Brexit

deal, the UK-EU Trade and Cooperation Agreement, requires both parties to cooperate on energy security including on emergency plans.[18] However, the agreement will only be fully tested in the event of an energy security crisis on one or both sides of the Channel. The UK and the EU would therefore be wise to prepare for scenarios where cross-border supplies of electricity are not available.[19]Finally, governments must develop truly resilient electricity systems similar to how, on the whole, they have developed resilient supplies of oil and gas. The first step to a resilient electricity system is recognising that things will go wrong, levelling with the public that some peoples' lights will go out some of the time. The UK Government's new Electricity System Restoration Standard is a good first step, codifying how quickly the Government expects the grid operator to restore supplies after a catastrophic failure of the grid; something that has thankfully never happened in the UK.[20]

Governments could go further by asking their regulators and grid operators to examine the potential to operate grids in smaller "islands" in the event of the transmission network failing. In the UK for example, could the electricity grid in Scotland or the South West of England operate independently from the rest of the UK in the event of the key transmission cables failing?

In addition, governments must develop more detailed and more targeted plans for how the electricity system will operate during a crisis. The UK's Electricity Supply Emergency Code (EMSC) sets out how rolling blackouts (or 'rota disconnections') would be used to ration electricity in the case of prolonged shortages, whilst maintaining supplies for designated key services such as hospitals, railways and airports.[21] The transition to Net Zero means that emergency codes must keep up with rapidly changing definitions of key services. For example, chargepoints for electric vehicles increasingly provide a critical service, particularly as emergency and military vehicles are converted to electric.

Emergency codes must also keep up with new technologies that could allow a more targeted approach in the event of emergencies. Whilst electrification of the energy system creates risks in cyber security exposure, it also provides new tools for managing usage at a granular level. The UK's current plan requires network companies to turn off parts of the electricity network, disconnecting customers for three hours at a time. This relatively crude process does not allow the network companies to keep the electricity flowing to individual households who might have critical needs, for example because they rely on a constant supply of electricity to power life-saving medical devices. However, new technology embedded in smart meters could allow network companies to keep some customers connected 24/7 if they can demonstrate a critical need.[22] Any proposals in this area would be hugely controversial but could help to protect vulnerable people during genuine emergencies.[23] By discussing these types of measures openly, governments can start broader discussions about energy resilience, including alternatives like providing incentives for households to install battery storage for backup if they live in areas with frequent electricity outages; any scheme could learn from similar programmes in the US States of Vermont and California.[24,25]

***Earlier this year the failure of several transmission lines in Romania caused a serious disturbance to the continental European grid, requiring grid operators to disconnect customers in France and Italy.***

## Electrification makes energy security local

In many countries, the transition to Net Zero is well underway, and the path to a global economy that relies less on oil and gas is becoming clear. However, we will continue to rely on oil and gas for a long time, not least in critical industries like aviation and petroleum products, and for defence. Therefore, the new, more local risks to energy security posed by an increasing reliance on electricity must be managed alongside the traditional, global risks to oil and gas supplies. Even in a world with less oil and gas, countries will still have strong incentives to ensure stability in oil- and gas-producing regions, not least because of the potential for global trade in low-carbon hydrogen produced from either renewables or fossil fuels with carbon capture.

Hydrogen and hydrogen-derived fuels like ammonia are the big unknown in the world's future energy mix. There's significant uncertainty over how hydrogen will be used in our economies, how much countries will produce domestically from indigenous renewables or natural gas with carbon capture, and whether a global market for hydrogen could ever rival oil and gas.

Despite the inherent uncertainties over the future energy mix, it's clear that governments must step up their work on energy security in the electricity sector, probing how their electricity systems could fail and how they can be made more resilient. Governments must also ensure that electrical infrastructure is not a poor relation to oil and gas infrastructure, where energy security mainly focuses. If governments can stay on top of these new risks then a resilient, Net Zero energy system is in reach. As an added bonus, countries that currently import oil and gas will instead rely more on domestic sources of renewable energy, potentially increasing resilience in the face of inevitable future energy security crises.

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## Notes

1. 'Net Zero' refers to greenhouse gas emissions across an economy or for a company. For example, the UK Government has committed to Net Zero emissions across the UK by 2050. The "Net" in Net Zero refers to a balance between positive emissions (e.g. from burning fossil fuels) and negative emissions (e.g. from planting trees or capturing carbon dioxide from the air).
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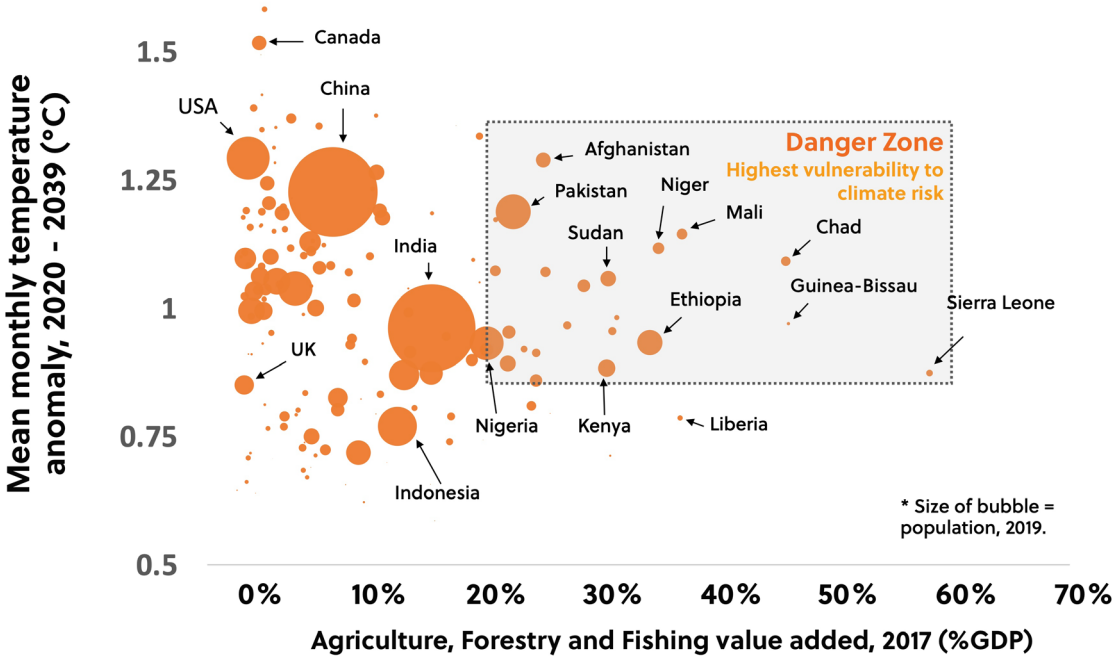
# Many Developing Countries are Disproportionately Vulnerable




All economic sectors are vulnerable to the system-wide effects of climate change. Even where a sector is not directly exposed to changes in weather systems, the connectedness of modern supply chains ensures it will be impacted indirectly. Some economic activities are more directly exposed to changes in the weather than others as they use large amounts of natural resources as inputs, such as agriculture or forestry.[1]

The effects of climate change are therefore more pressing for countries with a greater economic dependency on these exposed sectors. Box 1 in the graph above highlights countries with the dangerous combination of a high forecasted change in temperature (more than 0.8°C between 2020 and 2039) and a high economic dependence on agriculture, forestry and fishing (above 20% of Gross Domestic Product).

Many of these countries are also Least Developed Countries (LDCs). The combination of less developed institutions, narrow economic bases and a high economic exposure to changes in the weather, means these countries are particularly susceptible to the effects of climate change. Due to this susceptibility, climate change is more likely to drive instability or conflict in these countries.

***The combination of less developed institutions and a high economic exposure to changes in the weather, means these countries are susceptible to the effects of climate change.***

Fragile states combined with climate change can increase the chances of internal or inter-state conflict. Researchers have suggested that human-induced climate change made the Syrian droughts of 2007-2010 twice as likely. This contributed to internal civil unrest, such as increasing rates of internal migration as harvests failed, creating conditions that likely encouraged the 2011 Syrian uprising.[2] In Somalia's latest Nationally Determined Contribution to the UNFCCC, it outlined how 14 major drought events of the last 50 years affected six million people in the country, accelerating land degradation and rural-to-urban migration. According to the Somalian government, this "increased conflict over natural resources and the continued loss of lives and livelihoods".[3]

Further, climate change can also intensify existing conflicts. The United Nations Development Program (UNDP) recently noted that 'farmer-herder' conflicts in several African countries can be intensified by an increasing scarcity of resources.4 Where state and economic institutions are unable to cope with such pressures, migration also becomes more likely.

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## Notes

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# A NEW TECHNOLOGICAL ORDER

**Bruno Maçães highlights the increasing age of competition between economic blocs and spheres of influence, which is being accelerated by climate policies**

***By Bruno Maçães***

Forget about the climate crisis as a moment to overcome geopolitics. More likely, geopolitics will be more present than ever. As David Wallace-Wells recently argued, we should brace ourselves for a future of intense state competition, a new scramble for territory. There will be fights for new resources, with demand for the materials in solar panels tripling or more over the next few decades, and the need for battery ingredients like cobalt, lithium, and other rare earths growing so quickly that countries will be forced to scramble for control over specific geographies:

> *"That is, mines all around the world opened to disgorge resources at a rate much faster than those that powered the global industrial revolution over centuries, and in ways that invariably generate state conflict."*[1]

If the climate crisis will inaugurate a new economic and technological model, the last thing we should expect is that the transition will be a peaceful one. What history teaches us is that moments of transition are understood by state actors as a threat and an opportunity, rare moments when new orders may be created and new states may ascend to the commanding heights. It was, after all, by leading the fossil fuel revolution that England became the ruler of a global empire, and the United States took advantage of a similar opportunity by leading the technological transformations of the Second Industrial Revolution.

In September 2020, Xi Jinping announced a plan to achieve carbon neutrality before 2060. If China were to achieve its announced goal, it would lower global warming projections by around 0.2 to 0.3°C, the biggest single reduction ever estimated by the Climate Action Tracker. Assuming full implementation of the Paris "pledges and targets", without the new China announcement, the CAT estimates global temperature increase will be 2.7°C by 2100. The Chinese announcement would lower it to around 2.4 to 2.5°C.

Traditionally, of course, it is the capacity to mobilise resources that stands as a marker of national power. How was it possible that a country so obsessively committed to the goal

***The goal is to control as many of the key technologies powering the climate economy. No country can expect to lead the process without a firm commitment to decarbonise.***

of national rejuvenation was now announcing what Pierre Charbonnier calls a "program of fossil disarmament"?[2] If we knew something about China and climate, that was surely that the country has long held that wealthier nations, who benefited from earlier industrialisation, should carry most of the economic burden for preventing catastrophic warming. What has changed?

The answer is that China is not so much announcing a retreat from a technological model as the beginning of a new one. The country leads the world in clean energy investment, with its current level of investment in climate change being approximately equal to that of the United States and the European Union combined.

A lot is at stake. As each economic bloc increasingly focuses on specific technologies, it must make sure that those technologies become dominant, providing something of a global standard. The European Union has actively bet on hydrogen. Countries in East Asia are racing to develop solid-state battery technology. The goal is to control as many of the key technologies powering the climate economy. No country can expect to lead the process without a firm commitment to decarbonise.

The European Green Deal could have a major impact on Russia, a country heavily dependent on exports of fossil fuels to the European Union. 2025 could become an inflection point for the critical automobile industry, the moment when electric and combustion vehicles are projected to cost the same. Countries in East Asia are racing to develop the battery technology of the future, and China is developing integrated supply chains for electric cars in Indonesia. European companies are still world leaders in wind turbines and Germany is striving for global leadership in hydrogen technology, but China is quickly catching up even in these areas. Where China is still lagging, as one perceptive report notes, is in "breakthrough innovation that can alter entire markets and create paradigm shifts."[3]

Initial estimates suggest that China's pledge made in September to go carbon neutral could involve a total investment of up to $15 trillion. If even a small fraction of that amount is invested in transformative clean energy technologies like fusion power, that could mean Chinese firms are more likely to own the intellectual property that powers the planet at the end of this century. The goal is to control as many of the key technologies powering the climate economy. "Just as the advent of coal and oil remade the world, clean energy is set to do the same. The energy transition will not only cut emissions: it will redistribute power." The fact that China has continued to invest in coal power — the country built over three times as much coal plant capacity as the rest of the world in 2020 — may seem at odds with its bold climate goals, but the contradiction disappears once we understand that what Chinese authorities envision is a diverse industrial base where investment in emerging technologies can go together with less advanced sectors for as long as those remain marginally profitable.

*China provides 98% of the EU's supply of rare earth elements, Turkey provides 98% of the EU's supply of borate, and South Africa provides 71% of the EU's needs for platinum.*

In the case of the European Union, the hermeneutic circle is complete. Climate politics leads to geopolitics and geopolitics leads to climate politics. Much of the recent geopolitical awakening in Brussels is climate-driven. Because Europe's ambition to deliver on its climate goals is so heavily reliant on access to natural resources, we have suddenly entered a world

***Shifting EU import payments for critical raw materials from other international currencies to the euro would have some advantages such as reducing price volatility, and making EU importers and third-country exporters less dependent on US dollar funding markets.***

that increasingly looks like the old scramble for territory. Critical raw materials are essential to the functioning and integrity of a wide range of industrial ecosystems. Tungsten makes phones vibrate. Gallium and indium are part of light-emitting diode technology in lamps. Semiconductors need silicon metal. Hydrogen fuel cells and electrolysers need platinum group metals. The climate transition will not inaugurate an age of freedom from the old need to control raw materials. The EU now admits that the only thing that has changed is the list of critical materials. From fossil fuels to metals and rare earths, but tragically Europeans will continue to be vulnerable because many of these raw materials are sourced from abroad and the global competition for access and control is becoming fiercer.

The supply of many critical raw materials is highly concentrated. For example, China provides 98% of the EU's supply of rare earth elements, Turkey provides 98% of the EU's supply of borate, and South Africa provides 71% of the EU's needs for platinum and an even higher share of the platinum group metals iridium, rhodium, and ruthenium. For electric vehicle batteries and energy storage, the EU would need up to 18 times more lithium and 5 times more cobalt in 2030, and almost 60 times more lithium and 15 times more cobalt in 2050, compared to the current supply to the whole EU economy. What to do?

The situation is made all the more desperate by the fact that Europe's main rivals are all already working to secure future supplies. They do this by controlling access to the main global producers through partnerships with resource-rich countries or strategic acquisitions, and by developing their own, internal supply chains. A recent EU document goes so far as to recommend that the EU marshal its sophisticated fleet of satellites: "Remote sensing using Europe's earth-observation Copernicus Programme can become a powerful tool to identify new critical raw material sites, monitor the environmental performance of mines during their operating life and after closure."[4] In parallel, the EU will also negotiate Free Trade Agreements with a number of important countries from a raw materials perspective. Energy and economic diplomacy with third countries is important to reinforce the resilience of critical supply chains for the clean energy transition and energy security. Shifting EU import payments for critical raw materials from other international currencies to the euro would have some advantages such as reducing price volatility, and making EU importers and third-country exporters less dependent on US dollar funding markets.

We are well on our way to a world divided in regional spheres of influence, and the immediate cause is the need to deliver on climate promises and commitments. "It is important," the European Commission claims, "to integrate the Western Balkans into EU supply chains". Serbia, for example has borates, while Albania has platinum deposits.

There is something I would call a "technological order" which is deeper and more fundamental than political and economic orders, albeit less visible and often taken for the way nature presents itself. The last time we witnessed a change in the "technological order" was with the industrial revolutions of the modern age. The climate crisis signals a similar change: the moment when our fundamental way of relating to the natural environment is rethought and, as a result, new political and economic arrangements become both possible and necessary.


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## Notes

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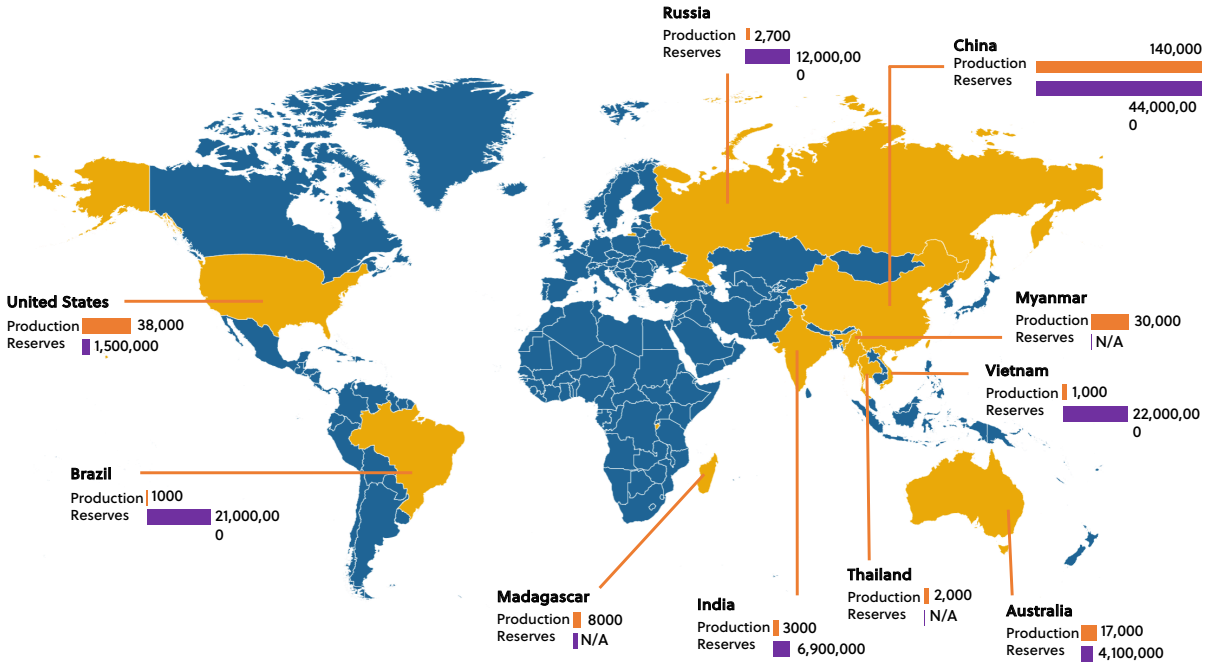
# The Geopolitics of Rare Earth Elements




Rare Earth Elements (REEs) have qualities that make them a crucial input for many low-carbon technologies. As governments decarbonise economies more aggressively, transitioning towards low-carbon energy systems and electrified transport, demand for these metals will grow exponentially.[1] This confers a geopolitical advantage on countries with more developed supply chains and proven reserves.

Although their name is somewhat misleading (they are more abundant than most assume), the current global supply of REEs is heavily concentrated in a small number of countries. China has a virtual monopoly on them, in terms of both production capacity – operational mines and processing facilities – and proven reserves to call upon later.

Anxieties over China's dominance of the global supply has already sparked international disputes. In 2010, China imposed export quotas on some REEs, a move which was overturned in 2015 through a WTO case launched by the US, EU and Japan.[2] As the world pursues decarbonisation, the security of supply may well become a problem.

The obvious solution to reducing China's dominance of the market is to diversify supply. Yet, as reflected in the graphic above, little progress has been made in doing so since 2015. This is due to two reasons. First, known reserves of REEs are spatially concentrated and exploration is nascent, since they have only recently come into high demand. Even within China, a single mine in Inner Mongolia produces 50% of China's Rare Earth Elements.[3] Second, commercially extracting REEs is a capital-intensive task and capital markets are still turning their attention to the issue.

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The future could involve some diversification of supply away from China. Countries like Brazil and Australia have large natural endowments of REEs, and so they could become larger exporters, reducing China's market dominance. China is also the largest importer of REEs, increasing its reliance on other market players.[4] It has invested heavily in exploration around the world through its Belt and Road Initiative. Investment in exploration of new sources of REEs is ongoing, both on land and at sea, and new reserves could be discovered. Rising demand will also continue to inflate the prices of Rare Earth Elements, incentivising countries that are sitting on large natural endowments, such as Brazil, to invest in production.[5] There has also been an escalation in sea bed mining, which raises questions about ecological impacts and access rights in international waters.

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# KEEPING INDIA AT 'YES'

**A clearer vision of India's place as a leader has helped to move India towards climate action, argues Mihir S Sharma. Keeping it there will require the West to mobilise private capital for developing economies**

***By Mihir S Sharma***

In 2015, Subrahmanyam Jaishankar – who was then India's chief diplomat, but is today foreign minister – delivered a speech that contained perhaps the most important and succinct formulation of India's foreign policy aims under Prime Minister Narendra Modi. India, he said, was transitioning from being a "balancing power" to a "leading power".[1] If, in the past, a non-aligned India sought to maintain the balance in a multi-polar world, under Modi it would seek to shift orientation to become one of those poles. To what degree this transition is fact and what aspiration is unclear. It is perhaps a little of both; in New Delhi today, the line between aspiration and reality is not as clear as one could wish.

Yet what is certainly true is that Jaishankar's formulation provides us with a very useful structure within which to try and understand India's approach to geopolitics. In some sense, India's position in the world has always led it towards an uneasy balance. Must it define itself as an emerging economy? A poorer country? A liberal democracy? A continental or a maritime power? Pro- or anti-trade? In the past, both Indian rhetoric and actual positions typically attempted to lay claim to all these identities; whatever consensus position emerged was either incoherent or just plain wrong. Partly as a consequence, the country in the past generally failed to take a leadership position in any grouping of countries with similar identities. The Jaishankar-Modi formula seeks to push back against this.

No global issue reveals the multiple forces pushing India in multiple directions, or Modi's new approach, as much as climate change. In 2009, Indian intransigence was one of the most crucial – if not the most crucial – reason for the failure of the Copenhagen climate summit. Less than a decade later, Modi's assent helped put the Paris Agreement over the top. In the years since, India has become something of a climate leader, particularly in terms of its ambitious rollout of renewable energy generation capacity. Getting India to "yes" – to climate agreements, closer military partnerships, and so on – was a long effort. What can be done to keep India there?

The fact remains that, even on climate change, India straddles multiple fault lines somewhat uncomfortably. On the one hand, it will be deeply affected by global warming and weirder weather; one 2020 study, published in Nature, predicted that heat stress alone would reduce Indian productivity by 30 to 40 per cent by the end of the century.[2] On the other hand, it is dealing with a youth unemployment crisis – one oft-cited number is that a million young people join the workforce every month. There are jobs for very few of them already, and even fewer will be available if carbon-heavy growth such as that experienced by the People's Republic of China over the past two decades is ruled out for environmental reasons. As a developing country, it feels the need to emphasise the importance of common but differentiated responsibilities for climate change. But, as a large and influential economy, it recognises that its own unilateral action on de-carbonisation will have a tangible impact beyond its borders. In other words, India might be the greatest victim of climate change, as well

as the greatest victim of de-carbonisation; it is a developing country that is seeking to behave like a developed one.

What, therefore, has tipped the Indian establishment under Modi into making climate change one of the pillars of its foreign policy outreach? This is where the "leading power" aspiration comes in. Essentially, the lure of leadership in this domain was powerful enough for the ponderous battleship of Indian diplomacy to turn 180 degrees, an event which is both awe-inspiring and rare. This is one of the few domains where the Indian political establishment's need to play a commanding role on the world stage can be satisfied. Previous Indian governments and political leaders had a substantially different political calculus: they considered that their domestic and electoral rewards would come from demonstrating steely resolve through blocking or vetoing global agreements, on climate change or trade, that only imperfectly served India's national interest. For the current leadership, however, the payoffs are different: there are political returns to India being seen as providing strong and determined global leadership. Through this leadership, the desired political image of the prime minister himself is reflected.

It follows that for this new orientation towards climate action in foreign policy to be sustained over time it is essential that India's action be acknowledged – indeed, be recognised as leadership. What would be disastrous, for example, is what former U.S. President Donald Trump did: single out India and China as not taking sufficient action on emissions control, as reason for America's own back-sliding on the subject.[3]

Such messaging about India and China would be problematic not just because it would be untrue, or because it would reduce the political "leadership dividend" for the Indian political class. It would also be extremely poorly received in New Delhi because both policy makers and electorate would resent bracketing India with China. This is the context in which to judge how self-defeating it is, for example, to push India to better China's "net zero" target. From the Indian point of view, India and China are not comparable in terms of climate ambition, achievements, or even programmes.

***India might be the greatest victim of climate change, as well as the greatest victim of de-carbonisation; it is a developing country that is seeking to behave like a developed one.***

New Delhi's policy makers are aware that de-carbonisation would mean denying to India the extractive and resource-intensive route to prosperity taken by China, which is as much richer than India than the U.S, is richer than China in turn. Attempts to claim that India should match or exceed China's ambitions on climate change would be viewed as insulting. The Indian establishment considers that the world's manufacturing superpower must act to make deep cuts the way any developed economy would – even if it cannot be trusted on its carbon accounting any more than it can be on its economic statistics.

A related question for New Delhi is whether the current U.S. administration and Beijing could come to a rapprochement over climate change – and the degree to which that would involve compromises made by Washington to Beijing on other issues. While India signed up to the Paris Agreement, policy makers are still angry that they were pressured into concord with a bargain drawn up by the American and Chinese presidents as an unofficial global duumvirate. Any sign that this is recurring on climate change under President Biden would be disastrous. If the notion takes hold that the West is arguing in New Delhi for an agenda that it has quietly decided on with China, and which India must sign up to,

***Policy makers are still angry that they were pressured into concord with a bargain drawn up by the American and Chinese presidents as an unofficial global duumvirate. Any sign that this is recurring on climate change under President Biden would be disastrous.***

then India could well be pushed not just off its climate path but back towards a long-term distrust of Western intentions. The dangers of allowing climate to be turned consciously or unconsciously into a geopolitical wedge between India and the West should be obvious.

In other words, if you need India's cooperation on climate – and you do – you will need India's requirements to be central to working out the next compromise. That is realistic, given that perhaps one-third of new emissions in the coming decades will be from India under a business-as-usual scenario. That is moral, given the energy-poverty of India's vast population. And it is pragmatic, given that the costs of creating a consensus on climate change without India would be felt in other domains, from maritime security to geo-economics.

What, therefore, would India expect out of a new climate change consensus, and would it have broader implications for global geopolitics?

New Delhi would certainly demand that any new geopolitical compromise on climate change take into account the question of financing de-carbonisation for the emerging world – and this has a geopolitical dimension which Indians are very happy to spell out. This view argues that Beijing's investments abroad through the Belt and Road Initiative are a major source of future financed emissions. The lack of Western finance for green infrastructure through the emerging world is forcing developing countries to use Chinese finance to build new capacity – to pump out the very carbon that Beijing claims to be cutting down domestically.

In other words, New Delhi believes that its own development partnerships and diplomatic outreach to the rest of the emerging world centres climate change as an issue the way that China's do not. Beijing's financing of foreign emissions through the BRI, therefore, should be set against New Delhi's focus on the International Solar Alliance and on electricity grid interconnection across the developing world through the Modi proposal of 'One Sun, One World, One Grid'.

Private finance for adaptation, mitigation, and broader infrastructure development will thus be at the centre of geopolitics for India, the Indo-Pacific, and the broader emerging world.

The general inability of Western strategists to understand the consequences of developments in the global macro-economy is a bit of problem here. Countries like India were buffeted beyond belief last decade by the round of Western crisis stimulus and withdrawal, which has contributed to their unwillingness to enhance economic relationships with the West in this decade.

Yet, in the West, a fresh round of stimulus packages and "new green deals" are being devised with zero attention paid to the implications for developing countries' fiscal positions, infrastructure investment and low-carbon growth. Domestic "green new deal" transitions are insular programmes, designed to soak up private capital through incentives and taxation. What will suffer as a consequence is the natural flow of return-seeking private finance to India and the rest of the emerging world.

Strategists understand that a reduction in, say, global military commitments are a sign of a dangerous inward turn, and might be willing to argue against it. They must similarly realise that the forceful redeployment of the West's entire reserve of private capital on the West's own internal projects is no different. It is also a sign of an inward turn, and even more dangerous in its implications. The West's sole remaining geopolitical instrument is private capital. It must not fail to use it. On other issues – security, trade, digital regulations – India may eventually evolve towards Western views and groupings. On climate change, without finance, it will not.

Without flows of private finance to the emerging world, incentivised through the correct institutional changes in the centres of global capital, not only will the Paris goals not be met, but there will be no chance to redevelop a broader geopolitical coalition that maintains the liberal international order against the imperial threat of Beijing-centric state capitalism. This is the Indian consensus position on the geopolitics of climate change. It has the not inconsiderable merit of being, for once, absolutely correct.

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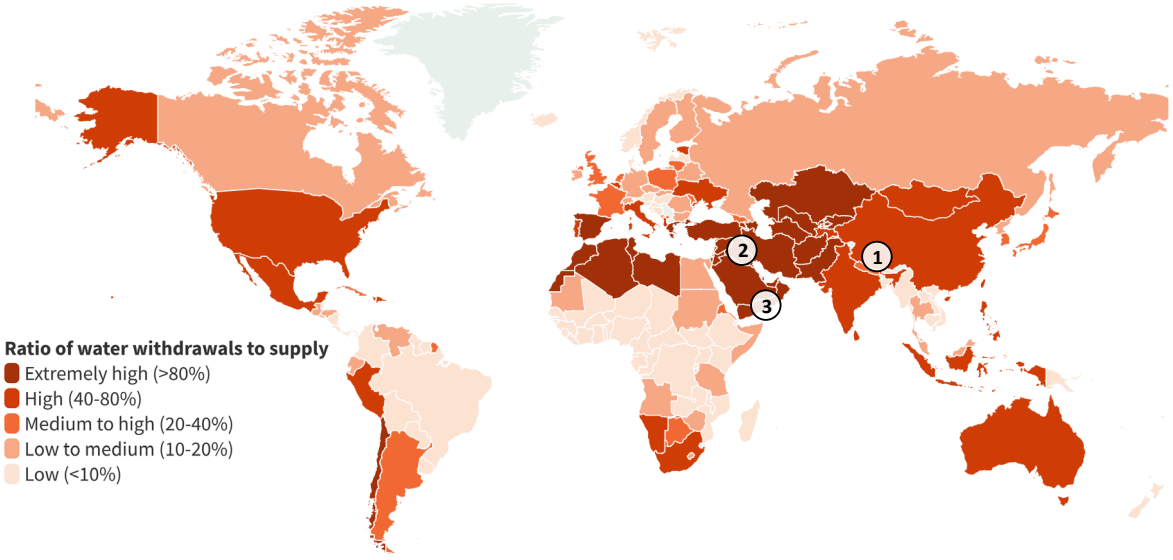
# Climate Change, Water Stress, and Security




Climate change will alter precipitation patterns, potentially reducing the supply of water for some countries.[1] The UN estimates that nearly six billion people will lack access to clean water by 2050.[2] The twin trends of rising demand and falling supply will increase water stress around the world, which is defined as the ratio of water withdrawals to supply.

By 2040, worsening water stress will create winners and losers, in turn influencing the trajectory of geopolitics by intensifying existing conflicts, stoking domestic unrest, and creating new security risks.

As water stress worsens, the underlying motive for conflict – access to a scarce resource – becomes stronger. For instance, China is planning to construct dams throughout the Tibetan plateau **(Number 1)**. The CCP's justification is to increase the supply of hydroelectric power, contributing to the country's Net Zero by 2060 target.[3] India and other countries downstream are concerned China is gaining too much control over the Brahmaputra river. Tensions between the two are likely to deteriorate further in the future, as neither party is a signatory to the UN's international framework for resolving trans-boundary river disputes, and both are projected to experience rising levels of water stress.[4]

Increasing water stress also shapes domestic geopolitics. For instance, in Iraq **(Number 2)**, against the backdrop of widespread inequalities and domestic unrest, mass protests over unequal access to water and electricity led the Prime Minister to resign in 2019.[5] Water stress can therefore stoke existing domestic tensions, which can lead to domestic conflicts and unrest.

*Worsening water stress will influence the trajectory of geopolitics by intensifying existing conflicts, stoking domestic unrest, and creating new security risks.*

Areas of the world like the Middle East are relatively well adapted to water stress (**Number 3).** They are some of the most arid areas on earth, coupled with the highest per capita water consumption. In Qatar, 98% of consumed freshwater comes from desalination. It is tempting to think that growing water stress is not a large security threat for these countries, because they are used to dealing with arid conditions, but an over-reliance on desalination creates security of supply risks. For instance, an intentional or accidental oil spill in the Gulf area could contaminate sea water, preventing desalination. In 1997, a diesel oil spill contaminated the supply of sea water to a desalination plant, leaving the city of Sharjah without water for a day.[6] In addition, underground aquifers that have supplied some regions for thousands of years have shown worrying signs of depletion.

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