

Road from Paris

Ensuring Effective and Equitable Climate Action

Edited by Vikrom Mathur & Aniruddh Mohan

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Foreword

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In February 2016, the Observer Research Foundation (ORF), in conjunction with the University of Oxford, organised a round table discussion on the ‘Road from Paris’ in New Delhi. The aim of the roundtable was to discuss the implementation of the historic Paris Agreement agreed upon at COP 21 in December 2015, as the next step for enhancing the UN Framework Convention on Climate Change (UNFCCC). This book features contributions from many of the international panelists present at the roundtable discussion as well as other scholars from the field of climate policy.

Implementation of the Paris Agreement has raised new issues and concerns regarding climate equity, technology, finance and mitigation. From an Indian perspective, the question on our mind is if this Agreement can meet the needs of India’s development paradigm. India’s policy realities reflect four documents – our Cancun pledge to reduce the carbon intensity of our economy, the National Action Plan on Climate Change, the Sustainable Development Goals (SDGs) agenda and last but not least, India’s Nationally Determined Contribution (NDC) for implementing the Paris Agreement. Balancing an equitable socio-economic development agenda focused on poverty eradication with various climate and sustainability goals will indeed be tricky, since India will be the first economy aiming to industrialize without using its due share of the carbon budget.

Besides its domestic imperatives, India’s actions and policies will also be influenced by the multilateral frameworks within which it seeks to operate. Although the UNFCCC and the related Paris Agreement were negotiated and signed by countries, a whole range of actors within various tiers of government, the States and the federal government, the private sector, think tanks and the non-government community will need to put their heads together, to tackle climate challenges and attain the SDGs.

During the years spent in the UNFCCC deliberations, I have learnt

the value of listening to others, especially those one may not agree with! This volume is an excellent collection of the thoughts, opinions and perspectives from academics and practitioners from across the globe on key themes concerning the way forward from Paris and how countries can work towards ensuring effective and equitable climate action. The challenges in mobilizing resources significant enough to tackle climate change and sustainable development; balancing adaptation needs with mitigation action; stimulating technological innovation that will deliver clean energy breakthroughs; and enhancing trust and legitimacy in the Paris Agreement, are the major themes that have been debated and discussed in the pages that follow.

It is my hope that this collection serves to inspire many more debates and conversations around the intricacies and problems that will be encountered in the implementation of the UNFCCC and the related Paris Agreement. The global community needs to strengthen its response to climate change and produce outcomes that protect the most vulnerable in our societies. Doing so will require us to think innovatively and collectively – that is the aim of this publication and I congratulate the authors and the editors, Vikrom Mathur and Aniruddh Mohan, for bringing this to print.

We'll Always Have Paris

Vikrom Mathur, Aniruddh Mohan

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On 12 December in Paris, 196 Parties to the United Nations Framework Convention on Climate Change (UNFCCC) reached a landmark agreement: the UN Secretary General, Ban Ki-Moon, described the Paris Agreement as a ‘monumental triumph for people and our planet’.

The new agreement is ‘built-up’ from self-defined national contributions of all parties. The evolving climate regime – one that combines bottom-up national pledges for climate action with top-down rules for review, transparency and collective consideration of overall adequacy – is a paradigm shift from the architecture of the Kyoto Protocol. In Paris, countries found ‘middle ground’, charting a new course in a two-decade old effort to respond to global climate change.

Will the new agreement precipitate effective and equitable action? The Paris Agreement in itself will not save the planet – a multilateral agreement could however facilitate action at multiple levels by sub-national and non-state actors. Climate resilient development, energy transitions and processes of technology innovation will all have to be re-examined in light of the newly evolving climate regime.

Climate change is a ‘wicked’ problem. Horst Rittel and Melvin Webber introduced the notion of ‘wicked’ problems in 1973.¹ They argued that wicked problems are complex societal challenges that lack simple and straightforward resolutions. Climate change is deeply connected with many aspects of social and economic systems – poverty, marginalization, inequality, and energy access. Solutions to climate change can be transformative and/or disruptive, precipitating significant redistributive impacts and hard choices about jobs, growth and development as well as the use of fossil fuels and the lifestyles that are supported as a result. The historical responsibility of developed countries in contributing to global warming contrasts starkly with the distribution of climate impacts,

which are overwhelmingly concentrated in the global south. Poorer countries and their populations are more vulnerable to climate change even though they have done little to create the problem in the first place.

The Paris Agreement is not likely to ‘solve’ climate change but could prove to be a step in the right direction. Global climate policy has been anchored in the UNFCCC. The UNFCCC brought all countries on board a single agreement to tackle the global, collective action problem of climate change, delivering global consensus on the need to take action under a system of rules and overarching structure. It provided the normative umbrella. The Convention also enshrined principles that would guide global efforts going forward – Common But Differentiated Responsibilities (CBDR) and Respective Capabilities (RC) which acknowledge the differences in responsibility for global warming and capability to tackle climate change.

The Kyoto Protocol in 1997 under the UNFCCC was the first framework conceptualized for actual reduction of global carbon emissions. It mandated developed countries to undertake emission reductions while developing countries were spared legally binding commitments. Kyoto faced several problems in its implementation – the US which was the world’s biggest emitter at the time failed to ratify it; other countries backed out at a later date. Developed countries wanted emerging economies to come under the mitigation regime and accused certain developing nations of free-riding on their actions. The second commitment period of the Kyoto Protocol is set to end in 2020.

The search for a successor to the Kyoto Protocol must acknowledge its failures. Steve Rayner has called the Kyoto Protocol an ‘elegant solution’ to a wicked problem – too simple a solution when more clumsy and flexible approaches were required.² The Kyoto Protocol was also mitigation focused; adaptation was not part of the regime. However, with increasing severity of climate impacts and the recognition that adaptation would be required in the interim while countries scale up their mitigation commitments, adaptation started to gain prominence in the climate discourse. It became evident that a top-down model of differentiation and enforced commitments was unworkable – countries would act in their self-interest.

New institutionalizing arrangements became the focus of the COP process after COP 19 at Warsaw in 2013. The concept of Nationally Determined Contributions (NDCs) was formalized at Lima, COP 20 and ahead of the Paris conference, countries submitted their voluntary pledges and targets for climate action. As a result, in Paris; rather than top-down mitigation targets, the parties opted for a hybrid approach – bottom-up pledges and top-down monitoring and review and collective assessment of progress – towards a global goal of keeping average temperature rise to below 2°C.

The new approach has its own set of challenges. In the case of mitigation, compilation of NDCs by parties revealed that they add up to global warming of 2.70C, far higher than the 1.5 degrees goal called for in the text or even the two degrees goal required to avoid dangerous levels of climate change. Countries also do not face any penalties for meeting their targets, raising the prospect that actual results will be far less ambitious. An absence of legally binding commitments on reducing emissions by developed countries in particular has led to some calling the Paris Agreement toothless. Whether a loose, facilitative and non-punitive agreement can enable ambitious action is not clear but criticism of the agreement needs to simultaneously factor in the failures of Kyoto which attempted to enforce negotiated targets. The agreement calls for a five yearly stock-take where countries have to report on their progress as well as present more ambitious plans each time. Ratcheting up level of ambition over time will be critical to ensure that climate action corresponds to scientific pressures of limiting temperature rise to a pre-determined amount.

This collection brings together a range of policy perspectives on the post Paris agenda for climate action. How will the themes of adaptation and resilience; energy transitions and technology innovation and; the role of non-state actors in the evolving climate regime develop under the new regime? What should be the post-Paris policy research agenda to drive the implementation of the Paris Agreement?

In his essay in this collection, Steve Rayner argues that there is both good and bad news from the Paris outcomes. The good news is that it draws a line under the Kyoto Protocol which he contends was a doomed exercise in climate reductionism. The bad news is to do with the target of limiting temperature rise to 2 degrees. The only

Representative Concentration Pathway (RCP) scenarios from the Intergovernmental Panel on Climate Change (IPCC) that gets us to 2°C is RPC 2.6, which assumes significant installations of negative emissions technologies that would have staggering effects on food security, water resources and biodiversity. More pragmatic policy responses will be needed – those that support adaptation to current climate variability and invest in energy R&D to provide electricity access to millions more disconnected from the grid in developing nations.

Adaptation has received more attention in Paris. In his article, Ian Fry argues that Paris represents a “significant but not overwhelming step forward” with respect to adaptation in climate policy. It has created a legally binding obligation on adaptation and reinforced a sense of collective responsibility. However, issues around financing remain unresolved as does the question of a global goal on adaptation. Although loss and damage is included as a major feature of a climate agreement for the first time, it nevertheless fails to resolve many outstanding issues. There is also some contradiction between the spirit of what is conveyed in the agreement and the text of the COP Decisions, which for instance preclude any option for liability or compensation through the loss and damage clause. Resolving those dichotomies will be key to perceptions of equitable outcomes in the eyes of Least Developed Countries and Low Lying Island States.

Technology transfer faces many of the same challenges. The Technology Mechanism under the UNFCCC is central to the agreement which also establishes a Technology Framework that will provide guidance for the work of the Technology Mechanism. An attempt to link financial support with technology transfer is also made in the text although it is unclear how that may deliver more support to developing nations. In his commentary on the Technology Challenge, Anand Patwardhan calls the technology outcomes from Paris “modest” and “unambitious”, reliant on existing mechanisms under the Convention. One of the positives from the Paris Agreement is the focus on innovation for an effective global response to climate change. John Alic’s piece on innovation emphasises the role of the private sector and actors at the grassroots level in driving change.

On the question of finance, while the Paris Agreement has made it legally binding for developed countries to report on their financial

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There is both bad news and good news from the Paris talks. The bad news relates to the much talked about target for limiting temperature rise to 2°C, with an aspiration to 1.5°C. The problem is not with the target itself, but the assumptions about how we might meet it. Of the Representative Concentration Pathway (RCP) scenarios from the Intergovernmental Panel on Climate Change, only one gets us to 2°C, i.e. RPC 2.6, which assumes that we have installed a vast amount of biomass energy with carbon capture and storage (BECCS) on a global scale. BECCS is a negative emissions technology (NET) whereby biomass feedstock is grown and burned to generate electricity, but the carbon is captured from the waste stream and stored. Experience with the impacts of liquid biofuels production on biodiversity and land use, particularly in the tropics, suggests that large-scale deployment of BECCS would have significant affects on food security, water resources and biodiversity that would be truly staggering.

There are other NET options. These include enhanced weathering, in which a mineral is spread on land to enhance the ability of soils to draw carbon out of the atmosphere; adding calcium or iron to the ocean to take carbon out of the air; and large-scale afforestation, among others. Some scientists are currently developing mechanical devices that would extract carbon from the ambient air, either to sequester it underground in a compressed form or convert it into carbonate rock. But we really don't have any firm knowledge about whether these technologies will actually work, how reliable they will be in practice, or how secure carbon sequestration would be.

We also know little about the resource implications of deploying them at scale. Could we build this technological system in the timeframe that is actually going to have any substantial impact on climate by the middle of the century? In the absence of a stable carbon price, who is going to pay for all this? How would it be financed? What would be the opportunity costs in terms of diverting resources away from other climate and development imperatives? Will such technologies pose a

assistance to developing nations, actual targets are not legally binding. The USD 100 billion per annum promised by developed countries at Copenhagen in 2009 is only mentioned in the preamble of the agreement and thus enjoys no legal force. It is instead hoped that transparency mechanisms to monitor flow of finance and contributions of individual countries will pressure developed nations to step up commitments and, therefore, enhance their ambition of supporting climate action in developing countries. Aled Jones' analysis on climate finance points to emission trading schemes and green bonds as two potential sources of significant finance in the years to come.

Paris was the first climate agreement to give a significant role to non-state and civil society actors. Both the Agreement text and conference itself embraced actions by cities, cross national alliances, investors, companies and civil society. Amy Weinfurter's article however cautions that "while sub-national and non-state activities can help spurs and complement climate action, national leadership will still be essential to meeting global goals."

The polycentric outcome at Paris throws up old questions as much as it raises new ones. Addressing challenges over equity, financial flows, technology transfer and adequacy of mitigation action will be key to the effectiveness, legitimacy and durability of the new regime. Our concluding piece argues that a loosely structured agreement will need to be held together by building trust amongst actors and creating perceptions of legitimacy. Understanding the steps to achieve that should be the focus of scholars, practitioners and civil society in the years to come. The opportunities and challenges presented by the Paris Agreement make it certain that there will be no end to debates over governance of our climate just yet.

1: Rittel, H. W., and Melvin M. Webber. "2.3 planning problems are wicked." Polity 4 (1973): 155-169.

2: S. Rayner, 'Wicked Problems: Clumsy Solution - Diagnoses and Pre-descriptions for Environmental Ills', Jack Beale Memorial Lecture on Global Environment, Sydney, Australia, July 2006.

moral hazard that would lead people to be complacent about efforts to pursue conventional mitigation? Do we have an adequate regulatory framework?

Consequently, there are lots of reasons to suppose this is going to be problematic. Yet, at the present moment, no government, no major research council or funding body is supporting a proper assessment of these technologies. They are just assumed in RPC 2.6. So, the bad news is that adopting a goal of 2°C, let alone 1.5°C without some kind of negative emissions technology, is to engage in magical thinking. Someone should either be funding serious research into these technologies or modellers should take these imaginary technologies out of the emissions scenarios and recognize that the 1.5°C target is much, much harder than has been recognized at Paris. That is the bad news.

There is also good news which, to put it bluntly, is that Paris finally drove a stake through the heart of the Kyoto Protocol. The world wasted 20 years because the Kyoto architecture was based on three misleading analogies. The first was the analogy with ozone depletion, which appeared to be a model of how to deal with anthropogenic releases of gases into the atmosphere. The ozone regime, with its framework convention and implementation protocols, was a distinctly top-down approach to dealing with CFCs. It worked for ozone, but the analogy with climate change was deeply flawed. CFCs were industrially produced artificial gases for which there were a small number of producers and a readily available technological substitute. These conditions do not apply to greenhouse gases.

The second analogy was the USEPA Sulphur Trading Programme. This was very successful at reducing sulphur dioxide (SO₂) pollution by allowing polluting electric utilities to burn dirty coal by buying spare emission permits from utilities that were generating electricity more cleanly. But again, the analogy was flawed. SO₂ was a single gas, regulating a single legal regime in a small market involving a handful of traders. Again this is not a good analogy for global trading in multiple greenhouse gases.

The third analogy was the Strategic Arms Reduction Treaty (START), from which the Kyoto architecture borrowed the idea of mutually verifiable staged reductions. But START was a treaty between just two

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governments to control nuclear weapons directly under their control. Again this was not a good analogy for dealing with climate change.

Subsequently, climate negotiations were an exercise in reductionism, whereby the complex issue of climate change was treated as an old-fashioned 1960s end-of-the-pipe pollution problem, but with national pipes. The challenge was simply to cap the amount of stuff coming out of these imaginary pipes. This is much too simplistic, particularly when we recognize that the world needs much more energy than it has at present. There are 1.6 billion people on the planet lacking basic energy access. Little wonder that the Kyoto approach was doomed from the start and finally abandoned in Paris.

The replacement framework that emerged from Paris is, however, uncannily familiar to those who were working on climate policy in the 1980s. At the time that the UNFCCC was negotiated in 1992, the implementation mechanisms under discussion were ‘policies and measures’ and ‘pledge and review’. The idea then was to allow countries to develop their own policies based on their specific capabilities, resource endowments and developmental stages. They would then come together periodically to look collectively at what each country had achieved and how. The idea was that countries would learn from each other – things that work, things that did not work – by allowing for a wide range of experimentation by a variety of actors and policy mechanisms. This approach was displaced in Kyoto by the neoclassical-economic fantasy of global carbon pricing rectifying all of the problems associated with climate change.

Paris has returned climate policy to the pre-Kyoto track. The original idea of ‘policies and measures’ is now embodied in the ‘nationally determined contributions’; ‘pledge and review’ has been reintroduced as the proposed five-year review cycle

Paris has returned climate policy to the pre-Kyoto track. The original idea of ‘policies and measures’ is now embodied in the ‘nationally determined contributions’; ‘pledge and review’ has been reintroduced as the proposed five-year review cycle. This has opened the door to a ‘polycentric’ approach to climate action, which recognizes the diversity of the endowments, capacities and development priorities of different countries. It substitutes positive local and near-term aspirations for the big carbon stick. There is an opportunity to reverse the standard logic that climate action will bring ancillary benefits and to argue that the best way to control greenhouse gas emissions is to pursue sustainable local development, improved air quality and energy modernization. These are goals which are good in their own right and which bring benefits to people where they are today, not benefits that are going

to accrue to people far away in a far distant future. If they are done right, they also reduce greenhouse gas emissions. This approach can create a discourse of opportunity rather than discourse of constraint. The polycentric approach also creates opportunities to address equity issues much more effectively than was possible under the previous architecture.

Another intriguing possible benefit recently suggested by the head of the UK Supreme Court, is that although emissions reductions in the Paris arrangements are not legally binding under international law, they can be made legally binding at national and local levels through state legislation, provincial laws and city bylaws. The pursuit of a legally binding agreement along Kyoto lines was always really meaningless because there was never going to be a proper and effective enforcement mechanism.

The polycentric approach also facilitates restructuring of mitigation as a technology challenge rather than end-of-the-pipe environmental problem. While the past decade has seen massive improvements in the costs of renewables, wind and solar energy remain intermittent sources and we don't have very satisfactory ways of storing large amounts of energy in power grids, which is required to overcome this limitation. Distributed generation with household battery storage might work very nicely in suburban southern California but it is not going to be a solution for major urban conurbations like Delhi.

To deal with technology challenges like energy storage requires publicly funded research development, demonstration and deployment (RDD&D) to reduce risk to innovators. The success of unconventional gas-extraction technology demonstrates the importance of this as it was developed largely with US Department of Energy funding. But public funding on sustainable energy RDD&D is not nearly enough. Countries spend significant amounts on research where they see a strategic benefit or imperative for them to do so. For example, it has been estimated that the US and China spend approximately US\$ 80 billion a year on military R&D. A small carbon tax of US\$ 5/ton could raise about \$ 30 billion/year in the US and China and \$ 80-150 billion a year globally, which is consistent with the kinds of sums that the International Energy Agency has argued should be spent on energy research. India already has a coal tax that is set around this level. These kinds of low level taxation specifically aimed

at investment in technological innovation could be designed into the climate agreement internationally or implemented nationally, or by multilateral clubs that would not require waiting for a global consensus.

The energy modernization approach presents real opportunities for India and China that were completely absent from the Kyoto architecture. China, as we are already seeing, is leading the world in cutting the costs of wind and solar generation technologies. India has the opportunity to really take the global lead in the smart technologies, required for smart grids and smart cities and smart homes.

Just as we should reformulate the energy technology challenge from being one of limiting emissions to being an energy modernization programme, we should reformulate adaptation to climate change as adaptation to climate variability

The polycentric approach adopted at Paris also opens the door for a stronger emphasis on adaptation. Adaptation has always been the poor cousin of mitigation. Because it has been framed as a cost of failed mitigation, adaptation has consistently received a small fraction of international funding. We should think about adaptation differently. Just as we should reformulate the energy technology challenge from being one of limiting emissions to being an energy modernization programme, we should reformulate adaptation to climate change as adaptation to climate variability.

Climate is already dangerous. It kills people all the time through extreme weather events. We can save lives and property and enhance human dignity today by making significant investments to protect people better from climate. Adaptation to climate variability, if done right, will also lay the foundations for adaptation to the climate change that we are unable to avoid through mitigation. Once again, the polycentric framework emerging from Paris provides a more promising basis for effective adaptation policies that are relevant to local and near-term needs at the same time as tackling climate change.

Implications for Adaptation, Loss and Damage

Ian Fry

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The Paris Agreement to the United Nations Framework Convention on Climate Change¹ represents a significant, but not overwhelming step forward, in the context of adaptation to the impacts of climate change and actions to respond to these impacts. This policy paper tentatively explores how the international community has advanced its policy response to adaptation and loss and damage as a result of the agreement.

The outcomes from Paris on adaptation and loss and damage can be grouped into nine key themes. These include legally binding obligations on adaptation; responsibility for action; the politics of vulnerability; review mechanisms; funding arrangements; accountability; collaboration; the burden of reporting for developing countries; and new approaches to addressing climate change impacts: loss and damage. This paper will discuss each of these and explore how work under these themes will evolve as the Paris Agreement enters into force.

LEGALLY BINDING OBLIGATIONS ON ADAPTATION

Finding the right wording to incorporate adaptation in the Paris Agreement was not easy. Adaptation is generally considered a country driven activity and it proved difficult to find obligations to fit within a legally binding agreement, other than ensuring that adaptation activities for the most vulnerable countries was properly funded. The Paris Agreement, through Article 7 creates a legal requirement for all parties to strengthen cooperation on adaptation (Article 7.7) and to engage in adaptation planning processes (Article 7.9). This is a significant step forward as it creates an obligation on all countries to take adaptation seriously.

During the negotiations there was considerable debate whether or not the agreement should include a goal for adaptation. African

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countries were keen to establish a quantitative goal as a means of ensuring that adaptation efforts were tested against a goal. This keen interest by African countries for an adaptation goal appeared to be driven by the 2014 UNEP Adaptation Gap Report which suggested that there were financial, technical and knowledge gaps that hindered the diffusion of appropriate adaptation technologies and know-how.² Developed countries seem more reluctant to include a quantitative goal as it may give rise to expectations of greater financial support for adaptation. In the end, the agreement makes a qualitative goal of enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change (Article 7.1).

RESPONSIBILITY FOR ACTION

The Paris Agreement steered a new path in defining who was responsible for taking adaptation action and who was responsible for supporting this action. Previously the UN Framework Convention on Climate Change specified that it was the responsibility of the developed world to support developing countries that were particularly vulnerable in meeting the costs of adaptation (UNFCCC, Article 4.4). The Paris Agreement recognizes that adaptation is a global challenge and that all parties should strengthen their cooperation on enhancing action on adaptation (Article 7.7). This has shifted the traditional North-South divide towards a more collaborative approach to adaptation and has the potential to drive greater efforts in the context of South-South cooperation.

The agreement also encourages the United Nations specialized organizations and agencies to support the efforts of parties. While many UN agencies are already engaged in providing support for adaptation, eliciting their support through a legally binding instrument gives greater impetus and direction to their actions.

THE POLITICS OF VULNERABILITY

Perhaps one of the most divisive aspects of the adaptation negotiations (certainly at least within the G-77 and China) was the reference to who was the most vulnerable. As previously noted, Article 4.4 of the UN Framework Convention on Climate Change makes a generic reference to assisting the developing country parties that are particularly vulnerable, although the preamble to the convention identifies ‘low-lying and other small island countries, countries with low-lying coastal, arid and semi-arid areas or areas liable to floods,

drought and desertification, and developing countries with fragile mountainous ecosystems’ as being particularly vulnerable to the adverse effects of climate change.

The Bali Action Plan that was agreed in 2007, further narrowed the definition of vulnerable countries. It identified that least developed countries and small island developing states were especially vulnerable to the impacts of climate change and took into account the needs of countries in Africa affected by drought, desertification and floods.³ It became apparent that certain countries felt they had been missed out in the definition of ‘especially vulnerable’ in the Bali Action Plan and did not want this repeated in the Paris Agreement. Various formulations were tried. As soon as one group was identified, another would make claim. At one stage the G-77 and China included in their list of vulnerable countries, ‘territories under occupation.’ In the end, the Paris Agreement returns to a generic reference to ‘particularly vulnerable to the adverse effects of climate change’ (Article 7.6). For small island developing states and least developed countries, this represented a significant step backwards in recognizing their particular vulnerabilities. For others, it created a level playing field for everyone to be considered particularly vulnerable (if such a thing exists in the context of climate change vulnerability).

REVIEW MECHANISMS

Perhaps one of the key set of elements for adaptation in the Paris Agreement are the review mechanisms. These mechanisms have two components. The first component is the transparency framework for action and support, established in Article 13. The purpose of the transparency framework is to provide a clear understanding of climate change action, including clarity and tracking of progress towards achieve each party’s adaptation actions (Article 13.5).

Critically the transparency framework can identify good practices, priorities, needs and gaps and will link to the global stocktake (Article 14). The transparency framework under Article 13 requires each party to provide information on adaptation. Furthermore, developing country parties are required to provide information on financial, technology transfer and capacity building support needed and received (Article 13.10). These actions have the potential to allow a global review of adaptation effort and if organized properly, could

identify deficiencies in the system. The process for the reporting mechanism has yet to be determined and will be taken up as part of the work plan of the Ad Hoc Working Group on the Paris Agreement (paragraph 95(c), Decision 1/CP.21).

The second element of the review mechanism is the global stocktake. This is to be held every five years and includes adaptation and means of implementation (Articles 14.1 and 14.2). The purpose of the global stocktake is to enhance international cooperation for climate action. The first stocktake is to take place in 2023, although further work will be required to define its modalities of operation. The Ad Hoc Working Group on the Paris Agreement has been requested to identify the sources of inputs for the global stocktake (paragraph 100, Decision 1/CP.21).

The Working Group has been given some guidance with respect to reporting on adaptation through the accompanying decision in that it should consider the ‘state of adaptation efforts, support, experiences and priorities....’ (paragraph 100 (ii), Decision 1/CP.21). Compiling a global assessment of these parameters on adaptation could be a significant effort. Whoever undertakes this synthesis will have a considerable amount of work ahead of them.

Some would contend that the Paris Agreement undermines the principle of common but differentiated responsibility and respective capability. How this will play out in the funding processes remains to be seen

FUNDING ARRANGEMENTS

The funding arrangements for adaptation in the Paris Agreement initially follow the traditional North to South obligations (Article 9.1). Nevertheless, there is a shift towards a broadening of support to incorporate all parties (Article 9.2). This is quite a dramatic step in the globalization of climate change cooperation. Nevertheless, it has implications for considerations of the historical responsibility for climate change. Undoubtedly some would contend that the Paris Agreement undermines the principle of common but differentiated responsibility and respective capability. How this will play out in the funding processes remains to be seen.

The particular sources of funding for adaptation are not clearly enunciated in the Paris Agreement. Decision 1/CP.21 reiterates the pledge of USD 100 billion per year by 2020 made originally in the ill-fated Copenhagen Accord, but this pledge is not focused on adaptation funding. It is placed in ‘the context

of meaningful mitigation actions’ (paragraph 54 of Decision 1/CP.21). There are no similar pledges with respect to adaptation although the Paris Agreement states that scaled up financial resources should aim to achieve a balance between adaptation and mitigation (Article 9.4). The uncertainty over the sources of adaptation funding makes adaptation the ‘poor cousin’ in the Paris Agreement.

One concession that the agreement makes is that the Adaptation Fund ‘may’ serve the agreement subject to the relevant decisions of the Conference of Parties serving as the meeting of the Parties to the Kyoto Protocol and the Conference of Parties serving as the meeting of the Parties to the Paris Agreement (paragraph 60 of Decision 1/CP.21). This means that two approvals have to be reached before the Adaptation Fund can continue. Both institutions would need to decide the source of funding for the Adaptation Fund. Its primary source currently is the share of proceeds from the sale of certified emission reductions from the Clean Development Mechanism. It is unclear whether such an arrangement will be duplicated in the Paris Agreement. While a carbon trading mechanism or mechanisms are likely to be developed (as provided for in Article 6), it is unclear whether the carbon market will be a significant generator of enterprise within the Paris Agreement and whether a ‘share of proceeds’ concept will apply. Much work now rests with the Standing Committee on Finance and the Executive Board of the Green Climate Fund to determine how funding for adaptation will be apportioned and where this funding will come from.

In an interesting twist to the ‘vulnerability’ issue, least developed countries and small island developing states are identified in the finance section of the Paris Agreement as being particularly vulnerable to the adverse effects of climate change and having significant capacity constraints (Article 9.4).

ACCOUNTABILITY

The Paris Agreement creates greater accountability requirements for developed countries to provide quantitative and qualitative information on the support they provide for adaptation. This information is required to be provided biennially. It is interesting to note that other parties are also encouraged to provide similar biennial information (Article 9.5). This information should link with the

The uncertainty over the sources of adaptation funding makes adaptation the ‘poor cousin’ in the Paris Agreement

global stocktake (Article 9.6).

All parties are required to submit and update periodically an ‘adaptation communication’ (Article 7.10) and that these submitted communications will be kept in a public registry maintained by the secretariat (Article 7.12). Having a generic term for an adaptation communication is the result of another divisive debate within the G-77 and China. There was contention whether or not parties should prepare intended nationally determined contributions (INDCs) (and hence subsequent nationally determined contributions) on adaptation. It appeared that many Latin American countries were supportive of requiring INDCs for adaptation.

In discussions with this group, it appeared that they supported this concept as a means of giving greater political prominence to adaptation within their national governments. A number of African countries were also keen to support INDCs for adaptation, although the least developed countries did not support this notion. The LDCs were concerned that they already had National Adaptation Programmes of Action and many had commenced writing their National Adaptation Plan. Adding a further reporting requirement would create an undue reporting burden. During the negotiations on adaptation, it appeared that most developed countries were not supportive of INDCs for adaptation as this diverted the political interest away from mitigation INDCs.

The Paris Agreement also requires that each party undertake adaptation planning processes, which may include national adaptation plans (Article 7.9). The inclusion of the word ‘may’ creates considerable flexibility in how adaptation will be carried out and reported. It will be interesting to see how all this information is collated and assessed.

COLLABORATION

The concept of collaboration with other institutions is an important element of the Paris Agreement in the context of adaptation action. While adaptation is generally considered as a country driven activity, it is inevitable that countries will seek external support for their endeavours. Article 7 of the Paris Agreement requires that all parties should strengthen cooperation on enhancing action on adaptation. A list of actions is defined within the agreement. These including sharing information on lessons learned, strengthening institutional

arrangements, and help developing country parties identify effective adaptation practices (Article 7.7 (a-e)).

United Nations specialized organizations and agencies are encouraged to support efforts of parties identified in Article 7 (Article 7.8). While UN agencies already provide considerable adaptation support to countries, establishing an obligation within a legally binding agreement will provide greater impetus and incentive for the UN agencies to enhance their work in this important area. In prescribing this mandate to the UN agencies, they are given a subtle cautionary note to take into account important principles identified in Article 7.5 of the agreement. These principles include: a country driven, gender responsive, participatory and fully transparent approach, taking into consideration vulnerable groups, communities and ecosystems, and should be based on and guided by the best available science and, as appropriate, traditional knowledge, knowledge of indigenous peoples and local knowledge systems. This cautionary note to the UN agencies will hopefully ensure that they do not impose themselves too heavily into the adaptation planning processes of each country.

As an aside, it is important to note that both gender and the knowledge of indigenous peoples are recognized in the section on adaptation. Incorporating their issues and concerns within a legally binding agreement is another important step forward.

THE BURDEN OF REPORTING FOR DEVELOPING COUNTRIES

One of the trade-offs for enhanced support for adaptation is the increased burden of reporting for developing countries. This issue was a point of discussion within the adaptation negotiations. As noted earlier, some countries, particularly the least developed countries, already have considerable adaptation reporting processes. These include National Adaptation Programmes of Action and National Adaptation Plans. Article 9.7 of the agreement spells out various actions that parties should undertake and report on. These may include: national adaptation plans, assessments of climate change impacts and vulnerability, monitoring and evaluating and economic diversification and sustainable management of natural resources. While all of these actions appear to be logical processes within adaptation planning they do place a burden on countries with limited capacity to report on their efforts.

One of the trade-offs for enhanced support for adaptation is the increased burden of reporting for developing countries

For small countries much of their effort on adaptation could be spent on reporting rather than actually undertaking action on the ground. The concern over the reporting burden is acknowledged within the Paris Agreement (Article 7.10). Undoubtedly small countries with limited capacity will not produce elaborate adaptation communications. As a consequence, there is a fear that these countries may miss out on adaptation funding because of the limitations of their reporting capabilities. This fear was evident during the negotiations and manifested itself within the negotiations concerning INDCs for adaptation. It will be interesting to see who receives priority for adaptation funding. Will it be provided to the most vulnerable or to countries that are more capable in writing adaptation communications? One of the most innovative outcomes of the Paris Agreement was the section relating to loss and damage (Article 8). It was certainly one of the most controversial issues within the Paris Agreement. Article 8 of the Paris Agreement only contains five clauses. Nevertheless, it has significant implications for future work on loss and damage. It covers a broad spectrum of issues including early warning systems; emergency preparedness; slow onset events; events that may involve irreversible and permanent loss and damage; comprehensive risk assessment and management; risk insurance facilities, climate risk pooling and other insurance solutions; and non-economic losses (Article 8.4).

There are many examples of risk transfer schemes in Africa and the Caribbean as well as national insurance funds and safety net programmes. Establishing a clearing house of these schemes will help countries and regions identify the best risk transfer opportunities that suit their needs

NEW APPROACHES TO ADDRESSING CLIMATE CHANGE IMPACTS-LOSS AND DAMAGE

While Article 8 establishes loss and damage as a legally binding process as part of treaty law, the accompanying decision on loss and damage is likely to be the key driver for new and innovative work (Decision 1/CP.21, paragraphs 48 to 52). Of particular note are the provisions relating to developing a clearing house on risk transfer, and establishing a task force to address displacement.

The idea for a clearing house emanated from the least developed countries in a submission they made in 2014.⁴ There are many examples of risk transfer schemes in Africa and the Caribbean as well as national insurance funds and safety net programmes. Establishing a clearing house of these schemes will help countries and regions identify the best risk transfer opportunities that suit their needs. If done properly, the clearing house will be a major fillip for countries seeking access to risk transfer measures. Hopefully the insurance and

re-insurance industry will be able to provide considerable support in this endeavour.

Another major outcome in the decision accompanying the Paris Agreement is the request to the Executive Committee of the Warsaw International Mechanism (WIM) to establish a task force for integrated approaches to avert, minimize and address displacement related to the adverse impacts of climate change (paragraph 50, Decision 1/CP.21). Initially the least developed countries sought inclusion of this task force within the Paris Agreement. This was met with significant resistance from the European Union. It appeared to be one of the few issues where the European Union took a substantive position in the debate on loss and damage.

Due to sensitivities associated with refugees fleeing the war in Syria, the European Union appeared to be very reluctant to accept another category of displaced people. This is a highly regrettable position and one that the European Union may rue in the future. It is inevitable that more and more people will become internally and externally displaced by the impacts of climate change and action to deal with these people will need to be taken. This is not a new issue. Migration and human mobility had already been incorporated in the Cancun Adaptation Framework in 2010, although little work has advanced on this issue since the framework was established.⁵

Despite the resistance from the European Union, language on displacement was agreed by the COP. Work on this issue by the Executive Committee of the WIM has already commenced and is likely to fill the void created since Cancun. Establishing legal protection for people displaced by the impacts of climate change will be a substantial opportunity for the Executive Committee of the WIM and other interested groups and parties. While it is a new area of international law, there are opportunities to draw from existing institutions and processes. Some have suggested that Guiding Principles on Internal Displacement, and the various operational guidelines developed as part of the work of the Global Protection Cluster, apply to climate related internal displacement situations, and offer useful advice and guidance.⁶

The UN High Commission for Refugees has noted that the 1951 Convention relating to the Status of Refugees and some regional

refugee instruments provide answers to certain cases of external displacement related to climate change, and these ought to be analyzed further.⁷ They have suggested however, that the term ‘climate refugee’ should be avoided as it is inaccurate and misleading. Work established under the Nansen Initiative could provide a useful basis for further work in providing appropriate protection for people displaced by the impacts of climate change although the Nansen Initiative also deals with so-called natural disasters.⁸

The Executive Committee of the WIM can provide a pivotal role in coalescing existing work in this field. In saying this, the Executive Committee will need to be mindful of work under the Sendai Framework for Disaster Risk Reduction and avoid overlaps.⁹ Collaboration with other institutions will be a critical role for the Executive Committee of the WIM. It will be important to avoid overlapping agendas and potential ‘turf wars’ over mandates and responsibilities. The real victims in such mandate disputes will be those affected by the impacts of climate change.

Overall, the nine key themes for responding to adaptation and loss and damage represent a substantial step forward in international environmental law. It creates significant new opportunities to assist countries build resilience and respond to the adverse affects of climate change. New initiatives such as those relating to a clearing house on risk transfer and a task force on displacement will provide considerable opportunities to afford appropriate protection for the most vulnerable. This work must progress at pace if it is going to meet the demands of a world confronting the ever growing threats of climate change. The challenge will be to find adequate and predictable funding to meet the growing needs of those affected by the impacts of climate change.

1: Paris Agreement as contained as an annex to UNFCCC Decision 1/CP.21, FCCC/CP.2015/L.9/Rev.1.

2: UNEP, The Adaptation Gap Report 2014. United Nations Environment Programme (UNEP), Nairobi, 2014, p. 69, at xiv.

3: Bali Action Plan, Decision 1/CP.13, FCCC/CP/2007/6/Add.1.

4: Submission by Nepal on behalf of the least developed countries group on the ADP Co-Chairs’ Non Paper of 7 July 2014, on Parties Views and Proposal

on the Elements for a Draft Negotiating Text. URL: http://www4.unfccc.int/submissions/Lists/OSP_SubmissionUpload/39_99_130584499817551043-Submission%20by%20Nepal%20ADP_21%20Oct%202014.pdf, p4.

5: The Cancun Agreements: Outcome of the work of the Ad Hoc Working Group on Long-term Cooperative Action under the Convention. Decision 1/CP.16, FCCC/CP/2010/7/Add.1, paragraph 14(f).

6: Volker Türk and Alice Edwards, ‘Introductory Note to the Bellagio Summary of Deliberations on Climate Change and Displacement’, International Journal of Refugee Law 23(3), 2011, pp. 558-560, p 560.

7: UNHCR, ‘Summary of Deliberations on Climate Change and Displacement’, International Journal of Refugee Law 23(3), 2011, pp. 561-574, p. 562.

8: The Nansen Conference, Climate Change and Displacement in the 21st Century, Oslo, Norway, 5-7 June 2011, Norwegian Refugee Council, pp. 22.

9: The Sendai Framework for Disaster Risk Reduction 2015-2030. URL: http://www.preventionweb.net/files/43291_sendaiframeworkfordrren.pdf.

A Matter of Capabilities

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We tend to think about mitigation of climate change merely as a policy challenge to reduce emissions. If we, however, think about what drives policies, we arrive at more fundamental questions related to domestic constellations of the economy, political risk-taking, innovation and capabilities. Though the UNFCCC Technology Mechanism and the Paris Agreement address these questions, both could do more.

Botswana is a middle-income country of about two million people – sparsely populated, with good institutions, great solar energy resources, and lots and lots of coal in the ground. Its relative wealth has largely been generated by well managed diamond exports. Recently, it has had to develop its electricity system in order to meet growing demand, as imports from neighbouring South Africa have declined. The government is well aware of the vulnerability of hot and arid Botswana to climate change, and has progressive views on mitigation. However, it is facing difficult choices in deciding how to diversify its economy away from diamonds and fuel its further development: using easily available coal, or investment-heavy and technically more challenging solar.

The Netherlands is a highly industrialized country of close to 17 million inhabitants. Its economy relies heavily on energy intensive industry, the transportation sector and its sizable gas reservoirs. Within the EU, the Netherlands is among the highest per capita greenhouse gas emitters, despite having shown leadership on climate change as early as the late eighties. A reliance on fossil fuels for many of its economic activities means that the Netherlands is firmly locked into the fossil economy. The government has plans to reduce emissions, but in practice, over the past decades, the social and economic interests of those invested in fossil fuels have prevailed.

Indonesia, Qatar, India, the United States, South Africa, Argentina and every single country, big and small, has its own specific story and mitigation challenges, deeply intertwined with the economy,

energy supply and agricultural system. None of the world's countries are against mitigation. None are opposed to reducing greenhouse gas emissions. What many countries expect (and fear), however, is great economic damage if they reduce emissions and decarbonise. If a country (or, for that matter, a politician) does not stand to gain from the transition, it will be disinclined to implement costly and risky measures towards that transition. The gains do not need to be only financial: they can be jobs, economic development, government income, energy security, political clout, etc.

Countries need to perceive benefits from mitigating climate change. And the politically credible narrative for such benefits will be different for every country. Abandoning production and consumption of fossil fuels needs to be a part of it, but the more interesting question is: what economic activity will replace them? And how can this economic activity be as, and preferably even more, attractive to the country?

This is where innovation comes in. The most common argument why innovation is key is that mitigation technologies need development and cost reductions, and innovation can provide this. However, I would argue that those positives should be seen as side effects of innovation. The central aim of low-carbon innovation should be to serve the economic development of countries while helping them move onto a low-carbon trajectory. Finance for innovation can do this by funding R&D programmes, but mostly by developing the right kind of local capabilities. Only then can Botswana, India or Indonesia develop their own, nationally specific, low-carbon economies.

How do countries know that they are developing the right capabilities for sustainable economic development? If we look at highly developed economies, we see that their workforce features a myriad of skills. Three rough categories of technological capabilities are often distinguished. First, we need people who can operate and maintain equipment, and repair it if needed. These are basic skills that are present in practically all countries, although in many poorer countries they are in short supply for advanced or relatively novel technologies.

Second, the capability to adapt technologies to local circumstances, and to manufacture the core equipment as well as spare parts is needed. Especially if a technology is likely to be used extensively in a

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country, importing it from other countries will be relatively expensive and unlikely to benefit the local economy. Of course, not all countries will be producing all the technologies they use; also now not every country is manufacturing cars, solar panels, gas turbines or airplanes. Among other factors, the technological complexity and local market size of each piece of equipment will determine the intensity of international competition for global market share. However, those countries without any or with insufficient capabilities are certain to lose out and will be destined to import while the profits are made elsewhere.

Third and finally, it is important to possess the ability to innovate on technology, to improve manufacturing processes, to conduct fundamental research and to develop new technology. In practice, these capabilities are most present in industrialized countries, with China becoming an important player, as demonstrated by research into patent databases.

In addition to technological capabilities in companies, among entrepreneurs and within research institutions, capacity in the public sector to regulate new technology and to make effective policies for implementation and innovation is important. Often, the development of more advanced capabilities follows a parallel path to maturing institutions, but not always.

Scholars in innovation and development studies have examined how to evaluate whether the necessary capabilities are present and how they can best be built. They came up with the term 'innovation system', and identified functions that need to be fulfilled in such a system in order for it to realize a certain technology in a national context, or to reach a flourishing, innovative economy. Such functions include knowledge development, entrepreneurial experimentation, and legitimization by the wider public and by law.

It is not easy to build a flourishing innovation system around low-carbon technology, particularly if the 'background' innovation system is poorly developed, like in most developing countries. Also, different functions need to be promoted at the same time as they need to reinforce each other. If knowledge is developed around a certain mitigation technology, but no capital is available for its entry in the market, it will still not be implemented.

If an innovation system around low-carbon technologies remains underdeveloped in a country, that economy will not have a built-in incentive to continue investing in low-carbon transition. It is unlikely that such a country will modify its trajectory. Therefore, it is essential that capabilities are developed, or else pledges in the Paris Agreement will not be met.

This is not new, and the United Nations Framework Convention on Climate Change of 1992 already acknowledged the importance of capabilities, included under both technology transfer and capacity building arrangements. However, Article 4.5 on technology transfer has had limited impact on the ground. As a response, during COP16 in Cancun in 2010, the Technology Mechanism was initiated, consisting of a ‘policy arm’ called the Technology Executive Committee (TEC) and an implementation arm, called the Climate Technology Centre and Network (CTCN). The CTCN is supposed to fulfil some of the functions in an innovation system. Primarily, it responds to requests for support by developing countries around building institutional and innovation capabilities. However, it is limited by small budgets, as it has no structural funding.

Around both the TEC and the CTCN’s activities, it is interesting to observe the political economy in most countries which favour fossil fuels. Industrialized countries, leaders in the global technology market, which the UNFCCC and the Cancun Agreement anticipate to be donors to the Technology Mechanism, are reluctant to invest in capacity development abroad, partly for fear of creating their future challengers in the global technology leadership race. This attitude has inhibited funding for innovation capabilities in developing countries. The result is that the CTCN is severely underfunded, and the TEC suffers from highly politicized and largely ineffective discussions. Something needs to change for the Technology Mechanism to reach its aims.

Although some progress was made at COP21 in Paris, the discussions on technology did not move forward. Industrialized countries opposed strong commitments to North-South and South-South R&D collaboration as well as binding, significant support to developing countries. Developing countries argued for a strong link with the Green Climate Fund (GCF) so that technology related programmes could count on funding from the GCF, allowing for structural

instead of the current incidental support. For a long time it looked like agreement on technology was going to be difficult, but finally a compromise text did emerge.

Article 10 on technology in the Paris Agreement emphasizes R&D cooperation, hints at a link with finance, and reinforces the existing Technology Mechanism. However, it is only a mild addition to the Technology Mechanism as agreed in 2010. Although the importance of collaboration on R&D between institutions in different countries is re-emphasized, as well as the need for developed countries to fund or finance such efforts in developing countries, no firm commitments were made. From a legal point of view, the commitments are sufficiently vague so that they can easily be ignored by countries without consequences.

The UNFCCC ought to develop itself as a catalyst for meaningful and politically salient action that helps countries get onto self-reinforcing low-carbon trajectories by developing capabilities for low-carbon economies

Much of technology transfer happens outside of formal UN institutions. But we have seen that it does not happen sufficiently without intervention. The UNFCCC ought to develop itself as a catalyst for meaningful and politically salient action that helps countries get onto self-reinforcing low-carbon trajectories by developing capabilities for low-carbon economies. The basic institutions are in place in the form of the UNFCCC Technology Mechanism, but it desperately needs strengthening in order to play its envisioned role. For this, developed countries should overcome their fear of creating competition in the global low-carbon technology marketplace, and developing countries and UN institutions need to be more convincing that the funding will be spent wisely. If this is not done, the implementation of the Paris pledges, and eventually the temperature goal, might easily get out of reach.

So in what research agenda does this result? Questions could include, for each country, what capabilities are most needed and under which circumstances international action can be helpful in building them. Research could contribute to developing a narrative for developed countries that makes financing low-carbon technology transfer attractive and in their self-interest. Another important question is what projects in the GCF could be ‘Technology Mechanism-proof’. But most importantly, the above suggests that the long-standing question of innovation, economic development and sustainability is still not sufficiently understood to build international institutions that work.

Energy-Climate Innovation

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Stabilizing atmospheric greenhouse gases (GHGs) in accord with the Paris targets will require very large reductions in energy related carbon dioxide (CO2) emissions. This can only be achieved through continuous, aggressive and ongoing innovation. Innovation of this sort depends, in turn, on rapid diffusion, adoption and adaptation, processes that are integrally linked with ‘upstream’ technological advance through feedback loops embedded in economic markets.

Policy makers sometimes seem to hope that ‘breakthroughs’ will emerge fortuitously to sweep existing technologies aside. Such hopes are misplaced, if not naïve, for two reasons. First, true breakthroughs – radical innovations – are rare and unpredictable, and no one knows how to foster them other than by spending more money on relatively fundamental research. This may be desirable; yet at the same time new technologies tend to be costly and unreliable, and offer relatively poor technical performance when first introduced.

Improvement comes over time periods commonly measured in decades: this was true of solar photovoltaic (PV) cells, invented in the mid-1950s; gas turbines introduced earlier in the twentieth century; and steam power going back to Newcomen and Watt in the eighteenth century. Over the next several decades, accordingly, the world should expect to work with what it has, existing technologies that can and will – because this is inherent in innovation – advance on technical measures of performance (e.g. efficiency) and reduction in costs (in most cases) through continuous, incremental innovation.

The difficulties will be great. They are practical difficulties, chiefly concerned with devising and implementing policies to foster upstream advance and at the same time strengthen the feedback loops that link applications experience with science, research and engineering, while avoiding lock-in of the sort that at present slows decarbonization of electrical power in wealthy countries.

As the world moves toward decarbonization, large-scale, system-wide, socio-technical-economic changes will play out. There will be much Schumpeterian creative destruction. Although cumulatively transformative, it is not very helpful to think of these processes as amounting to some sort of ‘transition’ – a too-comforting term that suggests manageability between stable states. Since the dynamics will involve continuing change, unpredictable and frequently disorderly, and since governance too is messy and unpredictable, it would be better to think in terms of migration; migrants, after all, often end up at other than their expected or desired destinations (and may then seek to move on).

WHAT DO WE KNOW ABOUT ENERGY-CLIMATE INNOVATION?

- **Point 1:** Profit-seeking businesses conceive, develop, and introduce most new technologies. As Edmund Phelps, 2006 Nobel laureate in economics, notes, ‘An awful lot of innovation just comes from business people operating at the grassroots having ideas on the basis of what they see around them. Nothing to do with science – it’s just creative mankind chipping away at things.’¹

Governments make two main contributions. They feed the knowledge base through funding for research and education. Second, procurement – for instance, of public works and infrastructure, of military systems – also stimulates innovation. Private firms exploit the publicly funded knowledge base and government purchases create initial markets for many emerging technologies; examples include the first PV cells and integrated circuits (ICs) and also the gas turbines that utilities so often now buy for electric power generation. The implication: Effective innovation policies will provide incentives for profit-seeking businesses. This is true worldwide, although mechanisms will differ from country to country.

Most innovations carry high costs and perform poorly when first commercialized, meaning that the pace and extent of ongoing incremental advance determines whether or not innovations survive and continue to improve

- **Point 2:** Most innovations carry high costs and perform poorly when first commercialized, meaning that the pace and extent of ongoing incremental advance determines whether or not innovations survive and continue to improve (or vanish from the marketplace). The first solar PV cells were inefficient (5-6%) and too expensive for applications other than space systems. Much the same was true of other transformative innovations rooted in solid-state physics, such as IC chips, and for gas turbines and jet engines. Gas turbines operate on

a thermo-dynamic cycle patented in 1872, and several firms introduced industrial turbines in the first decade of the twentieth century; even less efficient than the steam engines of the time, they soon disappeared for lack of sales. Test-stand demonstration of jet engines followed in the 1930s, spurred by the coming world war. The first jet aircraft guzzled far more fuel than piston-engine planes – some could stay aloft for no more than 10 or 15 minutes – and needed major maintenance every few dozen hours. Yet, their military advantages were such that development continued and, as manufacturers learned over time to improve efficiency and longevity, costs came down and utilities began to buy turbines based on ‘cores’ designed for aircraft propulsion, first for peaking power and then for base load applications.

As cumulative technical advance reduces costs and improves performance, applications expand. For the technologies mentioned above – PV cells, ICs (and computers, smartphones, and so on), gas turbines – the gains have been accumulating for decades and should continue more or less indefinitely. This is the usual process of innovation, one in which breakthroughs such as the first PV cell or the first IC or first successful jet engine, simply mark the initial step on a long pathway, one that often branches as a result of subsequent developments (e.g., thin film PV cells, turbines designed specifically for utility service). The implication: Governments must support innovation over lengthy time periods, using multiple tools (including, e.g., procurement); it is not enough simply to support research.

- **Point 3:** Energy differs from many other technologies in that, as a commodity, incentives for innovation are weak. Firms that supply energy – although not firms that design and produce goods and services that depend on and consume energy – cannot expect to differentiate their products. Price is what matters to customers, which means that costs are what matters to producers, distributors, and end-suppliers. By contrast, firms in other industries can focus on product features they expect will appeal to customers: ICs that draw less power, yielding greater smartphone battery life; passenger cars with heated seats and more horsepower; pickup trucks with powered tailgates.

Given the commodity nature of energy, it is easy enough to argue that prices are too low to induce much innovation. Certainly a price on carbon would, if high enough, stimulate much technological

Governments will have to subsidize energy innovation heavily to drive needed advances into the marketplace

improvement and application expansion. Yet, efforts to establish such policies have come to little, and the Paris meeting probably marks the end of much beyond the sort of local and regional initiatives the world has recently begun to see. Furthermore, no one can know what price levels would be needed to cut GHG emissions quickly and rapidly, while even in wealthy countries high energy prices would mean hardship for many and, in poorer countries, would be devastating for billions. The implication: Governments will have to subsidize energy innovation heavily to drive needed advances into the marketplace.

- **Point 4:** The Mission Innovation initiative announced in Paris by twenty governments, including that of India, will be more effective if it targets innovation broadly, including diffusion and incremental gains, rather than narrowly focusing on research, which is how it has mostly been read. Much the same is true of the private sector Breakthrough Energy Coalition publicized by Bill Gates and others. Yet, even if restricted to R&D – which costs far less than downstream development, testing, and applications-oriented engineering – the sums announced can only be viewed as falling well short of the needs.

The Mission Innovation statement calls for a doubling of ‘governmental investment in clean energy innovation.’ According to the International Energy Agency (IEA), spending by member countries on ‘public energy technology research, development and demonstration’ (RD&D) totalled about \$ 17 billion in 2014. IEA members account for the great bulk of world spending on energy-climate RD&D (led in 2014 by the United States at \$ 6.3 billion, followed by Japan at \$ 3.3 billion, with France and Germany the only other countries reporting public RD&D expenditures of more than \$1 billion). By almost any standard of comparison, these totals seem modest, and would be so even if doubled.

For context, consider air transportation, an industry that accounts for a minor share of energy related GHG emissions, less than 2.5% of the world total (or 10-11% of transport related emissions, the bulk of which stem from road vehicles). Airlines nonetheless go to some length to publicize their commitments to lowering energy consumption and CO2 emissions – easily understandable since jet fuel accounts for one-third or more of their operating costs (depending on price levels), expenditures that translate quite directly to profit and loss statements. Thus when shopping for new equipment,

airlines press airframe manufacturers (Airbus, Boeing) and jet engine firms (Pratt & Whitney, Rolls-Royce, General Electric) to reduce fuel consumption. The resulting innovations carry high price tags.

When deliveries of Pratt & Whitney’s geared turbo fan began late in 2015, after nearly 30 years of development (slow-paced because oil prices were low over much of the period), the R&D costs alone were reported at \$10 billion. For this sort of expenditure, airlines anticipate fuel burn to decline by around 15% (depending on routes flown). R&D costs for Boeing’s 787 came to a good deal more, in part because of the plane’s troubled launch and early teething troubles. Built largely from lightweight composite materials – less weight means less fuel per passenger-mile – R&D spending for the 787 has been put at \$28 billion. And to reiterate, air transportation is one among a great many sources of CO2 emissions, and nowhere near the top of the list. The implication: Even a doubling of public spending on energy-climate RD&D will result in total expenditures that seem modest relative to the need (and to private-sector spending).

• **Point 5:** Technologies diffuse internationally chiefly through channels created by private firms in the ordinary course of doing business. While national innovation systems differ, many countries today have the human and organizational skills needed both to innovate and to absorb and adapt new technologies, along with the requisite financial resources and market conditions. Examples include Brazil’s migration to sugarcane ethanol and a road vehicle fleet adapted to this fuel, consequences of mostly indigenous innovation. Other illustrations include high-volume manufacture of PV cells at low costs in China and rapid penetration of both solar and wind power in parts of Europe. As these sorts of country-level and regional-level dynamics proceed, technology diffuses internationally through the day-to-day activities of profit seeking firms. Technologies move (as artifacts, as knowledge) within multinationals (within and between divisions), among unaffiliated firms linked by contractual agreements (both vertical and horizontal), and through joint ventures and strategic alliances (taking many forms).

The implication: Governments should rely on private-sector channels for diffusion of energy-climate innovations. These channels can be expected to function more effectively – because of profit incentives – than efforts organized and managed by governments, non-profits, or

intergovernmental organizations. Innovative policies will strengthen private sector channels without seeking to replicate them, while also protecting public interests.

It is wishful thinking to expect some sort of energy technology ‘breakthrough’ to emerge from research. Innovation is a continuous process best viewed in terms of learning: technological learning; organizational learning

Decades of debate and discussion over responses to climate change have overlooked or oversimplified the dynamics of innovation, diffusion, adoption, and adaptation. It is wishful thinking to expect some sort of energy technology ‘breakthrough’ to emerge from research. Innovation is a continuous process best viewed in terms of learning: technological learning; organizational learning; policy learning. What will be needed in the years ahead are practical strategies and structured priorities that capitalize upon and provide incentives for private firms, guided by realistic road maps rather than the wish lists that too often emerge from governments. To have any real hope of reducing GHG emissions sufficiently to approach or meet the Paris targets, governments will have to identify and pursue better functioning innovation policies. The effort should be at the heart of the post-Paris agenda.

1: Howard R. Vane and Chris Mulhearn, ‘Interview with Edmund S. Phelps’, Journal of Economic Perspectives 23(3), 2009, pp. 109-124; quotation from p. 123.

Energy Transitions in China

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ENERGY TRANSITION IN CHINA AND EXPERIENCES TO OTHERS

Ensuring a successful energy transition is crucial as we try to limit temperature rise to no more than two degrees Celsius by the end of the century, as agreed to at the Paris Climate Summit in December 2015. It is also now clear that though more difficult, the need for an energy transition is far greater in large developing countries such as China and India. Since the energy demand in these countries is growing rapidly, a transition to low carbon and sustainable sources would not only help avoid a huge lock-in with expensive and high carbon energy infrastructure, but also demonstrate the possibility of a different path to others in the developing world who are looking for development and prosperity in this century.

Technology holds the key to enabling an energy transition. Technology development in renewable energy has already driven down the cost of wind turbines and solar PV panels to about one-tenth of what it was even a decade back. In countries such as Germany, US and China where these technologies are mass manufactured and installed, generation costs from these renewable energy sources are increasingly becoming competitive in comparison to the traditional coal and gas fired power plants. Electric vehicles are quietly changing people’s preference in many countries, and sales have grown exponentially in the last few years so much so that there is growing concern among oil producers about possible impacts on oil price, not in the distant future, but as soon as 2030. Finally, with improved energy storage and smart grids, the world is also steadily moving away from the old school of having robust, centralized energy systems to decentralized generation and networks to improve the security of power supply.

A common mistake made by most developing countries is to assume that acquisition of technology by itself would automatically lead to an energy transition. This may explain why they focus more on getting the technology rather than on modulating policy, regulatory systems

A common mistake made by most developing countries is to assume that acquisition of technology by itself would automatically lead to an energy transition.

and business environment that nurture the technology in the first place. This has also resulted in intensive discussions on technology transfers between the industrialized world and emerging countries such as China and India. Drawing upon experiences from China’s successes and difficulties in traversing this course could provide some useful insights to other developing countries.

To better understand this argument, we need to ask the following questions. Will technology transfer necessarily facilitate the development of improved technology capacity in the recipient country? Second, can improved technology by itself facilitate an energy transition?

The answer to the first question is a clear no. Technology transfer involves three different streams, each operating at different levels. The first relates to the transfer of equipment, service and design to be used, basically making available the technology to users. The second stream involves the transfer of skills and know-how for operation and maintenance, knowing why the technology operates the way it does. These two streams together help the recipient country to build new production capability. The third, and the most critical stream, involves acquiring the knowledge and expertise behind the technology, thereby enhancing the capacity of national innovation systems which is what will enable invention to take place and accumulate for further improvement.

Previous cases of technology transfer to China, India and countries like Malaysia have mostly focused on the first two streams or, sometimes, only on the first stream. However, without the third stream of technology transfer, a country is unlikely to see significant improvement in its technology capability. It is, however, insufficiently realized that for the third stream of technology transfer to be operational, a country needs both a vibrant culture of entrepreneurship and an enabling market environment, as well as requisite government support to be able to develop its own national innovation system.

Experience from China also suggests that it should be business and not the government which manages the innovation. Government interventions in industrial decisions and ill-designed subsidies that attempt to hasten the innovation process often result in poor outcomes. The process works much better when companies have a

Government which manages the innovation. Government interventions in industrial decisions and ill-designed subsidies that attempt to hasten the innovation process often result in poor outcomes.

strong incentive to acquire certain technologies and invest resources of their own to absorb the technologies most suitable for the local market. Simultaneously, governments must realize that technology learning is a process that works better if it is bottom-up rather than top-down. In the technology transfer framework agreed to in Paris, a greater effort needs to be made to increase the engagement of local business so that they can drive the process instead of taking it as given.

The degree of preparedness in the market too needs to be given due consideration before the recipient governments make their request for low carbon technologies from the countries /firms which have them. There are also bound to be significant differences in requirements for national technological capacity when seeking transfer of sophisticated technologies such as gas turbines, which only five companies in the world possess, as against more readily available ones such as biomass and solar PV panels. It also requires very different conditions to facilitate such technology transfer, further adjusted and improved to suit a country's specific conditions, and taking into account the needs of local partners. Thus, the answer to the second question too is a clear no.

As a global leader in renewable energy, China has benefited a lot from technology transfers from the industrialized countries by ensuring a combination of strong policy support by government, a large domestic market, and the presence of vibrant entrepreneurs investing in these energy technologies. Even then, it took more than a decade for China before the resources it invested in these sectors started to pay out. In the first decade of the new millennium when China acquired advanced wind and solar energy technologies and emerged as a world leader in renewable power installation there was no energy transition. If anything, the share of coal in China's energy mix actually increased during that time.

Though wind technology got an early start in China, it did not become popular until the government started to promote it by providing special concessions which ensured a guaranteed return to developers for their investment. The government also pushed technology transfer through joint ventures by specifying a high local content requirement for wind farms supported by government subsidy. The most significant technology transfer of wind power actually took place when leading Chinese wind manufacturers went on to purchase second tier wind power companies in Europe after the economic crisis, as did the

Indian leader, Suzlon. But acquisition of this technology by itself did not lead to much change, mainly because consumers who prefer green electricity realized that a large share of electricity generated from wind was not readily accessible to the power grid due to various conflicting interests in the system. This is why even though China has installed the world's largest wind power generation capacity, the actual generation from wind power is about one-third less than the US. In 2015, the output of wind power generation was only as much as the generation from the giant Three Gorges Dam.

The story of the solar PV industry is similar to that of the wind sector. Initially taken up by local manufacturers, considerable effort has been expended both by the government and the business sector in making huge investments to absorb the technologies. Unlike in the case of wind turbines, which were not only regulated through licencing and technologies had to be sourced from international competitors, a lot of money was invested into the innovation of the solar PV technology as it is relatively simple. Technology transfer thus followed a different route to that of the wind industry, though in the end China was able to create a world class manufacturing capacity with advanced technology, despite a few setbacks during the trade disputes with the EU and USA.

In both the cases of wind and solar PV, the dominant players driving the technology capacity improvement were private investors, though policy support and certainty in development targets was helpful. However, when it comes to more sophisticated low carbon technologies such as high speed railway and third generation nuclear power, the technological and institutional barriers are so high that, at least in China, only state owned enterprises (SOEs) are interested in and in a position to pursue the technology. Yet, despite the huge influence and deep pockets of Chinese SOEs, success is far from guaranteed in the pursuit of technology for the reasons discussed above. Often one may need the support of a charismatic figure to break through the political and institutional barriers to facilitate the penetration of the new technology into a sluggish system.

What we have also seen in China, despite becoming a global leader, is that none of these technologies has necessarily led to an energy transition. Even as low carbon energy technologies have enjoyed a fast growth in China in the last decade, so too has coal, understandable

at a time when China is desperate for increased energy and thus looking at all options. So if new technologies are growing, it is more because of the increased demand for energy and not because they are the favoured choice in the given market conditions and currently, renewable energy accounts for only a small slice of the market. Huge investments were poured in renewable energy based on the government promised subsidies, but over-reliance on subsidy in turn led to the creation of excess capacity in the industry as neither its domestic deployment nor overseas market could be guaranteed by the government. Thus investment in low carbon technology that was occasioned by government policies has now become a liability instead of serving as the foundation for further innovation, as fast changes in low carbon technology have made these appear as locked-in assets in last generation technologies.

The energy transition in China that we are now talking about only happened because of two unrelated developments. The first is the severe smog prevailing in Beijing and North China which became a matter of huge concern to the middle class and possibly resulted in a small-scale political crisis. The second was the slowing down of the economy, in part resulting from a serious overcapacity in heavy industries. Further, because of the environmental measures needed to improve the air quality, as also for addressing the slowing down of the economy, China has seen a reduction in coal consumption and a lowering of carbon emission on an annual basis for the first time in decades. The continuous increase in the use of renewable energy in this context may lead to a more noticeable change in China's energy structure, with implications for its energy future.

So, what lessons does China offer for other developing countries? First, low carbon technology transfer comes with different streams, and the best way of acquiring the low carbon technology will depend on the nature of technology, the capacity of the recipient country and its business environment. Governments need to focus more on building a supportive environment for the technology and let business drive the process, instead of choosing for them.

Second, improvements in technological capability by itself cannot lead to a successful energy transition, especially when, at least so far, without government subsidies renewable energy is not a favoured choice. Developing countries seeking a low carbon energy transition

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The key is to strengthen the foundations of a national innovation system in which innovation can emerge and flourish, rather than pick the winner by distorting the market

must understand that critical for success is changing the operating conditions of the market so that it favours low carbon technology and embracing the transition early instead of delaying it until some external event makes it imperative.

Third, since the process of innovation cannot be rushed, the government needs to exercise patience. The key is to strengthen the foundations of a national innovation system in which innovation can emerge and flourish, rather than pick the winner by distorting the market. For example, levying a uniform carbon tax will both result in reducing carbon emissions and favour renewable energy over fossil fuels. Providing additional support (subsidies) for using a specific low carbon technology is unlikely to promote innovation.

Fourth, for a new technology to be mainstreamed, the greater need is to focus on the business model instead of the scale of its deployment. Large-scale use that is only made possible by public funding support risks a lock-in at the early stages of technology. This is likely to be costly especially when developments in low carbon technology are picking up pace. Nurturing a viable business model is a better way to create an enabling environment, which is far more important than merely meeting a prescribed target.

This is a good time for countries like India, Brazil, and other emerging economies to follow suit in the pursuit of low carbon energy transition, not only because the cost of low carbon technologies – from wind turbines to solar PV panel – have declined by more than 90 per cent over the last decade, but also because the world now knows more about and is willing to accept those technologies. There is also new thinking about decentralized energy and its contribution to the safety of the electricity system. Entrepreneurs, who are key if one is to ratchet up the development of these technologies, are waiting eagerly for policy support for the market for new low carbon technology.

The Technology Challenge

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THE IMPORTANCE OF TECHNOLOGY

The magnitude of the technology challenge in moving towards a low-carbon climate resilient future is considerable. To meet the two degree target, the world needs to decarbonize at an annual rate of between 4 and 10 per cent from now on, depending on population and economic growth assumptions. Historically, only a few countries, such as Sweden and France, have been able to decarbonize at these rates and this has been accomplished by more rapid deployment of non-fossil electricity generation – hydropower in the case of Sweden and nuclear in the case of France. Global rates have been much lower (about 1.3% over 2000-2013). The more rapid (approximately 2%) decrease rate for most western economies in recent years is inflated due to a decreasing manufacturing sector and concomitant increased imports.

Most IPCC scenarios that leave decarbonization to later dates require negative emissions relying on carbon capture and sink technologies that currently show no prospect of being commercially deployable. Other, more proven non-fossil energy technologies such as nuclear or renewables are expensive and often not affordable by poorer countries. However, rapid decarbonization will require improvement and innovation in precisely these technologies – and therein lies the challenge facing a technology agenda for climate response.

TECHNOLOGY AND THE PARIS AGREEMENT

Despite widespread agreement about the importance of technology, and the presence of a number of innovative proposals in earlier versions of the negotiating text, the final form of the Paris Agreement is relatively modest and unambitious with regard to technology. For the most part it relies on the Convention's existing technology mechanism, including the Technology Executive Committee (TEC) and the Climate Technology Centre and Network (CTCN).

On the positive side, it does place a new focus on innovation as ‘critical

for an effective, long-term global response to climate change.’ It commits the UNFCCC’s technology and financial bodies to support R&D and developing countries’ access to technology, ‘in particular for early stages of the technology cycle.’

Perhaps potentially of equal significance are related initiatives launched at Paris, such as Mission Innovation and the Breakthrough Energy Coalition. The relationship of these initiatives with the formal multilateral process remains a key question for the road ahead from Paris.

KEY ISSUES RELATED TO THE ROLE OF TECHNOLOGY

As we consider the role of technology for achieving an ambitious and equitable global response to climate change, four key issues will need to be considered:

- **Accelerating action across the entire technology cycle:** In order to realize the full potential of technology, it will be important to work towards coordinated action across the entire technology cycle – from basic and applied research to technology development and deployment. In much of the developing world, however, national innovation systems are weak and not well developed. Given that these emerging markets may well be the first point of market entry for many technologies, it is necessary to think of downstream market and commercialization linkages, in addition to upstream investments in research and development. While an approach such as the DoE’s SunShot initiative that emphasizes applied R&D may be appropriate for countries like the US where there is a mature innovation ecosystem that can move new technologies into the market, additional and complementary interventions will be needed in developing countries where these linkages are not well established.

The challenge of decarbonization is more than replacing one product technology by another – it involves changing an entire socio-technical regime or system

- **The clean energy transition is more than just a product transition:** Energy technologies are not just isolated physical artifacts, but complex socio-technical regimes that include hardware (devices, equipment, etc.), software (awareness, information, know-how, etc.), human resources (quality and quantity), financial resources, and enabling environments (regulatory frameworks, institutional arrangements, infrastructure). Consequently, the challenge of decarbonization is more than replacing one product technology by another – it involves changing an entire socio-technical regime or system. An all-electric

transport future, for instance, will involve a change of not only the hardware in terms of the drive train of automobiles or batteries but also the rest of the ecosystem which include a range of ancillary businesses that have evolved around a particular technology system of a combination of gasoline and the internal combustion engines. For example, will fuelling stations become battery replacement stops?

- **Heterogeneity and variety are key for the clean energy transition:** Moving to a low-carbon future will likely need an ‘all of the above’ approach – there is no single technology silver bullet. Unlike in the case of the Montreal Protocol where the challenge was finding and deploying a substitute for a specific product, carbon is deeply embedded into our entire economic fabric. In the absence of a single technological solution, the technology and innovation architecture needs to encourage experimentation, heterogeneity and variety. For example, what sorts of renewable energy technologies will replace centralized fossil based electricity generation? Centralized or distributed?

In many situations, distributed solar thermal with combined heat and power may be more attractive than centralized PV. Hybrid renewable energy solutions often have better economics than those that rely on a single source. Further, solutions may need to be customized, and the process of customization and localization itself may generate indirect economic benefits beyond the direct benefit of electrification. For example, in a country like India, there may be interesting possibilities for connecting renewable energy technologies with rural industries. And so, simply replacing 500 mw coal power plants by the equivalent of utility scale solar PV might potentially miss out on a much larger opportunity for connecting the energy agenda with the rural economic development agenda.

- **Ensuring equitable distribution of not just the costs, but also the benefits of the clean energy transition (the political economy of decarbonization):** The transition to a clean energy future is creative destruction in its fullest sense which means that there will be winners and losers. While there is much talk about the environmental benefits of clean energy, from a developing country perspective, the question about the distribution of the costs and benefits of this transition and particularly the economic returns remains. It is important to remember that resource rents fuelled

much of the wealth creation in the early days of the 20th century, though in many countries it was as much of a resource curse as a resource blessing.

Of course, in the case of the clean energy transition, resource rents will be replaced by knowledge rents because the exploitation of renewable resources requires technology, while the resource itself is essentially free. Among other aspects, this increases the importance of IP. The question then is to whom do these returns accrue? Will the economic returns reinforce the current inequalities in distribution of wealth across and within countries? Or, can the transition also lead to a greater democratization and sharing of the returns from the transition?

SOME PRACTICAL NEXT STEPS

Even as we work towards addressing the key issues mentioned above, a good starting point might be to identify practical next steps that can build on current initiatives, and which address some important constraints and barriers. Five specific ideas might form the core of a near-term agenda for technology in the implementation of the Paris Agreement:

- Mission Innovation is a welcome step, but how can the domestic R&D efforts in different countries be connected and linked to accelerate the technology cycle, both with regard to R&D as well as eventual commercialization? Can the multilateral process support joint development or collaborative technology development?

- Scaling up existing technology cooperation mechanisms: After a careful review and assessment of lessons learnt, existing bilateral mechanisms such as the US-India Joint Clean Energy R&D Centre (JCERDC) could be scaled-up and potentially adapted to a multilateral setting. For example, can these collaborative development projects have stronger application/commercialization prospects, perhaps by setting specific technology goals/deliverables? Can these projects address a broad range of technology areas? How can the private sector be most effectively engaged in these collaborative projects?

- Adapting and adopting existing mechanisms for the multilateral process: There are mechanisms for collaborative R&D and early

stage technology development that include strong private sector participation that could be examined and adapted/supported under the multilateral process. Examples include models such as the US-Israel BIRD Foundation, which funds joint industry-industry collaborative projects that are closer towards commercialization.

- Finding creative solutions/approaches for Intellectual Property Rights (IPR) issues: IPR is often the ‘third rail’ of international negotiations, as there are some countries that are completely allergic to any mention of it. However, in practice, there are many situations where it is necessary to find approaches that better balance public benefits versus private returns, such as in healthcare. Compulsory licensing, march-in rights and patent pools are all examples of approaches that try and safeguard returns to innovators while ensuring that society benefits from the new technologies. For example, patent pools have been used in sectors ranging from manufacturing to electronics (MPEG) to biotechnology, including situations where the government has at least partly funded their creation. It may be worth exploring whether the multilateral process could support the creation of suitable patent pools in specific areas of clean energy (such as energy storage), perhaps by combining public and private and national and multilateral finance. If a private company like Tesla can make its IP available in order to grow the market; surely it should be possible to devise mechanisms to enhance access to clean energy technologies for commercialization and find ways of balancing private returns to the inventor with the public (and global) benefits of clean energy technologies.

- Making the current trade regime more climate friendly: Given the overriding global benefits of more rapid mitigation, we need to ensure that the current rules and governance process of global trade do not act as a constraint or barrier for low-carbon technology deployment. In this regard it may be helpful to create a ‘green box’, where environmentally sustainable technologies are regarded as ‘public goods’ and where countries agree to not pursue trade disputes in the larger global interest.

Compulsory licensing, march-in rights and patent pools are all examples of approaches that try and safeguard returns to innovators while ensuring that society benefits from the new technologies

Financing Climate Action

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The Paris Agreement was the culmination of a series of high level government meetings over many years. It aimed to bring together a very complex set of agendas, vested interests and political ambition into a unified framework for action.

In the run up to the Copenhagen Conference of Parties in 2009 the global ambition for a legally binding agreement that would deliver strong emission reduction targets and delivery mechanisms for adaptation seemed set to be delivered. Unfortunately that was not to be the case. It took another 6 years for a new way forward to be agreed and in the end a lot of the legal nature of the agreement has been dropped but some of the ambition does remain. Many commentators have argued that the Paris Agreement is as good as we could ever have hoped for – but not good enough to tackle climate change. However, it may start the momentum towards real change and once the world sees a new direction of travel then maybe the ambition can be cemented into something more concrete and we can build on this foundation.

The Paris Agreement sets out three key deliverables out of which everything else flows. These are listed under Article 2 (article 1 lists definitions used in the agreement). Critically the first two deliverables are more aspirational targets – keeping temperature below 2 degrees with an ambition to improve that to below 1.5 degrees and supporting adaptation to any climate change due to historic emissions. The third deliverable is the mechanism by which the first two can be achieved: to provide ‘finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development.’ (Article 2c)

Therefore, climate finance is the mechanism by which the world will tackle climate change.

Article 9 expands on the definition of climate finance and makes clear that this should be new, significant and involve public funds.

Article 9

3. As part of a global effort, developed country Parties should continue to take the lead in mobilizing climate finance from a wide variety of sources, instruments and channels, noting the significant role of public funds, through a variety of actions, including supporting country-driven strategies, and taking into account the needs and priorities of developing country Parties. Such mobilization of climate finance should represent a progression beyond previous efforts.

4. The provision of scaled-up financial resources should aim to achieve a balance between adaptation and mitigation, taking into account country-driven strategies, and the priorities and needs of developing country Parties, especially those that are particularly vulnerable to the adverse effects of climate change and have significant capacity constraints, such as the least developed countries and small island developing States, considering the need for public and grant-based resources for adaptation.

The Paris Agreement also sits alongside two other major international frameworks recently agreed – the Sustainable Development Goals and ‘Financing for Development’. Finance is a key component of all three frameworks and any financial flows will need to take into account the aspirations and targets contained in all three with estimates of an additional \$600-800 billion annually for energy investments and up to \$7 trillion for the overall implementation of the Sustainable Development Goals per year.

This of course represents a substantial challenge in how to mobilise, manage and channel the capital needed. In particular raising potentially large sources of money and creating a pipeline down to small projects on the ground is a challenge. Some estimates from the United Nations have indicated as much as 80% of these investments must come from the private sector.

Many organisations, groups and partnerships have been set up to work on this challenge. This ranges from the formal Green Climate Fund to groups focussed on particular issues. One such group is the

C40 cities initiative. In a recent report entitled New Perspective on Climate Finance for Cities, the C40 in partnership with Siemens and Citi outline six financing mechanisms. Two key finance mechanisms outlined in this report have often been highlighted as a potential sources of significant finance.

The first is through the use of emission trading schemes. Current trading schemes have reached \$34 billion in value (2015) and account for 12% of global emissions. Trading schemes can potentially mobilise finance in two ways. The direct engagement of companies and organisations who are part of the trading scheme of course moves capital around to unlock investments into energy. However, criticism of the largest emission trading scheme in the world – the European Emission Trading Scheme (EU ETS) is increasing as it demonstrates its inflexibility to cope with economic changes and initial political and corporate pressure to ensure financial impacts were minimised. While the EU ETS will most likely deliver on its emissions target, partly due to the financial and economic crisis still being experienced, it is not driving innovation in climate investing. The other use of ETS schemes is to use the tax or some surplus emission credits to channel funds to other regions and countries. While this type of mechanism has been used for many years now it is still at a very small scale compared to what is required and critics often argue that this can lead to market distortion that also hinders climate investing.

The second finance mechanism is that of green bonds. The green bonds market has been growing rapidly over the past decade with early issuances from multilateral development banks, such as the World Bank, leading the way for a much wider engagement. Estimates put green bond issuances in 2015 between \$50 and \$70 billion covering energy, buildings, transport and water. Emerging economies are now seen as leading the development of the green bond market.

Emerging economies are now seen as leading the development of the green bond market

Direct public finance is still an important issue. Developing countries have long argued that historic emissions and the impact of climate change within their countries should result in climate finance flows from developed to developing countries. The Green Climate Fund, set up as part of the commitment to the Paris Agreement and the negotiations that led up to the agreement, has \$10 billion in committed development aid. This money, alongside other flows through international finance institutions and export credit agencies,

should contribute in part to meeting the commitment to mobilise \$100 billion a year by 2020. Various international bodies put a figure of between \$180 to 540 billion a year as the total required investment flow between 2010 and 2030. However, the current \$10 billion committed is a total amount and not an annual flow.

In 2016, as part of China's Presidency of the G20 a new Green Finance Study Group has been set up and is chaired by China and the UK. This new group will explore "how to enhance the ability of the financial system to mobilize private capital for green investment". It will look at banks, bond markets and institutional investors and the barriers they face to climate investing. Given that private finance is expected to make up to 80% of the total investments, removing these barriers and creating enabling conditions is urgently needed.

The Global Innovation Lab for Climate Finance, a public-private partnership involving the governments of the UK, Germany, US, Denmark and Netherlands as well as Bank of America Merrill Lynch, Willis Group and others, is starting to pilot specific finance mechanisms to address certain barriers in climate investing. These include platforms for sharing risk and specific projects in energy efficiency and water infrastructure. Additionally, and importantly, the Oasis Platform which provides analytic tools that can be used to better understand and manage risks in investment will be made available.

Given the need to mobilise and move capital into developing countries there has been a lot of focus on the structures that would allow this to happen at scale. Of course climate finance also needs to occur at home – in whichever country you are resident. Schemes such as the ETS should help deploy capital in an optimal way but further direct funding through local funds, private equity investments or debt is needed to meet this challenge. Often these are better managed and implemented locally but capturing information and sharing lessons between regions is vital for their success and growth. Linking climate financing to other local issues can also boost investments – such as the need to tackle air quality issues in cities or the need for increased investment in rural economic development. Several central banks are starting to argue that climate change presents a real risk and therefore public investing into this sector, or at least better risk assessment of the economy such as the Bank of England's prudential review of the UK insurance sector, is growing.

Support is needed to help developing countries mature their investment climate so that the risks involved come down and allow investments with appropriate rates of return to be made

Current data suggests private sector investments account for 57% of the climate investment in developing countries and 88% in developed countries. Therefore, the figure of 80% of total investment coming from the private sector seems feasible although the scale of investment needs to increase significantly in both developed and developing countries. Support is needed to help developing countries mature their investment climate so that the risks involved come down and allow investments with appropriate rates of return to be made. In developing countries current estimated climate finance, 12% of which goes into adaptation and the rest into mitigation, needs to be more than double to meet the required investments.

However, challenges remain in implementing climate finance. As with the EU ETS other climate finance programmes are facing a range of criticism from various bodies. Whether these are critiques relating to the additional nature of aid money or particular technologies such as biofuels which may or may not contribute to mitigating climate change the particular definitions used for deploying finance need to be clarified. For example, many see the possibility of the Green Climate Fund investing in a proposed renewable energy scheme by Deutsche Bank as demonstration that it is not taking on the more challenging investments and opting for already profitable schemes. At worse some investments are described as 'greenwash'.

Meanwhile domestic politics often gets in the way of progressive and far sighted ambition. The US House of Representatives recently voted to stop the Obama administration from providing money to the Green Climate Fund. The divided nature of US politics will continue to frustrate efforts to ensure a global coalition which remains stable over time.

At the heart of climate finance is the ability to move capital from carbon intensive industries to cleaner sectors. This is the goal of all climate finance initiatives in the end but subsidies for fossil fuels continue. The UN has recently criticised both the UK and Germany governments for their continued support through subsidies and tax breaks for oil and gas, and coal sectors respectively.

Therefore, the challenge of meeting the temperature target set out in the Paris Agreement still stands and while it is promising that the agreement itself acknowledges the central place that climate

finance has achieving the necessary mobilisation of funds has many barriers. Indeed meeting the investments needed in renewable energy technology, transport, energy efficiency and adaptation face their own existing challenges. To meet the lower temperature target, which requires the mass deployment of biomass energy with carbon capture and storage to take carbon dioxide out of the atmosphere, will require a whole other set of market mechanisms, the development of technologies which are totally unproven and a global carbon price. Even discussing a global carbon price has proven impossible at international negotiations.

New business and financial models are possible. We need bold leadership to unlock the potential and shift current markets into new cleaner and greener versions.

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Climate Action Beyond Mitigation and the Global North

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Paris has seen the most comprehensive kind of framework for non-state and sub-national climate action to date. The growing importance of such action is part of a larger development towards polycentric climate governance in which traditional state based regimes are complemented by private and hybrid regimes involving both national and sub-national governments, as also civil society, business and investors.

This article focuses on the implications for developing countries and points out three challenges and criticisms of the outcomes of the Paris climate conference to facilitate non-state action. First, both policy and academic discussions have in general been biased towards direct mitigation actions while neglecting action in developing countries. Second, though there is great potential for non-state climate action in the global South, many actions remain ‘under the radar’. Third, in the period before 2020, the international community is heavily betting on non-state and sub-national action. This is a risky strategy when the range of options left to prevent dangerous climate change have shrunk.

A FACILITATIVE FRAMEWORK

Paris has seen a surge in efforts to address climate change by a wide variety of non-state and sub-national stakeholders, including business, investors, civil society, cities and regions. The Non-State Actor Zone for Climate Action (NAZCA), a platform launched at the 2014 Lima Climate Conference by the Peruvian government in collaboration with the UNFCCC, currently features more than 11,000 actions. Through initiatives such as NAZCA and high-level events during climate conferences, non-state actions have gained greater visibility and international acknowledgement. However, increased visibility and acknowledgment is not without risk. A lack of guidelines for (featured) non-state actions could lead to easy UN stamps of approval and green-washing, such that business-as-usual is represented as

Paris has seen a surge in efforts to address climate change by a wide variety of non-state and sub-national stakeholders, including business, investors, civil society, cities and regions

clean and green. Moreover, without a more systematic tracking of climate actions, overall implications for mitigation and adaptation to climate change may never be properly understood.¹ Nonetheless it must be acknowledged that governments have agreed to the most comprehensive framework for non-state and sub-national climate action to date in Paris.

Elements of this framework include (i) an expanded NAZCA platform to register non-state and sub-national action; (ii) the continuation of technical examination processes for mitigation related solutions and enhanced actions before 2020, and a new parallel technical examination processes for adaptation related actions; and (iii) the installation of ‘high-level champions’ to coordinate activities to reach out to a variety of stakeholders.²

A heavy reliance on non-state and sub-national actions, even with a more comprehensive framework, remains a risky pre-2020 strategy to prevent dangerous climate change

Together these elements improve visibility and acknowledgement of non-state and sub-national climate actions within the international climate regime, as well as strengthen the interface between various stakeholders and policy makers. Moreover, these elements constitute an institutional anchor for the continued mobilization of non-state and sub-national actors until at least 2020.³ However, this framework is skewed towards ‘high impact’ mitigation actions, and does not expressly address the under-representation of developing country based stakeholders among climate actions.⁴ Overall, a heavy reliance on non-state and sub-national actions, even with a more comprehensive framework, remains a risky pre-2020 strategy to prevent dangerous climate change.

EMPHASIS ON HIGH MITIGATION POTENTIAL

A focus on high mitigation potential seems reasonable and necessary to prevent dangerous climate change. In the context of the UNFCCC, the Climate Technology Centre and Network (CTCN), as well as the Technical Examination Process (and related meetings) have focused on identifying high mitigation potential actions and action areas and solutions that are scalable and replicable, though the strategy is not without its risks. In the following I would like to comment on three elements of ‘high mitigation potential’, namely: ‘high’, ‘mitigation’, and ‘potential’.

First, high mitigation potential assumes large-scale action that can accrue significant and measurable greenhouse gas (GHG) emissions reductions. Large-scale action may be ‘scaled up’ from demonstrated

mitigation solutions. However, transformative technologies and innovative solutions may (initially) be small-scale, with low mitigation potential in absolute terms. Transformative technologies will need to be demonstrated before they are applied at scale. A comprehensive framework for climate action should, therefore, facilitate innovation and allow for the incubation of transformative technologies rather than only promote large-scale solutions.

Second, high mitigation potential implies a greater focus on GHG emissions reductions than on other aspects of climate change, most notably problems related to resilience and adaptation to climate change impacts. However, a facilitative framework should not ignore the need for adaptation and greater resilience for at least three reasons:

- Given that many developing countries have long been sceptical of greater non-state and sub-national engagement, their political support for such engagement will depend on sustainability co-benefits of climate actions, rather than only mitigation.⁵
- To some extent the post-Paris framework for non-state and sub-national climate action addresses the imbalance between mitigation and adaptation by extending the Technical Examination Process to adaptation.⁶ However, adaptation and resilience actions still need more support to become effective, as these actions have been relatively underperforming.⁷
- A lot of actions labelled ‘high mitigation potential’ are in fact not directly aimed at mitigation.⁸ Rather, they address a variety of other climate related challenges, including adaptation and aspects of sustainable development. Their designation as ‘high mitigation potential’ is more often a political projection rather than a reflection of the actual and self-stated purposes of climate actions.

Third, the potential of climate actions is often defended on theoretical grounds and more likely to differ from actual impacts. Theoretically speaking, only a few targeted non-state actions and sub-national efforts in high emission sectors could close the global mitigation gap.⁹

There are, however, problems in realizing this potential.

For one, newly emerging actions rarely help set mitigation targets. Even

if they do, their mitigation potential falls (far) short of actually closing the global mitigation gap.¹⁰ Current research suggests that non-state and sub-national actions rarely meet – let alone over-achieve – their targets.¹¹ Therefore, a simplistic focus on high mitigation potential may lead to unwarranted and overly optimistic estimations of non-state and sub-national efforts.

An associated concern relates to the double counting of GHG emission reductions. For instance, reductions by a city action may be simultaneously counted as reductions by the city, region, and/or country in which an action takes place.¹² This raises the question whether separate emissions accounting at the level of individual climate actions is possible and necessary. I argue that a standardized accounting methodology for emissions across all climate actions is undesirable for political and practical reasons.

First, in the context of the UNFCCC, all emissions accounting occurs at the national level. Second, when non-state and sub-national climate actions are subject to rigid Monitoring, Reporting and Verification (MRV), they are likely to be seen in competition with the international UNFCCC regime. Moreover, quantified emission reductions by climate actions should not become a reason for governments to resile from their mitigation responsibilities. Third, most climate actions would not benefit from, or even be in a position to conduct rigid MRV. Only a few climate actions set direct mitigation targets; many more focus elsewhere. For instance, an action could aim to improve health by combating air pollution – while also generating emissions reduction as a ‘co-benefit’. It is doubtful whether smaller actions should especially invest their scarce capacities into standardized MRV, in particular when mitigation is not the main purpose.

Nonetheless, there is analytical value in tracking climate actions and their mitigation impacts to demonstrate particularly effective solutions and to better understand the scale and aggregate impact of climate actions. The task of tracking non-state climate action, however, should not burden the UNFCCC process, the UNFCCC Secretariat, or smaller-scale climate actions and those that do not primarily focus on mitigation. Existing initiatives such as CDP (for business) and ICLEI’s Carbons (for cities) should continue to play a role in the tracking of climate actions. Moreover, the analytical community,

including researchers, experts and consultants, have already conducted studies and set up databases to track climate actions.¹³ Most studies and data collection initiatives, however, have focused on tracking promises and mitigation potential (see above). What really matters is to determine what climate actions actually achieve, and under what circumstances.

UNDERREPRESENTATION OF THE DEVELOPING WORLD

Multiple studies confirm that developing country based stakeholders are vastly under-represented in non-state and sub-national climate actions.¹⁴ While most climate actions (claim to) implement across the developing world, the actions seem to be primarily led by Europe or North American based actors. This pattern seems to reflect an imbalanced reality in which major North based actors define design, fund, and manage climate actions.

Observed imbalances may also be due to a selection bias in international processes (such as the existing Technical Examination Process) and platforms such as NAZCA. Their focus on ‘high mitigation potential’ directs attention to high profile actions, for instance by multinational corporations mostly based in the global North, while ignoring many smaller and community based resilience and adaptation actions in developing countries. A similar selection bias is also found in research, most studies on non-state and sub-national climate action are chiefly concerned with mitigation.¹⁵ Very few studies take into account sustainability impacts.¹⁶

To effectively respond to the under-representation of developing country based non-state and sub-national stakeholders, a comprehensive framework should both help improve the visibility of non-state and sub-national action in developing countries and also reach out to non-state and sub-national stakeholders in the developing world. Efforts have been undertaken to improve the visibility of climate actions in developing countries, most notably in the contexts of the 2014 UN Climate Summit and the UNFCCC’s Momentum for Change Initiatives.

In the run-up to the Paris Climate Conference, the organizing team of the 2014 UN Climate Summit mobilized new and enhanced climate non-state, sub-national and cooperative initiatives across

Multiple studies confirm that developing country based stakeholders are vastly under-represented in non-state and sub-national climate actions

eight ‘action areas’. Initially these areas encompassed sectors with high mitigation potential, such as transport, energy and forests. However, to better accommodate development needs, ‘resilience’ was added as a separate climate action area.¹⁷ Resilience actions focused more on the needs of developing countries, in particular low-income economies.¹⁸ However, a year after being launched, it became clear that progress on this front was slow and that many countries had failed to start work.

WHICH ACTORS TO MOBILIZE?

The UNFCCC secretariat features climate actions with development benefits in its ‘Momentum for Change’ campaign. The campaign highlights initiatives in four focus areas: ‘urban poor’ (‘recognizing climate action that improves the lives of impoverished people in urban communities’); ‘women for results’ (‘recognizing the critical leadership and participation of women in addressing climate change’); ‘financing for climate friendly investment’ (‘recognizing successful and innovate climate smart activities’); ‘ICT solutions’ (‘recognizing successful climate change activities in the field of information and communication technology’). Although the Momentum for Change campaign highlights wider economic, social and environmental challenges, it does not directly redress imbalances between developing and developed countries. In fact, a large majority of initiatives winning the ‘Momentum for Change Lighthouse Activity Award’ is led by stakeholders based in the developed countries.¹⁹

To address the under-representation of developing country based stakeholders, continued efforts are necessary. One promising development is the incorporation of the resilience action area in the ‘Action Agenda’, initiated by the French and Peruvian governments, the UNFCCC Secretariat, and the Executive Office of the Secretary of the United Nations. However, not all developing country based climate actions are addressing resilience, and long-term attention is needed to improve the visibility of developing country based climate actions. While parts of the action agenda has been mandated in Paris (in particular relating to pre-2020 action), specific attention to stakeholders in developing countries is not guaranteed. For instance, the Momentum for Change campaign is financed through the budget of the UNFCCC Secretariat, and contingent on the political commitment by the Executive Secretary of the UNFCCC and the (quiet) consent of Parties to the UNFCCC.

The most visible activities to reach out to in the developing world happen at climate conferences, for instance through so-called ‘High-Level Meetings on Climate Action’ (or ‘Action Days’). However, it is questionable whether such events are suitable for facilitating climate action in the developing world. Stakeholders from developing countries may have a limited (e.g. financial) capacity to be present at these events. While such events provide a rare interface between negotiators and non-state and sub-national stakeholders, developing country delegations are usually minimally staffed and need to focus on simultaneous negotiations rather than side events. Regional or national events and processes to explore the potential of non-state and sub-national climate action in developing countries may better address the limitations of smaller developing country based stakeholders and governments.

Not only is there huge potential, but also a need for global South based stakeholder engagement in climate action. In particular, the involvement of cities in developing countries as drivers of climate action will be vital in the next decade. Future infrastructure alone, mostly in the urban global South, would require an estimated third of the remaining carbon budget.²⁰ The good news is that in the run-up to Paris many commitments have been made by cities and regions. Moreover, cities in developing countries are not necessarily under-represented in climate actions such as the ‘C40’ initiative or the ‘Compact of Mayors’, although in other transnational networks they remain under-represented.²¹ Many city commitments, however, are declarational in nature, for instance in the Paris City Hall Declaration in which mayors promised to exceed the Paris Agreement targets. Engaging cities in the global South is a first step, but commitments and promises need to become actionable. Concerted efforts by the UNFCCC, the wider UN system and governments should help the realization of city commitments, for instance by facilitating access to expertise and finance.

Another, relatively neglected type of stakeholder is business in the global South. Efforts by North based multinational corporations attract much attention at the global stage. However, for most developing countries, small and medium sized enterprises are of greater economic and social importance. One option to increase local business engagement is to focus on upgrading global value chains instead of a single (multinational) corporation. This would create

State owned enterprises are important drivers and inhibitors of climate action, especially in emerging countries like China, Vietnam and India opportunities for smaller suppliers in developing countries to innovate and create more value. Additionally, the role of business should also not be narrowed down to private business alone. State owned enterprises are important drivers and inhibitors of climate action, especially in emerging countries like China, Vietnam and India.

OVERRELIANCE ON PRE-2020 NON-STATE AND SUBNATIONAL ACTION?

At the 2011 Durban Climate Conference, governments agreed to a separate work stream on pre-2020 mitigation action in the negotiations towards a new agreement. Pre-2020 climate action is necessary to increase the likelihood of limiting the increase of global average temperature below 2°C above pre-industrial levels. This continues to hold true after Paris, as commitment cycles in which countries update or communicate their climate pledges will only take effect after 2020.

The only agreed strategy on pre-2020 climate action heavily relies on dialogue with non-state and sub-national stakeholders, information sharing, and the ‘technical examination processes’ on mitigation and adaptation. This is a high risk strategy, since very little is known about the effectiveness of non-state and sub-national climate action. Non-state and sub-national actions do not seem a safe bet to produce the pre-2020 results that would allow for a peak and decline of GHG concentration levels by the mid-century (as described in RCP 2.6 and RCP 24.5 scenarios, IPCC AR5).²² First, the gap between potential and realized emissions reductions is likely to be wide (see above). Second, there is also political risk in relying on non-state and sub-national climate actions in the pre-2020 period.

The post-Paris Action Agenda remains overly dependent on the political whims of governments and political leaders. High-level leadership changes within the UN system, in particular a new Executive Secretary of the UNFCCC and a new Secretary General of the United Nations will impact on efforts to engage non-state action. A greater reliance on non-state and sub-national climate actions also requires a high level of political commitment to a more comprehensive facilitative framework that not only solicits promises and commitments, but also encourages real mitigation and adaptation contributions.

There is little doubt that Paris has seen the emergence of the most comprehensive framework for climate action yet. The Paris COP decision has expanded technical examination processes that include non-state and sub-national stakeholders; it has also reaffirmed the NAZCA platform which gives visibility to over 11,000 climate actions; and it institutionalized a longer-term Action Agenda by the appointment of high-level champions for climate action. Nevertheless, this framework is not comprehensive enough. Functionally, it is far too narrowly focused on actions with a ‘high mitigation potential’, while adaptation actions go relatively under-appreciated. In participatory terms, the action agenda does little to address the relative under-representation of stakeholders based in the global South. Therefore, the post-Paris Action Agenda should combine a broader focus on climate impacts with broad engagement with actors in the global South.

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Contextualizing and Linking Climate Commitments

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The Paris Climate Conference was remarkable on several fronts. In addition to the agreement’s movement towards a new, ‘bottom-up’ style of goal-setting, the conference embraced action from cities, regions, companies, investors, and civil society organizations at an unprecedented scale. On 4 December 2015, over 400 mayors, representing more than 650 million people, spoke out in support of climate action at the Summit for Local Leaders.¹ Nearly 5,000 companies, hailing from more than 88 countries, and representing over \$38 trillion USD in revenue, have pledged to mitigate their emissions, support adaptation efforts, or finance climate action.² As these efforts continue to grow, efforts to understand and quantify their contributions to climate adaptation, mitigation, and finance are increasingly vital.

Data and analysis will play a central role in ensuring the successful implementation of climate action from sub-national (i.e., state and region) and non-state (i.e., business, investor, and civil society organization) actors. These commitments could help fill the gap between the mitigation the world needs to prevent the most devastating impacts of global warming, and the actions countries have pledged. As part of the Paris Climate Conference, countries submitted post-2020 climate action plans, or Intended Nationally Determined Contributions (INDCs) to the United Nations Framework Convention on Climate Change (UNFCCC). While they represent an increase in global ambition, these plans still leave a 12 gigaton gap – slightly more than China’s 2012 emissions³ – between the action that has been pledged, and the action scientists deem necessary to keep the world on a safe warming trajectory.⁴

Climate action from cities, regions, the private sector and civil society could help countries meet their existing targets, and help fill in this mitigation gap. However, sub-national and non-state commitments

Data and analysis will play a central role in ensuring the successful implementation of climate action from sub-national and non-state actors. These commitments could help fill the gap between the mitigation the world needs to prevent the most devastating impacts of global warming, and the actions countries have pledged

are only now beginning to be closely analyzed, and the level of funding, planning and resources dedicated to ensuring their implementation varies widely.⁵ Measuring their progress will be vital to ensuring an accurate and realistic picture of their ability to contribute to national and global climate goals.

EFFORTS TO UNDERSTAND THE SUB-NATIONAL AND NON-STATE CLIMATE ACTIONS CAN BE EXPLORED FROM THREE ANGLES

- The global mobilization of sub-national and non-state actors, and the common themes, trends and aggregate impact of their commitments.
- The degree of horizontal integration, or alignment between peer networks of cities, states, companies, investors and civil society organizations.
- The level of vertical integration, or alignment between local, regional, and national climate action frameworks.

More accurately understanding non-state and sub-national climate action from all of these angles is crucial to ensuring the successful implementation and growth of this promising array of pledges and commitments.

ASSESSING THE SCOPE AND IMPACT OF SUB-NATIONAL AND NON-STATE ACTORS

The scope of sub-national and non-state climate action can be assessed in terms of both the profile of its participating actors, and the content of their mitigation, adaptation, or finance commitments. A growing body of recent research has characterized and quantified the emissions impact of commitments from different repositories of sub-national and non-state climate actions.⁶ The Non-State Actor Zone for Climate Action (or NAZCA platform) represents the largest current collection of these commitments, synthesizing over 11,000 commitments to climate action contributed by seven different data providers. Launched at COP20 in December 2014, the platform highlights the extent of climate action occurring voluntarily, outside of national governments.

The participation captured by the NAZCA platform tells an encouraging story. A recent analysis of the platform’s contents found

that NAZCA includes cities and regions representing 17 per cent of the global population, along with nearly two-thirds (61 per cent) of the 500 companies with the world’s largest market capitalizations.^{7,8} Sixty-one per cent of the companies listed on NAZCA are members of the world’s largest public companies,⁹ representing approximately \$19.2 trillion USD in revenue. The platform also includes 15 of the 20 banks with the world’s largest market capitalization.¹⁰

While this overall level of engagement tells a positive story about the broad scope of climate action and the growing leadership of key cities, companies, and organizations, some gaps remain. In terms of its representation of climate action specific to India, NAZCA includes 29 climate commitments from 14 Indian cities and regions, focused on renewable energy, energy efficiency, and resilience. Globally, renewable energy and energy efficiency also emerge as the most common themes in city and regional climate action. Together, these cities and regions represent approximately 28 million people, or just over 2 per cent of India’s population of 1.2 billion. Approximately 18 per cent of the Indian companies ranked among the world’s largest public companies (10 of the 54 Indian companies on the Forbes 2000) are currently included on NAZCA, representing over \$500 million USD in annual revenue. While significant, the activity currently captured by NAZCA falls far short of capturing the full scope of climate action currently underway in India, mirroring data gaps across the broader landscape of non-state and sub-national action.

Efforts to collect and understand sub-national and non-state climate action currently focus on mitigation activities taking place in the Global North. They offer a less complete picture of commitments targeting adaptation and resilience, and fail to capture the full scale of climate action in developing and emerging economies. In part, this reflects the challenge of capturing climate action that is often categorized under another label. Efforts to install a bus rapid transit system, for instance, might be classified as development activities, rather than as mitigation strategies, reflecting the priorities of the governments implementing this work. Governments may also lack the funding or capacity to implement or monitor climate actions. Finding better ways to account for the synergy between sustainable development and climate action will help identify successful strategies and support the broader adoption of these activities.

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HORIZONTAL INTEGRATION: CHALLENGES AND OPPORTUNITIES

Even when a climate commitment is captured completely by the platform, research to contextualize it is key to understanding its ability to generate meaningful greenhouse gas reductions. For instance, though NAZCA includes 15 of the world’s 20 largest banks, these institutions’ commitments target the footprints of their operations, rather than the more significant emissions embedded in their investment decisions.¹¹ Emissions reduction targets from companies and investors range from a low of 0.3 per cent, pledged by a utilities company, to the Danish Lego Group’s commitment to cut hundred per cent of its operational emissions through renewable energy procurement.¹² Across sectors, average mitigation reduction targets span goals of 31.7 per cent to 14.4 per cent.¹³

Horizontal integration, or the coordination between peer networks of climate action, plays a pivotal role in contextualizing and clarifying sub-national and non-state climate action. At the moment, data providers and climate actors apply different approaches to framing their commitments. Reporting requirements also vary widely, and comparing or aggregating the data from such heterogeneous systems is difficult. The sheer number of climate action networks and types of commitments risk overwhelming would-be climate action participants and the public. Working towards the harmonization of commitment frameworks between different networks would enable a clearer assessment of the impact of different types of commitments. A more cohesive framework for climate action would make the landscape of climate action more legible, making it easier to identify leaders and laggards within and across key high emitting sectors.

VERTICAL INTEGRATION: CHALLENGES AND OPPORTUNITIES

Vertical integration describes the coordination between different scales of government, to leverage their respective strengths in order to produce more effective climate action.¹⁴ Aligning city, state, regional, and national climate action planning and reporting helps create synergies to help drive climate action forward. For instance, cities and regions are well positioned to pilot new policies, which national governments can then scale up to meet their mitigation targets. A Yale University report investigated the mitigation potential of scaling nine innovative local or regional climate actions to the national level,

finding that this process could cut 2020 carbon emission by 1.09 gigatons, narrowing the emissions gap by approximately 10 per cent.¹⁵

As countries prepare to ‘ratchet up’ the ambition of their climate action plans in the five year cycles articulated in the Paris Climate Agreement, sub-national and non-state climate action could help identify new strategies for achieving national goals. Sub-national governments also benefit from these partnerships, as national governments can help build capacity to implement and develop mitigation and adaptation strategies by supplying financial, technical, and other forms of support. Merging sub-national governments’ ability to pilot new solutions with the resources and scale of impact national governments could help drive climate action forward at both levels.

Understanding the degree of alignment between different levels of climate action is also crucial to avoiding double counting (i.e., accounting for a city’s emission reductions twice, once on behalf of the city and once on behalf of a country’s climate target). Establishing an accurate sense of sub-national and non-state contributions to national goals helps avoid overestimating the impact of these contributions. While sub-national and non-state activities can help spur and complement climate action, national leadership will still be essential to meeting global goals.

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Building Trust and Legitimacy

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A paradigm shift occurred in global climate negotiations because of a failure to introduce a successor to the Kyoto Protocol based on a top-down negotiated model of targets. The Paris Agreement has been built on the back of ‘bottom-up’ pledges by parties, in a loose, non-punitive structure with top-down rules of the game around review and collective effort. The relative lack of enforcement written into the Paris Agreement has led to accusations of it being weak and inadequate. Nevertheless, obituaries of multilateral efforts to prevent dangerous levels of climate change should not be written just yet.

Paris represents a step away from the rigidity and inflexibility that underpinned and then ultimately undermined the Kyoto Protocol

A growing body of literature post the failure of the Copenhagen talks in 2009 called for climate governance to adopt more ‘polycentric’ approaches,¹ emphasizing the need for an ambitious ‘direction of travel’ over long-term targets and penalties for non-compliance,² which were hard to agree on. In the Paris Agreement, the global community is searching for middle ground – a fine balance between bottom-up voluntary contributions and top-down rules. A ‘clumsy’ approach to climate policy may just work; institutional experts have pointed out the problems with applying ‘simple’, ‘elegant’ solutions to complex problems such as climate change. Paris represents a step away from the rigidity and inflexibility that underpinned and then ultimately undermined the Kyoto Protocol.

However, in the absence of the incentives and sanctions regime that characterized Kyoto, the Paris Agreement will have to rely on new avenues to foster cooperation to avoid inadequacy of action, breakdowns in implementation and compliance, and lack of progress on climate goals. Trust and legitimacy, in particular amongst Parties to the Agreement and beyond, will be key to glue the many ‘moving parts’ of the agreement together.

TRUST AND LEGITIMACY IN INTERNATIONAL COOPERATION

In a sense, the limited legally binding power in the Paris Agreement is what makes its legitimacy all the more important. Legitimacy may

refer to the ‘normative belief by an actor that a rule or institution ought to be obeyed.’³ In the absence of legal enforcement options, Paris is moving beyond the scope of legitimacy solely as a legal concept, instead framing it in the context of norms, approaches and expectations. It has been noted that lack of a legal basis is no deal breaker for other notions of legitimacy in the eyes of actors.⁴ Julia Black, for instance, makes the case for the international Forest Stewardship Council, an institution which is seen as legitimate by a number of actors in related industries such as chemical and forestry industries and yet lacks any legal basis for that perceived legitimacy.⁵ In polycentric, loose and hybrid regimes norms, values and expectations have to be reinforced for securing perceptions of legitimacy,⁶ which in turn may influence behaviour and decisions about interests. The success of the Paris Agreement will be contingent on favourable perceptions of legitimacy amongst its parties for effective implementation, compliance and consensus.

Similarly, enhanced trust amongst Parties to the Agreement and beyond will be central to the peer review system proposed in the agreement as well as prevention of free-rider problems. While no single definition for trust exists in the context of international cooperation,⁷ we can nevertheless outline the key principles that shape trust amongst actors. Scholars agree that trust refers to an inclination that may permit placing the fate of one’s interests in the hands of others.⁸ This can certainly be applicable to the climate change arena where countries are basing their well-being and, in some cases, survival on action that may or may not be taken by others. Trust amongst poorer countries and their wealthier counterparts will need to be built to ensure that both sets of actors continue to step up ambition of climate action and prevent a breakdown in implementation.

Trust and legitimacy are, therefore, different but interlinked. Increasing levels of trust will be necessary for perceptions of legitimacy – a coalition of the willing cannot work if members do not trust each other and yet, for them to trust each other and their objectives, the legitimacy of agreed goals and actions should be evident. The next section deals with both issues and how they are central to many aspects of the Paris regime.

CLIMATE REGIME AND ISSUES OF TRUST

The global climate is a common pool resource (CPR). A limited carbon budget remains to prevent dangerous levels of climate change

and global warming. Governance of the commons usually depend on approaches that stress the ‘prisoner’s dilemma’. However, Daniel Cole points out that climate negotiations may instead be better understood as an ‘assurance game’, a concept advanced by Amartya Sen.⁹ Assurance game outcomes depend on perceptions of cooperation and the levels of mutual trust built over time amongst actors. Polycentric approaches are more likely to build that trust Cole talks about, instead of massive, centralized conferences involving thousands of participants in closely followed meetings.¹⁰ Keohane has further argued that informal, bilateral discussions, along with cooperation on a wide variety of issues, may be more conducive to building trust than the traditional relationships characterized by large, intransigent bureaucracies that strictly control discourse and discussion with external actors.¹¹

Bilateral and minilateral clubs of action will make it more likely for common ground to be found between countries that may eventually push forward larger multilateral agendas

Compromise, as has been noted by Barrett, is also not uncomplicated when done in full public spotlight.¹² Countries are more likely to engage one another constructively if they are not under the pressures of large multilateral conversations conducted in full public glare. The Paris Agreement may be a step in the right direction in that regard. The lead up to Paris, for instance, saw many bilateral agreements being signed between countries such as the US-China and US-Brazil, accords which helped achieve breakthroughs in larger multilateral conversations. Bilateral and minilateral clubs of action will make it more likely for common ground to be found between countries that may eventually push forward larger multilateral agendas.

The Paris Agreement’s structure allows for building of trust over time. For instance, commitments made by member states are not legally binding. However, meeting commitments can lead to building of mutual trust. For instance, Ostrom et al. have previously argued that trust can be earned by mutual commitments that are credible.¹³ The collective peer review mechanism also helps promote that agenda – parties can review the contributions and progress of others. Trust built over time through peer confirmation of action can lead to increased ambition of action over time. As Cole notes, verifiability is central to trust.¹⁴ Further, action at lower governance levels which are marked by successful cooperation can be useful for fostering trust that then translates to all levels of decision making.¹⁵

Lastly, international relations can be seen to have developed increasing levels of trust when leaders of states devolve power and agency to

interact with others to lower units of governance in the belief that their counterparts are trustworthy.¹⁶ In the context of climate change, increasing trust among parties to the Paris Agreement may mean greater agency transferred to non-state and sub-national actors as well as transnational efforts.

LEGITIMACY GOING FORWARD

One interesting new development in the Paris Agreement was the reference to climate justice and human rights in the preamble text. Climate change is quite simply intertwined with almost every aspect of modern economics and politics as well as with issues around social justice. The complexities of climate change, both physically and otherwise, may mean that climate governance needs to link itself to other regimes – issues of trade, human rights, justice or banking and finance. Strong interdependencies of impact, causality and action mean that the UNFCCC may just be an overspecialized regime for dealing with the problem of climate change.¹⁷ An attempt to address climate change is also an undertaking to transform the very fundamentals of our food systems, machinery, electricity grids, transportation and economic models, not to mention the patterns of consumption and production that have sustained us thus far. Previous action on climate change risked being viewed as illegitimate when it failed to account for these interconnections and dependencies that significantly affect the success of climate action.

For instance, the US vs. India case at the World Trade Organization (WTO) over solar panels illustrates the contradictions at play between different regimes. India's national solar policy has domestic content requirements (DCR), which dictate that all investors have to source 30 per cent of input locally. The US challenged the DCR at the WTO, arguing that it violated India's commitment to global trade rules and discriminated against American firms, who had witnessed a 90 per cent fall in solar exports to India from 2011 when India imposed the clause. India tried to justify the clause, arguing that it was necessary to ensure compliance with its commitments under the United Nations Framework Convention on Climate Change (UNFCCC). This was, however, rejected by the WTO who ruled that international environmental obligations imposed no binding commitments on nations and thus were not 'laws or regulations' that had to be complied with. Naturally, this presents a massive problem. Energy transitions should also fuel growth, create jobs and build an

ecosystem of innovation. If trade regimes reject the legitimacy of climate agreements, ambitious action is unlikely to be forthcoming.

The new polycentric order emerging in climate governance will benefit from extending the actors and stakeholders under the climate umbrella and recognizing the opportunities and co-benefits associated with tackling concurrent global challenges

Calls for linking regimes of governance, therefore, go hand in hand with both polycentricity and issues of legitimacy. Climate action will increasingly be viewed as legitimate when it starts to account for the core causes and implications of our economic systems – organization of labour, international trade, issues around human rights and climate induced migration as well as norms around banking which affect investments into clean energy. Institutional linkages boost legitimacy and external and internal perceptions of legitimacy are in turn critical to survival of regimes and institutions.¹⁸ Absurd contradictions and hindrances such as the WTO case also need to be prevented. The new polycentric order emerging in climate governance will benefit from extending the actors and stakeholders under the climate umbrella and recognizing the opportunities and co-benefits associated with tackling concurrent global challenges.

Another positive development from Paris is that it is the first climate treaty to not only recognize the importance of non-state actors but also conceptualize a framework for their action. Non state actors in the past had limited sway over international climate governance as transnational governance approaches were eschewed in favour of centralized multilateralism between member states. However, the Paris Agreement explicitly welcomes action by non-state and sub-national actors and the COP Decision Text creates a framework for their action. All future COPs, for instance, will have a 'high level action day' where companies and cities report on their efforts, a process directly linked under the formal review of the UNFCCC. Furthermore, all actors, not just countries, are encouraged to voluntarily pledge commitments on climate action.¹⁹ Transnational alliances such as the Mission Innovation Fund also promise to deliver meaningful contributions to climate action.

Just as time has allowed us to judge Kyoto's failures in a harsher light, so must time and space be allowed to the Paris Agreement before adjectives of success or failure become synonymous with the outcomes of COP 21. Paris has several unfinished agendas on its plate, and dealing with those may be key to the durability and effectiveness of the regime. Differentiation, technology, finance, loss and damage and review mechanisms all remain unresolved. For breakthroughs in these areas, it is important that notions of legitimacy and trust amongst

actors is credible. As this article has outlined, polycentric approaches to dealing with climate change may just create conditions that allow for that to happen, and therefore deliver equitable outcomes that protect both our planet and the most vulnerable in our societies.

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3: Ian Hurd, ‘Legitimacy and Authority in International Politics’, *International Organization* 53(02), 1999, pp. 379-408.

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7: Aaron M. Hoffman, ‘A Conceptualization of Trust in International Relations’, *European Journal of International Relations* 8(3), 2002, pp. 375-401.

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12: Scott Barrett, *Environment and Statecraft: The Strategy of Environmental Treaty-making*. Oxford University Press, Oxford, 2003.

13: Elinor Ostrom, Roy Gardner and James Walker, *Rules, Games, and Common-Pool Resources*. University of Michigan Press, 1994.

14: Daniel Cole, op. cit., 2013, fn. 9.

15: Ibid.

16: Aaron Hoffman, op. cit., 2002, fn. 7.

17: Stephen Humphreys, ‘Climate Change: too Complex for a Special Regime’, *Journal of Energy and Natural Resources Law*, 2015, pp. 1-6.

18: Joel A.C. Baum and Christine Oliver, ‘Institutional Linkages and Organizational Mortality’, *Administrative Science Quarterly*, 1991, pp. 187-218.

19: Paris Agreement, Decision 122.

About ORF

Set up in 1990, ORF seeks to lead and aid policy thinking towards building a strong and prosperous India in a fair and equitable world. It helps discover and inform India's choices, and carries Indian voices and ideas to forums shaping global debates. ORF provides non-partisan, independent analyses and inputs on matters of security, strategy, economy, development, energy, resources and global governance to diverse decision-makers (governments, business communities, academia, civil society). ORF's mandate is to conduct in-depth research, provide inclusive platforms and invest in tomorrow's thought leaders today.

The Observer Research Foundation's ongoing research on climate change policy focuses on the implementation of the Paris Agreement, India's commitments in its Nationally Determined Contribution to the UNFCCC, and the evolving architecture of climate governance. New knowledge will be central to the future of climate action and ORF's existing inroads into the policy making community as India's leading multidisciplinary think tank, will ensure that insights generated by the organisation continue to inform policy debates.

Notes

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The Paris Agreement has charted a new course
in a two-decade old effort to respond to global climate change.

The Agreement balances bottom-up national contributions with top-down rules for review, transparency and collective consideration of overall adequacy. This book brings together a collection of essays which analyse how the themes of adaptation and resilience; energy transitions and technology innovation; climate finance and; the role of non-state actors in the evolving climate regime will develop under the new framework. Addressing a complex challenge like climate change will require action at multiple levels by a diverse set of actors; building trust and legitimacy in the eyes of actors, across a range of goals, will be central to the successful implementation of the Paris Agreement.