

COP21 at Paris: What to expect

The issues, the actors, and the road
ahead on climate change

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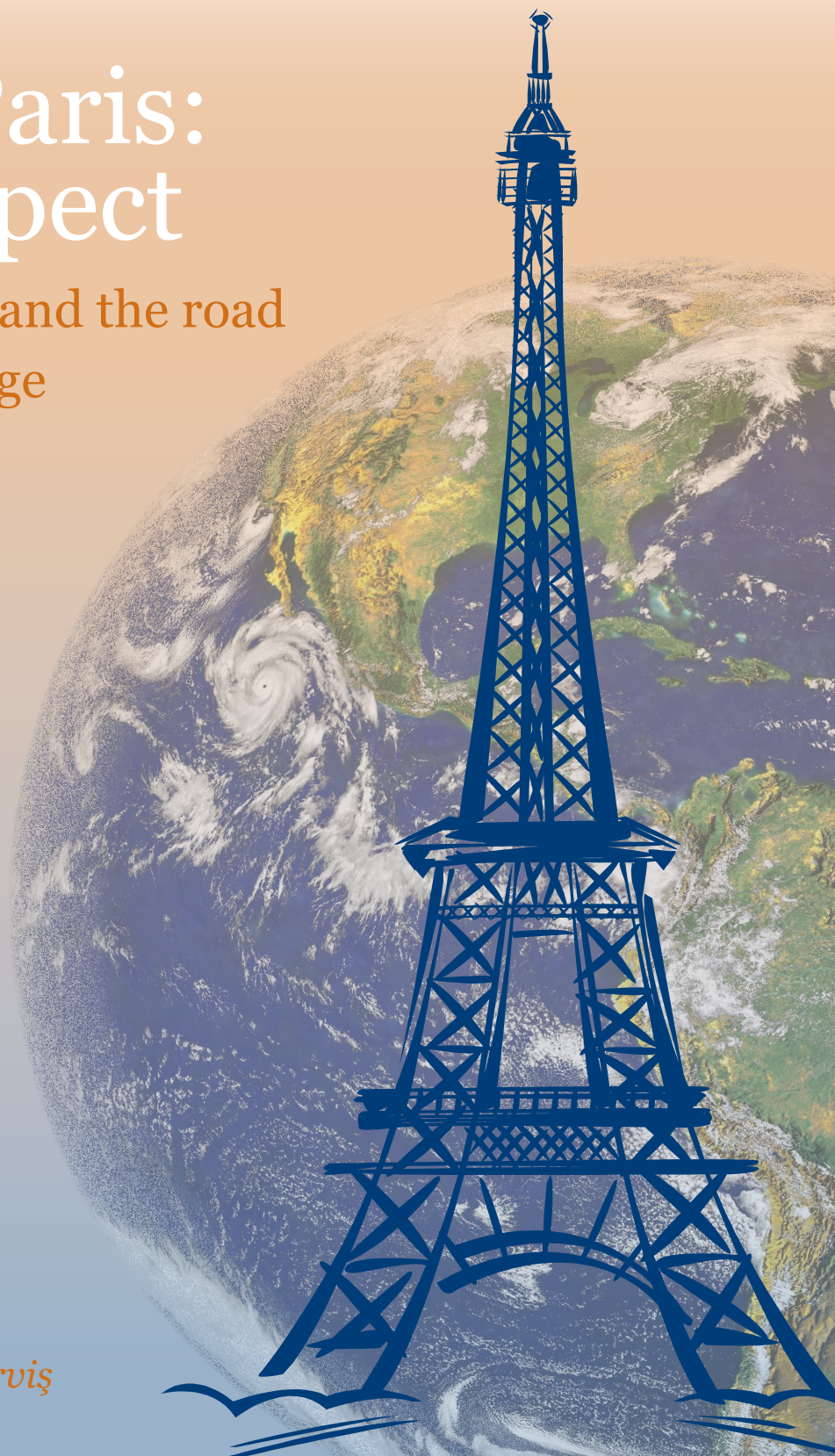
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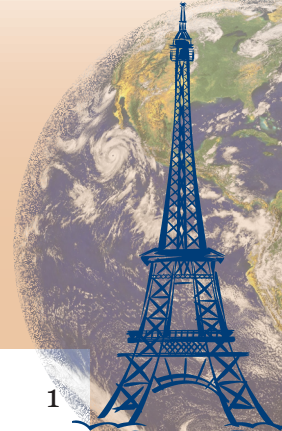
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Foreword



In 2005, the World Bank assembled a group of well-known economists, including Nobel Prize winner Michael Spence and the father of growth theory Robert Solow, and frontline policymakers, such as Governor Zhou Xiaochuan of the central bank of China, to discuss the future of economic growth. I was part of the group. Not one of us mentioned climate issues or climate change during our first meeting.

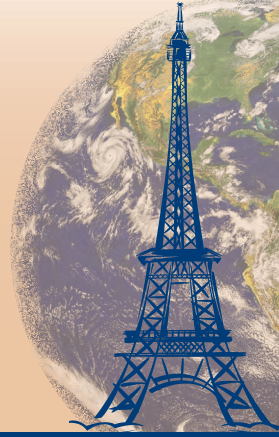
The world has come a long way over the last decade. It is no longer possible to discuss long-term growth without at the same time discussing climate. Growth economists and environmentalists have finally converged; they no longer live in different intellectual worlds.

That does not at all mean that there is solid agreement on what should be done. Opinion leaders take different positions on many ethical, analytical, factual, and implementation-related issues. That is normal. Both climate science and economic science give us probabilities, not certainties, and ethical and distributional convictions may differ. There are trade-offs among welfare objectives as well as among advantages and disadvantages of particular policies. Some believe firmly that carbon pricing is far more efficient than quantitative controls. Others believe that carbon quotas are needed if only for distributional reasons, as the income transfers that could in theory generate distributional objectives although are unlikely to happen in practice. Nobody, however, can ignore the issues or the debate.

This collection of short briefs is a modest effort from Brookings in the crucial few weeks before the COP21 in Paris. One of the most important messages is that there is great worldwide mobilization and that many countries as well as businesses and cities are putting forward their own plans to protect the planet from dangerous amounts of climate change. These plans do not yet add up to a sufficient worldwide effort, even if they were fully implemented. Never before has there been more concrete and broad-based ambition, however. I want to take the opportunity, therefore, to thank and congratulate the millions of citizens around the globe who helped bring policymakers to this point. Paris is an important milestone, but the effort will have to continue in the spirit of how we got to Paris.

Kemal Derviş

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The ‘Paris Moment’

A Transformative End to the Year



Timmons Roberts

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2015 has been an unexpectedly positive year for climate change efforts, as the long-floundering U.N. process has finally begun to deliver some of what is needed. Make no mistake: We are still on track to overshoot the limits of our planet's ability to absorb the fossil pollutants we are pumping into it. But substantial progress is being made, and denying that would be counterproductive to the important cooperation that has occurred.

For all the complaining about the cumbersome United Nations Framework Convention on Climate Change (UNFCCC) process, real progress is being made in two important areas this year: national pledges and a new agreement text. Four somewhat unexpected tailwinds have also helped this year: increased perceptibility of climate change, the pope's campaign to raise the issue, the plunge in renewable costs, and collaboration between China and the United States. Still, some key issues loom that will have to be dealt with carefully in Paris and earnestly followed up on in 2016.

A year of positive, but still inadequate, pledges

This year's meeting in Paris will reverse the earlier model of climate action. Rather than produce a collective decision that divides up the "atmospheric space" available for emissions, the COP21 will build on the 2009 and 2010 negotiations in Copenhagen and Cancun. Nations will bring emissions pledges based on their individual circumstances, and the world will review those pledges for fairness and ambition, and see if they are adequate to the task.

The pledges are called Intended Nationally Determined Contributions (INDCs), a phrase emphasizing that countries are protecting their sovereignty against binding commitments. That is problematic when considering enforceability and overall adequacy of ambition, but the approach has allowed a far wider range of countries come in with national pledges. The approach began in Copenhagen with five people: Obama and the leaders of the BASIC group (Brazil, South Africa, India, and China). Since these five nations produced this system, they now need to show that it can actually work.



Here is what's new: This year's INDCs are supposed to be universal. In the previous system (under the 1997 Kyoto Protocol), only the rich countries were responsible for emissions reductions. Now all countries are expected to act, and the “firewall” between richer and poorer countries is being taken down. The world has changed dramatically since 1992, when that first annex of “rich” countries was defined; the highly vulnerable countries in the Alliance of Small Island States (AOSIS) and the 48 least-developed countries (LDCs) broke from the big emerging economies to say that they had to act on emissions as well. They were especially concerned with China, whose massive growth since 2000 has led to it now being responsible for over 30 percent of total global emissions.

Despite uncertainty, the pledges have rolled in. By the October deadline, 128 INDCs were on the U.N. website, representing about 150 countries and about 88 percent of all global emissions. Lagging are the major oil producers and some of the poorest nations in the world. The INDCs are revealing. They show what each country believes its abilities are regarding climate change, how they see the issue, and where we might see movement in the future.

Preparing INDCs has also forced ministries across national governments to begin planning national emissions targets and pathways to meet them. Ideally, these plans involved public input, but this is less clear and will need widespread improvement.

Mexico pledged to reduce emissions 25 percent at a joint announcement with the U.S. in March, but also offered a 40 percent reduction if certain conditions were met: a global agreement addressing “international carbon price, carbon border adjustments, technical cooperation, access to low-cost financial resources and technology transfer.” Mexico is a growing manufacturing country without the huge hydroelectric potential some of its neighbors have. Its pledge is significant and shows how countries can act alongside others in a mix of unconditional and conditional pledges that factor in historical carbon debt.

Indonesia, often considered a country resistant to emissions reduction obligations, released an INDC promising to shift away from fossil fuels, especially coal. “Despite the challenges common to other developing countries, Indonesia is committed to transition its current development pathway toward climate resilience in a phased approach. The pathway towards de-carbonization of the economy will be fully integrated into Indonesia’s National Medium-Term Development Plan for the period 2019-2024.”

The INDC from the Gambia was particularly impressive. Despite being one of the least-developed countries, the Gambia pledged impressive absolute and unconditional emissions reductions. Planned methods for this included reforestation, and the installation of renewables for lighting, communication, health facilities, and pumps. Gambian Environment Minister Pa Ousman Jarju declared that “By presenting this INDC, the Gambia would like to provide a moral voice for all responsible and capable countries to undertake actions that are proportionate for their responsibilities and capabilities not only for themselves, but for the whole global community.”



The success of the INDC process was in part is due to leadership by the United States and China in making joint announcements in November 2014 and September 2015 that their INDCs would be ambitious, though in different ways. They were “differentiated” pledges: The U.S. pledged 26-28 percent emissions reductions overall by 2025, the maximum the Obama administration could squeeze out of existing policies without requiring congressional action. China pledged to peak its emissions by 2030 and increase its share of renewable energy by then. Premier Xi’s September announcement in Washington that China was creating a national cap-and-trade program by 2017 provided more momentum to the process.

The Obama administration was impressive and successful in coordinating with other major emitters to create meaningful action this year. The U.S.-China announcements come from the countries responsible for nearly half of global emissions, and apparently the two nations understand that they can have more impact together. The U.S.-Mexico joint announcement showed the U.S. was willing to work with other nations also, and administration officials reached out to numerous countries to encourage more ambition. While its own pledge is far weaker than needed, for once in the climate talks the U.S. was a leader and a cheerleader.


What do the INDCs add up to? Not enough reductions, unfortunately. We are still headed to 3.5 degrees Celsius, 3.1 C, or 2.7 C of warming above pre-industrial levels...

What do the INDCs add up to? Not enough reductions, unfortunately. We are still headed to 3.5 degrees Celsius, 3.1 C, or 2.7 C of warming above pre-industrial levels, depending upon the assumptions one uses in projections. But the INDCs do represent big reductions in likely warming. One estimate set puts the reduction with INDCs from 3.9 degrees to 3.1 degrees. To remove nearly 1 degree of likely warming in one year is remarkable progress.

It is striking that most INDCs affirm the “principles of the Convention” that countries should all act according to their “common but differentiated responsibilities and respective capabilities”—meaning, the rich countries should go first in reducing their emissions. However, each INDC did this in a rather pragmatic way, realizing that all countries needed to act. Most lacked explicit text on the “climate debt” of the so-called global North.

The painful emergence of the Paris Agreement

As the last day of climate change negotiations before the COP21 in Paris wound down in Bonn in October, Mexico’s negotiator expressed alarm at the strongest hurricane ever recorded—Patricia—moving toward his coast. It is time to “get this deal done” and put aside differences, he said. Low-lying areas and small island states face inundation if oceans rise as quickly as predicted. Their negotiators want a strong deal, but mostly they fear no deal at all.



Two weeks before the October Bonn session, the co-chairs of the main UNFCCC negotiating section introduced a boldly streamlined draft text. Working to sharply pare down a confusing 85 pages, the co-chairs' initial text was a slim eight pages in main document—and only 20 in all. The options were clearly laid out, but too much text had been cleared out; the G-77 objected, suddenly reunited over the perceived slight from the co-chairs' text and from the lack of a clear roadmap on how the wealthy countries were planning to reach the targeted \$100 billion in climate finance by 2020.

The co-chairs relented, allowing “surgical insertions” of parties' greatest priority items. The negotiating text ballooned from 20 pages to 55, including 1,255 bracketed parts that indicated disputed phrases. “No one actually compromised. Come December, all the hard decisions will still be on the table.”

Is this time different, or is the U.N. up to its old shenanigans? This time has to be different, since Paris is a crucial deadline to seal a deal. In 2011, it was agreed in Durban that an agreement would be struck in 2015 to guide humanity away from excessive carbon emissions, which endanger the stability of our climate system. Many other actors are beginning to move on climate change, but those actions may not prove sufficient or be sustained. Only states can collectively agree on enforceable commitments. There is no other available forum for a global agreement: We need the U.N. to succeed on climate change.


Promises made in Paris will come into effect in 2020, and the targets that have been set by countries this year are for emissions reductions by 2025 or 2030. This has led some people to say that the agreement will have no effect until then. This is incorrect. Countries are already having to begin preparing to meet the pledges they have made. That is where the difficult work begins, in redirecting national economies away from high-carbon pathways of development.

Four new tailwinds for success in Paris

Four tailwinds make 2015 different from the disappointing 2009 Copenhagen meeting.

First, people are perceiving climate change happening around them; they don't have to just believe the scientists. Fall is coming later and is warmer, springs come earlier. Summers are hotter and last longer. The extreme weather of hurricanes, drought, heat waves, floods, and wildfires are affecting millions of people around the world, including Americans. Sea levels are steadily rising. In the United States, new polls say that skepticism about climate change is plunging, including among Republicans.

In the United States, at least, a second tailwind is the economy, which was a massive headwind in the face of negotiations in 2009. Relatedly, President Obama used the economic crisis to direct some of the billions in stimulus funds to efficiency and lower-carbon approaches, when some nations were unwilling or unable to put major funding into climate change.



Third, and also relatedly, is the wind itself. Solar and wind has become nearly as cheap as coal—at “[grid parity](#)” in some places. A few countries have begun to remove fossil fuel subsidies, and the U.S. is leading in shifting away from coal. Americans and people in other countries are seeing that the necessary shift from fossil fuels and toward efficiency and new renewables creates millions of jobs and economic growth. This also has the effect of creating a class of people in whose interest it is to drive down global emissions, since it creates new business and job opportunities.

A fourth tailwind boosting action in 2015 is the pope’s message and campaign to make climate change and climate justice a moral and deeply religious issue. He sought in numerous speeches and his impressive encyclical [Laudato Si](#) to connect issues of human development, poverty, and justice to the need to listen to the science of climate change and to act ambitiously.

The Paris Moment

We cannot expect the COP21 negotiations in Paris to resolve everything, and it won’t. Key parts of the Paris agreement are still not coming together, such as how the pledge of \$100 billion in climate finance will be met and fairly apportioned. There is also major work to be done on the transparency of climate finance flows. There is demand, too, by the poorest and most vulnerable nations to secure a mechanism to address the “loss and damage” they are suffering, which cannot be adapted to.

Switching economic pathways away from coal and other fossil fuels can create a huge stimulus program to bring nations out of their “great slowdown.” Capitalism can be very low carbon, but a major pulse of climate finance will be required to get this going.

Finally, work will be needed immediately after Paris to continue to ratchet up efforts to keep the world under 2 C or even 1.5 C of warming. Far bolder plans will be needed to decarbonize the wealthiest economies by 2030, which would be fair, given those countries’ wealth and responsibility for creating the problem of climate change. The rest of the world will need to get to net zero carbon soon thereafter, probably by 2040 for emerging economies and 2050 for the least-developed ones. Together, decarbonization will require a major wartime-like mobilization. Switching economic pathways away from coal and other fossil fuels can create a huge stimulus program to bring nations out of their “great slowdown.” Capitalism can be very low carbon, but a major pulse of climate finance will be required to get this going. Governments have done this kind of thing before, and they can do it again.

First, though, they need to craft a workable and ambitious agreement in Paris—one that can secure the gains of 2015 and foster the greater ones we need ahead.

The Road from Paris



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Although there is work still to be done, the Paris COP21 promises to be an important turning point in the fight against climate change and in linking that fight to the broader sustainable development agenda. After years of sharp divisions and stalled actions there is a widely shared recognition of the dangers of delay and greater collective resolve to act at the national and global levels. All major world leaders have signaled their strong support for an ambitious Paris agreement. And it is remarkable that so many of them are coming together on concrete programs of action, including the leaders of the two largest emitting countries—China and the United States.

What can we reasonably expect from Paris?

The foundation of the Paris agreement are the Intended Nationally Determined Contributions (INDCs) that governments agreed to submit last year in Lima, Peru, at the COP20, setting out actions against climate change beyond 2020, including pledges to limit and reduce their annual emissions of greenhouse gases. The Paris COP21 will also seek to agree on a new multilateral instrument that will apply to all countries, set out a transparent and verifiable monitoring mechanism, and provide adequate means of implementation in terms of finance, technology, and capacity building. In particular, the UNFCCC will seek to reach a firm agreement on pre-2020 and long-term finance, notably on the \$100 billion per year by 2020 promised by the rich countries at the COP14 and COP16 in Copenhagen, Denmark, and Cancun, Mexico, to help poorer countries make the transition to low-carbon development and growth, and to become more resilient to those impacts of climate change.

More than 162 countries have now submitted their INDCs. Collectively, they suggest that annual global emissions of greenhouse gases in 2030 are likely to be 55 billion to 60 billion tons of carbon-dioxide-equivalent, compared with about 50 billion tons today. Given that some countries have made pledges in terms of reductions from business-as-usual scenarios and others in reduction of carbon emissions with respect to output, there is some uncertainty on the aggregate outcomes. The 55 billion to 60 billion tons are an improvement on the 68 billion tons that an analysis by the United Nations Environment Program suggests would result in 2030 from a “business as usual” global annual emis-

sions pathway. But these figures are far higher than an emissions pathway that would be consistent with having a 50–66 percent chance of avoiding global warming of more than 2 C. Such a pathway would require annual emissions of about 40 billion tons in 2030, with very sharp further reductions beyond 2030.

As current pledges to limit and cut annual emissions are insufficient, strong efforts are needed to ramp up actions using the commitments at Paris as a foundation. The Paris summit must not be regarded as a one-off opportunity to fix targets. Instead, it must be the first step of many, based on regular reviews of how close we are to meeting the goal of avoiding dangerous global warming. More broadly, the Paris summit is a chance to build an understanding not only of the threats and risks from unmanaged climate change, but also the opportunities that lay in the low-carbon transition—including the path it paves to fight global poverty.

Climate action and sustainable development goals

The ramping up of ambitions must therefore be seen against the broader context of the Sustainable Development Goals that were adopted by world leaders in September and the Addis Ababa Action Agenda from the Third U.N. Financing for Development Conference in July to support their implementation. The sustainable development agenda that has emerged from the intensive deliberations over the past year makes it clear that economic growth, development, and climate responsibility are closely intertwined. As the report on [“Better Growth, Better Climate”](#) by the Global Commission on the Economy and Climate pointed out in September 2014, sustainable growth and development support climate action. Portraying economic growth and development as being in conflict with climate action is a misunderstanding of the opportunities presented by the low-carbon transition and creates an “artificial horse race” between them. On the contrary, fighting climate change can promote development and tackle global poverty, and vice versa. We need, therefore, to raise ambitions on both development and climate action, and do so in a mutually reinforcing manner.

Sustainable infrastructure for better development and better climate

[A crucial link between economic growth, development, and climate action is the quantity and quality of sustainable infrastructure.](#) Investments in infrastructure can boost demand, raise productivity, and stimulate long-term growth. Massive investments will be required over the next two decades in energy systems, cities, transport corridors, and water and waste management. The magnitude of global investment needed in infrastructure over the next 15 years will be about \$90 trillion—more than the value of the current stock of infrastructure assets—or \$6 trillion per year on average, mostly in the developing and emerging economies. We need the infrastructure to be both of better quality and on a greater scale. A lack of infrastructure remains one of the most pervasive impediments against growth and sustainable development—and consequently in tackling poverty. Good infrastructure unshackles and removes constraints on economic growth and social inclusion. It fosters improvements in educa-

tion and health. Bad infrastructure kills people and puts pressure on land and natural resources. It creates unsustainable economic burdens for the future.

The way in which the massive investments in infrastructure are undertaken will have an enduring impact on climate resilience. The existing stock of infrastructure and its use accounts for more than 60 percent of the world's greenhouse gas (GHG) emissions. The scale of the new investments that must now be made offer a unique opportunity for accelerating the shift to a low-carbon transition, but, if not done well, also pose a great danger of locking in capital, technology, and patterns of economic activity that will last for decades and become progressively unsustainable. An understanding of the importance of and commitment to accelerating the shift towards sustainable infrastructure must therefore be a central goal of the discussions in Paris and a guide for concerted action going forward.

Tackling the impediments to sustainable infrastructure

There are four main areas where a virtuous cycle of action can produce the quantity and quality of infrastructure that can meet the collective ambitions on both development and climate. By addressing policy gaps and drastically reducing the cost of capital we can turn investment opportunities into investment demand.

First, Paris can set the course for bolder actions on the elimination of fossil fuel subsidies and the wider and faster adoption of carbon pricing that together fundamentally distort investment choices and have such a deleterious impact on health and well-being. Subsidies for oil, coal, and natural gas, including the lack of carbon- and pollution-pricing and other instruments to internalize externalities, are pervasive. A recent study published by the International Monetary Fund estimated that subsidies for fossil fuels will amount to about \$5 trillion in 2015, with the failure to price in the costs of local air pollution and climate change making up three-quarters of the total. When the impacts of air pollution and climate change are taken into account, the real cost of using coal is not the approximate \$50 per ton that is charged to acquire it, but well over \$200 per ton. These are not abstract externalities, but deaths and illnesses now and in the future from air pollution and climate change. As Warwick J. McKibbin, Adele C. Morris, and Peter J. Wilcoxon argue in their brief “Pricing Carbon” (see page 14), Paris represents an important opportunity to tackle the greenhouse gas externality through the adoption of carbon pricing, including carbon taxes or cap-and-trade schemes, as well as regulation. The G-20 nations that account for more than 80 percent of the distortionary subsidies need to take the lead in eliminating fossil fuel subsidies and putting a price on carbon.

Second, there is a need to strengthen and modify public investment frameworks since the public sector is responsible for shaping investment decisions and setting the regulatory environment for the building and operation of infrastructure. Given the time horizon, interconnectedness, and externalities (positive and negative) of infrastructure investments, governments need to be able to develop and set out strategic investment plans for sustainable infrastructure not only at the level of the central



government but also increasingly at the local and city levels. These plans need to assess the long-term sustainability and footprint of investment decisions and the opportunities for a transition to a low-carbon future so that they can guide both public and private investments. Future INDC commitments can be anchored by these plans. Governments need to have the capacity to translate these plans into cost-effective and sustainable investment programs and projects using methods such as public investment efficiency assessments, use of sustainability criteria and shadow pricing, and sustainable procurement. Governments also need to be able to formulate and implement public-private partnerships that provide value for money and adhere to sustainability goals. The scale of financing needs will require stronger mobilization of domestic public finance—including both tax and user charges—as well as better use of government balance sheets and contingent liabilities. To encourage private investments, governments need to be able to provide a sound investment climate, reduce government-induced policy risks, and deploy appropriate risk mitigation instruments. There are examples of good practice across all these areas but few examples where a country has integrated all these elements into a sound and forward-looking investment strategy and capability. There is a strong case for concerted actions by each individual country, supported by international cooperation, on knowledge and capacity building led by the multilateral institutions.

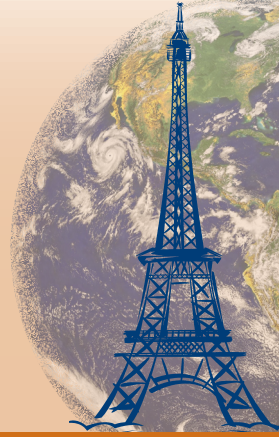
Third, there is a need to revamp the financing framework for sustainable infrastructure, especially for developing and emerging economies. Despite ample global savings and record-low long-term interest rates, infrastructure investments in developing and emerging economies are often unable to attract long-term financing, and the costs of financing are relatively high—in some cases prohibitively so. Lowering the costs of financing can make a big difference to the economic viability of the investment, to the affordability of the service provided especially for the poor, and for making sustainable investments more viable. For example, investments in renewable energy are primarily in the form of capital equipment, and the cost of financing will be a major factor in determining the financial viability of the investment. The biggest constraints on financing are at the early stages of the project when there are risks of cost overruns, and greater uncertainties and risks regarding future revenue streams. Costs of financing also reflect the financial standing of the sovereign or sub-sovereign and the project entity. Together, these constraints and risks can make both equity and debt finance relatively costly for many emerging and developing economies. Moreover, banks that are best placed to provide financing in the construction phase are facing constraints because of new regulatory requirements. There is also a huge potential for tapping the large pool of savings intermediated by institutional investors. Of the more than \$90 trillion managed by institutional investors worldwide, less than 2 percent is invested in infrastructure assets. Addressing institutional and regulatory constraints faced by institutional investors and taking steps to develop infrastructure as an asset class such as through standardization of contracts and aggregation can help unlock the potential contribution of this large pool of savings. The capacities of both multilateral and national development banks must be substantially expanded to provide and catalyze finance. These institutions have a comparative advantage in supporting sound project preparation and implementation, mitigating risks and crowding in the private sector, and

creating viable financing packages, including by tapping global capital markets at competitive rates. Climate finance (including the \$100 billion per year that has been committed by rich countries) and official development assistance can act as levers and complements to the trillions that need to be invested each year in infrastructure in developing- and emerging-economy countries over the next two decades. Lowering the costs of financing can make investments both more climate-friendly and pro-poor.

Fourth, there is need to build a stronger platform for cooperation and actions on technology and on building more efficient and sustainable infrastructure. There is tremendous scope to accelerate and benefit from innovation. While the price of solar energy has fallen very rapidly over the last few years, the IEA conservatively projects that it could fall by a further 20–40 percent over the next 5 years. Innovations such as Tesla’s Powerwall to advance the storage of photovoltaic energy, the Cerro Dominador concentrated solar plant in the Atacama Desert that can generate continuous electricity even when the sun is not shining, the Google driverless car, further progress in LED lighting and energy efficiency both in generation and use all hold the promise of a major transformation. Correcting market failures such as the availability of information, developing better networks such as smart grids, and capturing other co-benefits such as clean air and healthy eco-systems will help speed up the process of innovation. There have also been tremendous strides in improving management practices and reducing costs in the building of infrastructure not only in advanced economies but also in countries like China and Turkey that can benefit all countries. Better public support, public-private initiatives, and enhanced international cooperation can help accelerate these and other innovations.

A virtuous cycle of action

Actions in these four areas can unlock a virtuous cycle of action to transition to a low-carbon economy that can meet the aspirations on both development and elimination of poverty as well as manage the risks of climate change. Paris can also give impetus to complementary areas of action such as protecting the world’s forests and restoring degraded land and taking concrete steps to protect the most vulnerable countries and populations from the impact of climate change. By creating a better understanding, the Paris summit should provide the confidence to underpin the ramping up of ambition. It must lead us to recognize that action on the Sustainable Development Goals and action on climate change are part of the same story—and mutually supportive. And it must lead us to bring together and intensify the efforts of all actors: of governments, from ministries of finance to ministries of environments to local governments and mayors; of international institutions, including the multilateral development banks, the United Nations, and the G-20; of the private sector that will have to play an increasingly important and responsible role; and of other non-state actors from civil society, to foundations to the global citizenry at large. We must build on the collective recognition of the threat that climate change poses for humanity and the need for urgent action to address the growing threat. We can then rise to the two defining challenges of our time—overcoming poverty and creating a better life for all, and managing the enormous risks posed by climate change.



The Issues

Pricing Carbon

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In 2013, the UNFCCC set a path toward a new agreement for the post-2020 period. This year, negotiations have aimed to solidify that agreement and will culminate in Paris at the COP21 December meetings. So far, climate talks have tackled national emissions targets, global temperature targets, technology transfer, assistance to poor countries for adaptation and mitigation (a.k.a. “finance”), clean energy cooperation, forest preservation, compensation for countries affected economically by mitigation measures, and many other topics. In comparison to those issues, there has been little discussion of the most cost-effective means to reduce emissions: reducing fossil fuel subsidies and pricing greenhouse gas emissions.

Christine Lagarde, managing director of the IMF, and World Bank Group President Jim Yong Kim recently announced the formation of a “carbon pricing panel” consisting of an alliance of national, state, and local policymakers. This is an important move and should promote carbon pricing as a focus of the post-COP21 negotiations.

The prospect of a new long-term agreement and new venues for climate talks could open an important opportunity for carbon pricing consultations (CPC). Although carbon pricing should eventually be included directly in the UNFCCC process, a smaller-scale carbon pricing dialogue could be undertaken now outside UNFCCC. The goal would be to gather the economic ministries of the largest emitters to discuss the use of carbon pricing to reduce emissions cost-effectively, manage impacts on trade and competitiveness, and foster mutual confidence in the economic ambition of climate commitments.

A carbon price, arising from a cap-and-trade market, a carbon tax, or a “hybrid” policy creates broad, efficient incentives to reduce greenhouse gas emissions. Done well, these policies can gradually shift consumer demand, production methods, new investment, and technology development toward less emissions-intensive goods and services without unduly burdening poor households. A carbon tax or auctioned cap-and-trade allowances can also raise revenue to fund government outlays or reduce other, more distortionary, taxes. Longer-term carbon financial instruments can be used to create political constituencies to sustain the policy through political cycles. Finally, a carbon price can promote

economic growth by replacing less efficient tax, regulatory, and spending policies. For these reasons, economists nearly universally agree that a price on carbon is a highly desirable, even essential, step for reducing the risk of climatic disruption.

But why should carbon pricing be integrated into international consultations? There are six reasons:

First, outside of finance issues, few countries have included their finance and trade ministries in climate negotiations. The absence of the expertise of those most familiar with the economic outcomes of the commitments under discussion gives rise to calls for infeasible targets and timetables, and vague policy commitments. Framing discussions around the explicit or implied carbon price of proposed commitments would make their economic ambition more transparent and comparable, and foster mutual trust in the ambition of commitments.

Second, many countries have recently reduced fossil fuel subsidies or adopted carbon pricing policies, so there is increasing experience to analyze and discuss.

Third, some countries that have not yet adopted carbon prices, such as the United States, have considerable expertise in efficient administration of excise taxes and could provide valuable advice.

Fourth, talks to date have focused on emissions targets (both collectively and by country), divorcing the dialogue from the economic realities of achieving those commitments. It is much easier to reach consensus on the goal of containing global mean temperature increases to 2 degrees Celsius than to grapple with what it would take to achieve the goal and who should do it. Until negotiators directly address the levels of economic effort involved and how to minimize the cost, collective commitments to stabilization targets will remain both theoretical and infeasible, however compelling they may be scientifically.

Fifth, disparate carbon prices across different countries can shift emissions, production, investment, and trade patterns, and mutual understanding of these cross-border effects is of interest to major trading partners and the multi-national companies with which they operate.

Finally, the vehement opposition to the European Union's efforts to price carbon in aviation fuels suggests that unilateral approaches to carbon pricing can undermine cooperation and climate policy progress.

Toward carbon pricing consultations

It is important that the international community establish a much-needed place to discuss, laud, and understand efforts by countries to price greenhouse gases. The process we have in mind would complement talks under UNFCCC by focusing on administrative, economic, and trade-related aspects of policies that price carbon and other greenhouse gases. For example, discussions could include an exchange of countries' views, experience, and methodologies related to a number of important issues, which are detailed in Box 1.

Box 1. Important discussion topics for potential carbon pricing consultations

- how to report on carbon pricing policies in a way that allows comparisons across countries;
- how cap-and-trade and/or carbon tax systems work administratively;
- administration of excise taxes on carbon content of fuels, including ways to identify taxable entities, establish a tax base (emissions and sources), set reporting requirements for firms, track revenue, minimize administrative costs, and ensure compliance;
- ways to harmonize tax administration across countries to make it simpler for multi-national firms to comply and to prevent tax gaps and double-taxation;
- the potential economic benefits to developing countries of carbon pricing as a low carbon growth strategy and efficient revenue instrument;
- the environmental and economic effects of alternative carbon tax levels and tax trajectories;
- mechanisms for managing allowance markets and registries, and distributing allowances or allowance auction proceeds;
- the design and implementation of border carbon adjustments;
- approaches to taxing carbon in bunker fuels;
- the feasibility of including non-CO₂ gases, agriculture- and forest-related emissions, and process-related CO₂ emissions in a carbon pricing system;
- the role of sub-national approaches;
- the macroeconomic and trade impacts of carbon pricing;
- the distributional effects of a price on carbon, such as effects on poor households or disproportional regional effects, and how to address them;
- approaches to pricing carbon in imported and exported fossil fuels and closely related products;
- experience with the environmental performance of carbon pricing;
- other fiscal reforms made in conjunction with carbon pricing (such as budget deficit reductions or reductions in other taxes), and their impacts;
- approaches to fiscal cushioning (such as reducing other energy taxes while establishing a price on carbon);
- the relationship between carbon pricing and other policies, such as energy efficiency standards and renewable energy subsidies; and
- efficient implementation of carbon pricing in large, complex, federalist systems.

The goal of these international discussions would be to build mutual comfort and confidence in carbon pricing, share views, prevent disputes and trade disruptions, identify and replicate successful approaches, learn from one another's mistakes, build institutional capacity, and generally promote transparency and mutual cooperation on serious, economically efficient measures to mitigate emissions.

Carbon pricing consultations could also consider how to guide resources and activities of existing bilateral consultations, multi-lateral development banks, the Green Climate Fund, other institutions, and private sector entities toward efficient fossil fuel pricing. It may be possible to embed the discussions within the Major Economies Forum, the G-20, the U.N. Climate Summit follow-up meetings, or other existing forums.

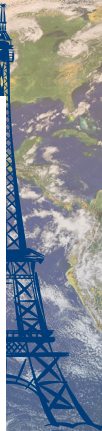
The defining characteristic of these talks, distinguishing them from existing clean energy and climate consultations, would be that the finance and trade ministries (not the environment and energy ministries) would take the lead. These are the ministries charged with international economic relationships, tax administration, and general macroeconomic stewardship. Of course, to the extent that environment or energy ministries oversee domestic carbon tax or cap-and-trade systems, they would play a role. However, the focus of the discussions would be on the technical, administrative, and economic cooperation aspects of carbon pricing policies, with minimal attention to whether any particular country's approach would achieve any particular emissions target or other goal. To that end, the typical level of engagement within the CPC may best lie below that of the ministerial level, and it should include those with technical expertise.

One advantage of this approach is that it would separate the work of the CPC (i.e., the pragmatic details of carbon pricing) from divisive issues such as who bears what responsibility for collective mitigation goals, who should compensate whom for what, and whose approach is more ambitious or moral. These debates, however important, have contributed little to global emissions mitigation. Subsequent or parallel efforts can review the adequacy of the price signals and seek to increase and/or harmonize them; the CPC should center on relatively low-profile but critically important administrative and technical policy exchanges by interested countries. An underlying premise is that major emitters have a mutual interest in effective policy machinery to price carbon.

One useful outcome of the CPC dialogue could be to shape negotiations under the UNFCCC so that countries can supplement their emissions targets with commitments in the form of carbon pricing, allowing compliance by either achieving their emissions targets or demonstrating significant effort through imposing agreed-upon price signals. Price-based commitments would reduce the risk of inadvertent stringency or laxity, help achieve and document compliance, and allow parties to reach an agreement to compare their efforts transparently.

The United States can contribute to a CPC process

Consultations around mutual efforts to price carbon are clearly in the interests of countries that have already adopted or are seriously considering adopting such policies. But the inclusion of the United States in such talks is also critical owing to the unique position of the United States as a global economic leader, the largest historical emitter, and the major trading partner for many other potential participants.



Even though the United States does not currently price carbon at the federal level, it could contribute to and benefit from carbon pricing consultations. First, an increasing number of U.S. trading partners are adopting carbon pricing, and it is in U.S. interests to follow these developments closely. Carbon taxes have been adopted in Sweden, Finland, Ireland, Norway, and South Africa, and the European Union has a major CO₂ emissions trading system. China has been experimenting with cap-and-trade measures at the local and regional level and has announced an economy-wide carbon trading system to be implemented by 2017. Canada also has several sub-national carbon pricing systems and is likely to move further on carbon pricing under the new government of Prime Minister Justin Trudeau.

To be sure, the magnitude of the price signals and the scope of emissions to which they apply vary significantly across and within countries. But gradually more global fossil fuel consumption is falling under some sort of carbon pricing policy. The United States should welcome a venue in which it can learn from other countries' efforts, discuss potential economic spillovers and effects on international commerce, and foster discussions that could prevent international incidents such as the dispute over the EU aviation tax.

Second, the United States has considerable tax administration and cap-and-trade expertise that could highlight potentially successful approaches. Although this experience is not climate-related, the United States deploys an efficient and highly compliant excise tax system, and it could assist developing country efforts to build their own capacity to tax carbon. For example, the United States missed an opportunity to applaud and support India's adoption of a small tax on coal. The United States could offer to share its experience in administering its similar coal excise tax, which it collects under the Black Lung Benefits Act of 1977. The United States also has long experience with cap-and-trade systems for criteria air pollutants, much of which is transferable to greenhouse gas emissions trading, and a number of states have or will develop some form of carbon pricing policy, including as a way to comply with new Clean Air Act regulations on power plants.

Finally, one key impediment to carbon pricing in the United States is the concern that if the United States prices carbon and other major emitters do not, then U.S. climate efforts will harm its economy to little overall environmental benefit. An international venue to discuss carbon pricing policies among major emitters could fruitfully evolve into a place to address such concerns and coordinate, if not fully harmonize, carbon price signals.

Shifting focus of the UNFCCC negotiations toward pricing carbon in Paris would be a welcome development. However, realistically, the case arises for a parallel process of carbon price consultations to foster the practical implementation of carbon pricing across major emitters.

The Role of Public Policy in Sustainable Infrastructure



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Infrastructure development, economic growth, and climate protection are intimately related. Infrastructure is a key driver of economic growth and development. In the current context of increasing concerns about prospects for global growth, infrastructure investment can play an especially important role, by boosting global aggregate demand today and laying stronger foundations for future growth. Infrastructure is also a key element of the climate change agenda. Done badly, it is a major part of the problem; infrastructure accounts for more than half of global carbon emissions. Done right, it is a major part of the solution, vital to both climate change mitigation and adaptation.

The historic opportunity of COP21

COP21 presents a historic opportunity to address this interconnected agenda. There is good momentum to build on as world leaders gather in Paris next month. The Sustainable Development Goals recently adopted by the international community incorporate climate sustainability integrally into the global development agenda. Infrastructure cuts across this agenda. The world has been underinvesting in infrastructure, but the need to substantially scale up investment in infrastructure—energy systems, cities, transport, water—and the related policy agenda are now receiving attention at major international fora, such as the G-20. There is also encouraging progress on both country-level commitments and global collective actions to combat climate change, helped by growing recognition that climate action is not only urgent but also not at odds with economic growth. Technological breakthroughs are opening new avenues for action and lowering costs. The challenge—and opportunity—in Paris is to advance on this mutually supportive agenda in a tangible and integrated manner.

Globally, investment needed in sustainable infrastructure over the next 15 years (2015-2030) is of the order of \$90 trillion. On an annual basis, investment in infrastructure will need to double from \$2.5 trillion to \$3 trillion currently to around \$6 trillion to fill existing gaps and meet growth in demand. The bulk of the increase in investment will need to take place in the developing world, particularly in middle-income economies, reflecting their growth needs, rapid urbanization, and sizable infrastructure backlogs. The largest part of the incremental investment needs, more than one-half, relates to

energy. The scale of the challenge is brought home by the fact that the assessed infrastructure investment needs over the next 15 years are almost twice as large as the value of the entire current infrastructure stock (estimated at about \$50 trillion). But this also presents a major opportunity to remake our physical environment in a way that better supports future economic growth and at the same time protects the climate.

How these infrastructure investments are made will be crucial. Infrastructure assets are long-lasting. There is a great danger of locking in high-carbon, polluting, and wasteful pathways if we build the new infrastructure in much of the same way as in the past, such as continuing to rely heavily on fossil fuels in meeting the future energy demand. But if the new investments are done well and factor in climate risks, they can not only bridge the infrastructure gap to underpin development but do so in a way that helps manage climate change. This means investing more, and better, in renewable energy, cleaner transport, more efficient and resilient water systems, and smarter cities to meet future needs. Sustainable infrastructure mitigates carbon emissions as well as builds resilience for adaptation to climate change.

The confluence of the need for a major boost in infrastructure investment and the urgency of climate action makes this a critical moment. The Paris meeting can seize the moment by reaching an ambitious global compact on climate change that provides a strong impetus for sustainable infrastructure as the model for the future.

The public policy agenda

Public policy has a central role to play in the agenda to promote sustainable development and manage climate change through provision of better infrastructure. This is in part because the public sector itself is a major investor in infrastructure. But, more importantly, public policy provides signals and sets the regulatory and institutional frameworks that influence the actions of all actors, including private investors and consumers. Given the magnitude of the infrastructure challenge, private in-

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vestment and finance will need to play a much greater role than before. Success in mobilizing private investment at scale and channeling it to sustainable infrastructure will depend crucially on incentives and an enabling environment provided by public policy—at national and international levels.

Clarity and credibility of public policy are especially important for infrastructure investments, given the longevity of these investments, associated externalities, and the inevitable and intimate links to government policies.

There are four key roles that public policy will need to play, all of which will be influenced greatly by the outcome of the Paris meeting.

1. Articulating national strategies for sustainable infrastructure. Countries need to articulate clear and comprehensive strategies for sustainable infrastructure and embed them in overall strategies for sustainable growth and development. Addressing one group of projects at a time will not do. There is a need for a broader articulation of strategies on the direction of change and plans to address policy and market failures and other constraints to sustainable infrastructure development. Only such integrated strategic frameworks will ensure coherence across individual public policy actions and provide the clarity and confidence to the private sector to do its part.

Sustainable infrastructure measures, to varying degrees, form part of the intended nationally determined contributions countries have announced in the lead-up to the Paris meeting. The commitments countries are making are more ambitious than their past commitments, but it is also clear that they collectively will fall short of the goal to limit global warming to no more than 2 degrees Celsius above pre-industrial levels. So a key test of the Paris agreement will be the extent to which it maps out a follow-up process to verify progress and raise the collective level of ambition. It will also be important for countries to reflect and integrate their Intended Nationally Determined Contributions (INDCs) in overall national development strategies.

The G-20 group of major economies can provide leadership on this effort. As part of G-20 processes, all G-20 countries have prepared and peer-reviewed national growth and investment strategies over the past two years. Climate sustainability so far has received limited attention in these strategies. COP21 and the INDC process provide an opportunity to better integrate the sustainability agenda into these national investment and growth strategies.

2. Addressing fundamental price distortions. Correcting pervasive distortions in the pricing of natural resources and infrastructure services is key to improving the public policy environment for sustainable infrastructure. The biggest distortions are fossil fuel subsidies and the lack of carbon pricing, which both strongly bias infrastructure investment toward high-carbon sources of energy and undermine efficiency in energy use. The magnitude of the distortions is huge. The IMF recently estimated that the total cost of fossil fuel subsidies, including the failure to price in pollution and climate change, is of the order of \$5.3 trillion a year, or 6.5 percent of world GDP. While some countries are taking steps to remove or reduce fossil fuel subsidies, taking advantage of the prevailing low petroleum prices, COP21 can give the phase-out of these subsidies a strong push.



The most important action public policy can take to shift the incentive structure toward lower-carbon investment and development trajectories is to put a price on carbon emissions. Currently, less than 15 percent of global carbon emissions are covered by a price, using a mix of instruments such as carbon taxes, fees, and cap-and-trade schemes. The World Bank and the OECD have developed a set of principles that can help guide future carbon pricing schemes. The FASTER principles are based on fairness, alignment of policies and objectives, stability and predictability, transparency, efficiency and cost-effectiveness, and reliability and environmental integrity. The Paris meeting can help develop stronger consensus, support, and coordination across countries on instituting carbon pricing.

Removing fossil fuel subsidies and taxing carbon emissions will not only help correct serious incentive distortions, they can also help mobilize additional fiscal resources that can be channeled to supporting sustainable infrastructure development—and better targeted social safety nets to cushion the impact of the price reform on the poor. Carbon taxes can be designed to be revenue-neutral as well. Depending upon their circumstances and objectives, countries could opt to raise more revenue from carbon taxes and less from other taxes that can negatively impact economic performance, such as taxes on capital and labor. So pricing carbon can be about smarter, more efficient tax systems, and not necessarily higher taxes.

3. Improving the enabling environment. Boosting sustainable infrastructure investment at scale and with the quality needed will require improvements in the policy and institutional framework governing investment in two important respects. First, there is a need to strengthen investment planning and project preparation and management capacities to build and implement a stronger pipeline of sound, investment-worthy projects. Such capacity improvements are particularly important in developing countries, but the need is not limited to them. A recent IMF study of G-20 economies estimated that those with the lowest efficiency of public infrastructure investment obtain only half of the growth “bang” from their investment “buck” compared to the most efficient. A key new challenge is to develop capacity and practice to incorporate climate risks and sustainability criteria systematically into all investment plans and projects, as well as develop and implement sustainable procurement processes. Implementation of the decisions made in Paris will require a step-up in national efforts and multilateral support to strengthen these capacities.

Second, countries need to improve the regulatory and institutional frameworks for private participation in infrastructure provision. Risks and transaction costs related to public policy are a major impediments to private investment in infrastructure. Such risks and costs keep the price of capital for infrastructure investment high, even when long-term interest rates are close to zero. Together with reform of infrastructure and carbon pricing, more transparent frameworks for project prioritization/selection and public-private partnership negotiations, consistent treatment of climate risk, and actions to improve the ease of doing business would facilitate greater private engagement in the effort to scale up sustainable infrastructure.

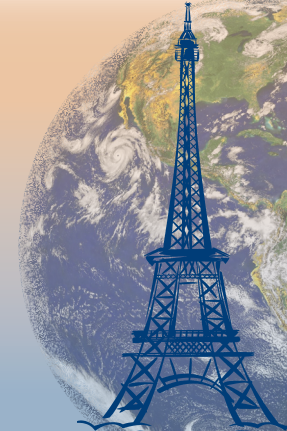
4. **Mobilizing financing.** Doubling annual investment in infrastructure will present a major financing challenge. It will require strong, concerted mobilization of both public and private finance, especially through new and innovative mechanisms. Given the constraints on public sector budgets, one half or more of the additional investment will need to come from the private sector. But public policy, through national and global collective actions, will have to play a key role in making this happen.

Doubling annual investment in infrastructure will present a major financing challenge. It will require strong, concerted mobilization of both public and private finance, especially through new and innovative mechanisms.

Stronger mobilization of domestic public finance should span both tax and infrastructure pricing policies. As subnational and local entities will take on increasing roles as investors in sustainable infrastructure, such as renewable energy, mechanisms for decentralized financing will become more important. The contribution of official external financing, bilateral and multilateral, will need to rise too, but these resources will have to be used increasingly in ways to leverage larger pools of private finance. Financing commitments made in Paris can have a much larger impact if used in such catalytic ways. Low-carbon, sustainable investments in many cases can entail higher upfront costs with large downstream benefits. Concessional financing could be used to attract private capital by financing sustainability premiums—to help meet the higher upfront capital costs of making traditional infrastructure projects sustainable. Multilateral development banks can help leverage more private capital for sustainable infrastructure through greater use of instruments such as guarantees, syndications, and financing platforms.

Further efforts will be needed to improve financial intermediation to channel more long-term finance to infrastructure. A major potential source is institutional investors that hold large pools of savings that can be better tapped with supportive regulation and improved supply of bankable, sustainable projects. Innovations in financial instruments specifically aimed at promoting sustainability, such as green bonds, can be encouraged. It is important to ensure that post-crisis reform of banking regulation does not have the unintended effect of limiting long-term financing for infrastructure. Work underway to review how the financial sector can take account of climate-related issues can help channel more funding to sustainable investments. Finally, developing countries need to step up efforts to develop their domestic capital markets. They will be pivotal to financing investment, especially in middle-income countries.

Aid and Climate Finance



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In 2009, the Copenhagen Accord was the first effort to spell out the financial implications of a global effort to reduce carbon emissions. Although not a legally binding document, delegates from all countries attending the COP15 meeting agreed to “take note” of the accord. Developed countries made three financial commitments as a result:

1. to provide \$30 billion for mitigation and adaptation financing for the period 2010-2012;
2. to mobilize \$100 billion per year by 2020; and
3. to make such funding new and additional, and sourced from public and private, bilateral and multilateral institutions.

Currently, there is no guidance on what should be expected from donors in terms of climate finance until the 2020 reference provided by the Copenhagen Accord (as opposed to the 2010-2012 goal). Now, at the COP21 in Paris, the major issues are likely to be how to define and set targets for “new and additional” climate finance; how to monitor the flows of official bilateral and multilateral finance—as well as “catalyzed” or leveraged private finance—in order to achieve the \$100 billion in promised new financing; and how to allocate across countries the portion of climate finance associated with official development assistance, taking into account both climate mitigation priorities and development objectives (especially poverty reduction).

‘New and additional’

From 2010 to 2012, developed countries reported about \$35 billion in fast start finance (FSF) to the UNFCCC. Such climate finance is self-reported by countries to the UNFCCC with a varied level of detail. But compared with official development assistance (ODA), climate finance has less information on specific projects (some data is reported only at the aggregate level), on disbursements (as opposed to commitments), on instrumentality and financing terms, and on recipients and implementing channels. A significant fraction of climate finance is in the form of ODA (an estimated 80 percent for the fast start financing period of 2010-2012), and is identified by “Rio markers,” where donors indicate whether a project has a “principal” or “significant” objective of climate mitigation, or adaptation or both.



Among major donors, only Germany has identified a new revenue source for climate support (from carbon markets) and has specified 2009 as the benchmark year from which to count additionality.

There was an increase in climate-related ODA in the 2010-2012 period, with the amounts recorded by most large donors more than doubling compared to 2009. However, the aggregate volume of aid, including finance-related, did not rise; in constant prices, ODA commitments from DAC donors peaked in 2009 and modestly declined until 2012. Further, a very large increase in climate-related aid was recorded for 2010, the first year of the fast start financing commitment. Since then, flows have stabilized or declined. Taken together, these data suggest that little of the FSF was actually *additional*. Rather, it appears to be associated with a labeling of many development projects as climate-related. In fact, climate-related aid accounted for 20 percent of total country programmable aid in 2013, compared to 9 percent in 2009.

At the project level, it is clear that climate finance is being mainstreamed into development cooperation, with individual examples clearly showing the extensive overlap between development and climate objectives. Japan has tagged its support of metro systems in Delhi, Kolkata, Bangalore, and Ho Chi Minh City as also having climate mitigation purposes. USAID has included dam projects in Pakistan that provide irrigation and power generation services. The United Kingdom counts its support to the Consultative Group for International Agricultural Research to address climate-related threats to food security as part of its climate finance.

Donors have, however, agreed to establish a Green Climate Fund (GCF), with an initial commitment of \$10 billion. As a new mechanism for allocating climate finance, with a new governance structure and a clear balance between climate mitigation and climate adaptation financing, the GCF can be considered genuinely new. Donors have also supported the preparation of Nationally Appropriate Mitigation Action plans and many renewable energy projects. These, too, are clearly additional to what might have been expected as development programs in the absence of climate change.

Measuring climate finance

Although the bulk of FSF was provided by donors in the form of ODA, it is anticipated that this will not be the case for the stepped-up financing that has been promised for 2020 and thereafter. For middle-income countries in particular, there is considerable scope to expand the contribution of multilateral development banks and other official development financing institutions. These entities can both provide low-cost long-term debt financing, needed to make the renewables more cost-effective, for example, as well as risk mitigation, through guarantees and insurance, to leverage private finance.

The issue is that while there are longstanding statistical methodologies and definitions for reporting on ODA, no such methods have been developed for multilateral agencies, bilateral export credit agencies, or the co-financing by private firms of associated climate-related projects. Statistical issues include the need to avoid double-counting (especially when multiple agencies co-finance the same

project), the need to break out the proportion of multilateral finance attributable to developed countries, the definition of “mobilized” or associated private finance (is there a causal relationship involved in co-financing?), the choice between committed funds and disbursed funds, and even the definition of climate finance (for example, there is an ongoing debate as to whether high efficiency coal-fired power generation should be counted or not).

The difficulties involved in measurement are clearly highlighted by the UNFCCC Standing Committee on Finance that concluded that on average between \$40 billion to \$175 billion per year of climate finance was mobilized in the period 2010-2012, of which \$35 billion to \$50 billion was from public sources and \$5 billion to \$125 billion were from private sources. More recently, the OECD has estimated flows of \$52 billion in 2013 and \$62 billion in 2014, with the increase largely attributed to multilateral development bank-funded projects.

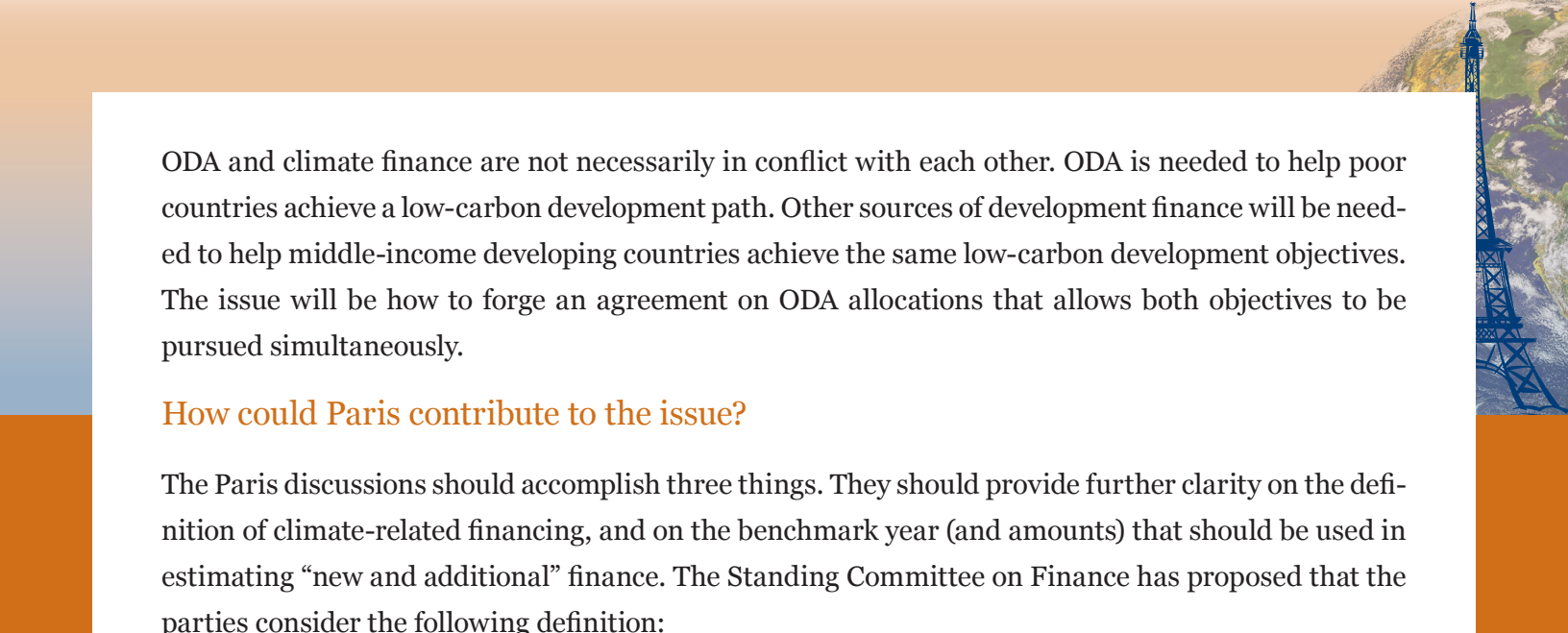
Flows from multilateral banks are set to increase. The World Bank Group, for example, has promised to increase its climate financing from \$10.3 billion today to \$16 billion by 2020. And it hopes to leverage an additional \$13 billion more from others in support of these projects. As such flows expand, the need for transparency, standardization, and accountability in reporting will grow.

The cross-country allocation of climate-related ODA and other finance

Most private finance for climate is currently oriented towards upper-middle-income countries. Multilateral bank climate-related financing is also geared towards middle-income countries. One issue that arises is therefore about the distribution of climate-finance among developing countries. The concern is that low-income countries may not receive the support they require. To the extent that low-income countries are also more vulnerable to climate change than others, they may also receive less than they deserve.

Currently, it appears that a significant fraction of climate-related ODA is a substitute for other development projects and programs. In multilateral development banks, for example, the formula for allocating aid across countries does not take vulnerability to climate change into account. For bilateral aid programs, there is a concern that a shift toward climate finance might also entail a shift toward allocating more aid to middle-income countries. In the absence of significantly higher aid volumes, this could even imply a reduction in ODA for some low-income countries.

This concern is underscored by the history of the allocation of FSF. None of the top 10 recipients of FSF are currently low-income countries. None are on the U.N. list of least-developed countries (LDCs). Only Kenya and South Africa are in sub-Saharan Africa. Yet countries in these categories are priorities for donors committed to poverty reduction. If the allocation of climate finance follows the allocation of FSF, and if the share of climate-finance in ODA continues to rise, then low-income, African and “LDC” countries could see a reduction in their ODA instead of the hoped-for increase as promised in the Addis Ababa Action Accord.



ODA and climate finance are not necessarily in conflict with each other. ODA is needed to help poor countries achieve a low-carbon development path. Other sources of development finance will be needed to help middle-income developing countries achieve the same low-carbon development objectives. The issue will be how to forge an agreement on ODA allocations that allows both objectives to be pursued simultaneously.

How could Paris contribute to the issue?


The Paris discussions should accomplish three things. They should provide further clarity on the definition of climate-related financing, and on the benchmark year (and amounts) that should be used in estimating “new and additional” finance. The Standing Committee on Finance has proposed that the parties consider the following definition:

Climate finance aims at reducing emissions, and enhancing sinks of greenhouse gases, and aims at reducing vulnerability of, and maintaining and increasing the resilience of, human and ecological systems to negative climate change impacts.

However, even this definition will need elaboration. For example, the dispute over high-efficiency coal plants referenced earlier could be interpreted to fit this definition (these do reduce emissions compared to current practices), but it could also be argued that such plants do not reduce emissions to levels consistent with what is necessary for only a 2 degree Celsius rise in temperatures. Thus, ongoing technical deliberations over definitions will be needed.

In addition, discussions in Paris should establish clear goals and targets for climate-related finance, starting from now, moving through the current 2020 benchmark, and forward to 2030 or beyond. Such targets will need to be monitored through agreed-upon mechanisms and methodologies. Currently, there are differences in approach among donors in moving from reporting to the OECD’s Development Assistance Committee using Rio markers at the project level, and reporting to the UN-FCCC. Multilateral banks have started to develop a harmonized system of reporting and are working with the International Development Finance Club to agree on measurement practices. The approach to measuring “mobilized” private flows also needs to be formalized and implemented. Ideally, there should be a common platform for aggregating all such flows from the myriad climate finance providers; where this platform should be located and who has the competence to organize it in the most effective way remains an open question.

Finally, the Paris discussions should establish principles for the allocation of various types of climate finance, particularly with regard to the use of aid-related climate finance in middle-income countries, and the share that should be provided to low-income or vulnerable countries. Partly, such principles could be based on the national needs and priorities that emerge out of developing countries’ own plans for low-carbon development pathways.



Developing countries will argue in Paris that climate finance should be largely based on additional ODA. Partly this is because ODA is an intergovernmental flow that is most easily monitored and verified, and partly this is because the high grant element of ODA would provide partial compensation for the climate-related damage that has been created through developed-country emissions. Developed countries, on the other hand, will be looking to the future, arguing that the most important objective will be to provide adequate, low-cost, long-term capital to make low-carbon investments financially attractive. Balancing these viewpoints will help determine how climate finance will be allocated in future.

What can we expect to see after Paris?

Following Paris, we can expect to see continued technical work on refining the measurement of climate-related finance. Debates will inevitably continue as to how to define “mobilization” of private capital. For example, if a country reforms its energy sector policy framework through the support of developed countries (or a multilateral institution), and this then “causes” additional private investment in the sector, should the investments count? Conversely, if a private investment was likely to happen anyway, but an official agency decides to offer a guarantee as a sweetener, should this be counted as additional finance being “mobilized”? While such debates may appear arcane, the definitions provide the incentive structure for how official agencies will behave, and therefore have real consequences.

We should, nevertheless, see considerable, rapid improvement in the transparency and accountability, by agency, of climate-related finance.

We can also expect to see continued debate over the mechanisms through which climate finance should be channeled. The preference of the developing countries is to use the newly established Green Climate Fund, partly because it promises to allocate financing equally to mitigation and adaptation, and partly because it could use countries’ own financing needs as the basis for disbursements. Developed countries may encourage greater use of the multilateral development banks with proven track records but that would need to scale up their ability to lead public-private partnerships in infrastructure projects.

In both cases, an upsurge in private investment in climate-related projects is expected. Given the relatively stable and long-term returns from infrastructure investments, and the low long-term real interest rates prevailing in capital markets in developed countries, there are significant financial incentives for private investors to participate in infrastructure projects in developing countries. If public money is added to the available blend of funds, and the right recipe of technical assistance, risk-mitigation, and dialogue platforms to build trust is found, there could be a tipping point of an exponential rise in project finance. If such a tipping point can be reached, Paris will have been a successful meeting for climate finance.

Financing Sustainable Infrastructure



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Climate change, development, and sustainable infrastructure

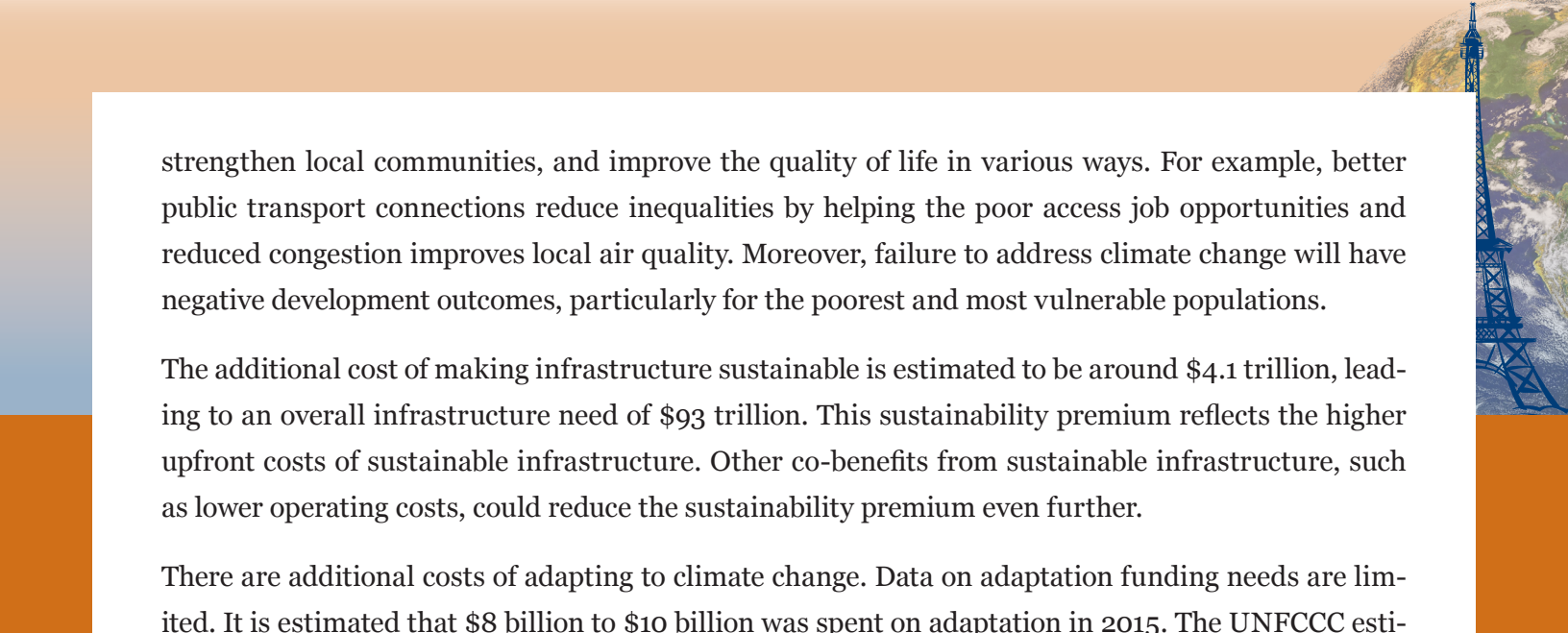
A key goal of the U.N. climate change negotiations is to agree on global mitigation actions that will limit global temperature increases to 2 degrees Celsius above pre-industrial levels. Achieving this climate goal will require a transition to a low-carbon economy. Climate finance will be needed to support this transition and to adapt to unavoidable climate change.

In this context, financing infrastructure will be one of the central challenges. Over the next 15 years the world needs to build approximately \$89 trillion in new infrastructure—a doubling of the existing capital stock in areas such as energy, transport, water, and cities. The focus of this chapter is on financing sustainable infrastructure, but climate finance is also needed in areas such as sustainable agriculture, avoided deforestation, and reforestation.

Given that approximately 50 percent of greenhouse gas emissions come from infrastructure, failure to build infrastructure that is sustainable will lock the world into a high-carbon pathway inconsistent with achieving the 2 degree climate goal.

Approximately two-thirds of the need for sustainable infrastructure is also going to be in the developing world. Moreover, the majority of the infrastructure needs and increase in greenhouse gas emissions will come from the developing world, underscoring the link between building better infrastructure and achieving global climate change goals.

Building sustainable infrastructure will also lead to better development outcomes. This importance of infrastructure for development is reflected throughout the recently agreed-upon post-2015 Sustainable Development Goals (see goals 7, 9, 11, and 13, on clean energy, infrastructure, sustainable cities, and climate action, respectively). This includes increased energy security and reduced air pollution from investing in renewable energy, and reduced commuting times and traffic congestion from investing in more compact cities. Such growth is also likely to be more inclusive, build resilience,



strengthen local communities, and improve the quality of life in various ways. For example, better public transport connections reduce inequalities by helping the poor access job opportunities and reduced congestion improves local air quality. Moreover, failure to address climate change will have negative development outcomes, particularly for the poorest and most vulnerable populations.

The additional cost of making infrastructure sustainable is estimated to be around \$4.1 trillion, leading to an overall infrastructure need of \$93 trillion. This sustainability premium reflects the higher upfront costs of sustainable infrastructure. Other co-benefits from sustainable infrastructure, such as lower operating costs, could reduce the sustainability premium even further.

There are additional costs of adapting to climate change. Data on adaptation funding needs are limited. It is estimated that \$8 billion to \$10 billion was spent on adaptation in 2015. The UNFCCC estimates adaptation needs by 2030 could be \$70 billion annually.

Sources of climate finance

Mobilizing enough climate finance to meet mitigation and adaptation needs is going to require mobilizing both public and private sector capital. For instance, private sector capital will likely have to

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contribute about half of the additional \$3 trillion per annum that will be needed for sustainable infrastructure over the next 15 years—around double the current level of private investment. The rest will have to come from public sources such as governments, development agencies, and multilateral, regional, and national development banks.

Climate finance in the UNFCCC

The focus of the climate finance discussion at the COP21 meeting in Paris in December will be on the developed-country pledge made at the 2008 U.N. climate change meeting in Copenhagen to mobilize “jointly \$100 billion dollars a year by 2020 to address the needs of developing countries.” This goal has been endorsed at subsequent COPs. (At COP16 in Cancun the \$100 billion goal was endorsed, and COP17 in Durban established a work program to analyze options. The 2011 COP18 in Doha called on participating developed countries to identify pathways to mobilize the scaling up of climate finance.)

According to analysis by Climate Policy Initiative and the OECD, in 2014 \$61.8 billion of the \$100 billion per annum pledge was realized. This comprised \$43.5 billion in bilateral and multilateral public finance, \$1.6 billion in export credits, and \$16.7 billion of private finance that was mobilized by public finance.

Going forward, the recently established Green Climate Fund (GCF) is expected to “play a key role in channeling new, additional, adequate and predictable financial resources to developing countries.” This will include catalyzing public and private climate finance from domestic and international sources. The GCF has commenced operating and currently has paid-in capital of around \$10 billion.

Key climate finance issues in the UNFCCC

There is considerable disagreement in the U.N. climate change negotiations on many of the core climate finance issues. For instance, there is no agreement on what should count as climate finance. While it has been agreed that the \$100 billion would be made up from “a wide variety of sources, public and private, bilateral and multilateral, including alternative sources of finance,” developing countries would prefer public finance (often in the form of grants) due to its concessionality.

The issue of what counts as climate finance is also linked to disagreement over how to determine whether climate finance meets the standards of being “new and additional.” Given that investments in addressing climate are often closely related to development outcomes—think of investments in access to clean energy, reducing air pollution, and financing mass transport systems—developing countries want to ensure that development aid is not simply repurposed for climate change, detracting from other (often seen as more pressing) development needs. Moreover, determining whether private finance is “new and additional,” that it would not have been invested but for the contribution of public finance, introduces notions of causality that are often difficult to establish.

Using climate finance for sustainable infrastructure

The discussion on climate finance at the U.N. climate meeting in Paris needs to be situated within the broader need to transition to a low-carbon economy and how to finance \$94 trillion in sustainable infrastructure over the next 15 years.

The challenge of financing sustainable infrastructure is not due to a lack of capital. Indeed, current assets under management among institutional investors are around \$110 trillion. Instead, low interest rates globally combined with large unmet needs for investment in infrastructure point to other barriers, particularly when it comes to scaling up private sector investment.

Moreover, two-thirds of the infrastructure investments will be in developing countries where the costs of building sustainable infrastructure are often higher due to greater risks and a higher cost of capital. There are also demand-side constraints due to the more limited capacity of governments and consumers to afford the fees or tolls that come with new infrastructure.

How can Paris help?

A Paris agreement should situate climate finance in the context of facilitating a transition to a low-carbon economy, consistent with development needs as reflected in the SDGs. This context is already central to the operation of the Green Climate Fund, where it has been agreed that “in the context of sustainable development, the Fund will promote the paradigm shift toward low-emissions and climate-resilient development pathways by providing support to developing countries to limit or reduce their greenhouse gas emissions and to adapt to the impact of climate change.” Success here will mainstream climate into development goals and help ensure that development and climate finance are complementary.

It is unlikely that agreement will be reached on all climate finance issues at Paris, which may be desirable given uncertainties over the extent of climate change and the costs of addressing it. The Paris climate change meeting should, however, reach agreement on a legally binding framework that can guide the mitigation and adaptation actions that will be needed over time to achieve the 2 degree goal.


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Given the size of the needs and the limits to climate finance, at Paris the parties should reaffirm the \$100 billion goal and agree on the need to scale up financing over time. Yet even a commitment to do more will require climate finance to be used in a targeted approach that catalyzes further public and private capital and creates opportunities to scale outcomes.

Given the central role of the GCF going forward, the following outlines some specific areas that a Paris agreement could address in relation to the operation of the GCF.

1. Strengthen the “country-enabling” environment

Climate finance should be used to strengthen countries’ enabling environment. This includes reducing policy and political uncertainty including rule-of-law issues that increase the risk of investing in sustainable infrastructure. These risks are heightened for infrastructure, which is often long-term, illiquid, and, in the case of clean energy, usually relies on some form of policy support to be commercially viable (such as feed-in-tariffs or tax breaks).



Climate finance could also be used to build government capacity to undertake project preparation and planning, including the negotiation of complex public-private partnerships, standardizing contracts, and project evaluation procedures.

Climate finance could also support government efforts to develop a carbon price and phase out fossil fuel subsidies. The IMF and World Bank Presidents Christine Lagarde and Jim Yong Kim have recently highlighted the need for reform of these policies to support the transition to a low-carbon economy.

2. Reduce the financing costs of sustainable infrastructure

The higher cost of capital in developing countries is another barrier to investing in sustainable infrastructure. Climate finance should be blended with other sources of finance to reduce the overall financing cost of an infrastructure project, using climate finance to close the sustainable financing gap. This could include using climate finance to target the higher risk stages of infrastructure project lifecycle, typically at the project development and construction phase.

Scaling up private sector investment, particularly from institutional investors, will also require expanding commercial investment vehicles such as YieldCos and green bonds.

Improving data and information on sustainable infrastructure investments is needed to allow investors to properly assess risk, and determine what works and can be scaled. Tying climate finance to improved measuring, reporting, and verification under a U.N. climate change agreement can facilitate this information-gathering process. Improving coherence and cooperation across the climate finance funds within and outside the UNFCCC can also improve experience-sharing and dissemination of lessons learned, increasing the scope for climate finance to be targeted, effective, and catalytic.

3. Finance adaptation

The GCF has already recognized the important role of climate finance in helping developing countries adapt to climate change, particularly in the poorest countries where there will be limited scope for private sector funding.

Transforming the Global Energy Environment



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In the wake of the December 2015 COP meeting in Paris the world will be confronted by a host of energy and environmental policy issues on how to meet the burgeoning projected energy demand for the next 20 years.


While there will be much talk about the role that the current 162 announced Intended Nationally Determined Contributions can play in holding future temperature increases to the global target of 2 degrees Celsius, in reality, the world is already well beyond any chance of meeting this target. According to Christina Figueres, executive secretary of the UNFCCC, even if all the Intended Nationally Determined Contributions (INDCs) are implemented the world would still be on a trajectory toward 2.7 C.

A world that is 3 degrees warmer will witness a significant drop in food production, an increase in urban heat waves (equivalent to the one that killed thousands of people in India), and more droughts and wildfires, according to Oxford physics professor Ray Pierrehumbert. A warmer world will witness more climate refugees. In this regard it is worth remembering that the Syrian crisis commenced as an environmental crisis.

Global climate change is leading to an accelerated thawing of the permafrost, at a rate far in excess of any existing climate models. Scientists estimate that by 2100 melting permafrost around the world could release as much as one-half the amount that the U.N. Intergovernmental Panel on Climate Change believes gives a 66 percent chance of making it impossible to keep the warming of the earth under 2 C apace.

Financing challenges

While historically from 2007-2013 over 60 percent of global investment in renewable energy occurred in the OECD nations, this trend appears to be shifting dramatically. The International Energy Agency now predicts that between 2014-2020 countries outside the OECD will account for 53 percent of total renewable investment, with China alone accounting for 30 percent of global cumulative investment.



While global cumulative investments in renewables have skyrocketed since 2000 and are projected to level out at around \$225 billion to \$245 billion dollars annually, this level is far below what is needed to meet the long-term development scenarios (\$400 billion annually by 2030 in the IEA's World Energy Outlook Bridge Scenario), making the question of the OECD's willingness to finance the transition to a carbon-free society for the rest of the world the chief unresolved issue emanating out of Paris.

Projecting global energy demand

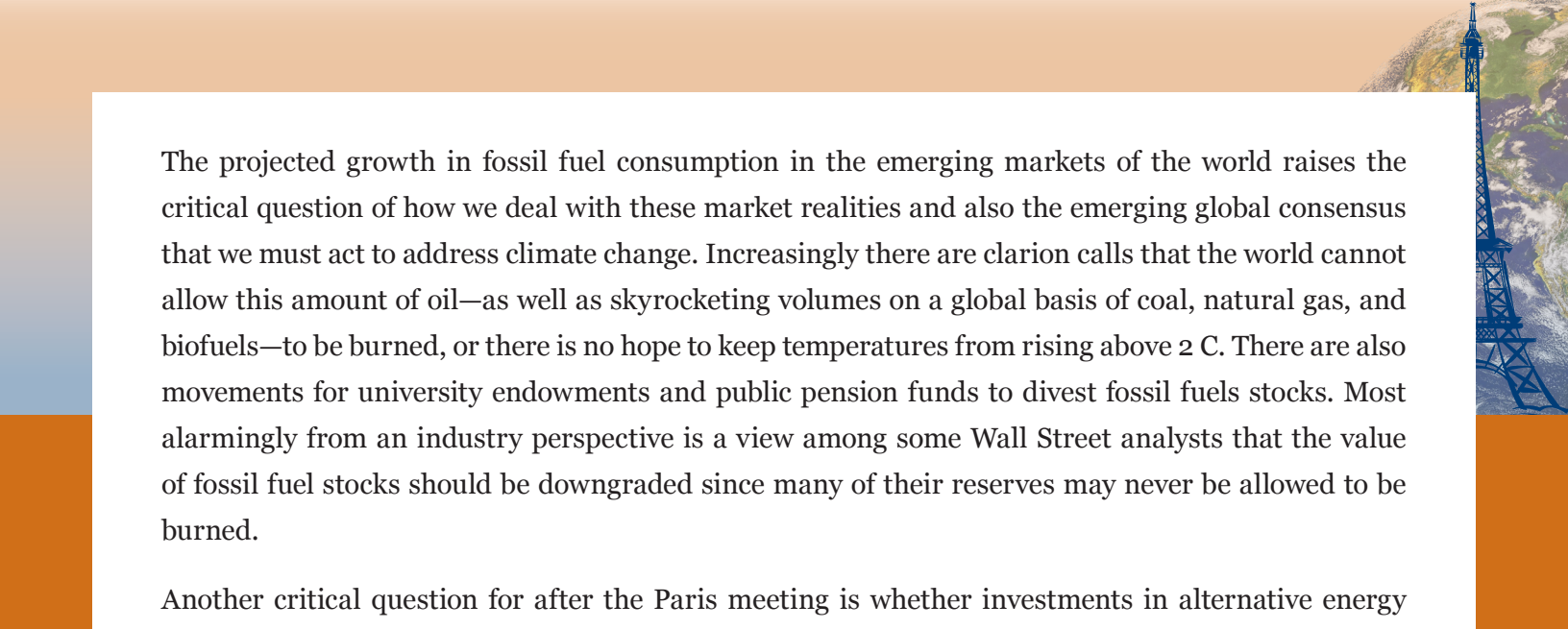
Another critical policy question centers on whether projections that the world's demand for liquid fuels (oil, biofuels, and other liquids) will rise by 19 million barrels per day (mmbd) to 111 mmbd (BP Statistical Review) are correct. In this projection demand growth comes almost exclusively from the non-OECD economies, where consumption by 2035 reaches nearly 70 mmbd, a level 56 percent higher than in 2013. In this same period, OECD demand is projected to fall to around 40 mmbd, a level not seen since 1986.

While forecasts by OPEC, other oil companies, prominent consulting firms, and governments are a bit lower for 2035, almost all of them see robust growth in oil demand cumulatively adding anywhere from 12 to 19 mmbd of oil demand in the 2035 to 2040 period. Although not directly related to climate change, a major question is: Where is this volume of oil likely to come from?

Since the key known areas that could produce this oil are Iraq, Iran, the Orinoco Tar belt of Venezuela, the pre-salt offshore fields in Brazil, Saudi Arabia, the Arctic, and the deep offshore, there is little reason to be sanguine that this amount of oil will be produced unless political conflict can be overcome and prices rise to a level that justify production (\$90 or more) in these frontier regions. However, if this oil is not produced and we do not find a means to back out oil demand especially in fast-growing transportation sectors in non-OECD markets, global economic growth could be seriously impeded.

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While some renewable proponents argue that a combination of advanced biofuels, wind, solar, and enhanced efficiency will lead to the development of electric cars and replacing fossil fuels in electric generation, it is time to bring some reality into this debate. Currently in the United States there are only 330,000 hybrids and pure electric vehicles on the market out of a total vehicle fleet of over 260 million vehicles running on gasoline and diesel fuel. It is time to address scalability issues in earnest and stop wishing for a sectorial transformation that is at best several decades away.



The projected growth in fossil fuel consumption in the emerging markets of the world raises the critical question of how we deal with these market realities and also the emerging global consensus that we must act to address climate change. Increasingly there are clarion calls that the world cannot allow this amount of oil—as well as skyrocketing volumes on a global basis of coal, natural gas, and biofuels—to be burned, or there is no hope to keep temperatures from rising above 2 C. There are also movements for university endowments and public pension funds to divest fossil fuels stocks. Most alarmingly from an industry perspective is a view among some Wall Street analysts that the value of fossil fuel stocks should be downgraded since many of their reserves may never be allowed to be burned.

Another critical question for after the Paris meeting is whether investments in alternative energy sources and new transformative technologies such as large-scale battery storage could cut these pro-

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jections for oil consumption growth by half or more. However, for this to happen the consumption of all fossil fuels would have to be seen as socially and politically unacceptable. In addition there would have to be massive investments above those already projected in renewables, distributed electric generation, enhanced energy efficiency, the development of completely different automotive technologies, carbon capture and sequestration (CCS) for both gas and coal, advanced large-scale battery storage technologies, and new small-scale, or modular, fission reactors based on completely different technologies than the light water reactor.

A shift in investment policies away from traditional fossil fuels (i.e., oil, gas, coal) and their attendant delivery systems (pipelines, long distance transmission lines) on a global basis could create hundreds of billions of dollars of stranded investments.

In summary, while the euphoria going into Paris is commendable it is vital as we come out of meeting that we as a global society make a somber assessment of what technologies are scalable, and that we keep as diversified an energy portfolio as possible and live up to whatever financial commitments are promulgated.

Agriculture in the COP21 Agenda



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In a few weeks, world leaders and international negotiators will gather in Paris, home of the famed *Champs-Élysées*, to establish a new generation's global climate accord. However, the agreement is not likely to delve into the sector-level practicalities of how countries will achieve the relevant targets. From the perspective of agriculture, one of the foremost drivers and burden-bearers of climate change, the COP21 agreement might best be dubbed “*Les Champs-Oubliés*,” or forgotten fields, since it will largely neglect this fundamental concern of societies everywhere.

What is the relationship between agriculture and climate?

There are at least four core dimensions to the global agriculture-climate challenge.

1. First, humanity needs to substantially increase the amount of food it produces in order to meet the needs of a growing population and rising average incomes per person, the latter of which is linked to greater demand for animal products. By 2050, the world needs to produce at least 50 percent more food than it does today.
2. Second, agriculture accounts for approximately 14 percent of greenhouse gas emissions, and 25 percent when including forestry and other land use. The major drivers of the problem are deforestation, soil and nutrient management, and livestock emissions, so a “business as usual” (BAU) approach to boosting global food production would have substantial negative consequences for climate change.
3. Third, due to its dependence on the biophysical environment, agriculture is the economic sector most uniquely susceptible to changes in climate patterns. The effects are highly place- and crop-specific. Some geographies, such as the Sahelian region of Africa, have already experienced a significant long-term decline in precipitation. Other regions, especially in Asia, have seen increases in both inland and coastal flooding. Meanwhile, colder regions like Canada, Russia, and the Nordic countries may see their farms benefit from warming temperatures, linked to longer growing seasons and expanded opportunities for planting. Across all regions, pests and dis-

eases are likely to diffuse in new patterns under changing physical environments. In the worst case, major long-term warming will have disastrous agricultural consequences in many places. There is evidence to suggest that if local temperatures rise more than 4 degrees Celsius above pre-industrial levels, then many farming systems and natural ecosystems will be significantly compromised.

4. Fourth, the human costs of climate change are unequally spread. Many of the most significant agricultural consequences of climate change, such as extreme drought and flooding, are already being born by individuals and societies with the least ability to withstand shocks. There is also considerable evidence that increased temperatures are statistically linked to worse economic outcomes and even to higher risk of violence.

‘Climate-smart agriculture’

To address these issues, there is a global imperative to promote “climate-smart agriculture” (CSA)—meaning agriculture that uses inputs as efficiently as possible, is resilient to climate change, and significantly decreases greenhouse gas emissions, while still meeting the demand for food. On the mitigation side, agriculture’s main GHGs are nitrous oxide and methane, rather than carbon dioxide. Much of the medium-term solution lies in better carbon capture in soils, either through avoidance of carbon release or increased sequestration, although this is something of a one-off generational gain, since carbon sinks might saturate within 25 to 35 years.

A host of practical steps are needed to mitigate agriculture’s GHG emissions. They include better grassland management; restoration of degraded land (through steps like revegetation, reduced tillage, and water conservation); and improved cropland management (through steps like improved crop rotations, increased use of cover crops, reduced burning of residue, improved fertilizer application, and better water and nutrient management for rice). Livestock-driven methane emissions present around 10 percent of the sector’s abatement potential. They can be reduced through dietary adjustments, improved manure management to recapture nutrients and energy, and even changes in breeding practices. Reducing post-harvest food loss and post-retail food waste is also vital to decreasing the volume of food that must be produced.

The adaptation side of agriculture has multiple components, too—all of them dependent on the place-specific climate challenges. For rain-fed farming systems facing increasing propensity of drought, as in many parts of sub-Saharan Africa, one of the most important priorities is expanded access to irrigation, especially small-scale irrigation. For many parts of Asia, the opposing challenge of flood resistance is paramount, often tackled through improved seed varieties. Soil management is meanwhile crucial for strengthening the biological, chemical, and physical conditions under which crops are able to resist climate shocks. Insurance instruments are important for pooling risk and responding quickly to shocks when they arise.

Agriculture in Paris: Frail but not fallow

The U.N. Framework Convention on Climate Change (UNFCCC) has historically given short shrift to agriculture. Coming out of the Conference of the Parties in Lima last year (COP20), there was hope that agriculture would receive specific attention in Paris, but the draft agreement issued in early October 2015 indicates this is not likely to be the case. Instead, most of the implications for agriculture will be indirect, and overall Paris outcomes will be framed by general parameters. They will also be indirectly defined by the country-level strategies that have been presented through Intended Nationally Determined Contributions (INDCs) submitted in the lead-up to Paris. As of late October 2015, 155 countries, accounting for roughly 90 percent of global emissions, have submitted strategies, many of which include adaptation or mitigation actions in the agricultural sector.

Alongside the formal COP process in Paris, a large number of stakeholders will also participate in the Global Landscapes Forum, a major event first launched alongside the Warsaw COP in 2013. It convenes thousands of people from government, business, science, and civil society to discuss the interwoven challenges of climate and development. This year's forum will focus on issues like promoting support for the role of landscapes in climate solutions, beyond avoided deforestation; linking sustainable supply chain commitments to increased investments in sustainable landscapes; and strengthening the role of indigenous communities in decision-making for land management.

The INDCs are a mixed bag for agriculture

Country-level actions outlined in INDCs will likely be the most important COP21 outcome for agriculture. The challenge here is a lack of clear benchmarks. Much of the follow-up work will need to be addressed by the UNFCCC's Subsidiary Body for Scientific and Technological Advice (SBSTA), which links the policy negotiations to the technical communities. SBSTA needs to ensure there are clear standards for comparing and assessing the agricultural components of national CSA strategies. A number of initiatives are working in this direction. The Food and Agricultural Organization (FAO), for example, has launched the Economics and Policy Innovations for Climate-Smart Agriculture (EPIC) program. Meanwhile the World Bank and a number of agricultural research institutions have collaborated to develop an index-based country profile approach. These might all serve as useful starting points for more formal global standards.

A quick examination of submitted INDCs highlights the variation in country-level approaches to climate and agriculture. Advanced economy agricultural producers like Australia, Canada, and the United States do not mention specific emissions reductions in agriculture, apart from a brief mention that the sector will be included. The European Union identifies more specific areas within agriculture for emissions reduction, but does not clarify how those emissions will be measured.

Some large developing economies with major agricultural sectors are more specific. In Ethiopia, for example, livestock and crop cultivation are estimated to be responsible for more than half of total

emissions as of 2010. The share grows to around 85 percent of emissions when forestry is included. To achieve the country's goal of reducing 2030 emissions by 64 percent compared to fast-growing BAU trajectories, the government expects the vast majority of its reductions (around 86 percent) to come from the agriculture and forestry sectors.

Actions by major agricultural emitters will be important to watch. In India more than half the labor force is still employed in agriculture. The country produces the world's second-largest volume of agricultural emissions, after China, but its INDC emphasizes adaptation in agriculture rather than mitigation. Nonetheless, many of India's strategies to address agricultural adaptation will also support mitigation, such as the promotion of crop genotypes that consume less water, are more climate-resilient, and have enhanced potential for CO₂ fixation. The strategy also seeks to capture 2.5 to 3 million tons of carbon dioxide through expanded forest and tree cover by 2030.

Brazil is the third-largest agricultural emitter. Its INDC outlines a strategy to restore 15 million hectares of degraded pasturelands and to enhance 5 million hectares of integrated cropland-livestock-forestry systems by 2030. It also commits to strengthening South-South cooperation in low-carbon, resilient agriculture and reforestation activities.

Indonesia, a large emerging economy, is a major agricultural emitter and the top emitter in land-use change and forestry. Its INDC pledges a 29 percent decline from BAU scenarios by 2030, with a focus on improving land use, since 63 percent of its emissions come from land-use change, and peat and forest fires.

Some countries have made pledges conditional on international support. In Bangladesh, for example, the INDC's unconditional mitigation commitments are for 5 percent emission reductions by 2030, compared to BAU. Beyond that, however, the government outlines a variety of specific incremental measures that could be taken in agriculture, contingent on international support. These include a 50 percent reduction in draft animals, through increasing mechanization; a 35 percent increase in the share of organic compared to inorganic fertilizer; and expanding alternative wetting and drying irrigation for 20 percent of all rice cultivation.

Common priorities

International cooperation will be essential to advance the public goods required for individual countries' long-term success. Science and research will undoubtedly continue to play an especially major role in both adaptation and mitigation. The Consultative Group for International Agricultural Research, or CGIAR system, for example, can make crucial contributions through its collaborations with national agricultural research centers to develop location-appropriate seed varieties that are resistant to fluctuations in temperature and precipitation. The \$10 billion Green Climate Fund has identified climate-resilient agriculture as one of its five investment priorities. The Bill and Melinda Gates Foundation also allocates approximately \$100 million per year to agricultural research centers. At a SBSTA

workshop in June, countries highlighted the importance of early warning systems and contingency plans linked to extreme weather events.

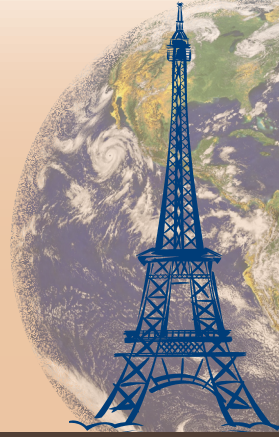
Private sector resources will play a critical role. Financial innovations can, for example, support adaptation strategies through proactive public-private participation. African Risk Capacity, a specialized agency of the African Union, uses risk pooling and other modern finance mechanisms to offer insurance against extreme weather events, providing governments with direct payouts when specific climate metrics are crossed. The Caribbean Catastrophic Risk Insurance Facility was created with a similar underlying logic.

Official development assistance is crucial too. Unfortunately, funding for adaptation remains only a small share of total ODA. Research conducted for the [Ending Rural Hunger project](#) indicates that, for most donor countries, less than 20 percent of bilateral projects to promote food and nutrition security—already a very small share of ODA globally—target adaptation as the concept is classified by the OECD. The corresponding figure for mitigation is less than 10 percent.

Next steps

Paris is set to establish the meta-frame for international climate cooperation beyond 2020, generating tremendous political attention around the world. The next step will be to translate that momentum quickly into the sector-level action required if the accord's ambitions are to be realized. For agriculture, the real work will take place in country- and landscape-specific strategies to tackle interwoven efficiency, adaptation, and mitigation challenges while promoting food security. In many cases the INDCs offer a starting point. But common standards are urgently needed to promote the local innovations and implementation strategies that tackle the priorities at scale. To achieve climate success, the fields cannot be forgotten.

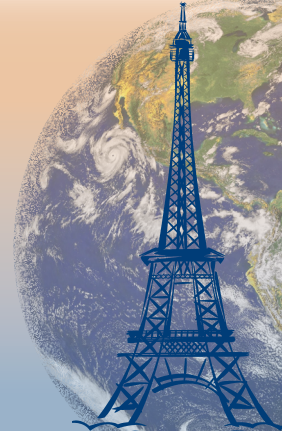
This paper was written in collaboration with Krista Rasmussen. I thank Reid Detchon, Mohamed El-Ashry, Celine Herweijer, and Melinda Kimble for extremely helpful comments.



The Players

United States:

A Credible Climate Action Plan, but Political Uncertainty



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The United States goes to the UNFCCC meetings in Paris in a good position to accomplish its goals for international cooperation: to reach a pragmatic international agreement that puts in place a framework to contain global warming to no more than 2 degrees Celsius, and which includes action from all countries while also providing flexibility that would allow implementation to reflect national circumstances. This goal was set by U.S. negotiators after the 2009 upheaval in climate governance at Copenhagen and builds on progress at the 2011 climate meetings in Durban. The United States recognized throughout this process that any climate framework would require legal force to be acceptable to other countries, yet also avoid an unworkable climate treaty that would never be approved by the U.S. Congress. To garner political acceptance in the United States, the agreement would have to be applicable to all countries, not just developed ones. The upcoming Paris agreement, and other fora like the Major Economies Forum and bilateral discussions, should incentivize the ambitious actions from all major emitters reflected in their Intended Nationally Determined Contributions (INDC). The agreement also needs to provide a mechanism to ratchet up ambition over time, taking advantage of changes in technology and reductions in costs.

In turn, to be acceptable to emerging and developing countries, the United States would need to make its best effort on its own INDC—President Obama’s Climate Action Plan—which would need to be ambitious yet still credible given the country’s political realities. And the United States would need to contribute to other key elements of the agreement, in particular by providing financial support to help meet the financing pledge of \$100 billion to help emerging and developing countries meet their own INDCs, including meeting the challenge of building resilience to a changing climate among the most vulnerable countries and communities. The United States and other donors have made strong efforts to show they are on track to meet the \$100 billion pledge, but will still need to deliver on post-2020 finance. This is becoming more contentious, with the G-77 seeking new pledges for this period.

These elements are all moving in the right direction going into the UNFCCC conference in Paris. But risks remain: to reaching a consensus in Paris, and more critically, to reaching the 2 C upper limit on warming.

The United States is playing its part

Two years ago, the United States presented its Climate Action Plan, announcing its intentions to reduce greenhouse gas emissions 26-28 percent below 2005 levels by 2025. Because new climate legislation from Congress is not feasible given the current politically divided government, the Action Plan uses existing federal laws along with state action to implement policy in more than 60 areas. The most controversial part of the Action Plan is the Clean Power Plan, which aims to limit carbon pollution from power plants. But the Action Plan also focuses on important policies and programs to accelerate investment in renewable energy, upgrade the electricity grid, support energy efficiency and increased fuel economy standards for heavy-duty vehicles, and reduce emissions from hydrofluorocarbons (HFCs) and methane, among others. It also focuses on actions to protect American communities from the impact of climate change, and aims to position the United States to lead.

A review on the plan's second anniversary outlined notable progress in the steps being taken to limit carbon pollution from power plants. Final rules for the plan were issued in August and published in the Federal Registry in October. They include: issuance of fuel economy standards for heavy-duty vehicles; new energy efficiency standards for appliances in January 2015; and actions to reduce methane and HFCs, with final rules issued by the Environmental Protection Agency (EPA) offering acceptable alternatives to HFCs for refrigeration and air conditioning while prohibiting uses of HFC-134a in applications where more climate friendly alternatives are available. Progress on preparing the United States for the impacts of climate change include Climate Change Adaptation Plans prepared by 38 federal agencies that outlined how they are addressing climate change issues that impact their missions as well a number of steps, like issuance of a Climate Resilience Toolkit, that build capacity.

An important part of the Climate Action Plan going into Paris is to build momentum through bilateral discussions with other major economies. Such bilateral talks will allow countries to build support for their own domestic programs by increasingly showing others that they are not "going it alone." These diplomatic efforts have also been used to build consensus on key issues ahead of the UNFCCC talks in Paris. The historic joint United States-China announcements provided a platform for the two countries to present their intentions in parallel: The U.S. Climate Action Plan was announced along with China's announcement of its intention to peak carbon emissions by 2030, with best efforts to peak earlier. The China announcement included its aim to increase its share of non-fossil energy consumption to 20 percent by 2030. In September 2015, during his visit to the United States, President Xi Jinping further announced that China would implement a national cap-and-trade program, providing further leverage on other countries to take similar action. These announcements, along with INDCs

from other emerging economies like Mexico and India, bolster the Obama administration's ability to build support for the actions it is taking domestically by providing assurances that it is acting in concert with others.

While U.S. contributions going into Paris are considerable, questions and risks remain. Questions around the political durability of the U.S. Climate Action Plan will color the negotiations. And more critically, concerns remain around the sufficiency of the INDCs to put the world on the path of limiting warming to 2 C. The Climate Action Plan will be vulnerable to this concern as reaching this goal will take stronger action than currently feasible to meet the projected pathway after 2025.

Delegates at the COP21 in Paris will be concerned about the risk of policy reversal given the political climate in the United States, with concerns heightened as the U.S. enters the 2016 presidential campaign season. As Congress is unwilling to enact major climate legislation, the Action Plan relies on actions that can be taken based on existing executive authority under existing laws, such as that which is provided by the Clean Air Act. These are not, as sometimes assumed by international observers, "stroke of the pen" actions by the president that can easily be reversed, but instead are subject to the highly structured regulatory rule-making processes that entail development of proposals, reviews, stakeholder consultations, legal reviews and, of course, the possibility of legal challenges. Other actions are extensions of existing programs or build on innovations happening at the state and local levels where popular support is more secure.

The Clean Power Plan, the lightning rod of the Climate Action Plan, is already subject to legal challenges. Twenty-four states and a coal company filed separate legal challenges on October 23, the day that the plan's regulations were published in the Federal Register. Recent analyses of the likely outcome of the legal challenges note that the Clean Power Plan is in a good position to withstand them. The EPA has an extensive record of success in defending Clean Air Act rules and has clear authority to regulate carbon pollution from the power sector. The final regulations were carefully written to ensure that they rest on a solid legal and technical foundation, eliminating some provisions in the draft regulations that might have been vulnerable to challenge. At the same time, many states are already implementing policies that will allow them to meet the plan's goals. One analysis concluded that 31 states are already on track to be more than halfway toward meeting their 2022 Clean Power Plan benchmarks, with 21 set to surpass it. Twenty states are already on track to be more than halfway toward meeting their 2030 Clean Power Plan target, with 16 set to surpass their 2030 Clean Power Plan targets.

Of course, litigation aside, if the Republican party takes control of the White House in 2016 and maintains power in Congress, the Clean Power Plan would likely be revoked. Even then, the Supreme Court decision in *Massachusetts vs. the Environmental Protection Agency* that affirmed that the administration is required to regulate CO₂ emissions would stand, so a new administration would in any

case need to come up with another plan to regulate such emissions. Beyond the political transition, the question at that point will be whether other economic and political dynamics that are working to create a new climate economy in the United States (rapidly lowering prices for renewable energy and natural gas; commitments by major corporations to decarbonize; and a strengthening voice of alternative energy providers along with state commitments to alternative energy) will provide sufficient momentum to keep the pathway to reducing carbon pollution in play.

In addition, while litigation over the Clean Power Plan will continue to be at the forefront of the news, other elements of the Climate Action Plan will likely be more “sticky”—that is, not as vulnerable to reversal. For example, energy efficiency standards, developed in partnership with stakeholders, will be hard to reverse once adopted, given that companies will have already retooled and new building standards will have been applied.

Another concern relates to whether the U.S. Climate Action Plan targets are likely to be met and whether the plan is sufficient. Assuming that the elements in the plan are vigorously pursued, the targets set for 2025 are achievable. However, to keep the U.S. (and indeed all players) on a trajectory that limits warming to 2 C will require considerable effort. For the United States, that will likely mean putting into place a national policy to put a price on carbon, such as a carbon tax, and investing in innovation. A World Resource Institute analysis concluded that with a national carbon price and additional greenhouse gas-cutting measures across the economy, the United States can reduce its emissions 40-42 percent below 2005 levels in 2030, and 50-53 percent in 2040.

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The United States strategy in Paris is to push for a review process of all INDC plans to help ratchet up effort and ambition, not just in the United States but also across all countries. Reviews every five years could put countries on a virtuous circle, allowing for more aggressive targets and actions to take advantage of rapidly evolving technological advances. This is a bet on the power of technological change to possibly lower costs, as well as on an increasing political acceptance for climate action.

Beyond Paris

After Paris, the challenge will be to maintain momentum and speed of action. President Obama has made climate action a priority, and we can expect that he and his administration will pursue the elements in the plan vigorously. This will include defending the Clean Power Plan and implementing the other elements in the plan as quickly as possible—especially those that are easier to implement and likely to endure beyond the current administration.

More broadly, while there may be reversals or changes at the federal level depending on the outcome of the 2016 elections, the elements for a more supportive climate change policy may be developing. Unfortunately, the impacts of a changing climate—droughts, floods, fires, and more powerful hurricanes—are more visible and dramatic. On the other hand, there remains a large partisan divide with conservatives remaining skeptical about the reality and causes of a changing climate, and democrats and independents expressing concern over the effects of a warming climate. Yet despite this divide, a majority of Americans are willing to take policy action. Seventy-four percent support regulating CO₂ as a pollutant and 64 percent support setting strict limits on existing coal-fired power plants.

President Obama has positioned the climate change issue as a moral one, and this was reinforced by the visit of Pope Francis to the United States in September. Business leaders outside of the fossil fuel industry are taking action. Action and innovation at the state and local levels will likely continue even without strong federal support. Leadership—at all levels of government, business, and civil society—will be needed need to navigate the political transition, with the pledges made to maintain warming at no more than 2 C firmly in the line of sight.

China:

Ambitious Targets and Policies



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Over the last decade China has been actively engaged in improving energy efficiency and direct interventions aimed at addressing rising carbon emissions. As the world's largest emitter of greenhouse gases, China has made a number of commitments in the lead up to the meeting of the Conference of the Parties to be held in Paris in December 2015. In its Intended Nationally Determined Contribution (INDC), China committed by 2030:

- To achieve the peaking of carbon dioxide emissions around 2030 and making best efforts to peak early;
- To lower CO₂ emissions per unit of GDP (emissions intensity) by 60-65 percent from the 2005 level;
- To increase the share of non-fossil fuels in primary energy consumption to around 20 percent; and
- To increase the forest stock volume by around 4.5 billion cubic meters on the 2005 level.

These commitments are reinforced in the two joint announcements ([here](#) and [here](#)) between the United States and China in November 2014 and September 2015, respectively. In addition to the 2030 commitments, China has announced a target for 2020 to reduce the emissions intensity of its economy by 40-45 percent relative to 2005. China has also announced targets in its Five-Year Plans (FYPs). Figure 1 presents China's targets over the 11th FYP (2006-2010) and the 12th FYP (2011-2015), as well as targets in 2020 and 2030.

Figure 1. Chinese energy and emission targets (%)

	2006-2010	2011-2015	2020	2030
Energy intensity reduction	20 (2005)	16 (2010)		
Emissions intensity reduction	17 (2010)	40-45 (2005)	60-65 (2005)	
Non-fossil fuel shares	10	11.4	15	20

Source: National Development and Reform Commission of China (2015). *Enhanced Actions on Climate Change: China's Intended Nationally Determined Contributions*.

Note: The years in brackets indicate the base years with which the targets are compared.

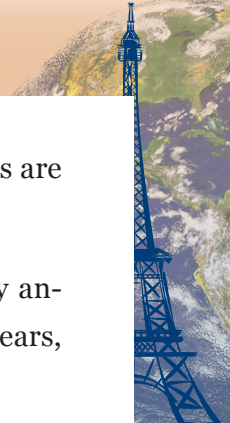
To achieve these goals, China announced substantial domestic climate actions in the joint statement with the U.S. in September 2015, in which China confirmed that in 2017 it plans to launch a national emission trading system (ETS) covering key industry sectors as well as implement a green dispatch system to favor low-carbon sources in electricity distribution. China has also announced that it will make available 20 billion yuan for setting up the China South-South Climate Cooperation Fund to support other developing countries in combatting climate change.

On November 2, 2015, French President Francois Hollande visited China to boost the upcoming climate negotiations and the two countries released a joint presidential statement on climate change. The two countries agreed that every five years the Paris agreement should be comprehensively reviewed, evaluating the overall progress made toward reaching the agreed-upon long-term goals. Both countries reaffirmed their commitment to shifting the world to a low-carbon path by the end of the century and stressed the responsibility of developed nations in helping developing nations mitigate and adapt to climate change, both through finance and technology.

The targets so far announced show that China is positioning itself as a leader in climate action. This is quite different from six years ago in Copenhagen when China was accused of thwarting attempts at establishing legally binding targets for carbon emissions.

Even though China's carbon emissions will likely continue to rise until 2030, how serious is the Chinese commitment? In a recent report commissioned by the Australian government, one of the authors of this brief, Warwick J. McKibben, found that the targets announced by China by 2030 incurred the second-largest cost to GDP of all the countries modelled. If measured by economic costs rather than the overall emission target, China's commitments to 2030 are significant.

Although the ambitious targets are likely to be relatively costly for China to achieve, there are several reasons why China is likely to follow through with its carbon pledges at the COP21. China has a number of domestic reasons for taking action. First, China is concerned about energy security driven by rapidly growing energy demand, a coal-dominated energy structure, and high and growing dependence on oil imports. At a high-level meeting in June 2014, President Xi Jinping called for a sweeping energy revolution in China in five areas: demand, production, technology, institutional governance, and global markets. Second, China faces an urgent need to tackle pollution from fossil fuels. In China, coal burning is responsible for most emissions of air pollutants such as sulfur dioxide, nitrogen oxides, suspended particulates, and overall air quality. The outcomes in these areas are deteriorating. Deadly smog, particularly in northern China where Beijing is located, has escalated into a major social issue in the last few years. In September 2013, six ministries jointly launched the Air Pollution Prevention and Control Action Plan (in Chinese) in the Beijing-Tianjin-Hebei Region requiring PM2.5, or "fine particle," concentrations in the Beijing-Tianjin-Hebei Region to be reduced by 25 percent in 2017 from the 2012 level.



China is also one of the countries where estimates of cost from climate change in future decades are significant. China is large enough for local actions to have global consequences.

Also, China has already taken a series of domestic actions in the last decade and has recently announced additional policies that will likely lead to significant emission reductions in future years, giving a real foundation to the pledges being made in Paris.

Recent policies

To achieve its energy and emission goals, China has implemented a series of energy and climate policies in the last decade but has mostly relied on command-and-control measures. The major programs include the Top-1000 Enterprises Energy Conservation Action Program during the 11th FYP; the 10,000 Enterprises Energy Conservation Action Program during the 12th FYP; the low-carbon city development pilot program; and mandatory closure of small power plants.

China's leadership has realized that administrative measures are not efficient, and it has gradually shifted to market instruments. As an overarching guidance, the Third Plenum of the 18th Central Committee of Communist Party of China in 2013 decided that markets play a decisive role in allocating resources. The market instruments include price reforms, subsidies and taxes, and emissions trading schemes. China has been moving away from centrally controlled price systems to market-oriented pricing mechanisms.

The most striking carbon policy in China is carbon trading pilots. Seven pilot ETS have been launched over 2013-2014: Shenzhen, Shanghai, Beijing, Guangdong, Tianjin, Hubei, and Chongqing. They apply to energy-intensive sectors covering 35-60 percent of the total emissions of the respective region and all together roughly 10 percent of the nation's total emissions. These pilots combined make up the second-largest ETS in the world following the European ETS. They cover 650 million to 700 million tons of CO₂ in 2014, compared with 2.1 billion tons in Europe, 382 million tons in Australia and 165 million tons in California. Although they are by no means mature markets and still face potential challenges, including a surprising lack of price volatility, the pilots have a significant demonstration effect for China's future national market.

Apart from the above policies, China is transforming its economy and energy systems, which will also have significant impacts on energy consumption and carbon emissions. To conserve energy and mitigate emissions, China has been restructuring its economy by upgrading traditional industries, supporting strategic and newly emerging industries as well as expanding the service sector, and phasing out backward production capacity. In 2013, the services sector was larger than the industrial sector for the first time.

In terms of energy structure, the government has started to tighten coal consumption. For example, in the Air Pollution Prevention and Control Action Plan in the Beijing-Tianjin-Hebei Region, the total

coal consumption of Beijing, Tianjin, Hebei, and Shangdong is required to be reduced by 83 million tons by 2017. The government has also been accelerating the development of renewable energy—particularly solar and wind power. Figure 2 shows rapid growth in generation capacity of non-fossil fuels in the last five years.

Figure 2. Generation capacity of non-fossil fuels in China over 2010-2014

	2010 (Gigawatts)	2014 (Gigawatts)	Growth over 2010-2014 (Percent)
Hydro	216.06	301.83	39.7
Wind	29.58	96.37	225.8
Biomass	5.50	9.48	72.4
Solar	0.86	28.05	3,161.6
Geothermal	0.03	0.03	7.1
Nuclear	10.82	19.88	83.7
Total	262.85	455.64	73.3

Source: *China National Renewable Energy Centre.*


Upcoming policies

China's ETS pilots have paved the way to a national ETS in 2017. There are two prevailing views on the development of a national carbon market. One is to expand these pilots in geographical coverage and sectoral scope, and the other is to construct a uniform national market based on experiences and lessons of these pilots. While local governments are cooperating on the research of cross-region trading, the central government may not roll out a national system by linking the pilots; more likely, it will construct a new uniform national system because of significant differences among the pilots.

China is also considering carbon taxes. The Draft Environment Tax Law (the carbon tax) was issued in May 2013 by the Ministry of Finance and sent to China's most carbon-intensive industry associations for comments and review. Finance Minister Lou Jiwei confirmed that China would expand environmental taxes to include carbon "in due time" at the China-U.S. Strategic and Economic Dialogue in July 2013. It is expected that the tax will likely come into force in the 13th FYP.

However, even if a carbon tax is also going to emerge in the 13th FYP, it is not clear how China is going to simultaneously impose both a carbon tax and an ETS. As the national ETS will be covering key industry sectors such as iron and steel, power generation, chemicals, building materials, paper-making, and non-ferrous metals, regions or firms in the carbon markets would be excluded from the carbon tax to avoid overlapping.

Apart from the carbon trading and the possible carbon tax, the Chinese government requires the share of non-fossil fuels in primary energy consumption to be 15 percent by 2020 and 20 percent by 2030. To achieve these targets, China is going to implement a green dispatch system to favor low-



carbon sources in electricity distribution. This system will accelerate power generation from renewable sources and, in turn, China's rapidly growing solar and wind capacity will support this system. In its INDC, China aims to further increase wind capacity to 200 GW and solar capacity to 100 GW by 2020, doubling wind capacity and more than tripling solar capacity from 2014.

To sum up, China has significant incentives to follow through with its carbon pledges at COP21. The gains to domestic issues such as local pollution and energy security make China a credible player in the global negotiations. The move toward concrete market-based mechanisms for pricing carbon, if they can be credibly implemented, will further drive the energy revolution slowly underway in China.

China's INDC and global INDCs

On October 30, 2015, the U.N. released a report showing that the aggregate effect of the 119 INDCs communicated by 147 parties by October 1, 2015 is not sufficient to maintain a temperature rise below 2 degrees Celsius. China's INDC and the joint announcement with the United States may break the deadlock of climate negotiations between developed countries and developing countries and enable further ambition in achieving the global emissions target, but this depends on how other countries perceive China's efforts and ambition of these targets.

China is in a very different position at COP21 in December 2015 than it was in Copenhagen in 2009. China has announced an ambitious INDC, and despite emissions projected to continue to rise until 2030, the commitment to addressing emissions in China is being backed by credible policies. While the U.N. has made it clear that the overall commitments for the COP21 are not sufficient to reach the 2 C target, China's contributions to the overall negotiations at the COP21 are likely to be real and credible. The crucial issue is not how to make China take action. It is how to encourage all countries to take greater action than so far pledged for the Paris meeting.

India:

Potential for Even Greater Emissions Reductions



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In 2013, India emitted 2.4 billion metric tons (GT) of carbon dioxide, making it the third-largest emitter in the world. India ranks in emissions behind only China (10.0 GT) and the United States (5.2 GT). Along with the European Union, these three countries emitted almost 60 percent of the worldwide CO₂ emissions in 2013. Thus, India's October submission of its Intended Nationally Determined Contribution (INDC) to the United Nations was widely anticipated.


In its Intended Nationally Determined Contribution, India expressed its intent by 2030 to:

1. Reduce the emissions intensity of GDP by 33-35 percent from the 2005 levels.
2. Increase the percentage of non-fossil-fuel electricity to about 40 percent of total electric power capacity.
3. Create an additional carbon sink of 2.5-3.0 billion tons of CO₂-equivalent through additional forest and tree cover.

Here I discuss the ambition of India's INDC, how it compares to the emissions goals of China, why there's significant potential to increase India's contribution to emissions reduction, and how that could be done.

India's emissions goals are less ambitious than they look

The goal to reduce India's emission intensity by 33-35 percent by 2030 seems ambitious, but if one examines the target more closely it does not seem very difficult to achieve. India's emissions intensity in 2005 was 0.47 metric tons of carbon dioxide per \$1,000 of GDP; it would be reduced to about 0.31 metric tons in 2030 if India's emissions intensity goal is reached. If the Indian economy grows at 7 percent between now and 2030 it will reach about \$18 trillion in terms of purchasing power parity, based on 2005 prices. If India's emissions intensity is then 0.31, then CO₂ emissions in 2030 would be about 5.6 GT.



In April 2014, an expert group convened by the Indian Planning Commission issued a report that called for a major increase in investment in nuclear, hydroelectric, wind, solar, and biomass capacity compared to a baseline or business-as-usual projection. The report projected 2030 emissions would be about 5.3 GT in a business-as-usual scenario, not much different than the expected 5.6 GT using the government's INDC goal for emissions intensity. If the report's proposal for a low-carbon growth strategy were to be accepted, the projected emissions in 2030 would be only 3.8 GT—that's 1.8 GT less than the INDC's 33-35 percent reduction in emission intensity.

India's intent to achieve 40 percent of total electric power installed capacity from non-fossil-fuel based energy sources by 2030 can also be achieved relatively easily. Current production capacity is already about 27 percent non-fossil-fueled. Total non-fossil-fuel capacity in the proposed expert group low-carbon strategy is projected to be 52 percent by 2030, much above the current Indian goal of 40 percent.

Some media outlets have reported incorrectly that India intended to produce 40 percent of its electricity from renewable sources rather than have 40 percent of its capacity be non-fossil-fuel-fired (see [here](#) and [here](#)). India's 40 percent target for non-fossil-fuel capacity includes nuclear energy, which is not a renewable source, as well as renewable sources such as hydro, wind, solar, and biomass power plants. Furthermore, hydroelectric, wind, and solar plants can operate on average at only a fraction of their nameplate capacity. As a result, non-fossil-fuel production is normally a significantly smaller percentage of *production* than it is as a percentage of *capacity*. Typically, hydroelectric plants operate on average at 45 percent, and wind and solar around 30 percent of full capacity because they are limited by the volume of water, wind, and sunshine available. Fossil-fuel-fired thermal plants can operate in excess of 80 percent of full capacity. For example, although the expert group projected that non-fossil-fuel *capacity* could be 52.0 percent with the strategy that they propose, non-fossil-fuel electricity output in 2030 would be only 24.2 percent of the total electricity *produced*.

Yet India's emissions goals are more ambitious than China's

As of November 2015, it seems clear that the INDCs submitted thus far are not sufficient to achieve the internationally agreed-upon target of limiting the growth of the average global temperature to less than 2.0 degrees Celsius by the end of this century. Climate Action Tracker, a consortium of four research institutions, estimates that by the end of this century the INDCs can limit global warming to 2.7 C—more than the 2.0 C target.

According to Climate Action Tracker, the range of uncertainty around their projection of 2.7 C is between 2.2-3.4 degrees Celsius. This seems to be a rather more narrow range than could be inferred from the uncertainties around the INDCs of both China and India, the first- and third-largest emitters of carbon dioxide in the world.



The reduction in CO₂ emissions implied by China's goal of achieving peak emissions by 2030 is very uncertain, because there is no limit on the growth of China's emissions between now and then. Over the last decade, greenhouse gas emissions by China have been growing at nearly 10 percent a year. If they grow half as fast between now and 2030, China's CO₂ emissions will more than double—from 10 GT in 2013 to 24 GT in 2030—and the per capita emissions of China would then be 70 percent more than in the United States before China even begins to reduce emissions.

India chose not to declare when their carbon dioxide emissions will peak. However, if India's emissions were to peak when India reached the same per capita income (on a purchasing power parity basis) as China is expected to have in 2030, we estimate that the peak will not occur until about 2043. An Indian commitment to a year of peak emissions would add little to reducing the uncertainty about future emissions growth.

...if India's emissions were to peak when India reached the same per capita income (on a purchasing power parity basis) as China is expected to have in 2030, we estimate that the peak will not occur until about 2043.

China's announced intent to reduce the emissions intensity of GDP by 60-65 percent compared to 2005 is a more meaningful constraint on emissions than its pledge to begin to reduce emissions in 2030. However, China's proposed reduction in emissions intensity also seems more ambitious than it is. In 2005 China's emissions intensity was 0.941 metric tons per \$1,000 of GDP, roughly twice that of India. If China reduces its emissions intensity from this level by 62.5 percent between 2005 and 2030, it will be 0.353 metric tons per \$1,000 of GDP in 2030, still well above the Indian 2030 target of about 0.310 tons per \$1,000 of GDP.

Furthermore, if China's GDP grows at 7 percent a year between now and 2030, and its emission intensity is 0.353 metric tons in 2030, its total emissions in that year will be approximately 15.5 GT, 50 percent more than in 2013 and almost three times the total emissions of 5.6 GT projected for India in 2030. China's emissions per capita in 2030 will be approximately 10.35 metric tons, almost three times the per capita emissions of India of 3.73 metric tons in 2030.

China has also announced its intent to increase the share of non-fossil fuels in its primary energy consumption to around 20 percent, a more meaningful target than India's for non-fossil-fuel sources to reach 40 percent of total electricity capacity. However, the impact on both Chinese and Indian emis-

sions has relatively little to do with how much non-fossil-fuel energy resources are used and a lot more to do with the energy efficiency of its new coal-based power plants, and, even more significantly, the importance of natural gas relative to that of coal for power production. Supercritical (high-pressure) coal plants can be almost one-third more efficient than subcritical (low-pressure) coal plants and emit proportionately lower amounts of carbon dioxide. Modern natural gas combined cycle plants (that use waste heat from gas turbines to produce additional electricity from steam turbines) can achieve efficiencies almost twice that of subcritical coal plants and produce two-thirds less CO₂.

There is significant potential to improve India's emission goals at Paris

As noted, the INDCs introduced for the COP21 negotiations are insufficient to achieve the goal of limiting a global temperature increase to 2.0 C. Thus, participants in Paris may explore how to improve the current crop of INDCs before the next round of negotiations. India has a lot of potential for improvement.

The level of emissions in 2030 implied by India's goal of reducing the emissions intensity of GDP by 33-35 percent is about the same as that in the business-as-usual case documented by the Planning Commission's expert group. Thus, India can achieve its current INDC emission goals by undertaking very few, if any, new initiatives.

The expert group proposed a low-carbon growth strategy that could result in 3.8 GT of carbon dioxide emissions in 2030, a reduction of 1.5 GT from the 5.3 GT of emissions projected in the business-as-usual case. The implied reduction in emissions intensity would be 55 percent.

The problem with the expert group low-carbon growth strategy is that it would require additional investment of approximately \$834 billion, or about \$650 per capita, over the 20-year period from 2011 to 2030, a very large investment for a low-income country like India.

The problem with the expert group low-carbon growth strategy is that it would require additional investment of approximately \$834 billion, or about \$650 per capita, over the 20-year period from 2011 to 2030, a very large investment for a lower-middle-income country like India. Most of the additional investments would be made in developing and building additional supercritical coal plants, hydro-electric and nuclear plants, and utility-scale wind and solar power plants compared to the business-as-usual case, which relies much more heavily on subcritical coal plants to meet the future growth in demand for electricity.



The expert group did not include as part of its low-carbon growth strategy any additional investment in highly efficient natural gas combined cycle plants, which are far less capital intensive than coal, hydro, nuclear, and renewable electric power and emit far less carbon dioxide than coal plants. Natural gas combined cycle plants can only achieve maximize fuel efficiency if a supply of natural gas can be assured to run the plants at close to full capacity—for example, by entering into long-term contracts for imported liquid natural gas. There also needs to be a tax on, or price for, CO₂ emissions such that it makes natural gas preferable to coal in the so-called dispatch order. Natural gas will also become more attractive if the administered price for local natural gas is abolished or linked to import prices for liquid natural gas. Currently, the linkage of administered local prices to domestic prices in Russia, Canada, the United Kingdom, and the United States makes very little sense for India and has discouraged exploration and development of local natural gas resources.

The energy policy reforms required to take more advantage of natural gas will be difficult to achieve but can generate significant benefits at a lower cost. In order to estimate the net benefits of including natural gas combined cycle as an alternative in a low-carbon growth strategy, I cut the expert group's reliance on supercritical coal plants by one-half, increased investments in wind power, and reduced investments in very high capital cost solar plants, many of which are not likely to be built because of transmission constraints. With this new low-carbon strategy:

1. Carbon dioxide emissions would be further reduced by about 400 million tons to 3.4 GT in 2030, 1.9 GT lower than the business as usual projection.
2. Additional investment requirements would be reduced by \$415 billion, cutting the total required additional investments in the expert group report by almost half, from \$834 billion to \$429 billion.
3. Non-fossil-fuel electric power capacity could be 52 percent of total electric power capacity in 2030, significantly higher than the 40 percent goal in India's INDC.

India's INDC is a good first step in defining its contributions to emission reductions and compares favorably with China's emissions goals, but the potential for even greater contributions by India clearly exists.

Africa:

Financing Adaptation and Mitigation in the World's Most Vulnerable Region



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Africa is the continent that contributes the least to global warming in both absolute and per capita terms. Africa accounts for the smallest share of global greenhouse gas emissions—3.8 percent. This compares to the largest emitters like China, the United States, and the European Union, which account respectively for 23 percent, 19 percent, and 13 percent of global emissions. Africa contributes less to global warming than countries such as Russia and India (each accounts for 6 percent of global emissions). In a telling example, the [Africa Progress Panel](#) notes that it would take the average Ethiopian 240 years to register the same carbon footprint as the average American. The region's low contribution to global warming is not surprising, as about two-thirds of its greenhouse emission is from land use, particularly from forest degradation and deforestation tied to the production of charcoal.

Yet despite its low emissions, Africa is one of the regions most vulnerable to climate change. It remains highly dependent on low-productivity agriculture for food, income, and employment. Agriculture accounts for about 30-40 percent of GDP in Africa, and about 80 percent of Africans remain dependent on low-yielding, rain-fed agriculture. Global warming, even if limited to below 2 degrees Celsius, increases the risk of drought in southern and central Africa and the risk of flooding in east Africa, which would lead to higher food prices and lower yields—by 2050, warming of less than 2 C could reduce total crop production by as much as 10 percent. Reduced agricultural production will have dire consequences on human development, as poverty in Africa predominantly affects rural agriculturalists or pastoralists in countries with some of the highest poverty rates in the world. For higher levels of warming, there are indications that yields may decrease by around 15–20 percent across all crops and regions. Progress in many areas will be reversed: Health will suffer through increased mortality and morbidity due to events like extreme heat and flooding. A reversal of progress in health attainment will have a negative impact on childhood educational performance. Recent research has even found strong causal evidence linking climatic events to human conflict across all major regions of the world.

Africa's adaptation and mitigation agenda

Africa needs to not only implement climate adaptation strategies to reduce its vulnerability to climate change but also adopt mitigating measures in order to achieve sustainable growth. While climate mitigation focuses on uprooting the causes of climate change, adaptation focuses on adjusting to the effects of climate change in order to reduce vulnerability and risk. In contrast to developed economies where the focus is on climate mitigation, both climate mitigation and adaptation are pressing issues in Africa.

Climate mitigation will help the continent avoid a high-carbon lock-in that other countries such as China have experienced in their economic trajectory. Rapid economic growth and demographic and urbanization trends will increase Africa's emissions of greenhouse gases unless mitigating actions—such as the adoption of renewable energy in power generation technologies—are taken. For instance, under the International Energy Agency baseline scenario to 2040, power generation in sub-Saharan Africa would quadruple, and the region's share of global CO₂ emissions would increase from 2 percent to 3 percent. The likelihood of this scenario can be reduced when renewable technologies, including hydropower, solar, wind, and geothermal energy are included the continent's energy mix. Furthermore, adopting such technologies can help broaden access to energy through both on- and off-grid solutions.

In Africa many national governments are initiating governance systems for adaptation such as disaster risk management, adjustments in technologies, and infrastructure and ecosystem-based approaches. Basic public health measures and livelihood diversification are also reducing vulnerability. The Africa Progress Panel notes examples from Ethiopia, Niger, and Rwanda where small-scale land-owners and communities are adapting to climate risk and leading the way for sustainable land use at a large scale.

**Africa will bear the brunt of global warming,
which will be mainly caused by developed economies
and some emerging ones; but Africa often has limited
bargaining power in international negotiations.**

A key challenge for African countries is that even with an increase in domestic revenue mobilization, their own resources will remain insufficient to tackle both climate mitigation and adaptation. As a result, international cooperation is needed to help fill Africa's climate funding gap. A 2013 study by UNEP estimates that in a 2 degree Celsius temperature increase scenario, meeting adaptation costs




in Africa by the 2020s will require a steep increase in annual funding for adaptation in Africa by about 10-20 percent annually. It concludes that present trends in funding will not meet these needs, and there is at present no clear and agreed-upon pathway or identified sources of funding through which such a rapid scaling up can be achieved. The international community could help fill the climate financing gap that Africa currently faces, but this would require that the current governance of the “global commons” be addressed. Indeed, Africa will bear the brunt of global warming, which will be mainly caused by developed economies and some emerging ones; but Africa often has limited bargaining power in international negotiations. Given that the Paris meeting can result in a binding agreement for all countries, it is therefore of the utmost importance for the continent to take a leadership role in the governance of the “global commons.”

Africa in Paris

Africa is speaking with one voice, and the continent has committed to achieve an inclusive, ambitious, and equitable COP21 agreement that would lead to lower carbon emissions. The Paris meeting aims to keep global warming to less than 2 C above pre-industrial levels (as agreed to in Cancun in 2010). It also seeks to keep global warming to below 1.5 C by 2100. The basis for the position that African countries will take to Paris in December 2015 is the African Common Position developed by the African Group of Negotiators and endorsed by the African Ministerial Conference on the Environment. African negotiators will seek to ensure that global climate governance will include the concerns of all 195 countries, and in particular those of poor countries and small islands. They will set a high bar in terms of the targets for the reduction of carbon emissions and seek firm commitments from developed economies to a mechanism that will adequately finance climate adaptation, and not just climate mitigation.

Among the issues to be agreed upon in Paris, climate finance and in particular the need for financing both climate adaptation and mitigation will probably be the most important concern for African negotiators. At the third Financing for Development Meeting in Addis Ababa in July 2015, the international community recognized the need to increase financing for low-carbon and climate-resilient development. In particular, developed countries committed to a goal of mobilizing jointly \$100 billion a year by 2020 from a wide variety of sources, including public and private sources, to finance mitigation actions and transparency on implementation (a goal previously set in 2009 in Copenhagen but not reached). In addition, the international community welcomed the initial resource mobilization process of the Green Climate Fund—the largest dedicated climate fund—which aims for a 50:50 balance between mitigation and adaptation over time and a floor of 50 percent of the adaptation allocation for particularly vulnerable countries (such as least-developed countries, small island developing states, and African countries). In Addis Ababa, the international community also noted the importance of continued support to address remaining gaps in the capacity to gain access to and manage climate finance.



The October 2015 Bonn Meeting on Climate Change, the last meeting before Paris, offers a preview of the African position on climate finance. Judging from their concerns in Bonn, African policymakers will, without a doubt, negotiate strongly for the main contributors of greenhouse gas emissions to commit to—and act upon their commitments—the level of financing, the use of financing for adaptation, and the sources of financing. In Bonn, African negotiators put climate finance at the center of the negotiations and strengthened their bargaining power by joining the G-77 and China group of countries, which together included 130 nations, accounting for 80 percent of the world’s population. African negotiators are seeking more finance, including a binding commitment from developed economies greater than \$100 billion by 2020. They are also warning that new public finance should be used to fill the climate financing gap and that existing official development assistance should not be diverted to climate finance. In addition, the current fragmentation of the climate finance architecture, with many separate multilateral agencies, does not serve the continent well and may not be conducive to leveraging private investment.

In addition to climate finance for adaptation, a likely stumbling block in Paris will be the discussions about loss and damage (L&D) associated with climate change impacts in developing countries. Loss and damage associated with impacts of climate change, including extreme events (such as hurricanes and heat waves) and slow onset events (such as desertification, sea level rise, and ocean acidification) can be relatively high in developing countries, given their vulnerability to the adverse effects of climate change. According to the World Bank, losses to insurers due to weather events have reached about \$200 billion a year, from about \$50 billion a year in the 1980s. In spite of the establishment of the Warsaw International Mechanism at COP19, which represents a first step in addressing loss and damage associated with climate change in developing countries, L&D will remain a contentious issue given concerns from developed economies about an “unending string of liability” and the binding nature of the Paris agreement.

A successful agreement in Paris would strengthen global governance, but whatever the outcome African countries should take the lead in developing and implementing sustainable strategies that can lead to a “triple-win” scenario. As noted by the Africa Progress Panel, Africa can lead the world on climate-resilient, low-carbon development and achieve the “triple-win” of boosting agricultural productivity, reducing poverty, and strengthening national efforts to combat climate change. The Intended Nationally Determined Contributions for the Paris meeting offer an opportunity for African governments to develop ambitious but realistic strategies leading to the triple-win scenario. Regional cooperation and the support of regional development banks such as the African Development Bank and multilateral institutions such as the World Bank and the Green Fund can help kick-start the process while the continent works to attract more international support, including through innovative financial solutions such as carbon finance.

List of Acronyms



AOSIS	The Alliance of Small Island States, a coalition of low-lying coastal countries that share similar concerns
BASIC	Brazil, South Africa, India, and China
BAU	Business-as-usual, referring to projected outcomes if no change is taken on policy outcomes
CGIAR	The Consultative Group for International Agricultural Research, a global partnership of food security research organizations
CO ₂	Carbon dioxide, the primary greenhouse gas emission caused by humans
COP	Conference of Parties, the decision-making body of the UNFCCC
CSA	Climate smart agriculture
DAC	The Development Assistance Committee, a 29-member OECD forum comprising many of the largest funders of aid
EPA	United States Environmental Protection Agency
EPIC	Economics and Policy Innovations for Climate-Smart Agriculture, an FAO program
ETS	Emission trading system
EU	The European Union
FAO	The Food and Agricultural Organization of the United Nations
FSF	Fast start finance
FYP	Five-Year Plan
GCF	Green Climate Fund
GDP	Gross domestic product
GHG	Greenhouse gases are those whose accumulation contribute to global warming
GT	Gigatons, or 1 billion tons, a common measurement term when discussing atmospheric carbon
HFC	Hydrofluorocarbons, a category of ultra-potent greenhouse gases
IMF	The International Monetary Fund
INDC	Intended Nationally Determined Contributions, voluntary commitments by countries on their actions and targets in respect to climate mitigation and adaptation that were agreed upon at COP20 in Lima
L&D	Loss and damage
LDC	Least-developed country, as defined by the United Nations
ODA	Official development assistance, as defined by the OECD in its efforts to spur development in developing countries
OECD	The Organization for Economic Cooperation and Development, a 34-member group that promotes economic progress and world trade.
SBSTA	Subsidiary Body for Scientific and Technological Advice, under the UNFCCC
UNFCCC	United Nations Framework Convention on Climate Change
U.N.	United Nations
UNEP	United Nations Environment Program
U.K.	United Kingdom
U.S.	United States
USAID	United States Agency for International Development

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