



DRIVING SUSTAINABLE DEVELOPMENT THROUGH BETTER INFRASTRUCTURE: KEY ELEMENTS OF A TRANSFORMATION PROGRAM

Amar Bhattacharya
Jeremy Oppenheim
Nicholas Stern

B | Global Economy
and Development
at BROOKINGS

THE **NEW** CLIMATE **ECONOMY**

The Global Commission on the Economy and Climate



Grantham Research Institute on
Climate Change and
the Environment



Amar Bhattacharya is a senior fellow in the Global Economy and Development program at the Brookings Institution.

Jeremy Oppenheim is Chair of the New Climate Economy Project

Lord Nicholas Stern is the IG Patel Professor of Economics and Government at the London School of Economics, President of the British Academy, and Chair of the Grantham Research Institute on Climate Change.

The Brookings Institution is a private non-profit organization. Its mission is to conduct high-quality, independent research and, based on that research, to provide innovative, practical recommendations for policymakers and the public. The conclusions and recommendations of any Brookings publication are solely those of its author(s), and do not reflect the views of the Institution, its management, or its other scholars.

The Global Commission on the Economy and Climate is a major international initiative to explore the links between economic growth and climate action. Chaired by former President of Mexico Felipe Calderón, the Commission comprises former heads of government and finance ministers, and prominent leaders in the fields of economics, business and finance. The Global Commission was established by seven countries: Colombia, Ethiopia, Indonesia, Norway, South Korea, Sweden and the United Kingdom.

The New Climate Economy is the Commission's flagship project and is undertaken by a consortium of partner institutes (World Resource Institute—Managing Partner, Ethiopian Development Research Institute, Global Green Growth Institute, Indian Council for Research on International Economic Relations, Overseas Development Institute, Stockholm Environment Institute, Tsinghua University) and a core team lead by Program Director Helen Mountford.

The Grantham Research Institute on Climate Change and the Environment was established in 2008 at the London School of Economics and Political Science. The Institute brings together international expertise on economics, as well as finance, geography, the environment, international development, and political economy to establish a world-leading centre for policy-relevant research, teaching and training in climate change and the environment. It is funded by the Grantham Foundation for the Protection of the Environment, which also funds the Grantham Institute for Climate Change at Imperial College London. More information about the Grantham Research Institute can be found at: <http://www.lse.ac.uk/grantham/>

Acknowledgements

This paper has been developed to inform discussions on smart infrastructure development and financing as part of the sustainable development goals (SDGs) and climate processes in 2015. It builds on the work of the Global Commission for the Economy and Climate (New Climate Economy), as well as that of the OECD, the IMF, the World Bank and regional development banks, UNEP-FI, G-20, G-24 and private sector initiatives within the institutional investor community. It has benefitted from the ongoing discussions in different fora and especially the deliberations on the draft Addis Accord to be adopted at the Third U.N. Conference on Financing for Development at Addis Ababa in July, 2015.

We would also like to acknowledge the many thoughtful comments and suggestions that we have received from colleagues at the Climate Policy Initiative, the European Bank for Reconstruction and Development, the International Sustainability Unit, the London School of Economics and Political Science, the Overseas Development Institute, the World Resources Institute, the New Climate Economy, McKinsey, Brookings, and the G-24.

We would like to pay a special tribute to the work and leadership of the late Prime Minister of Ethiopia, Meles Zenawi, whose pioneering efforts to foster sustainable infrastructure have been a powerful force for change in his own country and in the world as a whole.

This paper was produced as part of the “Better Finance, Better Development, Better Climate” project, which was made possible with support from, among others: UK Aid from the UK government, the government of Norway, the government of Sweden, the Children’s Investment Fund Foundation, and [Bloomberg Philanthropies](#). The views expressed here do not necessarily reflect the opinions or official policies of these institutions. Brookings and the New Climate Economy recognize that the value they provide is in their absolute commitment to quality, independence, and impact. Activities supported by donors reflect this commitment and the analysis and recommendations are not determined or influenced by any donation.

The Global Commission on the Economy and Climate oversees the work of the New Climate Economy project. Chaired by former President of Mexico Felipe Calderón and co-chaired by Lord Nicholas Stern, the Commission comprises former heads of government and finance ministers, and leaders in the fields of economics, business and finance. Members of the Global Commission endorse the general thrust of the arguments, findings, and recommendations made in this report, but should not be taken as agreeing with every word or number. They serve on the Commission in a personal capacity. The institutions with which they are affiliated have therefore not been asked formally to endorse the report and should not be taken as having done so.

LIST OF ABBREVIATIONS

AUM	Assets Under Management
COP21	2015 Paris Climate Conference (UNFCCC Annual Conference of Parties)
CPI	Climate Policy Initiative
DFIs	Development Finance Institutions
EBRD	European Bank for Reconstruction and Development
ESG	Environmental, Social and Corporate Governance
EU	European Union
GCF	Green Climate Fund
GDP	Gross Domestic Product
GEF	Global Environment Facility
IMF	International Monetary Fund
ISU	International Sustainability Unit
LSE	London School of Economics
MDBs	Multilateral Development Banks
NCE	New Climate Economy
ODA	Official Development Assistance
ODI	Overseas Development Institute
OECD	Organisation for Economic Co-operation and Development
PIDG	Private Infrastructure Development Group
PPAs	Power Purchase Agreements
PPPs	Public Private Partnerships
REDD	Reducing Emissions from Deforestation and Forest Degradation
S&P	Standard & Poor's
SDGs	Sustainable Development Goals
UNEP-FI	United Nations Environment Programme Finance Initiative
UNFCCC	United Nations Framework Convention for Climate Change
WRI	World Resources Institute

CONTENTS

Executive Summary1

1. Introduction 4

2. Scale of Infrastructure Financing Needed 9

3. The Broken Infrastructure Development Model 12

4. Unlocking Private Sector Investment Capital 15

5. Development Banks: More than the Money 19

6. Role of Official Development Assistance22

7. Targeted Climate Finance23

8. A Transformation Program for Better Infrastructure25

References 31

Endnotes34

LIST OF FIGURES

Figure 1: A commitment to better infrastructure can dramatically improve global outcomes for climate and development 3

Figure 2: Global annual investments requirement, 2015 to 2030, \$ trillion, constant 2010 dollars 9

Figure 3: Incremental annual investment from private institutional investors 15

Figure 4: Proposed annual incremental financing from different sources to close infrastructure gap26

Figure 5: Achieving better infrastructure outcomes requires concerted action.....27

DRIVING SUSTAINABLE DEVELOPMENT THROUGH BETTER INFRASTRUCTURE: KEY ELEMENTS OF A TRANSFORMATION PROGRAM

Amar Bhattacharya
Jeremy Oppenheim
Nicholas Stern

EXECUTIVE SUMMARY

The agendas of accelerating sustainable development and eradicating poverty and that of climate change are deeply intertwined. Growth strategies that fail to tackle poverty and/or climate change will prove to be unsustainable, and vice versa. A common denominator to the success of both agendas is infrastructure development. Infrastructure is an essential component of growth, development, poverty reduction, and environmental sustainability.

The world is in the midst of a historic structural transformation, with developing countries becoming the major drivers of global savings, investment, and growth, and with it driving the largest wave of urbanization in world history. At the same time, the next 15 years will also be crucial for arresting the growing carbon footprint of the global economy and its impact on the climate system.

A major expansion of investment in modern, clean, and efficient infrastructure will be essential to attaining the growth and sustainable development objectives that the world is setting for itself. Over the coming 15 years, the world will need to invest around \$90 trillion in sustainable infrastructure assets, more

than twice the current stock of global public capital. Unlike the past century the bulk of these investment needs will be in the developing world and, unlike the past two decades, the biggest increment will be in countries other than China.

Getting these investments right will be critical to whether or not the world locks itself into a high- or low-carbon growth trajectory over the next 15 years. There is powerful evidence that investing in low-carbon growth can lead to greater prosperity than a high-carbon pathway.

At present, however, the world is not investing what is needed to bridge the infrastructure gap and the investments that are being made are often not sustainable. The world appears to be caught in a vicious cycle of low investment and low growth and there is a persistence of infrastructure deficits despite an enormous available pool of global savings. At the same time, the underlying growth trajectories are not consistent with a 2 degree climate target. And climate change is already having a significant impact, especially on vulnerable countries and populations.

Yet there are major opportunities that can be exploited to chart a different course. The growth po-

tential of developing countries can be harnessed to boost their own development and global growth and demand. Long-term interest rates are at record lows and there are major untapped sources of finance. Technology change offers prospects for breakthroughs on development and climate outcomes (smart cities, distributed solar power). And there is growing recognition of the importance of decarbonization and new commitments to it by advanced countries as well as developing countries.

The current infrastructure investment and financing model needs to be transformed fast if it is to enable the quantity and quality of growth that the world economy needs. The urgency of action cannot be overemphasized. Given the already high level of emissions, the next 15 years will be a crucial period and the decisions taken will have an enduring impact on both development and climate outcomes. The forthcoming U.N. Conference on Financing for Development at Addis Ababa in July provides a historic opportunity to reach consensus on a new global compact on sustainable infrastructure. To this end, the paper proposes six critical areas for action:

First, there is a need for national authorities to clearly articulate their development strategies on sustainable infrastructure. These strategies need to address the still considerable opportunity for improvements in national policy in key infrastructure sectors, such as urban development, transport, and energy. There is a need for stronger institutional structures for investment planning and for building a pipeline of projects that take into account environmental sustainability from the outset, and greater capacity to engage with the private sector.

Second, the G-20 can play an important leadership role in taking the actions needed to bridge the infrastructure gap and in incorporating climate risk and sustainable development factors more

explicitly in infrastructure development strategies.

The G-20 can do this through their own actions and investment strategies and by supporting global collective actions such as the development of norms for sustainable procurement and unlocking both public and private pools of finance. The Global Infrastructure Forum proposed in the draft Addis Accord can build on the G-20 and other initiatives to create a global platform for knowledge exchange and action.

Third, the capacity of development banks to invest in infrastructure and agricultural productivity needs to be substantially augmented in order for them to pioneer and support changes needed for better infrastructure. In our view, MDBs will need to increase their infrastructure lending five-fold over the next decade, from around \$30-40 billion per year to over \$200 billion, in order to help meet overall infrastructure financing requirements. Several MDBs have taken steps and are actively considering options to enhance their role and capacity. The establishment of new institutions and mechanisms also creates the opportunity for greater flexibility and scale. Nevertheless, a more systematic review of the role of MDBs and needed changes could help strengthen their individual and collective roles and garner support from shareholders and other stakeholders.

Fourth, central banks and financial regulators could take further steps to support the redeployment of private investment capital from high- to low-carbon, better infrastructure. We already see progressive action from the Bank of England and the French government. Market-developed standards for instruments such as green bonds could also increase the liquidity of better infrastructure assets.

Fifth, the official community (G-20, OECD, and other relevant institutions) working with institutional investors could lay out the set of policy, regulatory, and other actions needed to increase their infra-

structure asset holdings from \$3-4 trillion to \$10-15 trillion over the next 15 years. This could include publishing project pipelines, standardizing contracts, providing government-backed guarantees for investments in sustainable infrastructure, and making longer-term policy commitments in terms of tax treatment of infrastructure investments. “Impact capital”—capital that is willing to take lower ex ante returns in exchange for significant reductions in policy risk is growing rapidly and could make a significant contribution.

Sixth, over the coming year the international community should agree on the amounts of concessional financing needed to meet the SDGs, how to mobilize this financing and how best to deploy it to support the economic, social, and environmental goals embodied in the SDGs. ODA can play a critically important role in crowding in other financing and in enhancing the viability of infrastructure projects. Beyond ODA, targeted climate finance, when combined with the much larger pools of private and non-concessional public financing, could offset additional upfront costs of

low-carbon investments in both low- and lower-middle income countries and help build more resilient infrastructure and help adapt to climate change. The Green Climate Fund (GCF) is a first possible step around which such a new approach can be built.

We know the main elements of the transformation agenda, although many details have to be worked out. They are entirely compatible with both sustainable development and climate goals. The aim is not to put in place complex and burdensome structures but responsive and flexible mechanisms capable of learning and bringing about real change. Working together across the Financing for Development, SDG, G-20, and UNFCCC processes, there is an opportunity to drive real change over the next 12 months.

Achieving better infrastructure outcomes will require concerted actions on many fronts. But moving from a business-as-usual approach to better infrastructure can dramatically affect global outcomes on both development and climate.

Figure 1: A commitment to better infrastructure can dramatically improve global outcomes for climate and development

From business as usual outcomes	To better infrastructure outcomes
Inadequate investments in sustainable infrastructure in most countries constraining growth and development	Scaled investment in sustainable infrastructure globally, leading to improved economic development and growth
Inadequate provision of affordable infrastructure for the poor, creating the risk of serious reversals in the fight for development and poverty reduction	Increased infrastructure access and affordability for the poor, leading to improved development outcomes
High proportion of high-carbon infrastructure investments and inefficient use of infrastructure, creating danger of lock-in and irreversible climate change	Increased preference for investments in low-carbon infrastructure , mitigating climate change risks and increasing probability of a 2 degree scenario
Low resilience infrastructure, creating vulnerability to risks of climate change (especially among the poor)	More resilient infrastructure that accounts for climate risks and protects populations most vulnerable to climate change

1. INTRODUCTION

2015 will be a vital year for the international community in terms of both sustainable development and climate change. The United Nations will hold the Third International Conference on Financing for Development in Addis Ababa in July 2015 with the aim of adopting a comprehensive financing framework for a set of sustainable development goals (SDGs). Global leaders will meet at the U.N. summit in September 2015 to agree on and finalize these SDGs for 2030. The Turkish presidency of the G-20 has made “investment” and “inclusion” two of the central pillars for the leaders’ summit in November 2015. Finally, the global climate change negotiations under the U.N. Framework Convention for Climate Change (UNFCCC) aim to reach a conclusion on a new climate framework at a global summit in Paris in December 2015.

The agendas of accelerating sustainable development and eradicating poverty, and that of tackling climate change, are so deeply intertwined that they will succeed or fail together. Growth strategies that fail to tackle poverty and/or climate change will prove to be unsustainable, and vice versa. Yet at present these agendas often operate in parallel universes and, at times, can even be perceived to compete. While linking these initiatives presents a challenging proposition for the global community, there is a common denominator that could provide the necessary impetus: infrastructure development. Infrastructure is an essential component of growth, development, poverty reduction and environmental sustainability. Closing the infrastructure deficit with better performing comparators could boost GDP growth by more than 2 percent a year in regions as diverse as Africa, Latin America, and South Asia.¹ Infrastructure investment can make an important contribution to poverty reduction, jobs, and equity through its impact on growth and other means.

An increase in infrastructure investment equal to 1 percent of GDP could add 3.4 million jobs in India, 1.3 million jobs in Brazil, and 700,000 jobs in Indonesia.² Furthermore, a one standard deviation increase in the quality and quantity of infrastructure can reduce a country’s Gini coefficient by 0.06.³ Determining how to implement and finance the extra \$2–3 trillion needed annually by the 2020s for sustainable infrastructure investment will go a long way towards contributing to the success of global efforts to achieve the SDGs.

The world is in the midst of a historic structural transformation. Developing countries are finally closing the gap with the developed world. They make up a growing share of the global economy and are major drivers of global savings, investment, and growth. The share of countries that are today classified as middle- and low-income in global GDP (on purchasing parity terms) has increased from less than 40 percent in 2000 to more than 50 percent in 2015 and is projected to increase to two-thirds by 2030.⁴

Growth and structural changes in the developing world will also drive the largest wave of urbanization in world history, as more than 1.5 billion people move to cities over the next two decades. This unique transformation is being accompanied and supported by rapid technical progress in digitization, biotechnology, materials, and other spheres. At the same time, the next 15 years will also be crucial for arresting the growing carbon footprint of the global economy and its impact on the climate system.

Investing in low-carbon infrastructure such as in energy is also likely to involve a decentralization of investment, involving a shift in capital allocation from large creditworthy entities (e.g., large corporations and central governments) to smaller, less creditworthy entities (i.e., households, smallholders, emerging economy cities without good credit ratings, new project developers).

For example, as power production shifts from fossil fuels to renewables, there is also a corresponding shift in infrastructure owners from relatively few large oil and gas companies purchasing multi-billion dollar infrastructure assets to many households and individuals buying individual solar panels or connecting to micro-grids. This shift requires a different intermediation pattern, together with the need for new aggregation and credit enhancement mechanisms. Even though the total volumes of financing may not differ much between the low- and high-carbon worlds, the actual composition of the investments and the key actors purchasing infrastructure are likely to be substantially different. This will open new channels for participation in the global economy.

A major expansion of investment in modern, clean, and efficient infrastructure will be essential to attaining the growth and sustainable development objectives that the world is setting for itself. Over the coming 15 years, the world will need to invest around \$90 trillion in sustainable infrastructure assets, more than twice the current stock of global public capital.⁵ Getting these investments right will be critical to whether or not the world locks itself into a high- or low-carbon growth trajectory over the next 15 years. At the same time, there is powerful evidence that investing in low-carbon growth can lead to as much prosperity (if not more) as a high-carbon pathway, especially when taking into account the multiple co-benefits and lower risk of climate-related losses.⁶ This includes increased energy security and reduced air pollution from investing in renewable energy, reduced commuting times and traffic congestion from investing in more compact cities; investments in restoring degraded farmland and reducing deforestation should increase agricultural productivity and farm incomes. 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; reduced congestion improves local air quality.

At present, however, the world is not investing what is needed to bridge the infrastructure gap and the investments that are being made are often not sustainable. There is understanding of how dangerously polluted, congested, and wasteful the past pattern of growth has been, and with it the desire and opportunity to set a new direction. Moreover, the global economy faces subdued and uncertain prospects and is in dire need of higher levels of investment. A step-change in the capacity to invest in better productive infrastructure can provide a boost to the global economy and contribute to global rebalancing. As the International Monetary Fund (IMF) has argued, infrastructure investment in the context of the current low real interest rates is as close as we ever get to a “free lunch.”⁷ Provided that the right planning, regulation and delivery mechanisms are in place, it has the potential to increase long-run productivity while also driving short-term activity. It could even reduce public deficits, given the low interest rates and domestic economic multipliers associated with infrastructure investment. However, there is a significant risk that the world will miss out on this free lunch due to multiple failures along the infrastructure investment chain. While this is true across all economies, the costs of failure are particularly high for low- and middle-income countries. The next 15 years could also open up a radical opportunity to transform and empower low-income communities globally.

This paper is therefore designed to respond to five main interconnected questions. First, why is a major increase in investments in better infrastructure essential to both development and climate goals? Second, what is holding back this investment? Third, how can

the deployment of private capital into infrastructure investment be doubled? Fourth, what is the distinctive role of development banks in closing the infrastructure investment and financing gap? Fifth, how can official development assistance and climate finance reinforce each other? The answers to these questions constitute an integrated program for infrastructure development that can deliver a cleaner, more sustainable, and progressive future: A future in which poverty is not only reduced, but in which the reductions can be sustained.

To this end we advance five propositions:

- ***A step increase in investments in productive, low-carbon infrastructure and land use is essential to achieving both development and climate goals.*** These goals are intertwined in logic and in policy solutions. The scale of investment needed is exceptionally large because of past inattention and deficits, shifts in global economic structure (from developed to low- and middle-income economies) and the unique nature of the development transformation that is now underway. Beyond the challenge of scale, infrastructure investments will need to be better and more sustainable than in the past in order to maximize the development gains and to avoid locking the world onto a high-carbon pathway.
- ***Such an increase on a global scale requires a major overhaul of the current approach to infrastructure investment and finance.*** The model of infrastructure development is broken, resulting in lower economic productivity (e.g., through black-outs, congestion), in fewer projects than are needed and could be financed if done better, and in a widespread failure to integrate sustainability and climate criteria into project design. This is true across most economies, but it is especially acute for low- and middle-income economies. This overhaul must also

facilitate the shift from large corporate balance sheet holders to smaller, less creditworthy entities.

- ***The large financing needs can be met only through more effective mobilization of private financing.*** There is a growing pool of private and sovereign wealth capital that could be attracted into better infrastructure investment. The current stock of \$3–4 trillion in infrastructure assets held directly by institutional investors could grow to over \$10–15 trillion over the next 15 years, with significant asset reallocation and in ways that could improve overall portfolio performance.⁸ The key to mobilizing this capital is a combination of better and more stable sectoral policies at the country level, more effective project planning, and appropriate risk-sharing instruments, which can all help to lengthen investor time horizons.
- ***Development banks—both domestic and multi-lateral—are pivotal players in the infrastructure investment chain and could catalyze its transformation.*** Their role, which was greatly diminished in the 1990s and 2000s, needs to be reinvigorated. Multilateral development banks (MDBs) and national development banks can play a key role in tackling failures across the infrastructure investment chain. But this will not happen in a business-as-usual scenario. For development banks to play this important role, a major transformation will be needed in their procedures, instruments, and scale of operations, which can only be achieved with a change in the mindset of the shareholders of these institutions. It should be possible for multilateral development banks to increase their annual rate of infrastructure investment from its current level of \$30–40 billion to closer to \$200 billion over the coming decade.⁹ Development banks will also need to play a critical role in facilitating solutions for large numbers of less creditworthy households, individuals, smallholders, and others to

become distributed infrastructure owners. This may include developing alternate credit mechanisms.

- ***Official development assistance (ODA) and concessional climate finance are not in conflict.*** Indeed they can together play a reinforcing role in helping to attain the SDGs and climate-compatible growth. But there is need for better accountability and governance frameworks for both. There are also options opening up for ODA to play a stronger catalytic role in financing sustainable infrastructure, especially through models that deploy ODA into public-private partnerships.

As the draft Addis Accord and the Global Commission on the Economy and Climate have argued, there is no time to lose on the climate change, poverty reduction, and infrastructure agendas. Significant work is needed to drive to better policies, institutional arrangements, and operational practices in a coordinated way. This paper examines each of the five propositions and concludes with a set of specific priority actions. The world will only meet its ambitions on sustainable development through a major scaling up of investments in sustainable infrastructure. The choices made on the quality of these investments over the next 15 years will have major lock-in effects. We must not lose the opportunity that these years present—to lock into a better future for the planet and secure a better life for all.

There remains a persistent and mistaken perception that the development and climate agendas are in conflict, and that within the development agenda, an emphasis on sustainable infrastructure comes at the expense of social development priorities such as education and health. The focus of this paper is on how to address the gaps in sustainable infrastructure but we argue in a separate forthcoming piece that there are fundamental and deep complementarities between the infrastructure, social development and climate agendas. Failure to address climate risk will have profound, long-lasting and potentially irreversible impacts on the wellbeing, health and future prosperity of all people but especially the poor. Moreover ensuring that the infrastructure is better and more sustainable will have strong positive effects on the economy and development outcomes in the short- and long-term as it will on climate. The perception that there is a conflict between these agendas comes partly from the view that there is a strictly limited pool of financing. In reality there is tremendous scope to augment the sources of financing and the synergies between them, especially from the private sector and development banks. A better financing architecture in turn can drive the changes that are needed and make possible the means to realize the scale and quality of investment in sustainable infrastructure.

Box 1: Better climate and better development through off-grid renewables

Off-grid renewables are clear examples of how we can achieve climate, development, and economic goals at the same time.

Many rural areas in developing countries still depend on kerosene lanterns to light their homes. This is a costly burden for families: A family of three in Tanzania can consume more than 15 percent of household income purchasing kerosene alone.¹⁰ Kerosene lanterns also create fumes and smoke that pollute indoor air quality and cause serious health problems. In response to this situation, many companies have emerged to offer a solution—distributed solar energy that allows households to generate solar power and pay less for lighting. These companies are able to provide less expensive energy to isolated rural communities, creating household-level savings, but community-wide economic growth.

The deceptively simple act of offering households solar panels can have far-reaching development and climate implications. Households are not just getting better light, they are getting the opportunity for a better life. From the development perspective, families can use the savings from cheaper energy to pay for school fees, buy more seeds, and a host of other activities that could increase their prospects for upward mobility and avoid the often serious health effects of indoor pollution from burning biomass and kerosene. The solar industry potentially creates jobs and indirectly supports local growth by increasing disposable income within communities.

The potential climate impact is also substantial. If families switch from kerosene to solar panels, there is reduced demand to expand the traditional utility infrastructure. While large-scale utilities will remain predominant suppliers of electricity, the demand for power plants, transmission lines, coal mining infrastructure, and the other features of traditional large-scale energy production will be reduced, lowering countries' reliance on fossil fuels and lessening carbon emissions.

In general, the changes brought on by the emergence of distributive solar energy is indicative of a shift we see of assets and decision-making moving from large, creditworthy entities (i.e., oil and gas companies) to small, less creditworthy entities (i.e., households, smallholders, cities without good credit ratings, new project developers). Many private companies (e.g. Off the Grid, BBOXX) have already developed mechanisms to expand credit. Through infrastructure-as-a-service models, where the company owns the underlying infrastructure asset and customers pay for the service that asset provides (e.g., light), they have found a way for households with low creditworthiness to gain access to infrastructure that provides cheaper and more sustainable energy. Transitioning to sustainable infrastructure does not simply require a shift in financing priorities, but also a shift in who we are financing.

2. SCALE OF INFRASTRUCTURE FINANCING NEEDED

Over the next 15 years, the global economy will need to invest around \$90 trillion in infrastructure assets. This equates to \$5–\$6 trillion of investments per year in cities, transport systems, energy systems, water and sanitation, and telecommunications.¹¹ This implies doubling the current infrastructure spending of \$2–3 trillion per year. The incremental costs to make these investments green could amount to \$4 trillion over the period on the basis that there would be significant savings to offset upfront costs. These infrastructure assets have significant multiplier or network effects, which increase the productivity of the whole economy. In addition and as discussed, sustainable infrastructure will produce multiple co-benefits, including from lower capital expenditures due to reduced use of fossil fuels from more compact and efficient cities. It is estimated that a further

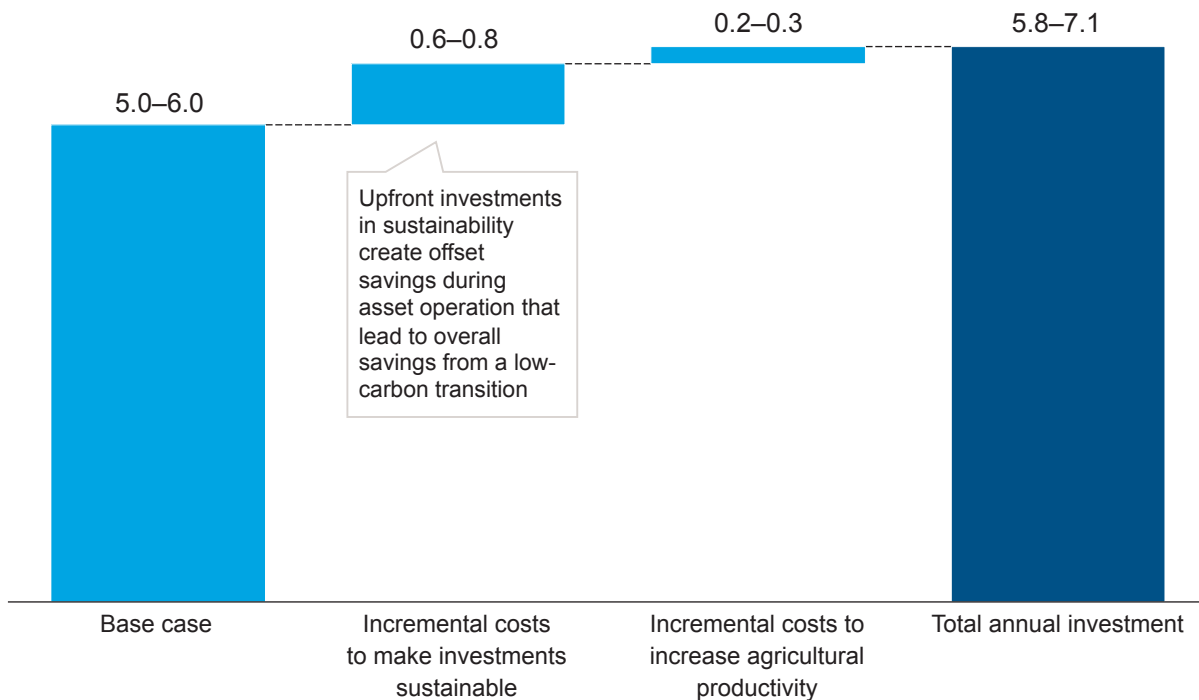
\$200-300 billion per year will be needed to drive up agricultural productivity and hence food security (Figure 2).

The rough breakdown of these investments across countries is:

- Around \$2 trillion per year in high-income economies;
- \$3–4 trillion per year in low- and middle-income economies depending on different assumptions about what would be normatively desirable versus what might be practically feasible.

In high-income countries, the main challenge is the early retirement of existing coal capacity and replacing aging infrastructure. But with it comes the opportunity to build more sustainable and resilient systems. In low- and middle-income countries, much of the investment will be greenfield, providing these countries the opportunity to

Figure 2: Global annual investments requirement, 2015 to 2030, \$ trillion, constant 2010 dollars
Indicative figures only—high range of uncertainty



Source: Global Commission on the Economy and Climate, *New Climate Economy report 2012*

learn from past mistakes and benefit from evolving technologies. Currently, high-income countries account for a third of global infrastructure investment and low- and middle-income countries for two-thirds, a big shift from the past. The pace of investments in China, which alone invests more in infrastructure than all other developing countries, will inevitably slow. In contrast, infrastructure investment spending will need to rise very significantly in the rest of the developing world.

Investments in sustainable infrastructure account for over 80 percent of the total incremental financing requirements that have been estimated in preparatory work for the Addis Conference on Financing for Development.¹² Getting investments in infrastructure and agriculture right will therefore be the key to delivering on both development and climate change agendas. It is almost impossible to separate the two. Indeed, the work of the Global Commission on the Economy and Climate demonstrated that better-planned cities, and energy and land-use systems will deliver both stronger economic and environmental outcomes. As outlined above, well-planned cities create higher economic productivity through reduced

congestion and better air quality (leading to a significant reduction in premature deaths from air pollution, estimated at a value of up to 10 percent GDP in some middle-income countries). Similar co-benefits and long-term gains are available in both energy and land-use systems, both of which are operating well within the efficiency frontier, often due to poor policies (e.g., fossil fuel subsidies) and weak institutions. For example, policies and investments to increase land-use productivity and reduce pressure to open up new agricultural land are likely to be the best instruments to protect forests and biodiversity over the medium-term (provided, of course, that complementary policies are also put in place to protect primary forests and other key natural assets).

The world faces a unique and historic opportunity over the next 15 years to successfully integrate the development and climate agendas through a concerted focus on the quantity and quality of infrastructure investment. While this is a laudable and achievable goal, many practical challenges will need to be addressed to fix the broken infrastructure development model.

Box 2: Defining sustainable infrastructure

Sustainable infrastructure is infrastructure that is socially, economically, and environmentally sustainable.

- **Social:** Sustainable infrastructure is inclusive and respects human rights. Such infrastructure meets the needs of the poor by increasing infrastructure access, supporting general poverty reduction, and reducing vulnerability to climate change risks. For example, infrastructure such as distributed renewable power generation in previously un-electrified rural areas can increase household income and improve gender equality by reducing the time needed for basic household chores. It is important to keep in mind that successful infrastructure development that is socially sustainable requires appropriate accompanying institutional development.
- **Economic:** Sustainable infrastructure is also economically sustainable. It positively impacts GDP per capita and job outcomes. Sustainable infrastructure does not burden governments with debt they cannot repay, or end-users—especially the poor—with tariffs they cannot afford. Economically sustainable infrastructure may also include opportunities to build local developer capacity.
- **Environmental:** Sustainable infrastructure is also environmentally sustainable. This includes infrastructure that establishes the foundation for a transition to a low-carbon economy. Environmentally sustainable infrastructure mitigates carbon emissions during construction and operation (e.g., high-energy efficiency standards). Sustainable infrastructure is also resilient to climate change (e.g., by building public transport systems in less fragile places or to different specifications due to climate change risks).

Sustainable infrastructure can also employ fundamentally different ways of meeting infrastructure service needs, including the implementation of more responsive and integrated information systems that complement hard infrastructure (e.g., demand-side management systems, super-responsive grids).

3. THE BROKEN INFRASTRUCTURE DEVELOPMENT MODEL

The persistence of chronic infrastructure deficits across almost all countries in the setting of an enormous available pool of global savings with record low interest rates is perhaps the most conspicuous signal that the infrastructure development model is broken. Fixing this model will require action and increased investment from governments, the private sector, development banks, and development aid agencies.

Official reserve assets have never been higher and there is a growing pool of savings managed by sovereign wealth funds. The greatest potential for additional financing lies with the private sector, especially with institutional investors. While banks may be less inclined towards long-term lending because of the new Basel capital rules, they continue to play an important role in the preparatory and construction phases of projects. Institutional investors with much larger funds at their disposal are looking for attractive, stable, relatively low-risk long-term yields—precisely the kind of returns that infrastructure should be able to provide. The real returns of 4–8 percent that can typically be realized in sound infrastructure projects should be particularly attractive in today’s sustained low interest rate environment.¹³ But, the two halves of the equation are not coming together. Neither investors nor developers appear to be taking advantage of the IMF’s free lunch. Something is wrong.

We have identified four major market and policy failures across the infrastructure investment chain. These failures are widely shared but are, not surprisingly, more acute in low-income countries:

- Public investment planning and spending failure;
- Policy risk failure;

- Project development failure;
- Private financing failure.

Public investment remains the major component of infrastructure investment in both developed and developing countries. The public sector plays a leading role in shaping and implementing infrastructure plans, even if projects are executed and financed by the private sector. Yet in most countries this leadership role is inadequate, and in many countries public investment is at historically low levels. In the EU, public investment is estimated at less than 2 percent of GDP, notwithstanding the ability of governments to borrow at rates close to zero. With the exception of China (and a few others), public investment rates in most developing countries are significantly below the 6–8 percent of GDP that would be consistent with growth rates of 5 percent or more per annum. Given that public investment is typically in excess of 50 percent of infrastructure spending (and can be as much as 80 percent) and can play an important role in crowding-in private sector involvement and finance (through various forms of public private partnerships), shortfalls in public investment have negative multiplier effects. Raising public investment will require increasing fiscal space, which is a severe constraint in many developed and developing economies. However, the problem runs deeper: Weak national infrastructure plans, and cumbersome planning machinery, create major costs for project developers and exacerbate problems of corruption. As a result of weak institutional capacities and planning inefficiencies, infrastructure projects are subject to endemic delays and cost over-runs, typically between 20–50 percent of project costs, which in turn increases risks to developers and raises financing costs. Also, there will be need for new mechanisms that allow subnational entities to effectively finance infrastructure projects. Much of the projected infrastructure investment will take place in cities, yet most cities in the developing

world cannot access financing. In fact, the World Bank has found that only about 4 percent of the 500 largest cities in developing countries are deemed creditworthy in international financial markets, while only 20 percent are deemed creditworthy in local markets.¹⁴ This will need to change over the next 15 years to achieve necessary public investment in infrastructure. Given the magnitude of investments that will need to be undertaken over the next 15 years, a sound but flexible approach will need to be taken towards debt management and debt sustainability. This scale of investment cannot be undertaken without debt financing playing a significant role; in this, what matters more is the quality of the investments that are financed, and not the level of debt that is financed.

Policy uncertainty is a major constraint for infrastructure developers, especially when private capital is required. Typical infrastructure assets take 3–7 years to build, with payback periods that extend well beyond 10 years. This makes investment returns highly sensitive to regulatory/policy risks during the construction and operating phases of the project. Some of these risks are familiar, such as the risk that governments will interfere with pricing regimes for electricity or water utilities. However, some of the risks are new, especially for the energy sector, including climate-policy risks. In many jurisdictions, the risk for investors to finance high-carbon, polluting assets has become greater. Investing in capital-intensive coal-fired plants may not make much sense if there is significant regulatory risk (within the next 10–15 years) that could strand the assets. Long-term institutional investors do not like to rely on regulatory grandfathering.

Project development capacity remains scarce in many developing and especially low-income countries. Few governments have built or retained much project development capacity. Weak project develop-

ment capacity translates into fewer bankable projects and much higher levels of risk. In addition, most low-income countries and many middle-income countries lack the capacity to negotiate and execute public private partnerships (PPPs), which constrains the development of a strong pipeline of projects. However, there is a growing pool of developers who have the sophistication to manage complex, multi-stakeholder, technologically demanding infrastructure projects. Increasingly, we see developers from middle-income countries that have mastered these capabilities and are expanding internationally. However, sustainability or climate change factors are generally not well-integrated into the infrastructure specifications and are still perceived as increasing upfront investment costs (which may or may not be the case). Hydroelectric power is an interesting example of this, with a growing range of hydro-power developers and industry-specified sustainability protocols, and yet with very little compliance in practice.

Private finance should, in principle, be available. For future financing we estimate that 80 percent of resources for infrastructure investment are likely to be domestic, except in low-income economies (where the ratio will likely still be around 50 percent). Developing countries therefore need to continue to strengthen their domestic financial sectors and develop local currency bond markets, as many are doing. We also know that infrastructure assets should be attractive as components of an overall institutional investor portfolio, given that they should have stable, bond-like characteristics, with returns above government paper. The returns are also often uncorrelated with wider market returns. However, institutional investors who control around \$110 trillion of total assets—with a net inflow of \$5–8 trillion per year—hold only \$3–4 trillion directly in illiquid, alternative infrastructure assets.¹⁵ They are likely to hold another \$5–10 trillion indirectly through their investment in corporate

balance sheets. Even more indirectly, they will have additional holdings of government paper. But only a very small proportion of these holdings are in emerging market assets. The World Bank estimates that in 2013, only around \$150 billion was invested in infrastructure in the developing world through PPPs or fully private projects.¹⁶ Private investments are constrained by: (i) policy-related risk; (ii) illiquidity; (iii) lack of easily investible, standardized assets; (iv) counterparty and currency risk; and (v) the lack of capacity among institutional investors to undertake independent appraisals, translating into a bias for shorter-term holdings.¹⁷

There is an urgent need to fix the model of infrastructure development in most countries. Such an approach must address the systemic constraints that lead to underinvestment in infrastructure, while ensuring that the investments that are made are developmentally and environmentally sustainable. Key elements for such a new model are:

- The integration of infrastructure development into the growth strategies of both developed and developing countries;
- Stronger institutional structures for investment planning and building a pipeline of projects that take into account development impact and environmental sustainability from the outset;
- Greater capacity to engage the private sector and infrastructure financing vehicles;
- Instruments that match the particular risks of infrastructure financing and ensure a total cost of ownership approach that can finance additional upfront capital costs for greater sustainability.

Many of these elements have been embraced by the G-20 for infrastructure investment broadly, but more attention is needed on sustainability and on how to gain greater synergies from the different players and pools of financing.

Box 3: Understanding sources of financing—Investor class taxonomy

Currently, \$110 trillion of investible assets are held by the private sector globally. Of this, we estimate \$70 trillion are managed by private-sector investors who are currently invested in, or have listed infrastructure as part of their longer-term strategy.¹⁸

Private sector investors can be segmented into six main groups:¹⁹

1. Banks and investment companies: \$69.3 trillion in assets;
2. Insurance companies and private pensions: \$26.5 trillion in assets;
3. Sovereign wealth funds: \$6.3 trillion in assets;
4. Operators and developers: \$3.4 trillion in assets;
5. Infrastructure and private equity funds: \$2.7 trillion in assets;
6. Endowments and foundations: \$1 trillion in assets.

The rationale for dividing our investor set in this manner is based on grouping players with similar investing motivations, risk appetites, and regulatory restrictions on their infrastructure investments.

4. UNLOCKING PRIVATE SECTOR INVESTMENT CAPITAL

Given the enormous global infrastructure investment needs and the widespread public sector constraints, it is clear that the greatest potential for mobilizing additional infrastructure financing lies with the private sector. There does not appear to be a fundamental shortage of investible savings, which are generating net inflows of \$5–8 trillion per year into mainstream institutional funds (private and public/sovereign).

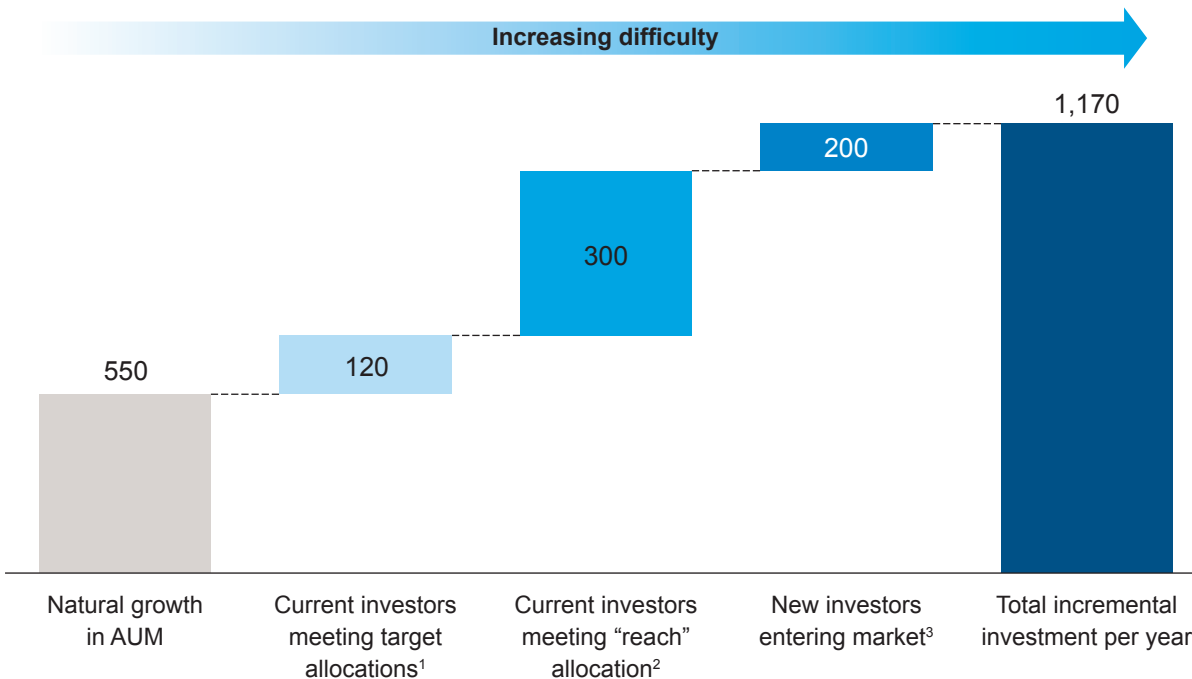
Current private sector financing for infrastructure globally amounts to \$1.5–2 trillion per year with the majority

coming from corporate investors (e.g., Shell, Verizon). Given total investible assets held by private institutional investors (estimated at \$110 trillion as of 2015), this group represents a significant opportunity to increase annual infrastructure investment.²⁰

Institutional investment in infrastructure could grow significantly if current investors meet their stated targets levels (from 5.2 percent of portfolio to 6 percent on average) as assets under management increase at the projected rate of 6 percent per year.^{21, 22} It would take a set of concerted actions to encourage investors to meet these target levels. But if successful, it would create incremental annual

Figure 3: Incremental annual investment from private institutional investors

USD\$ billion



¹ Weighted average target allocation = 5.96% across investor groups

² "Reach" allocation define as 8% weighted average across investor groups

³ Assumes 50% of non-infrastructure investors begin investing at level comparable to peer current allocations

Source: Preqin Ltd. 2015. Preqin Global Database.

infrastructure investment of \$800 billion from private institutional investors. If more aggressive measures are taken to raise the allocation to 8 percent or increase the pool of institutional investors investing in infrastructure, the incremental investment could increase to around \$1.2 trillion annually. This would help close roughly a third to a half of the gap between the \$2-3 trillion currently spent each year and the \$5-6 trillion annual spending needed each year over the next 15 years. Private sector contributions, especially from corporations, could be even higher if specific risk mitigation and return enhancement levers were pulled (Figure 3).

The challenge is to ensure that the right conditions are in place to attract these funds (mainstream and impact) into infrastructure, both domestic and international.

These conditions are well-known and well-documented but are worth reiterating:

- Good stable policies within a set of governance and contractual arrangements that can be relied on to provide fair treatment of investors over time;
- Instruments to help mitigate non-market risks (e.g., state-directed changes in utility pricing). These instruments can include forms of insurance through guarantees or co-investment by development banks (which help to comfort private investors);
- Blended finance approaches to infrastructure investments in developing countries in a way that helps to improve counterparty creditworthiness and makes the overall project more affordable, thereby making it easier to integrate sustainability/climate criteria into the investment;
- Capital market regulations which encourage these forms of investment, through (i) making it easier for investors to hold illiquid (and cross-border) assets,

(ii) enabling the development of more liquid, infrastructure asset classes including “green bonds” of which an estimated \$40 billion were issued in 2014;²³ and (iii) potentially adapting Basel III/Solvency II rules to ensure that infrastructure investment is not penalized in capital risk-weighting formula;

- Stronger regulatory oversight and transparency with regard to exposure to climate, carbon, and other environmental (e.g., water) risks embedded (but largely latent) in investors’ portfolios. Mandatory reporting frameworks are emerging for both companies and investors. These include Grenelle II in France and mandatory carbon reporting for companies listed on the Main Market of the London Stock Exchange. Furthermore, as of FY2016, institutional investors in France must measure and report levels of carbon exposure in their portfolios.²⁴ These requirements might expand to EU as the European Commission considers requiring retail investment funds to report on their approach to environmental, social and corporate governance (ESG) issues;²⁵
- Further actions to develop local capital markets and longer-tenure, local currency bond instruments in middle-income countries.

Institutional investors, on average, require between 4–8 percent real return on their infrastructure assets, but this can vary greatly depending on the asset class, stage in the project lifecycle, source of capital, and particular investors risk/return appetite. Returns depend on the exposure to market risks. For example, power projects with long-term power purchase agreements (PPAs) are at the low-risk end of the return spectrum while speculative merchant generators are at the higher end.^{32, 33} There is also often a risk premium for projects in developing countries, where investors perceive increased risk (e.g., sovereign, currency, policy). While many investors perceive infrastructure to be

Box 4: Impact of regulatory reform on infrastructure investment

Basel III is a global, voluntary regulatory framework aimed at strengthening banks in the wake of the financial crisis by increasing bank liquidity and decreasing bank leverage.²⁶ Basel III applies to project finance lending and may make project finance loans scarcer and more expensive due to stricter bank capital requirements and the way for which loans are accounted. Basel III regulation of banks' capital, leverage, and liquidity intentionally discourages mismatches in the maturity of assets and liabilities, which makes it harder and more expensive for banks to issue long-term debt, such as project finance loans.

Under Basel III, the provision of long-term debt such as project finance is made more expensive for banks by obligating them to match their liabilities with their assets in terms of funding.²⁷ Thus, Basel III increases the loan interest-rate spread and discourages long-term lending by financial instructions with predominantly short-term liabilities.²⁸ Additionally, project finance borrowers need to amortize debt over 15–20 years, while Basel III encourages shorter loan maturities for many players. This means refinancing is required after the initial loan period, creating additional refinancing risk for borrowers. Overall, Basel III regulations make infrastructure investments less attractive for banks.

Solvency II is an European Union directive that codifies and harmonizes EU insurance regulation, which largely concerns the amount of capital EU insurance companies must hold.²⁹ Solvency II treats long-term investments in infrastructure as of similar risk to long-term corporate debt or investments, requiring higher capital ratios. The increased capital requirements degrade return profiles for infrastructure investments more broadly and penalize, in particular, low-risk well-understood infrastructure investments³⁰ Some experts and insurers predict Solvency II will discourage infrastructure investment because the capital charges (i.e., the amount of money tied up in an investment multiplied by the cost of capital) have become too high given the increased capital requirements. Solvency II might also increase debt investment at the expense of equity investment since it has more favorable treatment.³¹ This legislation is scheduled to come into effect on January 1, 2016.

risky, research from Standard & Poor's (S&P) indicates that infrastructure projects are no more risky than corporate entities with similar rating levels. Average annual default rates from infrastructure project finance debt rated by S&P have been 1.5 percent since 1998, while corporate issuers have experienced an average annual default rate of 1.8 percent.³⁴

The key to reduce these capital costs for infrastructure assets is to lower policy and regulatory risk. There is no simple solution to this challenge; rather a combination of actions and involvement of different actors will be

required. Development banks can make a difference by providing greater "comfort" to private investors. The right institutional arrangements by governments—e.g., the commercial independence of state utilities, the robustness of contractual mechanisms for power purchasing agreements, national submissions to an international climate agreement—can signal long-term, stable public sector commitments. Actions to signal a more stable long-term investment framework for infrastructure could be worth 200–500 basis points for a "typical" middle-income country. Impact funds, which have the ability to scale from an estimated \$40 billion in assets under

management (AUM) in 2013 (\$12 billion of new commitments), can play an important role in low-income countries. It will be challenging to mobilize private international capital for infrastructure investments in low-income countries, although MDBs and ODA can be used strategically to improve the business case.³⁵

While the greatest potential for incremental financing is from institutional investors, developed countries will need to lead the way in establishing infrastruc-

ture as an asset class, creating a benchmark that can then be used by developing countries. In the medium-term the greatest potential for mobilizing private financing is from strengthening domestic financial intermediaries and deepening capital markets. Care has to be taken to ensure sound oversight and prudential practices by intermediaries and their regulators. Otherwise, there can be a rapid build-up of non-performing assets as has been the case in China and more recently in India.

Box 5: South Africa's success with procurement reform for renewables

South Africa's Renewable Energy IPP Procurement Program (REIPPP) provides a successful example of mobilization of domestic private sector financing for sustainable infrastructure. South Africa assembled a highly-skilled team of experts to develop and run a credible, transparent, and rigorous procurement process that substantially reduced energy costs over a short period of time while raising 86 percent of the debt from within South Africa. The REIPPP acts as a multi-round competitive bidding process and has been described as "the most successful public private partnership in Africa in the last 20 years." As of 2014, a total of 64 projects have been awarded to the private sector, and the first projects are already online. The private sector has committed an investment totaling \$14 billion, with these projects estimated to generate 3,922 megawatts (MW) of renewable power. Over the three-phase bidding period, average solar photovoltaic (PV) tariffs decreased by 68 percent and wind dropped by 42 percent, in nominal terms.

A critical success factor has been the requirement for bidders to submit bank letters stating that financing was locked-in, which basically outsources due diligence to the banks. In effect, lenders took on a higher share of project development risk and this arrangement dealt with the biggest problem of auctions—the "low-balling" that results in deals not closing.

South Africa's renewable energy procurement program required changes from all stakeholders to succeed along with broad political buy-in.³⁶

5. DEVELOPMENT BANKS: MORE THAN THE MONEY

Development Banks, both national and international, have historically played a major role in mobilizing capital for infrastructure development. Their financing and non-financing role waned in the 1990s and 2000s as the support of infrastructure projects became more contentious internationally and as national development banks fell out of favor. Excluding the European Investment Bank, the eight major multilateral development banks have been investing around \$35–40 billion in infrastructure annually³⁷ compared to total infrastructure investment in emerging markets and developing countries of around \$2 trillion.³⁸ At the national level, development banks play a major role in China, Brazil, South Africa, and a handful of other countries. In these three countries, national development banks have also assumed a large role in cross-border financing. In most other countries, however, the role of national development banks is relatively minor.

In principle, MDBs have the potential to play a leading role in mobilizing the investment capital required for the sustainable infrastructure development over the next 15 years. They can add value to this agenda in six main ways:

- Since only a fraction of capital is actually paid in, and callable capital has never been called upon and is hence considered safe, MDBs can mobilize multiples of what is paid in even with conservative gearing ratios. For example, in the case of the World Bank, which has built up the longest track record, paid-in capital contributions are only 3.5 percent. Even with a gearing ratio (loans to subscribed capital) of 1 to 1, the World Bank can mobilize \$28 from international markets for every dollar put in as paid capital. Moreover, the bonds issued by the World Bank can be held not just by private investors but
- Development banks can further crowd-in private capital for individual projects. Leverage ratios through co-financing vary across projects and institutions, but most generally achieve a ratio of 2:1 or 3:1. This means that, ultimately, \$1 of paid-in public capital can crowd-in anywhere from \$10 to over \$70 of private capital. In addition, through their very involvement, MDBs can help lower the cost of this private capital by mitigating private investor perceptions of project risk (especially for policy-related risks). Finally, they can deploy a range of risk mitigating instruments, though it is unclear how effective such instruments are in mobilizing large-scale private cross-border finance.
- They can also strengthen the actual project development phase in infrastructure investment. Their capacity to do this includes: (i) working with governments (both national and municipal) on key regulatory frameworks; (ii) providing in-house technical project appraisal capacity (which is in increasingly short supply in many private banks); and (iii) providing concessional finance to support project developers through the highest risk phase of the project life-cycle. Participation of development banks, assuming strong technical capabilities, not only reduces perceived risk but can also reduce actual project risk.
- Development Banks can develop more liquid markets for secondary instruments through securitizing their own asset portfolios. This provides an additional basis for institutional investors to participate in infrastructure finance. It also could help stimulate domestic capital market institutions, which have

by central banks and official institutions helping to recycle savings. Higher gearing ratios or willingness to accept a lower credit rating than AAA would allow for a further increase in leverage.

become increasingly important as sources of finance in middle-income countries.

- Development Banks, especially at the national and regional level, can facilitate the balance sheet shift of infrastructure ownership from larger corporate entities and governments to cities, households, and individuals using distributed infrastructure as a service. Enabling this shift requires creating mechanisms to assess and grant credit to large numbers of small entities and individuals typically considered less creditworthy. Actions could include supporting non-traditional credit ratings (e.g., through mobile phone payments), or acting as a guarantor (e.g., providing loan guarantees for smallholders and households).
- Finally, development banks can set standards vis-à-vis sustainability. First, they can demonstrate that their own investment standards deliver both development and climate benefits, while lowering overall project risk. Leading by example in this regard can promote development of industry standards and best practices for project finance. This would also support more rapid diffusion of know-how to low-income countries, all the while demonstrating the (low) incremental investment costs of more sustainable approaches to infrastructure development. The Global Commission has estimated these incremental costs to be around 5 percent of total infrastructure capital requirements, with some estimates suggesting an additional 1–2 percent required for greater climate resilience. However, it must be recognized that many of these costs could potentially be offset by lower operating costs, even before consideration of the non-financial benefits (e.g., from reduced air pollution and congestion, more accessible cities, lower vulnerability to volatile fossil fuel prices, enhanced energy security, etc.). Nevertheless, more sustainable approaches

typically tend to be more capital intensive and entail additional upfront financing requirements. There is a need therefore to find the means to mobilize additional capital and find ways to reduce the overall costs of financing to make the more sustainable option financially feasible and the output affordable to end-users. Development banks can play a critical role in this bargain—through the cost effectiveness of their own financing, crowding-in private sector financing at affordable cost, and blending, as appropriate, with concessional finance. Putting together viable financing packages based on sustainable investment strategies and projects can be a central instrument in supporting low-carbon growth strategies especially in the presence of fossil fuel price distortions and lack of carbon pricing.

While MDBs possess these key advantages required to play a leading role in infrastructure financing, their role in practice has become relatively minor. There is a genuine opportunity for development banks to increase their financing given relative under-allocation. This under-allocation is, in part, due to the absence of a sufficient pipeline of bankable projects in a range of countries, as well as the emergence of new sources of financing (including China). Notwithstanding these factors, the principal reasons that MDBs are not fulfilling their potential as intermediaries and facilitators of infrastructure investment appear to be more endogenous in nature: procedures and requirements are overly cumbersome, leading to costly and lengthy project approvals; financing instruments are not sufficiently flexible or appropriate in relation to the needs; and there has been a gradual erosion in the technical capacity and skills of staff. An analysis of 44 recent mega-projects (those over \$1 billion) indicates an average time from announcement to construction of five years. Many MDB projects can take up to nine years or more. While MDBs need to adjust their busi-

ness model to be more cost effective, they cannot simply go back to old practices of business-as-usual infrastructure. Instead, they have to pave the way to creating better infrastructure that is more productive and more sustainable.

Reinvigorating the MDB role in infrastructure finance will therefore require real internal change in order to:

- Reform safeguard policies so that they are far less procedurally burdensome while still being substantively effective;
- Rebuild staff capacity, skills, and confidence in making judgments;
- Put in place the necessary instruments to catalyze the different pools of private financing, including through more innovative uses of balance sheet capacity;
- Focus on catalyzing and mobilizing private finance through investments.

The good news is that, with the right leadership, the MDBs have demonstrated their ability to drive the required speed and scale of internal change. The European Bank for Reconstruction and Development (EBRD) shows what is possible, given the speed with which the bank has ramped up its investments in energy efficiency, by investing both directly and by leveraging its finance through domestic commercial banks. This class of investment now accounts for over 25 percent of the EBRD's annual lending.

Given the scale of anticipated demand, MDBs also need to be prepared to expand their capital much more rapidly than in the past. The governance of these institutions also needs to adapt, with developing countries now playing a major role in the global economy and development agenda. Allowing emerging markets

and developing countries to increase their share very significantly in the major global and regional financial institutions is critical. It will also allow these institutions to tap a willing and growing source of capital.

The establishment of new institutions by developing countries, notably the Asian Infrastructure Investment Bank launched by China, the New Development Bank launched by the BRICS and the ASEAN Infrastructure Fund, should be seen as welcome initiatives to augment the pool of available financing and an opportunity to learn and push for more effective approaches. There is now a renewed focus by the old and new institutions on infrastructure financing and with it a wide spectrum of experimentation and scope for learning. Successful cases of scaling up such as the financing for energy efficiency in Eastern Europe or roads in Kazakhstan by the EBRD can be replicated elsewhere.

The time has also come to revisit the role of national development banks. Although there are pitfalls, the experiences of the more successful development banks show that these institutions can fill an important gap in project development and oversight and crowding-in other sources of financing

Development banks cannot fix all the problems of the broken infrastructure investment chain. However, they are an obvious point of leverage. They are also trusted by many key stakeholders—in both the public and private sectors—making it possible to bridge and arbitrage between different public and private return requirements. Provided that they are able to operate with strong technical staff capabilities and sound governance structures, they can play an outsized role in transforming infrastructure investment and financing—through their impact on volume and cost of financing (directly and by mobilizing private capital) and through their impact on the quality and sustainability of the investments.

6. ROLE OF OFFICIAL DEVELOPMENT ASSISTANCE

ODA is likely to remain relatively modest compared to the scale of investment needs for sustainable infrastructure in low- and lower-middle income countries. However, it can play a critical role in closing financing gaps in the poorest countries including by crowding-in other sources of finance and in improving access and affordability for the poor.

ODA levels have increased significantly in recent years rising from \$54 billion in 2000 to \$135 billion in 2013. Around 30 percent of ODA has been targeted to the least developed countries. Historically, less than 15 percent was allocated for infrastructure spending despite the fact that it has been a large component of the recipient governments' capital spending.³⁹ Since the 2008 global financial crisis, following an initial decline, there has been an increase in concessional financing for infrastructure, with the total exceeding \$22 billion in 2013.⁴⁰

Yet these magnitudes are small compared to the scale of the needs. The most urgent and compelling need is to support poverty reduction and buttress basic social investments in the poorest countries. The additional annual financing requirements to meet minimum social investments such as education, health, and access to social infrastructure implied by the SDGs have been estimated to be on the order of \$40 billion.⁴¹ To meet growth and development targets, infrastructure investment in low-income countries will need to at least double from its present level of around \$150 billion a year. It will also be essential to address the growing unmet need for climate adaptation in both low-income and vulnerable countries, which, by some estimates, could amount to another \$60-\$100 billion a year.

Although the world should continue to push for all rich countries to live up to the internationally agreed targets, the total pool of ODA will remain constrained and relatively small going forward. Given that the pool of ODA is constrained, it is essential that official development capital mobilizes private finance for sustainable infrastructure investments in low and lower-middle income countries. Investment by development finance institutions (DFIs) can encourage participation from other investors directly through the mobilization of capital and indirectly through signaling a profitable market exists. This can be achieved through the demonstration effect, where investments lead to follow-on investment from the private sector, independent of further DFI involvement, as investors react to the signal of the sector's profitability. It can also be achieved through direct capital mobilization, where DFI involvement encourages the private sector to simultaneously (or soon after) invest in the same firm/fund. In this case, investors react to the signal of the DFI's judgment and/or ability to reduce risk. These effects have slightly different mechanisms but they are not mutually exclusive—they can and do often occur at the same time.

Direct capital mobilization can be measured through the leverage ratio, which indicates how many dollars of private investment each dollar of DFI mobilizes. An example of effective direct capital mobilization is Private Infrastructure Development Group's (PIDG's) role in AES Sonal's 85MW power plant in Limbe, Cameroon. PIDG provided \$30 million in 2003, and played the critical role of coordinating the balance of debt financing. The next time funds were required in 2006 PIDG rolled over its existing facility and increased its exposure to provide vital bridge financing. This paved the way for PIDG to be joined by six other investors, raising \$554 million, with \$547 million from the private sector.⁴²

7. TARGETED CLIMATE FINANCE

In recent years, there has been a proliferation of international funds related to climate finance, with 50 such funds established to date. The major financing mechanisms include the Global Environment Facility (GEF), the Adaptation Fund, the Climate Investment Funds, and most recently the Green Climate Fund and new financing instruments such as performance based payments for reducing emissions from deforestation, degradation, and enhancing forest conservation. The total pool of these funds is now around \$25 billion, which is small compared to the trillions needed for financing sustainable infrastructure and is very likely inadequate to meet the needs of concessional climate finance.

A key issue linking the Addis Financing for Development agenda and the outcome of COP21 is how to interpret and act on the \$100 billion in additional climate finance that was agreed in the Copenhagen Accord from the COP15 conference, which took place in Copenhagen in 2009 and embodied in the decision of COP16 conference in Cancun, Mexico in 2010.⁴³ This pool of targeted climate finance must be seen as an integral part of the much larger sums that will be needed to drive SDG strategies and finance, and designed to provide the strongest boost to “climate actions” while enhancing development effects. As set out in a separate paper by Lord Stern (and summarized in Box 6), the \$100 billion should be used to target some key areas of climate action. The paper also examines the question of how to define additionality of climate finance through, for example, new sources of income or areas of action. The definition of additionality is not the main purpose of this paper. The focus instead is on key areas of action and types of flows of finance, emphasizing complementarities in each case.

The other central issue is where this financing will come from and what counts towards the \$100 billion, given that it has always been seen as a contribution by rich countries to climate action in developing countries. As the paper by Westphal et al. lays out, there are several possible sources that could count towards the \$100 billion: developed country climate finance; leveraged private sector investment; MDB climate finance (weighted by developed countries capital share); and climate-related ODA.⁴⁴

There is still considerable disagreement on what should be counted from these possible sources. A too narrow an interpretation will not yield a productive outcome. Instead, the goal should be to drive true additionality and maximum leverage to produce results at scale. Some have argued that there is a conflict between development and climate finance, expressing a concern that the latter will come at the expense of the former. Clearly, there is a risk that donor countries could shift ODA towards climate finance in a way that could reduce funds for poverty reduction and the social sectors or could drive up energy costs (e.g., by insisting on higher-cost renewable energy, even for low-income countries). It is also possible that donors might choose to circumvent Development Assistance Committee guidelines and treat carbon offsets (e.g. for REDD+) as if it were ODA. But this has not so far been the case as Norway’s support for forests in Brazil demonstrates. The distinction between ODA and climate finance flows can in part be managed through proper transparency. Developed country commitment to ensuring an agreed percentage of ODA goes to lower-income and least-developed countries is another way that could address concerns about diverting ODA towards climate finance.

Box 6: Defining climate finance

As defined in Lord Nicholas Stern's paper "Understanding Climate Finance in Paris December 2015 in the Context of Financing for Sustainable Development in Addis Ababa July 2015," there are six major areas for climate finance and action:⁴⁵

1. Promoting low- or lower-carbon activity in infrastructure, through methods including lowering the cost of capital (important for scale and for renewables and public transport, both of which are relatively capital intensive);
2. Promoting low-carbon activities, including energy efficiency, in non-infrastructure activities including buildings, transport, industry, and agriculture;
3. Adaptation, particularly for the most vulnerable and poorest countries;
4. Avoiding deforestation, restoration of degraded agriculture and forest landscapes, more productive land use, and protection of fragile resources, including oceans and bio-diversity;
5. Innovation and breaking new ground on climate action such as new methods for public and private sectors to work together (e.g., carbon capture and storage or climate-resilient agriculture). Recall the green revolution in wheat and rice in the 1970s, when much of the action was in local agricultural research and extension. Innovation should be cross-cutting and everywhere but a direct focus would also be very valuable given how critical it is and the need for fitting into country contexts;
6. Regional action: Many climate actions for both adaptation and mitigation are regional in nature but at the moment are under-supported and under-funded.

8. A TRANSFORMATION PROGRAM FOR BETTER INFRASTRUCTURE

Better infrastructure is transformational for development, climate and the economy, and there is a path forward to make this a reality. This paper has argued that a step-increase is warranted in infrastructure investment over the next 15 years to support growth, structural transformation, and the broad achievement of the SDGs. At a time when the world is caught in a vicious cycle of low growth and low investment, a major resuscitation of infrastructure investment can provide an important boost to the global economy. But the challenge is not just more infrastructure but better infrastructure—if we are to effectively meet growth and development objectives and respect the planetary boundaries. Locking in infrastructure that is high-carbon and/or inefficient will prove to be cumulatively costly and difficult and expensive to subsequently unwind especially given the scale of what needs to be invested. The next 15 years will therefore be a critical period for sustainable global prosperity and the future of the planet. The architecture for financing and international cooperation will be a critical foundation to realize the scale of the ambitions and drive the changes that are needed.

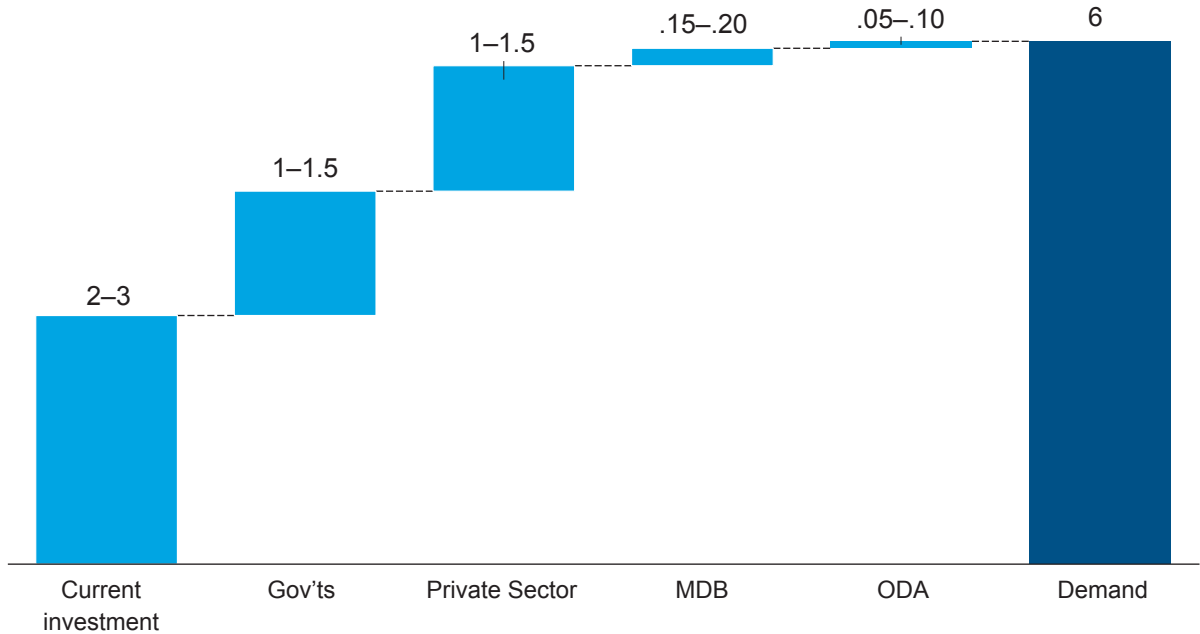
We can chart a course to reach \$6 trillion in annual spending (from current spend of \$2–3 trillion) through increased investment by private sector investors, governments, MDBs, and ODA. As previously discussed, the private sector represents a significant opportunity to close the spending gap as we have shown that natural growth in AUM combined with modest increases in allocation toward infrastructure could yield a \$1 trillion incremental increase in annual spending through 2030. This could increase to \$1.5 trillion if actions were taken to enhance private sector allocations to infrastructure and increase the base of infrastructure investors.

In addition, an incremental \$150–200 billion is possible from MDBs if specific actions are taken to expand their capacity (e.g., by increasing paid-in capital or expanding flexibility of balance-sheet use). As a joint paper prepared by the MDBs has underscored, beyond their direct financing, the MDBs have a critical catalytic role to play in helping to mobilize and use effectively the much larger sums of financing by crowding-in the private sector and through improved domestic resource mobilization.⁴⁶ Optimistically, increases in ODA may add an incremental \$50–100 billion of funding over the next 15 years, which would be in line with concessional finance growth over the past decade.⁴⁷

Governments will need to close the remainder of the spending gap partly because governments will need to remain centrally involved in many areas of infrastructure provision. Depending on participation from the private sector, public funding for infrastructure will need to increase by \$1–1.5 trillion per annum through 2030, either financed directly by governments or through their national development banks (which, in China and Brazil, have played such a significant role in infrastructure finance). This would amount to 0.7–1.1 percent of projected global GDP, which is a very achievable target for improved domestic resource mobilization, especially if it is supported by the elimination of fossil fuel subsidies and the introduction of a carbon tax.

The G-20 has already acknowledged these requirements through its ongoing efforts to integrate infrastructure investment into growth strategies, to address domestic impediments, and to mobilize increased financing from institutional investors. It has launched an initiative to improve knowledge of leading practices and promote enhanced public private partnership for infrastructure development and financing supported by a new Global Infrastructure Hub in Sydney. Several multilateral development banks (Asian Development Bank, African

Figure 4: Proposed annual incremental financing from different sources to close infrastructure gap
 USD\$ trillions, constant 2010 dollars



Source: Authors' estimates.

Development Bank, EBRD) have launched new initiatives to help with project preparation. The African Development Bank has established the Africa50 Fund and the World Bank is setting up a Global Infrastructure Facility, both of which aim to catalyse private sector projects and crowd in private financing. The Chinese government has launched a new Asian Infrastructure Investment Bank, which has already attracted more than 50 potential member countries and has a targeted capital of \$50 billion. The BRICS are moving forward with the foundation of the New Development Bank, with an initial authorized capital of \$100 billion and the aim of enhancing the provision of multilateral public infrastructure financing for emerging markets and developing countries.

The forthcoming U.N. Conference on Financing for Development at Addis Ababa in July provides an his-

toric opportunity to reach consensus on a new global compact on sustainable infrastructure. Bridging the infrastructure gap has been recognized as a central pillar of the financing for development agenda in the draft Addis Accord. What is needed now is to translate this shared recognition of the importance of sustainable infrastructure into a concrete program of action building on the many efforts that are already underway.

Achieving better infrastructure outcomes will require concerted actions on many fronts (Figure 5). In particular, we propose six critical areas for action⁴⁸:

- **First, there is a need for national authorities to clearly articulate their development strategies on sustainable infrastructure.** Very few governments, developed and developing, have well-articulated

Figure 5: Achieving better infrastructure outcomes requires concerted action

Areas	Actions
Financing costs	Transform low interest rates into low financing costs through effective de-risking and blending private financing with concessional finance
Subsidies and carbon pricing	Eliminate fossil fuel subsidies and establish carbon price corridor to incentivize sustainable infrastructure and augment resources ¹
Planning	Strengthen planning and preparation capabilities based on revamped national commitments and international support, improved governance, and incorporation of sustainability criteria
Financing mechanisms	Transform financing architecture to improve scale, affordability, and sustainability <ul style="list-style-type: none"> • Leverage MDBs to mobilize much larger sums of private capital commensurate with affordability • Ensure sufficient ODA to promote affordability and sustainability, especially in poor countries • Deploy targeted climate finance to tilt incentives and enable climate actions
Financial regulations	Address regulatory constraints on long-term financing and take further steps to encourage low carbon investments, including through the use of voluntary codes and standards ²
Environmental standards	Strengthen environmental regulations and standards to push for low carbon trajectories and other co-benefits ³
Technology	Promote new mechanisms and financing for technology innovation and diffusion

¹ This will take time so a key challenge is how to influence investment choice towards low carbon infrastructure and efficiency of use in the meantime.
² Examples include market developed standards for green bonds and codes of good practices by sovereign wealth funds.
³ A good example is the Clean Air Act in the U.S. which has been used to lower emissions including carbon emissions.

strategies and investment plans for sustainable infrastructure. These strategies need to address the still considerable opportunity for improvements in national policy in key infrastructure sectors, such as urban development, transport, and energy. These opportunities have been highlighted by a range of players, including the OECD, the Global Commission, and others. Better energy pricing, the phasing out/elimination of fossil fuel subsidies, appropriate water user

charges and stronger urban planning would all lead to higher productivity infrastructure investments, creating stronger economic and environmental benefits. Recent work by the IMF has highlighted the immense scale of energy subsidies and therefore the scope for them to serve as an important source of revenue.⁴⁹ Greater regulatory stability, potentially through more independent infrastructure delivery units, could also help to reduce financing costs and limit cost over-runs.

It is worth remembering that a 1–2 percent reduction in financing costs, due to greater policy predictability, could be worth up to \$100 billion per year. While there is wide variation in institutional capacities, past and ongoing examinations have highlighted several areas for institutional strengthening: the capacity to develop and implement project pipelines; the capacity to engage with and draw up contracts with the private sector based on appropriate risk sharing and value for money; the management of complex projects; effective dispute resolution systems; sound information and proper evaluation to support a results-based approach; and critically, the integration of sustainability considerations and criteria in sector strategies and individual projects. Many governments face the challenge of securing the necessary fiscal space, and many need to strengthen sub-national finance and institutions. Governments also need to deepen domestic financial intermediation to meet the particular requirements of infrastructure financing and help create a capable and contestable pool of project developers. In particular, the deepening of domestic capital markets and targeted instruments such as national development banks, project bonds, and specialized investment vehicles can help augment the pool of domestic financing.

- ***Second, the G-20 can play an important leadership role in taking the actions needed to bridge the infrastructure gap and in incorporating climate risk and sustainable development factors more explicitly in infrastructure development strategies.*** Given that the G-20 accounts for 80 percent of global GDP, a clear commitment to and concrete actions on sustainable infrastructure by G-20 countries will have enormous impact on global outcomes. The G-20 can also provide leadership on global collective actions to support infrastructure development more broadly. A good example is the need for a more standardized set of norms around

how public finance enables low-carbon, sustainable infrastructure. We would also call on the G-20 to play a leadership role in the strengthening of both national and international development banks, as well as in adopting more effective rules on public infrastructure procurement (especially for middle- and high-income countries). Building on the G-20 action plan, a major initiative could be launched as part of the Third Conference on Financing for Development Conference at Addis to strengthen institutional capacity for investment planning and project preparation of sustainable infrastructure in low-income and other disadvantaged countries.

- ***Third, we would encourage a strengthening of the capacity of development banks to invest in infrastructure and agricultural productivity, through their direct and catalytic role, and for them to pioneer and support changes needed for better infrastructure.*** The MDBs will need to increase their infrastructure lending five-fold over the next decade from around \$30–40 billion per year to over \$200 billion in order to help meet overall infrastructure financing requirements. This will not happen on a business-as-usual basis. There are a number of options to expand their capacity, including: (i) increases in paid-in capital; (ii) increases in callable capital; (iii) greater flexibility in using balance sheets, including securitizing existing loans, exchange of assets and standardizing/scaling the green bond market; (iv) more effective use of guarantee instruments including creating or supporting new investment vehicles; (v) more effective targeting of blended finance instruments, especially for low-income countries. The MDBs are actively considering these options and several have taken concrete steps in this direction. The establishment of new institutions and mechanisms also creates the opportunity for greater flexibility and scale. Nevertheless, a more systematic review of the role of MDBs and needed

changes could help strengthen their individual and collective roles and garner support from and counter the negative sentiment that exists among some shareholders, the private sector and the public at large. This review would need to consider the larger role of the MDBs in achieving the SDGs but could include some specific issues related to infrastructure development and financing: (i) the options to enhance infrastructure financing capacity of the development banks; (ii) how to address common impediments that constrain their role; (iii) the potential for strengthening collaborative arrangements; (iv) how much more sustainable infrastructure costs in practice; and (v) potential guidelines/limitations around development bank financing of high-carbon infrastructure. In addition, it is important to assess the catalytic role of the Green Climate Fund and other international climate funds. There may be a good case for switching these funds into debt instruments with greater leverage, rather than direct subsidies (e.g., for feed-in-tariffs) to low-carbon assets. This was an important finding from the work of the Global Commission.

- ***Fourth, central banks and financial regulators could take further steps to support the redeployment of private investment capital from high- to low-carbon, better infrastructure.*** We already see progressive action from the Bank of England and the French government. Common guidelines that require institutional investors (e.g. with > \$1 billion AUM) to reveal the carbon-intensity of their portfolios and hence their exposure to climate regulation that would be compatible with a 2 degrees scenario could help accelerate portfolio shifts. Market-developed standards for instruments such as green bonds could also increase the liquidity of better infrastructure assets, making them more attractive for pension funds. In fact, nearly half of the 1,900 existing green bonds could be eligible for inclusion

on mainstream indices given they have features usually required by institutional investors such as investment-grade ratings (i.e., BBB- and higher), are denominated in specific currencies, and have issuance sizes over \$200 million.⁵⁰

On the equity side, listed equity funds that pool projects, called YieldCos, are an example of another innovative structure providing liquidity and direct access to infrastructure investments. YieldCos typically own infrastructure assets that generate stable cash flows. These cash flows are then distributed to shareholders via public markets as dividends.⁵¹

- ***Fifth, the official community (G-20, OECD and other relevant institutions) working with institutional investors could lay out the set of policy, regulatory, and other actions needed to increase their infrastructure asset holdings from \$3–4 trillion to \$10–15 trillion over the next 15 years.***⁵²

These actions could include requiring countries to publish a clear project pipeline that would spur private investment by reducing uncertainty for investors and allowing for more long-term planning. Currently less than 50 percent of G-20 countries publish a clear project pipeline.⁵³ In addition, increasing standardization of contracts and financing agreements across regions would reduce transaction costs and encourage investment from those with more limited resources (e.g., pension programs). Providing government-backed guarantees for investments in sustainable infrastructure could also help as it would improve the risk-return profile of investments particularly when dealing with a new or unproven technology. Similarly, making longer-term policy commitments in terms of tax treatment of infrastructure investments would decrease uncertainty and encourage participation by institutional funds more widely.

We are also seeing the growth in “impact capital”—capital that is willing to take lower ex ante returns in exchange for significant reductions in policy risk. Current estimates suggest that impact investing could reach \$50 billion of new commitments per year by 2020, up from \$12.7 billion in 2014. Again, we need to determine what it will take to scale up this capital pool, especially for cross-border investments.

- ***Sixth, over the coming year, the international community should agree on the amounts of concessional financing needed to meet the SDGs, how to mobilize this financing and how best to deploy it to support the economic, social, and environmental goals embodied in the SDGs.*** ODA must remain targeted to eliminating poverty and providing basic social needs, especially in the poorest countries. In low-income countries, ODA can play a critically important role in crowding in other financing and in enhancing the viability of infrastructure projects, which is often constrained by the low incomes of users. ODA also needs to take into account the growing and urgent need to invest in climate adaptation in poor and vulnerable countries such as small island states. Beyond ODA, there is a need to secure an adequate pool of concessional finance that, when combined with the much larger pools of private and non-concessional public financing, could offset additional upfront costs of low-carbon investments in both low- and lower-

middle income countries. The Green Climate Fund is a first possible step around which such a new approach can be built. Other initiatives, involving other forms of concessional development capital invested through public-private partnerships, may also have significant scale-up potential.

The current infrastructure investment and financing model needs to be transformed fast if it is to enable the quantity and quality of growth that the world economy needs. The urgency of action cannot be overemphasized. The next 15 years will be a crucial period and the decisions taken now will have an enduring impact on both development and climate outcomes. Given the already high level of emissions and the structural transformations that are underway—for example, in the shaping of cities—we cannot afford to miss the opportunity offered to put in place an adequate and better infrastructure for sustainable development. We know the main elements of the transformation agenda, although many details have to be worked out. They are entirely compatible with both sustainable development and climate goals. The aim is not to put in place complex and burdensome structures, but responsive and flexible mechanisms capable of learning and bringing about real change. Working together across the Financing for Development, SDG, G-20, and UNFCCC processes, there is an opportunity to drive real change over the next 12 months.

REFERENCES

- African Development Bank, Asian Development Bank, European Bank for Reconstruction and Development, Inter-American Development Bank, International Monetary Fund, and World Bank Group. "From Billions to Trillions: Transforming Development Finance—Post-2015 Financing for Development: Multilateral Development Finance." *Development Committee Discussion Note*. April 2015.
- Andersson, Mats, Patrick Bolton and Frédéric Samama. "Hedging Climate Risk". *Columbia Business School Research Paper 14-44*, September 2014..
- Baker, Sophie. "France to require institutional investors to disclose carbon exposure". *Pensions & Investments*, 2015. <http://www.pionline.com/article/20150522/ONLINE/150529958/france-to-require-institutional-investors-to-disclose-carbon-exposure>
- Barton, Dominic and Mark Wiseman. "Focusing Capital on the Long-Term". *McKinsey Quarterly*, 2013. http://www.mckinsey.com/insights/leading_in_the_21st_century/focusing_capital_on_the_long_term
- Bhattacharya, Amar and Rachael Holt. "Assessing the Changing Infrastructure Financing Needs of Emerging Markets and Developing Countries". *GGGI-G24* (forthcoming).
- Basel Committee. "Basel III: A global regulatory framework for more resilient banks and banking systems". *Bank for International Settlements*, 2010. <http://www.bis.org/publ/bcbs189.pdf>
- Calderón, César and Luis Servén. *The effects of infrastructure development on growth and income distribution*, Central Bank of Chile Working Paper 270, September 2004.
- Calderón, César and Luis Servén. "Infrastructure in Latin America". *Policy Research Working Paper 5317*, World Bank, Washington D.C, 2010.
- Canfin-Grandjean Commission. "Mobilizing Climate Finance: A Roadmap to Finance a Low –Carbon Economy". June 2015.
- Dobbs, Richard and Herbert Pohl et al. "Infrastructure productivity: How to save \$1 trillion a year". *McKinsey Global Institute*, 2013.
- Dobbs, Farewell and Susan Lund et al. "Farewell to cheap capital? The implications in long-term shifts in global investment and saving". *McKinsey Global Institute*, December, 2010.
- Eberhard, Anton, Joel Kolker and James Leigland. "South Africa's Renewable Energy IPP Procurement Program: Success Factors and Lessons". *Public-Private Infrastructure Advisory Facility (PPIAF)*, 2014. <http://www.gsb.uct.ac.za/files/PPIAFReport.pdf>.
- Deloitte. "Where Next on the Road Ahead: Deloitte Infrastructure Investors Survey 2013". Deloitte, 2013. <http://www2.deloitte.com/content/dam/Deloitte/global/Documents/Financial-Services/gx-fsi-uk-icp-infrastructure-investors-survey-2013-11.pdf>

- EIOPA. "Technical Report on Standard Formula Design and Calibration for Certain Long-Term Investments". *European Insurance and Occupational Pensions Authority*, 2013. https://eiopa.europa.eu/Publications/Reports/EIOPA_Technical_Report_on_Standard_Formula_Design_and_Calibration_for_certain_Long-Term_Investments__2_.pdf
- European Commission. "The Directive 2009/138/EC of the European Parliament and of the Council, as amended by Directive 2014/51/EU, known as the Omnibus II Directive". 2014.
- Goossens, Ehren."Green Bonds Seen Tripling to \$40 Billion on New Entrants". *Bloomberg New Energy Finance*, June 2014. <http://www.bloomberg.com/news/articles/2014-06-03/green-bonds-seen-tripling-to-40-billion-on-new-entrants>
- Gupta, Sanjeev and Michael Keen. "Global Energy Subsidies Are Big—About US\$5 Trillion Big". *International Monetary Fund, Washington D.C.*, May 2015. <http://blog-imfdirect.imf.org/2015/05/18/global-energy-subsidies-are-big-about-us5-trillion-big/>
- Humphrey, Christopher. "The Role of Multilateral Development Banks in Infrastructure Financing". *GGGI-G24*, (forthcoming).
- Jones, Huw. "Insurers cast doubt on ability to help EU investment plans". Reuters, 2015. <http://www.reuters.com/article/2015/03/03/us-eu-insurance-regulations-idUSKBN0LZ1UM20150303>
- IMF. "Is it time for an Infrastructure Push? The macroeconomics effects of public investment." *World Economic Outlook*, October 2014, Chapter 3. <https://www.imf.org/external/pubs/ft/weo/2014/02/pdf/c3.pdf>
- IMF. "World Economic Outlook Database". *International Monetary Fund, Washington D.C.*, April 2015. <https://www.imf.org/external/pubs/ft/weo/2015/01/weodata/index.aspx>
- IMF. "Making Public Investments More Efficient", *International Monetary Fund, Washington D.C.*, June 2015. <http://www.imf.org/external/np/pp/eng/2015/061115.pdf>
- Kharas, Homi and John McArthur "Nine Priority Commitments to be made at the UN's July 2015 Financing for Development Conference at Addis Ababa, Ethiopia" *Global Economy and Development*, Brookings Institution, Washington D.C. February 2015.
- OECD. "Developing countries set to account for nearly 60 percent of world GDP by 2030, according to new estimates". *Perspectives on Global Development*, OECD, 2010.
- OECD. "Creditor Reporting System Database" and "DAC Annual Aggregates Database". *OECD*, 2015. <http://www.oecd.org/development/stats/idsonline.htm>
- OECD. "Mapping Channels to Mobilise Institutional Investment in Sustainable Energy". *Green Finance and Investment, OECD Publishing, Paris*, 2015. <http://www.oecd.org/env/mapping-channels-to-mobilise-institutional-investment-in-sustainable-energy-9789264224582-en.htm>

- Pensions & Investments. Data on Total Investible Assets. 2015. <http://www.pionline.com/data-store>
- PIDG. "AES – Sonel: Providing Year-Round, Reliable Electricity". *Private Infrastructure Development Group*. <http://www.pidg.org/impact/case-studies/aes-sonel>
- Preqin Ltd. Preqin Global Database. 2015. <https://www.preqin.com/section/alternative-assets/0>
- PwC Report. "Asset Management 2020: A brave new world". *PricewaterhouseCoopers*, 2014. <http://www.pwc.com/gx/en/asset-management/publications/pdfs/pwc-asset-management-2020-a-brave-new-world-final.pdf>
- Roumeliotis, Greg. "Analysis: Basel III rules could spell potholes, literally." *Reuters*, 2010. <http://www.reuters.com/article/2011/04/19/us-basel-infrastructure-idUSTRE73I3VP20110419>
- Stern, Nicholas. "Understanding Climate Finance in Paris December 2015 in the Context of Financing for Sustainable Development in Addis Ababa July 2015". *Center for Climate Change Economics Policy*, March 2015.
- The Global Commission on The Economy and Climate. "Better Growth, Better Climate: The New Climate Economy Report". September 2014. <http://newclimateeconomy.report>
- UNEP, Finance Initiative. "Portfolio Carbon: Measuring, disclosing and managing the carbon intensity of investments and investment portfolios." *United Nations Environment Programme Finance Initiative Investor Briefing*, 2013.
- UNNGLS. "Intergovernmental Committee of Experts on Sustainable Development Financing". *Report of the United Nations Non-Governmental Liaison Service*, August 2014.
- Wilson, Karen E. "New Investment Approaches for Addressing Social and Economic Challenges". *OECD Science, Technology and Policy Papers No 15*, 2014.
- Westphal, Michael, Pascal Canfin, Athena Ballesteros and Jennifer Morgan. "Getting to \$100 Billion: Climate Finance Scenarios and Projections to 2030". *World Resources Institute Working Paper*, June 2015.
- World Bank. "Planning and Financing Low-Carbon, Livable Cities". The World Bank Group, Washington D.C., September 2013. <http://www.worldbank.org/en/news/feature/2013/09/25/planning-financing-low-carbon-cities>
- World Bank Group Lighting Africa. "Communities Reap Multiple Benefits From Clean, Safe Solar Lights." The World Bank Group, Washington D.C., 2013. <https://www.lightingafrica.org/communities-reap-multiple-benefits-from-clean-safe-solar-lights/>.
- World Bank Press Release. "World Bank Group's Infrastructure Spending Increases to US\$24 Billion." The World Bank Group, July 2014. <http://www.worldbank.org/en/news/press-release/2014/07/18/world-bank-group-infrastructure-spending-increases-to-24-billion>

ENDNOTES

1. Calderón, César and Luis Servén. "Infrastructure in Latin America". *Policy Research Working Paper 5317*, World Bank, Washington D.C, 2010.
2. Dobbs, Richard and Herbert Pohl et al. "Infrastructure productivity: How to save \$1 trillion a year". McKinsey Global Institute, 2013. We calculate and apply domestic employment multipliers for the construction sector as an approximation to derive an estimate of the number of jobs related to infrastructure demand. Jobs include direct and indirect jobs.
3. Calderón, César and Luis Servén, "The effects of infrastructure development on growth and income distribution". Central Bank of Chile Working Paper 270, September 2004.
4. OECD. "Developing countries set to account for nearly 60 percent of world GDP by 2030, according to new estimates". *Perspectives on Global Development*, Organisation for Economic Co-operation and Development, 2010. This indicates that the share of developing countries would rise to almost 70 percent of global GDP in PPP terms, by 2030.
5. IMF estimated that the public capital stock was about US\$45 trillion in 2012. See IMF, "Making Public Investment More Efficient". *International Monetary Fund*, June 2015.
6. The Global Commission on The Economy and Climate. "Better Growth, Better Climate: The New Climate Economy Report". September 2014. <http://newclimateeconomy.report>
7. IMF. "Is it time for an Infrastructure Push? The macroeconomics effects of public investment." *World Economic Outlook, International Monetary Fund*, October 2014, Chapter 3. <https://www.imf.org/external/pubs/ft/weo/2014/02/pdf/c3.pdf>
8. Preqin Ltd. Preqin Global Database. 2015. <https://www.preqin.com/section/alternative-assets/0>

Preqin is an independent company that provides data and intelligence for the alternative assets industry. For this report, we utilized Preqin's database that compiles information from over 43,000 investment funds globally. Preqin gathers data through direct conversations with industry professionals, monitoring regulatory filings, making FOIA requests, and tracking news sources.

To calculate total current holdings by institutional investors, we took the weighted average of declared current allocation percentage to infrastructure by investor type (from Preqin 2015 survey) and applied to total Assets Under Management (AUM) for each investor group. We included assets only for funds indicating that they are actively investing in infrastructure. Projections for growth in institutional investor allocations to infrastructure are based on achieving target allocations levels as overall AUM grows 6 percent per year.
9. As discussed below, the lending capacity of the MDBs will depend on a number of factors. The steps that many of them are taking and the creation of new institutions and mechanisms could raise lending to \$100 billion. To double that amount, increases in paid-in capital will be required. These are not very large because only a fraction is paid-in but would need agreement and political consensus.
10. World Bank Group Lighting Africa. "Communities Reap Multiple Benefits From Clean, Safe Solar Lights." *The World Bank Group*, Washington D.C., 2013. <https://www.lightingafrica.org/communities-reap-multiple-benefits-from-clean-safe-solar-lights/>.

11. Estimates drawn from The Global Commission on The Economy and Climate. “Better Growth, Better Climate: The New Climate Economy Report”. September 2014. <http://newclimateeconomy.report>
12. UNNGLS. “Intergovernmental Committee of Experts on Sustainable Development Financing”. *Report of the United Nations Non-Governmental Liaison Service*, August 2014. Bhattacharya and Holt (forthcoming) estimate that infrastructure financing requirements of emerging markets and developing countries will need to rise from around \$2 trillion at present to \$3.5 to \$5.0 trillion by 2030.
13. Investor expectations for nominal returns from infrastructure assets appear to range from 8-15 percent depending on the asset class. These expectations were formed in a different interest rate era, suggesting the potential for significant reduction, given the right policy settings.
14. World Bank. “Planning and Financing Low-Carbon, Livable Cities”. *The World Bank Group, Washington D.C.*, September 2013. <http://www.worldbank.org/en/news/feature/2013/09/25/planning-financing-low-carbon-cities>
15. Pensions & Investments. Data on Total Investible Assets. 2015. <http://www.pionline.com/data-store>
We include total investible assets for the following groups: banks and investment companies, insurance and private pensions, infrastructure and private equity funds, endowments and foundations, and sovereign wealth funds. Total investible assets are typically defined as: total assets on the book of the institution, except items not considered as asset management product substitutes.
16. World Bank Press Release. “World Bank Group’s Infrastructure Spending Increases to US\$24 Billion.” *The World Bank Group*, July 2014. <http://www.worldbank.org/en/news/press-release/2014/07/18/world-bank-group-infrastructure-spending-increases-to-24-billion>
17. Barton, Dominic and Mark Wiseman. “Focusing Capital on the Long-Term”. *McKinsey Quarterly*, 2013. http://www.mckinsey.com/insights/leading_in_the_21st_century/focusing_capital_on_the_long_term
18. Preqin Ltd. Preqin Global Database. 2015. <https://www.preqin.com/section/alternative-assets/0>
19. NOTE: “Infrastructure and PE funds” includes: Infrastructure Fund of Funds Manager, Real Estate Fund of Funds Manager, Real Assets Fund of Funds Manager, Hybrid Fund of Funds Manager, Real Estate Firm (Investor), Listed Fund of Funds Manager, Private Equity Firm (Investor), Private Equity Fund of Funds Manager, Secondary Fund of Funds Manager, Infrastructure Firm (Investor). “Banks and Investment Cos” includes: Bank, Investment Bank, Asset Manager, Wealth Manager, Family Office—Multi, Family Office—Single, Investment Trust, Investment Company. “Insurance Cos and Private Pensions” includes: Insurance Company, Private Sector Pension Fund
20. Preqin Ltd. Preqin Global Database. 2015. <https://www.preqin.com/section/alternative-assets/0>
21. PwC Report. “Asset Management 2020: A brave new world”. PricewaterhouseCoopers, 2014. <http://www.pwc.com/gx/en/asset-management/publications/pdfs/pwc-asset-management-2020-a-brave-new-world-final.pdf>
22. Preqin Ltd. Preqin Global Database. 2015. <https://www.preqin.com/section/alternative-assets/0>
Target allocations represent a weighted average of the declared target allocation levels across investor groups as reported to Preqin. Investors often do not reach target allocations as sufficient investment opportunities may not be available. Thus current allocation is often lower than desired target.

23. Goossens, Ehren. "Green Bonds Seen Tripling to \$40 Billion on New Entrants". Bloomberg New Energy Finance, June 2014. <http://www.bloomberg.com/news/articles/2014-06-03/green-bonds-seen-tripling-to-40-billion-on-new-entrants>
24. Baker, Sophie. "France to require institutional investors to disclose carbon exposure". *Pensions & Investments*, 2015. <http://www.pionline.com/article/20150522/ONLINE/150529958/france-to-require-institutional-investors-to-disclose-carbon-exposure>
25. UNEP, Finance Initiative. "Portfolio Carbon: Measuring, disclosing and managing the carbon intensity of investments and investment portfolios." *United Nations Environment Programme Finance Initiative Investor Briefing*, 2013.
26. Basel Committee. "Basel III: A global regulatory framework for more resilient banks and banking systems". *Bank for International Settlements*, 2010. <http://www.bis.org/publ/bcbs189.pdf>
27. Roumeliotis, Greg. "Analysis: Basel III rules could spell potholes, literally." Reuters, 2010. <http://www.reuters.com/article/2011/04/19/us-basel-infrastructure-idUSTRE73I3VP20110419>
28. Dobbs, Farewell and Susan Lund et al. "Farewell to cheap capital? The implications in long-term shifts in global investment and saving". *McKinsey Global Institute*, December, 2010.
29. European Commission. "The Directive 2009/138/EC of the European Parliament and of the Council, as amended by Directive 2014/51/EU, known as the Omnibus II Directive". 2014.
30. Jones, Huw. "Insurers cast doubt on ability to help EU investment plans". Reuters, 2015. <http://www.reuters.com/article/2015/03/03/us-eu-insurance-regulations-idUSKBN0LZ1UM20150303>
31. EIOPA. "Technical Report on Standard Formula Design and Calibration for Certain Long-Term Investments". *European Insurance and Occupational Pensions Authority*, 2013. https://eiopa.europa.eu/Publications/Reports/EIOPA_Technical_Report_on_Standard_Formula_Design_and_Calibration_for_certain_Long-Term_Investments__2_.pdf
32. "Merchant generators" build power capacity on a speculative basis or have acquired utility-divested plants. These companies then market their output at competitive rates in unregulated markets.
33. Deloitte. "Where Next on the Road Ahead: Deloitte Infrastructure Investors Survey 2013". Deloitte, 2013. <http://www2.deloitte.com/content/dam/Deloitte/global/Documents/Financial-Services/gx-fsi-uk-icp-infrastructure-investors-survey-2013-11.pdf>
34. Standard and Poor's Ratings Services. 2014. "Global Infrastructure: How To Fill A \$500 Billion Hole" http://www.standardandpoors.com/spf/upload/Ratings_EMEA/HowToFillAn500BillionHole-Jan162014.pdf
35. Wilson, Karen E. "New Investment Approaches for Addressing Social and Economic Challenges". *OECD Science, Technology and Policy Papers No 15*, 2014.
36. All data come from Eberhard, Anton, Joel Kolker and James Leigland. . "South Africa's Renewable Energy IPP Procurement Program: Success Factors and Lessons". *Public-Private Infrastructure Advisory Facility (PPIAF)*, 2014. <http://www.gsb.uct.ac.za/files/PPIAFReport.pdf>.
37. Humphrey, Christopher. "The Role of Multilateral Development Banks in Infrastructure Financing". GGGI-G24, (forthcoming)
38. Bhattacharya, Amar and Rachael Holt. "Assessing the Changing Infrastructure Financing Needs of Emerging Markets and Developing Countries". GGGI-G24 (forthcoming)

39. ODA investment trends are from OECD Creditor Reporting System (CRS) and OECD DAC annual aggregates databases. <http://www.oecd.org/development/stats/idsonline.htm>. Values quoted are in current US dollars. Infrastructure here denotes energy, telecommunication, transport and water and sanitation sectors.
40. For comparison, ODA for infrastructure was about \$8.8 billion in 2000 and almost \$21 billion in 2008. Data from IMF World Economic Outlook database.
41. Kharas, Homi and John McArthur “Nine Priority Commitments to be made at the UN’s July 2015 Financing for Development Conference at Addis Ababa, Ethiopia” Global Economy and Development, Brookings Institution, Washington D.C. February 2015.
42. PIDG. “AES—Sonel: Providing Year-Round, Reliable Electricity”. *Private Infrastructure Development Group*. <http://www.pidg.org/impact/case-studies/aes-sonel>
43. COP21, also known as the 2015 Paris Climate Conference, will, for the first time in over 20 years of UNFCCC negotiations, aim to achieve a legally binding and universal agreement on climate, with the aim of keeping global warming below 2° Celsius. After COP15 in Copenhagen (December 2009) the secretary-general of the U.N. established in early 2010 a High-Level Advisory Group on Climate Change Financing chaired by Prime Minister of Ethiopia, Meles Zenawi and Prime Minister of Norway, Jens Stoltenberg (who replaced Prime Minister of the U.K., Gordon Brown in the middle of 2010). The group contained in its membership Larry Summers from the USA and Christine Lagarde from France. Nicholas Stern was also a member and, working with McKinsey and Jeremy Oppenheim, led much of the economic analysis. The group reported at the end of 2010. Its broad emphases are valid today including the role of MDBs, revenue from carbon pricing, and the abolition of fuel subsidies. In retrospect, the potential from carbon pricing has been weaker than hoped, but the understanding of the scale of fossil-fuel subsidies has shown that this is a potential source of revenue of great magnitude.
44. Westphal, Michael, Pascal Canfin, Athena Ballesteros and Jennifer Morgan. “Getting to \$100 Billion: Climate Finance Scenarios and Projections to 2030”. *World Resources Institute Working Paper*, June 2015.
45. Stern, Nicholas. “Understanding Climate Finance in Paris December 2015 in the Context of Financing for Sustainable Development in Addis Ababa July 2015”. *Center for Climate Change Economics Policy*, March 2015.
46. African Development Bank, Asian Development Bank, European Bank for Reconstruction and Development, Inter-American Development Bank, International Monetary Fund, and World Bank Group. “From Billions to Trillions: Transforming Development Finance—Post-2015 Financing for Development: Multilateral Development Finance.” *Development Committee Discussion Note*. April 2015.
47. ODA from all sources was \$80 billion in 2004 that has grown to over \$150 billion in 2013—an average increase of \$7.8 billion (in current US\$ terms). *Source*: OECD. “Creditor Reporting System database”. OECD, 2015. <http://stats.oecd.org/index.aspx?DataSetCode=CRS1>

48. These proposals are very much in line with the recommendations of the recently completed report of the Canfin-Grandjean Commission, which proposes actions in four specific areas: the carbon price signal; financial regulation and mobilization of private financial actors; development banks; and low-carbon, climate-resilient infrastructure. Source: Canfin-Grandjean Commission. "Mobilizing Climate Finance: A Roadmap to Finance a Low –Carbon Economy". June 2015.
49. Gupta, Sanjeev and Michael Keen. "Global Energy Subsidies Are Big—About US\$5 Trillion Big" *International Monetary Fund*, Washington D.C. May 2015. <http://blog-imfdirect.imf.org/2015/05/18/global-energy-subsidies-are-big-about-us5-trillion-big/>
50. OECD. "Mapping Channels to Mobilise Institutional Investment in Sustainable Energy". *Green Finance and Investment, OECD Publishing, Paris*, 2015. <http://www.oecd.org/env/mapping-channels-to-mobilise-institutional-investment-in-sustainable-energy-9789264224582-en.htm>
51. *ibid.*
52. It is worth noting that asset portfolios can now be constructed that will track key indices, but on a low-carbon basis. In effect, this means that institutional investors can allocate assets in a way that has no loss of performance, but contains a free option in the event of tighter climate regulation. Source: Andersson, Mats, Patrick Bolton, and Frédéric Samama. "Hedging Climate Risk". *Columbia Business School Research Paper 14-44*, September 2014..
53. Dobbs, Richard and Herbert Pohl et al. "Infrastructure productivity: How to save \$1 trillion a year". *McKinsey Global Institute*, 2013.



The views expressed in this working paper do not necessarily reflect the official position of Brookings, its board or the advisory council members.

© 2015 The Brookings Institution

ISSN: 1939-9383

BROOKINGS

1775 Massachusetts Avenue, NW
Washington, DC 20036
202-797-6000
www.brookings.edu/global

