McKinsey&Company

Financing change:
How to mobilize private-sector financing for sustainable infrastructure

Aaron Bielenberg
Mike Kerlin
Jeremy Oppenheim
Melissa Roberts

McKinsey Center for Business and Environment January 2016

Cover photo: © Sbk_20d pictures/Moment/Getty Images

Contents

Financing change: How to mobilize private-sector financing for sustainable infrastructure

Executive summary 2

Introduction 6

Part 1: Demand for infrastructure 10

Part 2: The supply of infrastructure finance 14

Part 3: Defining the sustainable-infrastructure gap 24

Part 4: The private sector's role in closing the gap 27

Part 5: Challenges to increasing financing to sustainable infrastructure 30

Part 6: Cracking the code: Creating the conditions for more investment in sustainable infrastructure 37

Conclusion 58

Executive summary

In 2015, an international architecture for sustainable development began to take shape. Building on the United Nations' Financing for Development Agenda in Addis Ababa and then the formal adoption of the Sustainable Development Goals in September, the year culminated in the Conference of Parties (COP) 21 in Paris. Almost 190 countries, accounting for more than 98 percent of greenhouse-gas emissions, agreed to a global climate-change strategy.[1] Each country submitted a voluntary plan, or intended nationally determined contribution (INDC), that set out how it will move its economy onto a lower-carbon growth pathway. Signatories have agreed to update their progress in 2018, and the terms of the Paris Agreement envisage higher targets for the INDCs over time, beginning in 2020. With this structure in place, attention is shifting toward how to implement and finance more sustainable growth.

While the INDCs will take years to play out, one likely effect is to shift investment, both public and private, toward more sustainable projects, including infrastructure. There are already substantive changes in the financing landscape. Each of the six major multilateral development banks, for example, has committed to significantly increasing its allocations to climate finance, by as much as two to three times.[2] The 20 governments that represent 80 percent of current global clean-energy research and development have pledged to double such investment in the next five years.[3]

This has been matched by increased interest and commitments in the private sector. A coalition of corporate leaders from around the world, the Breakthrough Energy Coalition, has pledged to invest billions in research and development of green energy.[4] Major institutional investors have pledged to decarbonize their investment portfolio and to assess the carbon footprint of their assets as part of the Portfolio Decarbonization Coalition.[5] As these commitments reverberate through the markets, they will reveal stubborn challenges—and also create new economic opportunities.

How countries build and operate infrastructure will be a major factor in whether they can deliver on their INDCs. In light of Paris, many countries are likely to scale up their investment in sustainable infrastructure—defined as infrastructure that is socially inclusive, low carbon, and climate resilient. Given the scale of investment required, creating the right conditions for private-sector investment is essential.

From 2015 to 2030, global demand for new infrastructure could amount to more than $90 trillion, according to the New Climate Economy's 2014 report, *Better Growth, Better Climate*; the value of the world's existing infrastructure is $50 trillion. In a sense, then, we will be literally building our world—for better or worse. Doing it sustainably will likely increase up-front capital costs by 6 percent or more for individual projects. Over a project's life cycle, however, sustainable infrastructure can save money and generate healthy economic returns, while reducing risks and negative externalities at the local and global levels.[6]

Current infrastructure spending of $2.5 trillion to $3 trillion a year is only half the amount needed to meet the estimated $6 trillion of average annual demand

over the next 15 years. More than 60 percent of this financing gap is likely to be concentrated in middle-income countries—those with per capita incomes between $1,045 and $12,745—and more than 50 percent in the power sector. Domestic capital markets will be pivotal to financing investment, particularly the banks, pensions, and insurance companies that are growing fast and hold more than 80 percent of institutional assets under management (AUM) in middle-income countries.

The financing gap for sustainable infrastructure is in large part the result of poor policies, institutional failures, and lack of investor familiarity with greener technologies and projects. Because infrastructure has strong public-good characteristics, typically requires large-scale capital mobilization, and is highly sensitive to local politics, governments have always played a central role. However, the scale of infrastructure spending required over the next 15 years, coupled with widespread public-sector fiscal constraints, means that private finance will be increasingly important. A positive "enabling environment"—that is, one characterized by sound policies, effective institutions, transparency, reliable contract enforcement, and other sector-specific factors—makes it easier to mobilize private finance. Conversely, a poor enabling environment—one characterized by distorting subsidies, unreliable counterparties, and flawed procurement processes—can raise the cost of private finance to the point where infrastructure projects are no longer economically viable.

Encouraging enough private-sector investment in sustainable infrastructure at reasonable cost will require overcoming or removing five major barriers:

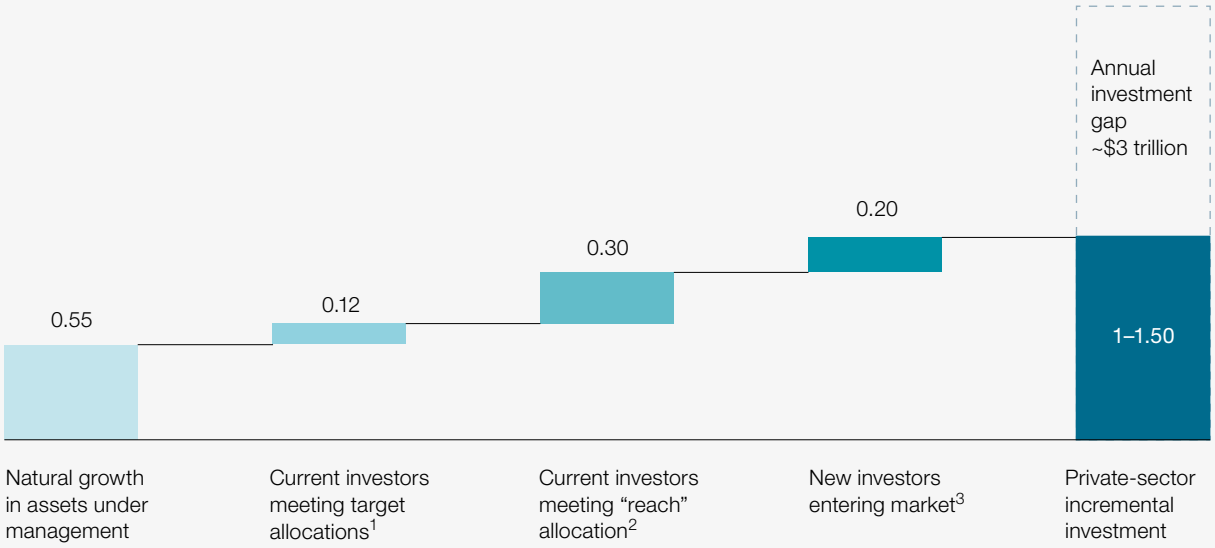
- *Lack of transparent and "bankable" pipelines:* Even in the G-20, only half the countries publish infrastructure pipelines.
- *High development and transaction costs:* Thirty percent of investments in new clean-energy capacity go to small-scale projects such as rooftop solar; such projects do not naturally generate the economies of scale that can keep costs down.
- *Lack of viable funding models:* Up to 70 percent of water provided by utilities in sub-Saharan Africa is leaked, unmetered, or stolen; therefore not enough revenue is generated to maintain or expand the system.
- *Inadequate risk-adjusted returns:* Investors may be willing to take on sustainable infrastructure but want higher returns to compensate them for the perceived risks. Infrastructure projects are also notoriously prone to corruption, creating significant additional risks.
- *Unfavorable and uncertain regulations and policies:* Basel III and Solvency II regulations could have the effect of reducing investment in infrastructure at the global level; uncertain tax policies can do the same at the national level. The fact that sustainable-infrastructure projects typically have higher up-front capital costs makes them even more sensitive to the cost and availability of capital.

To build sustainable infrastructure on the scale needed, all kinds of investors have to increase the quantity and quality of their financing—the private sector most of all. Right now, private investment accounts for up to half of total infrastructure spending—$1 trillion to $1.5 trillion a year; 65 percent to 75 percent of that comes from corporate actors, and the rest from institutional investors, such as private equity (PE) and pension funds. Private institutional investors could fill up to half the financing gap—provided that they can identify projects that are bankable and sustainable (Exhibit 1).

Exhibit 1

Private institutional investors could fill up to half the financing gap.

Potential incremental annual spending from private institutional investors,
$ trillion



[1]Weighted average target allocation = 5.96% across investor groups.
[2]"Reach" allocation defined as 8% weighted average across investor groups.
[3]Assumes 60% of non-infrastructure investors begin investing at level comparable to peer current allocations.

Source: Preqin Infrastructure Online, Funds and Limited Partnership Investors, June 2015

There are a number of ways this investment can be made more efficient and effective. A critical first step is to strengthen the enabling environment and to reassure investors that policies will be consistent. Second, actions that improve underlying institutional performance, especially around procurement practices, will boost confidence. This is particularly important in regard to cross-border finance, which carries extra risk because of exchange-rate movements. Finally, every project needs to fulfill a social need with economic benefits that are greater than the project costs. If these conditions are not met (at least to a first approximation), no amount of fine-tuning the design of financial instruments will make a difference in changing the risk perceptions of private investors.

While capital markets exist to mobilize large-scale investment, they are naturally skeptical about sectors and asset classes that they are unfamiliar with or where they perceive high political risks or project failure. There are six ways to encourage more capital to go toward sustainable infrastructure:

- *Scale up investment in sustainable project preparation and pipeline development.* Governments and development banks should focus investment on project-preparation facilities and technical assistance to increase the "bankability" of project pipelines (meaning those that have an attractive economic profile). This is the highest-risk phase of the project life cycle; it is critical to get right; and it is subject to significant rent-seeking conduct. Given a chronic

shortage in many developing countries of the right developer equity/expertise, this is an arena in which the right financing facilities could have disproportionate returns.

- *Use development capital to finance sustainability premiums.* Encourage development banks and bilateral-aid organizations to provide financing for the incremental up-front capital spending required to make traditional infrastructure projects sustainable, in economic, social, and environmental terms. Attract private-sector financing by demonstrating that risk-adjusted returns can be competitive with those of traditional infrastructure, even if the policy settings and prices do not fully reflect the total benefits of greater sustainability.

- *Improve the capital markets for sustainable infrastructure by encouraging the use of guarantees.* Increase development-bank guarantee programs for sustainable infrastructure by expanding access to guarantees. Insofar as these guarantees price in sustainability benefits, they could help to overcome the policy-sensitivity of these investments, reducing risks for private investors.

- *Encourage the use of sustainability criteria in procurement.* Governments should strengthen sustainability criteria in both public-procurement processes and public-private partnerships.

- *Increase syndication of loans that finance sustainable-infrastructure projects.* Encourage development banks to expand loan syndication and create a larger secondary market for sustainable-infrastructure-related securities. This would increase institutional-investor familiarity with the asset class, reduce transaction costs, and allow the recycling of development capital.

- *Adapt financial instruments to channel investment to sustainable infrastructure and enhance liquidity.* "Yieldcos" or "green bonds" have characteristics similar to traditional investment instruments, but with an emphasis on sustainability. Increasing use of these instruments could unlock investment from previously restricted investors, lower transaction costs, and reduce barriers to entry.

Provided that countries are putting the prerequisites of better policies, institutions, and project-development practices in place, there are opportunities to improve the speed, scale, and pricing with which private capital could flow into sustainable-infrastructure investment. If capital markets were perfect or could respond instantaneously, then it is possible that some of the actions proposed in this report would be redundant. However, in the real world, there is ample evidence of pervasive imperfections in the capital markets, partly due to policy and regulatory rules (for example, which result in risk mispricing or excess capital weighting for specific asset classes) and partly due to institutional conduct and agency factors. Given their limited direct exposure to infrastructure risk, institutional investors are naturally cautious about increasing their exposure to this asset class. That is why a muscular set of nudges and risk-sharing instruments are required: they can shift perceptions and get capital to flow.

If the world is serious about meeting the Sustainable Development Goals, including climate goals, accelerating the flow of private capital into sustainable infrastructure has to be part of the answer to building and sustaining urban, transport, water, and energy systems that the world needs. This report examines how to make that possible.

Introduction

In 2015, the world made an unprecedented collective commitment to respond to climate change and more broadly, to invest in sustainable development. Increasing investment in sustainable infrastructure—defined as projects that are socially inclusive, low carbon, and climate resilient—must be part of the answer. And we believe a "triple win" is within reach: infrastructure that reduces emissions and climate risk, spurs economic development, and increases returns for investors.

Sustainable infrastructure is at the nexus of growth, poverty reduction, and environmental sustainability and is therefore important to making progress toward the 2015 Sustainable Development Goals, which aim to end poverty by 2030.[7] Sustainable infrastructure will be critical to economic development; an increase in public-infrastructure spending equivalent to 1.0 percent of GDP has a multiplier effect of up to 2.0 in India (with 350,000 additional jobs), 1.8 in Argentina (68,000 jobs), and 1.3 in Mexico (193,000).[8] Better infrastructure can also help to reduce inequality; a one-standard-deviation increase in the quality and quantity of a country's infrastructure can reduce a country's Gini coefficient, a measure of inequality, by 0.07 (out of 1.0).[9] These results have been seen on the ground across the globe. For example, one Asian emerging market upgraded its water-sanitation systems—and saw health-insurance claims drop by more than half.[10] In a sub-Saharan African country, female employment rates increased by 9 percent after rural households in one area gained access to electricity.[11]

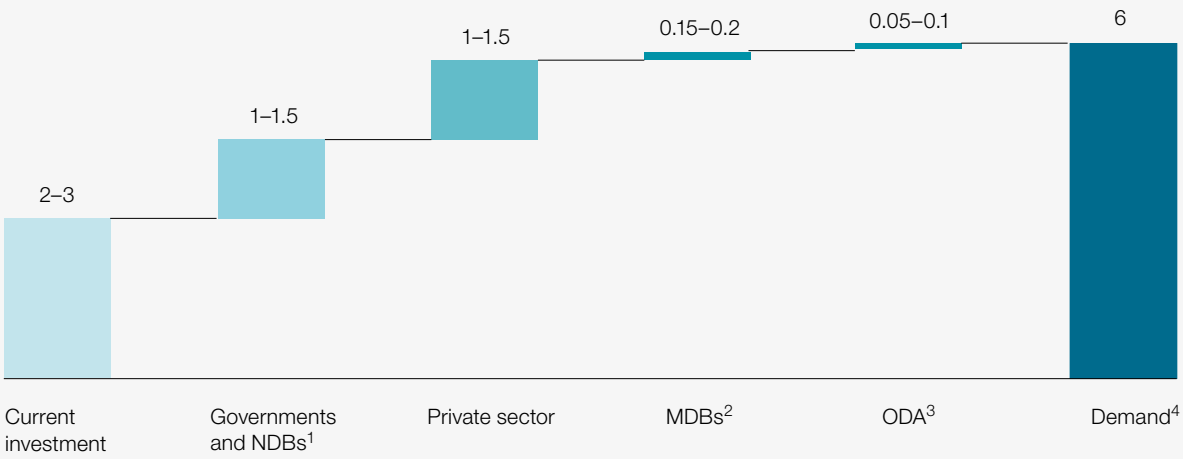
Infrastructure is also important in environmental terms. Infrastructure choices determine whether we have clean power, compact cities, and energy-efficient buildings and whether infrastructure will be resilient to a changing environment and climate. Getting these investments right will be critical to whether or not the world locks into a high- or low-carbon growth trajectory. Given that infrastructure lasts for decades, the choices we make will affect carbon emissions for much of the rest of the century.

Infrastructure choices determine whether we have clean power, compact cities, and energy-efficient buildings and whether infrastructure will be resilient to a changing environment and climate.

Exhibit 2

With the participation of the full spectrum of actors, it is possible to reach $6 trillion a year.

Proposed annual incremental spending by actor to close infrastructure gap,
$ trillion (constant 2010 $)



[1]National development banks.
[2]Multilateral development banks.
[3]Official development assistance.
[4]Based on demand of ~$93 trillion over 15 years (~$6 trillion per year).

Source: Amar Bhattacharya, Jeremy Oppenheim, and Lord Nicholas Stern, "Driving sustainable development through better infrastructure: Key elements of a transformation program," Brookings Institution global working paper, number 80, July 2015, brookings.edu; McKinsey analysis

Shifting capital to sustainable infrastructure presents a daunting challenge, as well as an opportunity for significant rewards for the investors that figure out the new models to make this possible.

The world is spending only $3 trillion a year on infrastructure, half of the $6 trillion a year required from 2015 to 2030.[12] Given the scale of investment requirements and limits to public-sector financing capacity, increased private-capital mobilization for long-term infrastructure investment, especially in developing and middle-income countries, will be critical. This report examines how to create the financing environment that could create a step change in private-sector capital flows into sustainable infrastructure.

With the participation of the full spectrum of actors—the private sector, governments, multilateral and national development banks, and official development assistance (ODA)—it is possible to reach the $6 trillion-a-year mark (Exhibit 2). The private sector will be critical. Right now, private investment accounts for $1 trillion to $1.5 trillion of annual global spending on infrastructure, with 65 to 75 percent from corporate actors and the rest from institutional investors. There is potential for private-sector investment to close more than a third of the sustainable-infrastructure investment gap if players choose the right initiatives and if they can identify enough bankable projects. Governments, development banks, and ODA could reasonably take care of the rest if motivated.

What is sustainable infrastructure?

In this report, infrastructure includes projects relating to power, transport, telecoms, and water and waste. "Sustainable infrastructure" is projects that are socially, economically, and environmentally sustainable.

Socially sustainable: Sustainable infrastructure is inclusive and respects human rights; it is designed to meet the needs of the poor by increasing access, supporting poverty reduction, and reducing vulnerability to climate change. For example, distributed renewable power in previously un-electrified rural areas can increase household income and improve lives by reducing time spent on household chores.

Economically sustainable: Economically sustainable infrastructure provides jobs and helps boost GDP. It does not burden governments with unpayable debt or users with painfully high charges. It also seeks to build the capabilities of local suppliers and developers.

Environmentally sustainable: Environmentally sustainable infrastructure mitigates carbon emissions during construction and operation and contributes to the transition to a lower-carbon economy, for example, through high energy-efficiency standards. It is resilient in the face of climate-change risks such as sea-level rise and the possibility of extreme-weather events. It also addresses local environmental challenges, especially regarding water provision and air quality.

Sustainable infrastructure can also employ different ways of meeting infrastructure service needs, such as demand-side management systems and responsive power grids.

Financing the level of sustainable-infrastructure investment consistent with climate change and Sustainable Development Goals faces three challenges. First, there is not enough private-sector financing for infrastructure in general. Second, even if more private capital is put to work, it will be difficult to ensure that it goes to sustainable infrastructure in particular. Third, a significant share of this financing needs to be redirected toward developing and middle-income countries, where the majority of demand will be concentrated.

Increasing the volume of private-sector financing and shifting these funds toward sustainable infrastructure are sometimes framed as opposing goals. They do not need to be. In fact, it is possible to improve economic, social, and climate outcomes.

This report seeks to establish where this is already being done and how such approaches can be scaled up. Our work is the culmination of an extensive literature review, a new analysis of financing flows, and interviews with more than 50 experts from banks, investment funds, pensions, development banks, universities, nongovernmental organizations (NGOs), insurance companies, endowments, and foundations, as well as operators and developers. In conversations with dozens of institutional investors from around the world, we tested what it would take for them to invest more capital in sustainable

© Spaces Images/Blend Images/Getty Images

infrastructure, especially cross-border investments into developing countries. We believe not only that it is possible to increase private-sector investment in sustainable infrastructure, but also that this can be done in a way that creates value for investors as well as improving climate and development outcomes. To reach that conclusion, we evaluate the global demand for infrastructure (Part 1), the supply of infrastructure finance (Part 2), and the size of the financial gap, as well as the reasons for it (Part 3). On the basis of that analysis, and also taking into account expert input, we turn to solutions. We discuss the possible role of the private sector (Part 4); explain the challenges to boosting investment (Part 5); and then detail specific approaches to encourage governments, institutions, and the private sector to invest more, with an evaluation of their feasibility and an estimate of their potential impact (Part 6).

Part 1: Demand for infrastructure

Finding the right strategies to increase financing for sustainable infrastructure requires understanding what is needed and where. Projections will differ depending on what is considered infrastructure, and on the underlying methodology and assumptions. The productivity of infrastructure development and the model by which infrastructure services are delivered also affect demand. Therefore, our estimates of the magnitude of investment needed are indicative, not exact.

The New Climate Economy (NCE) report assumes global growth of 3 percent per year[13]; it does not, however, consider rationing, productivity gains, or the additional up-front capital costs needed to pay for climate resilience. The business-as-usual scenario assumes infrastructure expansion that keeps pace with growth that could lead to a 6-degree Celsius rise in temperatures above preindustrial levels. The sustainable scenario, on the other hand, meets the same infrastructure demand with emissions consistent with a 2-degree pathway.

Demand by sector: The additional net $4.1 trillion capital investment required for a low-carbon infrastructure includes a projected $13.5 trillion increase in investment for energy efficiency and low-carbon technology. That, however, is offset by $9.4 trillion in reduced investments for fossil fuels, energy transmission, and distribution, as well

Infrastructure by the numbers

Estimates of infrastructure demand can vary widely, due to differences in definitions and assumptions about growth. This report often references the estimates from the New Climate Economy (NCE) report, *Better Growth, Better Climate*, which estimates baseline infrastructure demand to be $89 trillion from 2015 to 2030.[14] This study employs a broad definition of infrastructure, including energy, transport, telecoms, and water and waste.[15] Done sustainably, this figure would rise to $93 trillion (Exhibit 3),[16] plus an additional $300 billion to $600 billion in adaptation infrastructure, estimated by the World Bank.[17] In a 2013 report, *Infrastructure productivity: How to save $1 trillion a year*, McKinsey estimated a baseline infrastructure need of $57 trillion from 2013 to 2030. This estimate has been cited in many publications, and we believe it to be accurate.

The $32 trillion difference compared with NCE is largely because of different definitions of what is included in infrastructure. The estimated differences are most pronounced in the energy and water and waste sectors. The difference in energy estimates is largely due to differences in accounting for the full upstream investments needed to generate power, such as refining infrastructure investments for oil and gas, and infrastructure investments for coal mining. The difference in water and waste estimates is due to different definitions of infrastructure, such as whether irrigation is included. This report employs the NCE estimates since they include a more comprehensive picture of the energy sector and also break out the cost of investing in sustainable infrastructure.

as lower costs associated with more compact urban development. If estimated operating savings of $5.1 trillion are factored in, the sustainable scenario becomes even more attractive, costing $1 trillion less than business as usual (Exhibit 3).

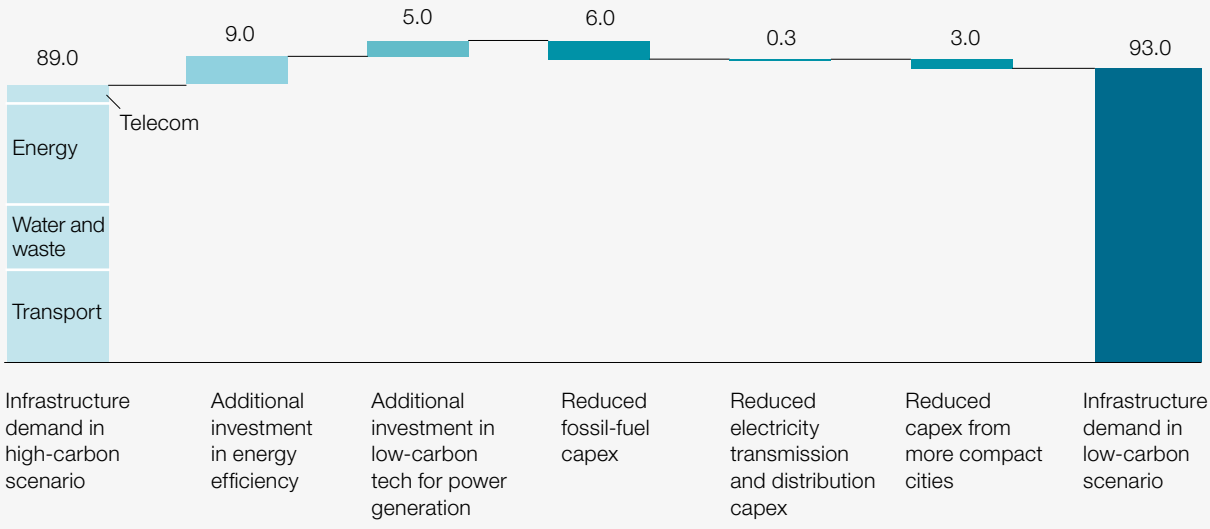
In the low-carbon scenario, two-thirds of the investment demand is concentrated in the power and transport sectors (Exhibit 4).

Demand by type of country: The World Bank has devised four country categories, based on gross national income (GNI) per capita: low income, lower-middle income, upper-middle income, and high income.[18]

Based on the 2014 classifications using 2013 economic-indicator data, there were 36 low-income countries with a per capita income of $1,045 or less. This group is made up of the world's poorest countries, such as Afghanistan, Ethiopia, and Liberia. They accounted for .03 percent of the global economy in 2010, and 8 percent of the world's population. The 48 lower-middle-income countries, such as India, Morocco, and the Philippines, have per capita incomes ranging from $1,046 to $4,125. They are home to almost 40 percent of the world's people and accounted for about 7 percent of global GDP in 2010. The upper-middle-income category covers 55 countries with per capita incomes from

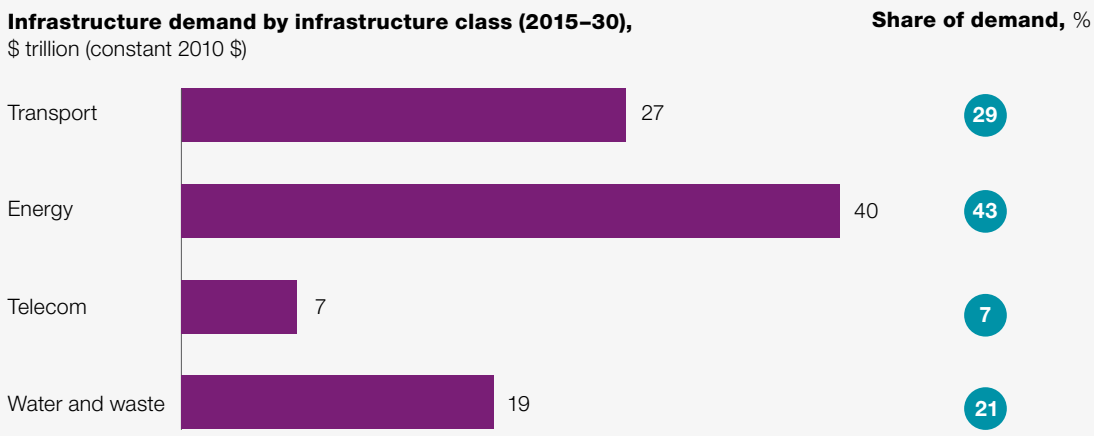
Exhibit 3 **Up-front capital costs to meet global infrastructure demand are estimated to be roughly 5 percent higher in a sustainable scenario.**

Global demand for infrastructure services, 2015–30,
$ trillion (constant 2010 $, indicative figures)



Source: Global Commission on the Economy and Climate

Exhibit 4 **Demand for sustainable-infrastructure finance is greatest in the power and transport sectors.**



Source: McKinsey analysis

$4,126 to $12,745, including Brazil, China, Iran, Mexico, South Africa, and Turkey. These countries are home to a third of the global population and accounted for 21 percent of GDP in 2010, a figure that is expected to reach 33 percent by 2030.[19] The increase comes largely from China, whose share of global GDP is expected to rise from 11 percent in 2010 to 18 percent by 2030. Lastly, there are 80 high-income economies; these made up 72 percent of global GDP in 2010 and 20 percent of the global population.

To estimate demand by country, we consider historic spending levels and projected shifts in GDP[20] from 2010 through 2030.[21] This assumes that countries' demand is based on the sustainable infrastructure needed to support the economy they will have in 2030. On that basis, we estimate that 46 percent of demand will come from high-income countries, and 2 percent from low-income ones. More than half—52 percent—will come from middle-income countries. These, however, will account for only 36 percent of global GDP by 2030, which is why finding affordable solutions is so important.

As middle-income countries design and build new projects, they can use the best, most-modern practices and technologies, just as many have done with telecoms. Also, productivity could be much improved. More productive use of assets lowers costs by reducing the amount of infrastructure that needs to be built. The McKinsey Global Institute has specified three ways to improve productivity:

- Smart selection of projects, with an emphasis on those that address clearly defined needs and that fit into a well-thought-out project portfolio
- Investing in the design and planning stages to reduce project changes and delays

- Increasing asset utilization, improving maintenance planning, and refining demand management for existing assets[22]

Implementing these measures could reduce the required outlays by 40 percent, or from $93 trillion to $56 trillion. It's also worth remembering that it is possible to overinvest in infrastructure, especially if existing infrastructure is not meeting demand efficiently. Some countries or regions have more physical infrastructure than they need; in such cases, building more brings little marginal value.[23]

© James Lauritz/DigitalVision/Getty Images

Part 2: The supply of infrastructure finance

Of the $2.5 trillion to $3 trillion a year invested in infrastructure, the private sector accounts for $1 trillion to $1.5 trillion. There are two main categories of private-sector finance.

Institutional investors comprise $350 billion to $400 billion of annual infrastructure spending and usually invest as part of a broader portfolio. Since 2000, the World Bank has collected project-level information on private participation in infrastructure in low- and middle-income countries. An analysis of this data shows that most corporate investment went to telecoms and energy. Public-sector entities, meanwhile, were more likely to pay for traditional public infrastructure, such as transport and water systems.[24]

Then there are corporations,[25] which invest in infrastructure as part of their strategic initiatives. In many cases, however, there is not often a clear distinction between corporate and institutional investment. For example, a significant share of corporate debt and equity in the energy and telecom sectors is held by institutional investors who are exposed to infrastructure through their corporate investments.

Although the corporate sector could expand spending in important sectors such as energy, and also plays important roles as builders and operators, the bulk of this report focuses on institutional investors. To understand the dynamics at work, it helps to break down institutional finance into three parts: players, products, and places.

Players: Institutional investors

Institutional investors can be divided into eight groups based on motivation, risk profile, and regulatory status. Understanding these different groups is essential to figuring out how each one can help to close the financing gap. Given the variations in risks and returns between projects and across life cycles, combining pools of capital from the different entities can help to meet demand:

1. *Banks* ($40.2 trillion in AUM)
2. *Investment companies* ($29.0 trillion in AUM)[26]
3. *Insurance companies and private pensions* ($26.5 trillion in AUM)
4. *Public pensions and superannuation plans* ($10.9 trillion in AUM)
5. *Sovereign-wealth funds* ($6.3 trillion in AUM)
6. *Infrastructure operators and developers* ($3.4 trillion in AUM)
7. *Infrastructure and private-equity funds* ($2.7 trillion in AUM)
8. *Endowments and foundations* ($1 trillion in AUM)[27]

Banks provide the most important source of debt for infrastructure projects.[28] They can act as the lead arranger, or they can participate through syndicated loan market. European and Asian project-finance banks traditionally led the market for cross-border infrastructure debt, but their involvement diminished slightly after the 2008–09 financial crisis because of the more restrictive capital

requirements under Basel III.[29] In recent years, some of these banks have begun to increase their exposure to infrastructure again.

Domestic private-sector banks play a particularly important role, given their ability to assess local-project and sovereign risks and to provide lending in local currency.[30] Both international and domestic banks, however, can struggle to offer the long tenors needed for sustainable-infrastructure projects, whose payback often comes later than in traditional projects. Still, banks have to be part of the answer to increase funding for sustainable projects, and in fact, they have taken a big role in renewable energy.

As many governments move toward auctions for awarding tariffs and power-purchasing agreements for renewable-energy projects, it is likely that banks will begin to play a more pivotal role in the project cycle—that is, well before the financial close rather than later in the project-financing process.[31] For example, South Africa's Renewable Energy Independent Power Producer Procurement Program (REIPPPP) requires bidders to submit bank letters stating that the financing is locked in. In effect, this outsources due diligence to the banks, who accept more project-development risk and also take a more strategic role, with the lure of generating higher returns.[32] For governments, this approach solves the pernicious problem of auctions resulting in lowball offers that can never be financed.[33]

Investment companies, insurance companies, and pension funds share similar strategies and preferences, and are subject to similar levels of regulation. Together, they represent more than 31 percent of global assets under management.[34] These investors have business models that require liquidity to meet ongoing customer obligations, and they tend to invest only when assets are operating. In recent years, they have shown interest in renewable energy, because these investments can be inflation linked, have low correlations to other assets, and provide long-term steady cash flow. In 2014, four Danish pension funds, the Canadian institutional-fund manager La Caisse de dépôt et placement du Québec, and the German insurer Allianz all made significant investments in wind and solar farms.[35] "Insurers like Allianz need stable investments and long-term yields—and this is exactly what wind and solar farms have to offer," explains David Jones, head of renewable energy at Allianz Capital Partners. "Here we are looking at an investment horizon of at least 25 years . . . and these yields are also totally uncorrelated with the ups and downs of the financial markets."[36]

Sovereign-wealth funds (SWFs), with $6.3 trillion in global assets, can afford to take longer-term risks. However, many of them are bound by government mandates that require diversification from domestic assets or certain asset classes. Others have mission-oriented or ethical mandates or goals. Norway's SWF, for instance, invests in green bonds and other vehicles to support sustainable infrastructure.[37] Last year, the fund, which has assets of more than $850 billion, said it would more than double its climate-related investments to $8 billion, with $3 billion of that to be invested in green-technology stocks.[38] Endowments and foundations ($1 trillion in global assets) often have similar investment themes to SWFs.[39]

Investment companies, insurance companies, sovereign-wealth funds, and pension funds—like banks—tend to get involved later in the infrastructure development process, and so historically have less leverage in shaping the sustainability of infrastructure projects. However, two trends support a more proactive role for these

players in shaping sustainable-infrastructure projects. First, these investors—particularly some pension funds—are increasingly investing directly in infrastructure projects rather than as limited partners in infrastructure funds, and so they get involved earlier as equity partners in project consortia. Second, many investment companies, insurance companies, sovereign-wealth funds, and pension funds are setting more aggressive portfolio targets both for infrastructure and for sustainability. This could lead general-partner infrastructure and PE funds and governments, developers, and operators to shape more sustainable projects upstream.

Private-equity and infrastructure funds are the most likely to invest in equity, rather than debt; they also seek the greatest returns. Many investment companies, pension funds, insurance companies, and SWFs are limited partners of private-equity and infrastructure funds. Representing a little more than 2 percent of global AUM,[40] private-equity and infrastructure funds invest heavily in unlisted assets. Some private-equity funds have achieved significant returns in sustainable infrastructure.

Private-equity and infrastructure funds are also getting more active in upstream project shaping. Some of the most successful sustainable-infrastructure investors—such as UK-based Actis' efforts in Africa—are building platform plays in wind and solar, where they partner with developers to try to strike multiple deals across the continent. This gives them the leverage to set standards that can be replicated (perhaps more quickly than bespoke projects with different investors and developers, due to learning effects) in other countries.

© TERADAT SANTIVIVUT/E+/Getty Images

With $3.4 trillion in AUM, infrastructure operators and developers play an important role in infrastructure finance. They are important players in the long-term economics for sustainable-infrastructure projects, because they are the ones who realize the benefits of lower operating costs.

Many of these operators and developers are large corporations, and can achieve scale nationally or regionally by developing infrastructure that supports other business lines. For example, mining companies have traditionally financed and built rail, roads, and ports to get their materials to market. Developers can shape the amount and timing of capital expenditure and assume construction risk. These critical elements are particularly relevant to sustainable infrastructure, given that they often have higher up-front capital requirements, longer time lines, or more complexity.

Many successful developers and operators get involved early in the life cycle, often at conception. An increasing number of governments accept unsolicited PPP bids. One developer we interviewed said that returns are up to 600 basis points greater when developers and operators are more than "order takers." Those that take sustainable-infrastructure projects to governments via unsolicited bids can differentiate their proposals and help governments meet dual objectives—of creating needed power, transport, water, and other infrastructure while also mitigating negative environmental effects and boosting resilience.

To draw in more private-sector money, the challenge is to bring in investors who may represent less of a natural fit with sustainable infrastructure, but who have significant assets. Coordination among government, financial institutions, and corporations will be critical to finding ways to match these different pools of capital and thus to close the finance gap. This is particularly critical for sustainable-infrastructure initiatives because these projects can require more up-front capital and therefore take long to pay back. Combining different pools of capital can lower the weighted average cost of capital (WACC) for projects by trading more expensive capital in riskier stages (construction) for less expensive capital in stages with steady cash flows (operations).

For example, banks, private-equity funds, project developers, and utilities have become deeply involved in recycling debt and equity capital for renewable energy. These investors own all or part of a wide array of renewable-energy assets that are generating predictable returns—and can thus be sold at some point to more risk-averse institutions, such as pension and insurance funds. Revenues from these sales can then be reinvested into new projects.[41]

Products: Debt and equity

In a review of more than 3,700 infrastructure financings from 2000 to 2015 that used both debt and equity, we found that debt averaged 70 percent of the total capital.[42] The implication is that a 70/30 mix allows projects to get funded with lower-cost debt capital while avoiding overleveraging, but we cannot be conclusive. The review only considered projects that received financing; an unknown number did not get financing and therefore are not part of the study. The larger point is this: given the need for both debt and equity, approaches to enhance sustainable-infrastructure investment should address both kinds of financing.

In a survey of investors active in infrastructure, 54 percent said they were willing to participate in projects through debt or mezzanine financing (such as subordinated debt). More than 85 percent said they were willing to assume a primary equity stake.[43] This focus on equity investing is likely due to the fact that infrastructure debt has traditionally been the focus of a small group of major international commercial banks. That is no longer

To draw in more private-sector money, the challenge is to bring in investors who may represent less of a natural fit with sustainable infrastructure, but who have significant assets.

the case. The number of players providing debt increased after the financial crisis and the Basel III regulations, and more investors are looking to invest in infrastructure equity, either directly or as limited partners in specialized infrastructure, private-equity, sovereign-wealth, and pension funds. As a result, tapping sources of debt and equity is now a far less significant concern compared with the scarcity of good projects.

Matching financing instruments to needs throughout the project life cycle is difficult. For example, capital may be in short supply early in a project, when there is often a lack of contractual or regulatory certainty. Debt financing is sometimes difficult to obtain until the project can generate revenue; often, the only private-financing option available is developer equity, which is risky, expensive, and scarce. In addition, many infrastructure investors do not have the capital to take on construction risk, leaving it to banks and developer equity. Because there is a limited pool of capital prepared to take on these risks, the result can be higher capital and debt costs, even though the faster construction time lines for some sustainable infrastructure (such as solar arrays compared with grid-connected gas- or coal-fired power plants) can actually reduce construction risk.

Places: Regional distribution of investment and financial assets

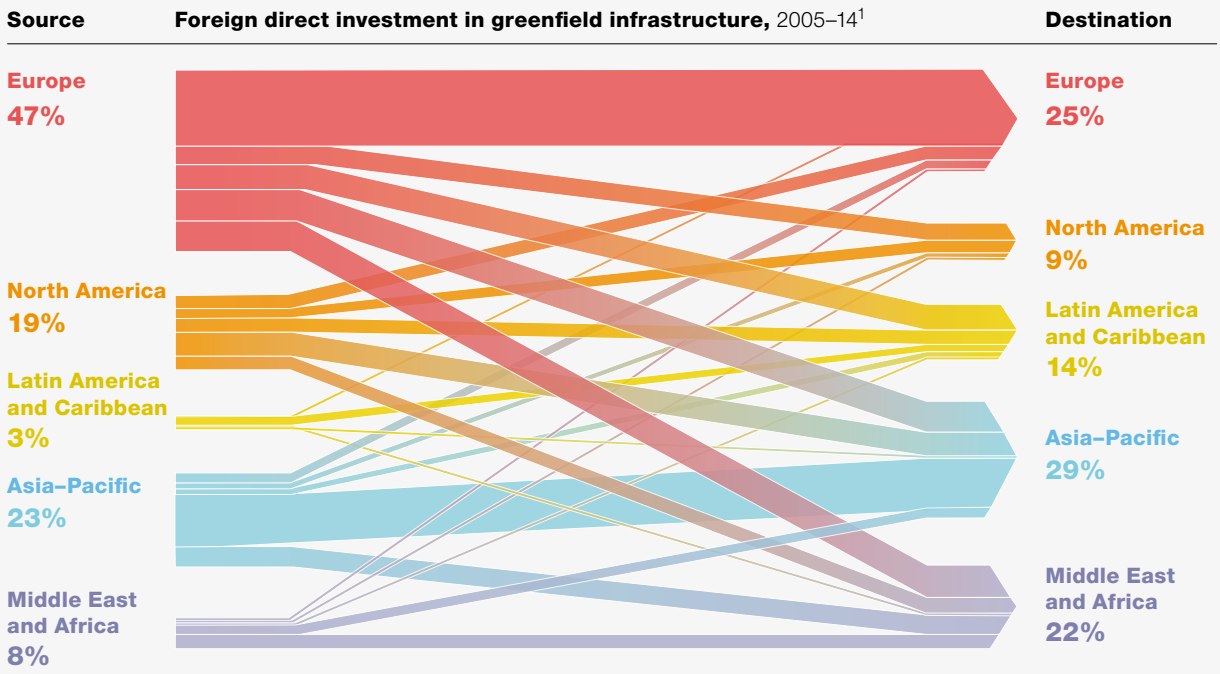
Infrastructure investors tend to invest in their home region. For instance, one survey found that 69 percent of North American infrastructure investors were targeting deals in North America for the next year. Only 11 percent were looking at Asia or emerging markets. The numbers were almost identical for European investors.[44]

The reason for this is that investors worry that they do not understand the physical environment, government policies, or overall business climate outside their home region. Also, as geographic distance increases, project management and delivery become more complex. Geographic diversification is increasing, however. Some infrastructure funds and pension funds are taking on more emerging-markets projects in order to find more deals and greater returns. For example, the Ontario Teachers' Pension Plan and Alberta Investment Management Corporation have invested in energy, roads, and water in Chile. Globavia, a Spanish infrastructure company, has worked with British universities, the Netherlands' PGGM, and Canada's OPTrust to provide exposure to emerging markets.[45] Europe and the Asia–Pacific region account for 70 percent of foreign direct investment (FDI) in new infrastructure; they also produced the most flows back into their own region. Overall, 40 percent of FDI was invested within the home region of the investor (Exhibit 5).

There are differences in risk factors among regions. Moody's studied 5,308 project-finance bank loans from 1983 to 2013, which represents more than 60 percent of all such transactions globally in that

Exhibit 5

Forty percent of foreign direct investment in new infrastructure flows to the home region of the investor.



[1]Figures may not sum, because of rounding. Investment in infrastructure was estimated based on assumptions about infrastructure intensity of various sectors receiving investment.

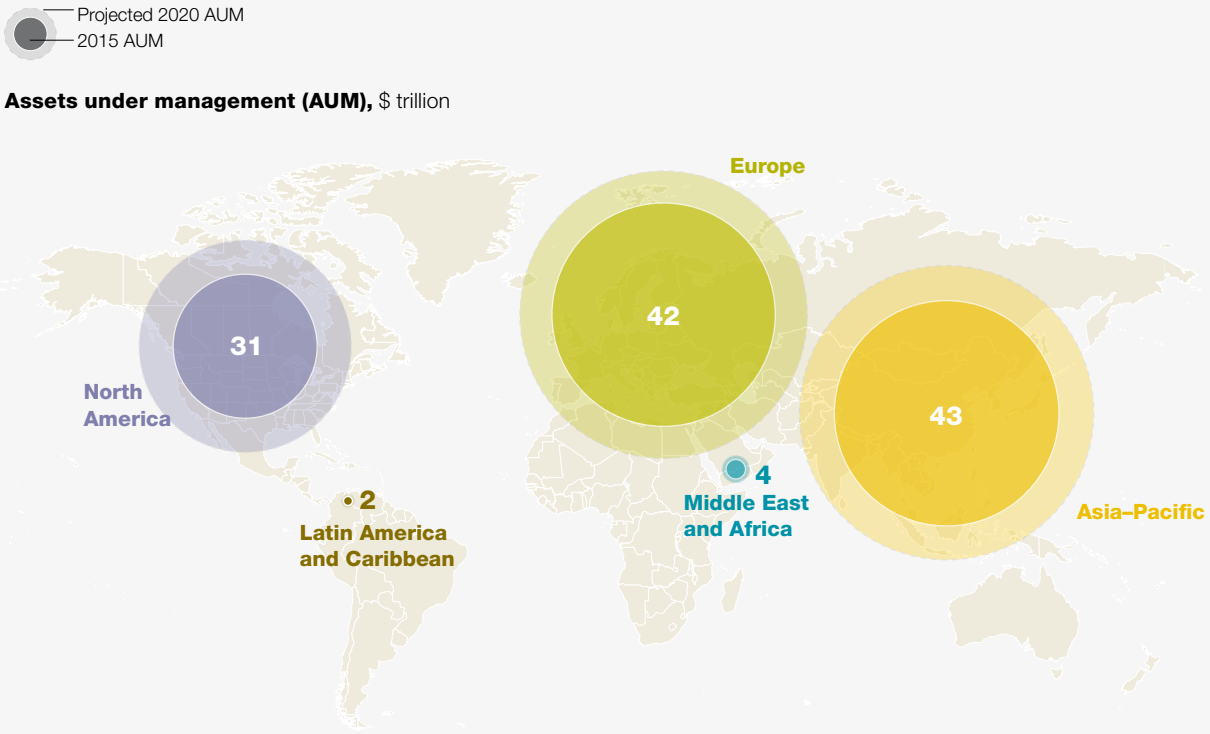
Source: Source: fDi Markets, 2015; McKinsey analysis

time frame.[46] The study found that the highest default rates were in Latin America, Southeast Asia, and North America (14.8 percent, 10.0 percent, and 9.9 percent, respectively) while the lowest were in the Middle East, Africa, and Europe (1.6 percent, 2.2 percent, and 4.8 to 5.2 percent). The Moody's review also found that default rates for project-finance bank loans in the 34 Organisation for Economic Co-operation and Development (OECD) countries was 5.7 percent, compared with 8.2 percent in non-OECD countries. The ultimate recovery rate, however, was almost identical: 80.1 percent for OECD countries and 80.9 for the rest. The implication, then, is that perceived risks can be greater than the reality—consider Africa and the Middle East, whose default rates are very low. Basing risk on broad generalizations, then, paints the picture with too broad a brush—and can mean investors miss profitable opportunities.

Regional trends

Private investors, including institutional ones, have about $120 trillion in global AUM, with $73 trillion (or 60 percent) of that in Europe and North America. By 2020, however, that could be down to 53 percent while the Asia–Pacific region alone could account for 40 percent of private AUM (Exhibit 6).[47] This shift in resources will enable some developing

Exhibit 6 **By 2020, over 40 percent of global assets under management will be in Asia–Pacific.**



Source: Preqin Infrastructure Online, Funds and Limited Partnership Investors, June 2015; *Asset management 2020: A brave new world*, PricewaterhouseCoopers, 2014; McKinsey analysis

regions to increase domestic investment. It could also encourage more cross-border investment, considering the demonstrated preference of investors to stay close to home.

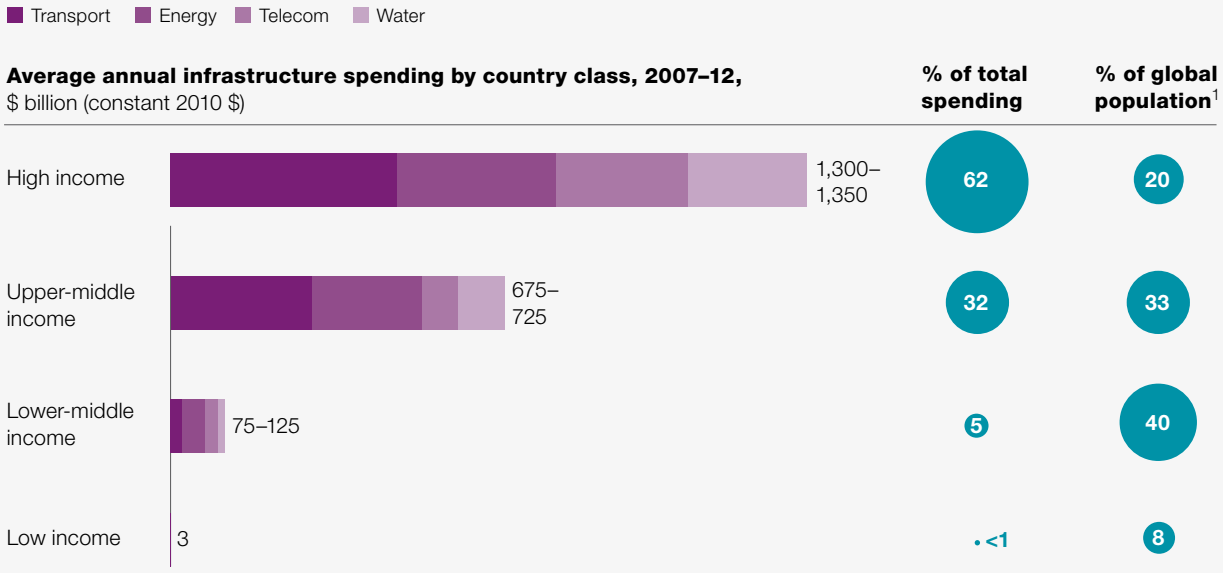
Spending by country type

In terms of spending, 62 percent of infrastructure investment from 2007 to 2012 was in high-income countries, and 32 percent went to upper-middle-income countries, with China accounting for three-quarters of the latter (Exhibit 7).

Of the $120 trillion under private management, 87 percent is in high-income countries, and 11 percent is in the upper-middle-income countries that will make up 45 percent of global demand for infrastructure from 2015 to 2030. These countries have access to more complex and sophisticated financial instruments than poorer ones. In lower-middle- and low-income countries, more than 80 percent of institutional assets are managed by banks, pensions, and insurance companies; SWFs

Exhibit 7

The majority of infrastructure investment has been concentrated in high-income countries and transport.



[1]Figures may not sum, because of rounding.

Source: Global Water Intelligence; IHS Global Insight; International Energy Agency; International Transport Forum; Organisation for Economic Co-operation and Development; McKinsey Global Institute analysis; McKinsey analysis

are also important. Therefore, boosting investor participation in sustainable infrastructure in these countries will mean finding approaches tailored to these kinds of investors.

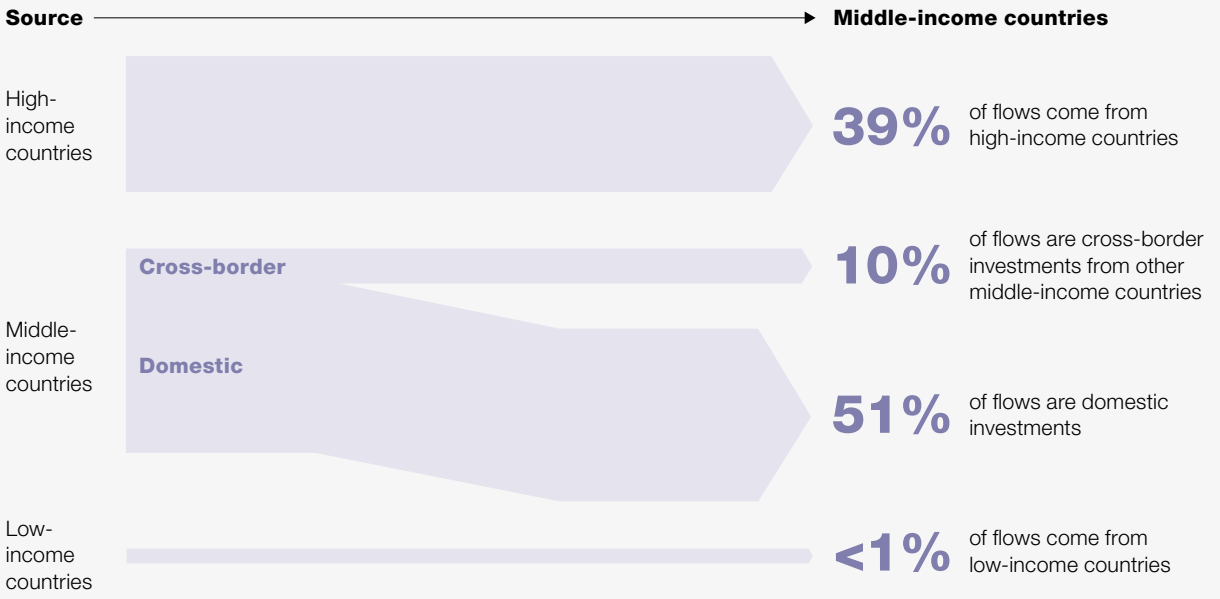
Given that most demand for infrastructure from 2015 to 2030 will come from middle-income countries (45 percent for upper-middle and 7 percent for lower-middle), understanding where their financing is coming from is important. An analysis of data from 2005 to 2014 found that more than 60 percent of private and public-private partnership (PPP) infrastructure financing flows to middle-income countries came from middle-income countries (domestic and cross-border); the rest came from high-income countries. In addition, more than half of private infrastructure flows in middle-income countries are domestic (Exhibit 8). Encouraging domestic investment, then, will be critical to closing the sustainable-infrastructure gap. Domestic investment often has lower transaction costs because investors are more familiar with the country context and can avoid currency risk.

PPPs also play an important role in financing infrastructure in middle-income countries, making up 22 percent of overall flows. They have also proved helpful in mobilizing capital from high-income countries, contributing a third of investment flows into middle-income countries. PPPs are particularly important for sustainable infrastructure because they allow the blended-capital structures that are

Exhibit 8

Over half of private and PPP infrastructure financing in middle-income countries is from domestic sources.

Private and public-private-partnership financing flows to middle-income countries, 2005–14[1]



[1]Analyzed data from more than 6,000 deals for 2005–14. Country classification by World Bank Atlas method.

Source: Private Participation in Infrastructure Database, World Bank; McKinsey analysis

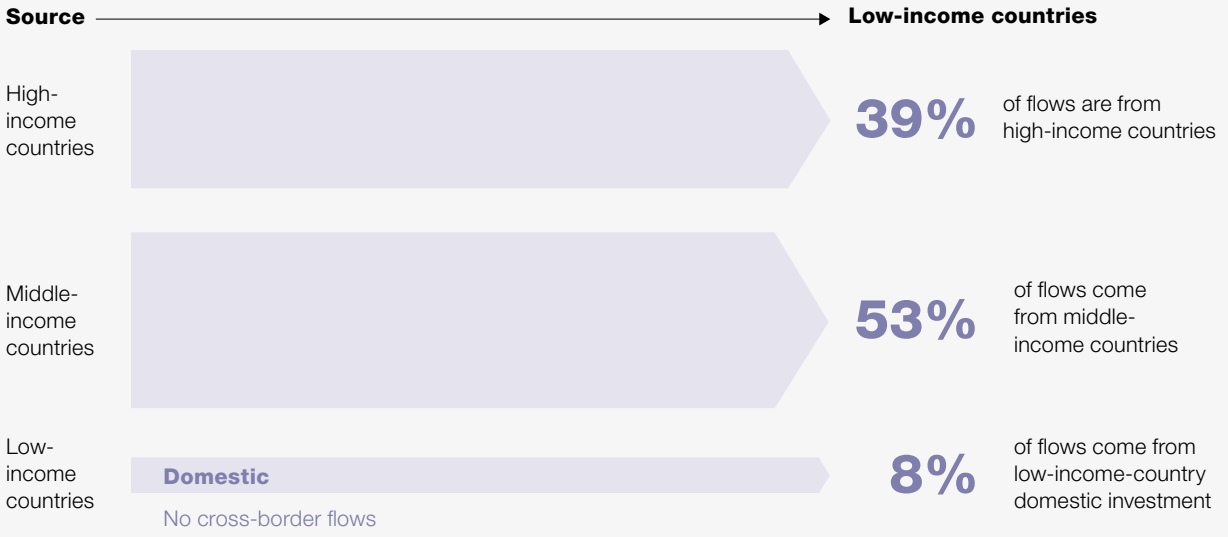
often necessary. PPPs also reduce private investors' perception of policy risks, since public investment signals genuine government commitment to the project. This is a matter of importance for sustainable infrastructure, which can be affected by rules and regulations related to feed-in tariffs, energy subsidies, and climate targets.

Low-income countries, by contrast, receive only 8 percent of finance from domestic sources, as Exhibit 9 shows, with the rest coming from high- and middle-income countries (39 percent and 53 percent, respectively). Closing the sustainable-infrastructure gap in low-income countries will require more investment from these sources, unless and until domestic savings increase sufficiently. PPPs contribute 18 percent of total investment.

Exhibit 9

Over 90 percent of private and PPP financing for infrastructure in low-income countries comes from high- and middle-income countries.

Private and public-private-partnership (PPP) financing flows to low-income countries, 2005–14[1]



[1]Analyzed data from more than 6,000 deals for 2005–14. Country classification by World Bank Atlas method.

Source: Private Participation in Infrastructure Database, World Bank; McKinsey analysis

Part 3: Defining the sustainable-infrastructure gap

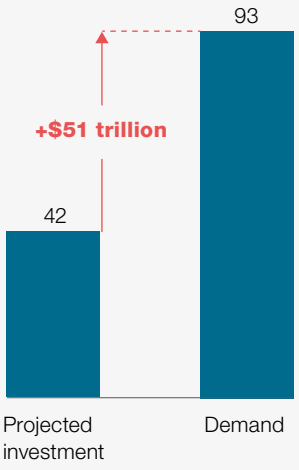
Between 2015 and 2030, the gap between demand for infrastructure and projected spending is estimated at $39 trillion to $51 trillion[48]; the latter figure is close to the current global value of all infrastructure assets. The wide range of estimates is due to uncertainties over China. Its spending on infrastructure as a share of GDP is the highest in the world but could start to decline (Exhibit 10).

The magnitude of the sustainable-infrastructure gap varies by type of country. Almost two-thirds (65 percent) of the gap is concentrated in middle-income countries, where projected demand is more than 2.5 times projected spending (Exhibit 11). These countries not only need more capital, but also more affordable capital.

Exhibit 10 **The gap between demand for infrastructure and projected spending is estimated at $39 trillion to $51 trillion over 15 years.**

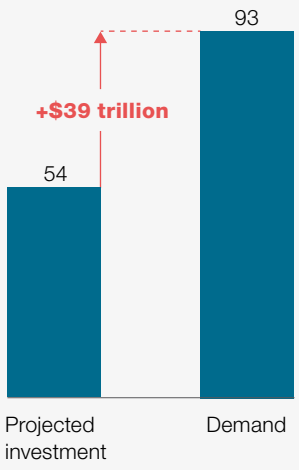
Global infrastructure gap, 2015–30, $ trillion (constant 2010 $)

Conservative investment-growth scenario



Assuming all investment, including China, grows 1.8% a year (rate of global growth excluding China)

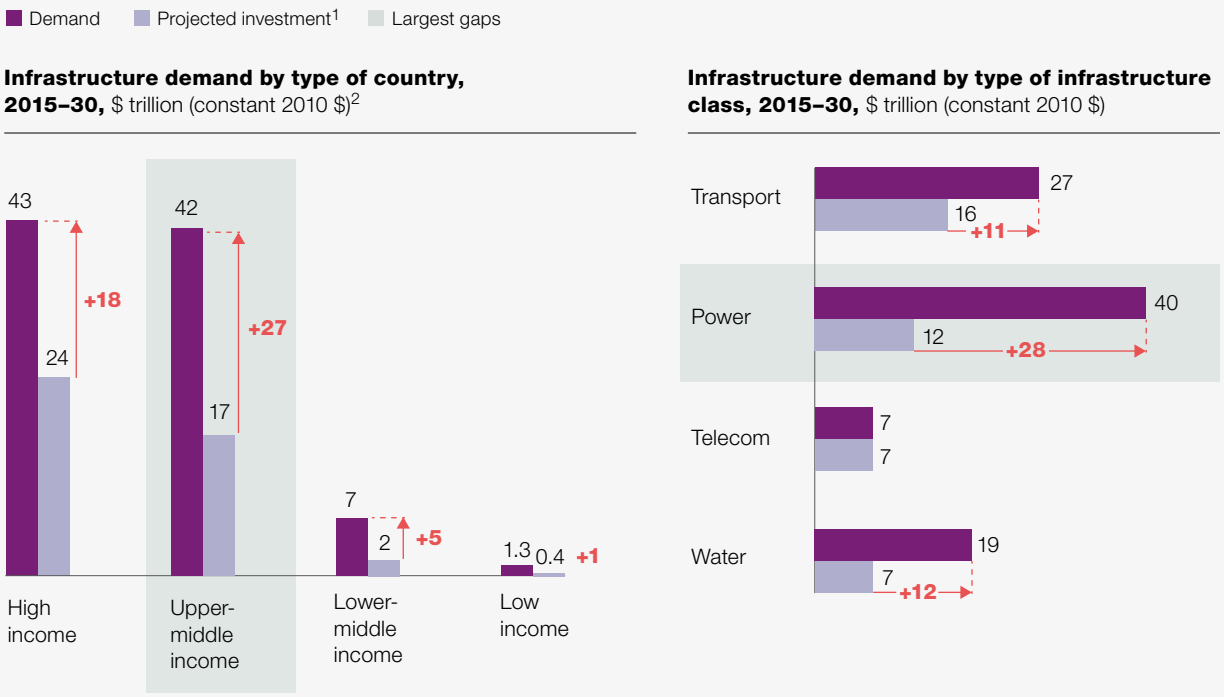
Aggressive investment-growth scenario



Assuming investment growth at historic rate of 4.3%; this implies that China continues to increase investment at 13% a year

Source: Global Commission on the Economy and Climate; McKinsey analysis

Exhibit 11 **The largest gaps are in upper-middle-income countries and the power sector.**



[1]Extrapolated from historical spending and assuming a continuation of real investment growth (assumes conservative investment-growth scenario).
[2]Figures may not sum, because of rounding.

Source: McKinsey analysis

The low-income-country gap is not huge in dollar terms ($1 trillion from 2015 to 2030), but it is significant in relative terms—three to four times projected investment. It is unlikely that private-sector money will be enough; development banks, multilateral institutions, and official development assistance will also need to get involved.

The sustainable-infrastructure gap also varies by infrastructure class, with energy accounting for more than half (54 percent) of the $51 trillion gap, followed by water and waste (24 percent), and transport (22 percent). Getting investment in power generation and energy-efficiency infrastructure in middle-income countries right will be key to a sustainable-infrastructure future.

Infrastructure spending in China

From 2007 to 2012, China's infrastructure spending grew from 17 percent to more than 27 percent of the global total. By 2012, it accounted for more than 65 percent of all infrastructure spending in middle-income countries. China's infrastructure spending grew at a rate of 13.4 percent over the period, bringing the global growth rate in infrastructure spending to 4.3 percent (compared with 1.8 percent without China).[49] While China's economy has grown more than 10 percent a year for the past 30 years, GDP growth has slowed recently—and so did the country's spending on infrastructure.[50]

Although China escaped the worst of the global financial crisis that began in 2008, it did so in part by boosting local-government spending, fueled by low-cost loans from state-owned banks. Many of these projects were unprofitable, and now local governments face large and growing debt burdens.[51] In addition, the Chinese government appears to be backing away from this strategy in favor of promoting domestic consumption and the service sector.[52]

China accounted for only a small proportion of private infrastructure spending from 2005 to 2014—just 4.4 percent of total private-to-PPP infrastructure investment in middle-income countries. Of all the private-to-PPP investment flows going to China, nearly 65 percent came from domestic sources.[53] Meanwhile, China financed 10 percent of private-to-PPP spending in middle-income countries.[54]

What happens in China will affect the future supply and demand for sustainable-infrastructure financing. In fact, changes in China could result in a $10 trillion difference to the forecast for the global gap in infrastructure financing through 2030.

© Markus Biemüller/Moment/Getty Images

Part 4: The private sector's role in closing the gap

Given the scale of the sustainable-infrastructure finance gap, it cannot be closed without increased investment from the private sector—in the form of both institutional investors and corporations. In addition to capital, the private sector can bring other benefits. For example, private investors can help to ensure that deadlines are met and cost overruns are minimized. They are more likely to develop projects with commercial potential and workable economic structures. Private-sector participation can also provide a signaling effect, helping to bring in additional investment. To fulfill its potential, though, the private sector needs projects with the right risk-return profiles.

Scaling up private institutional investment: We estimate that, with the right incentives, private institutional investment in infrastructure could increase by $1 trillion to $1.5 trillion a year. Currently, institutional investors finance $300 billion to $400 billion of infrastructure a year. If current infrastructure investors continued average allocation levels of 5.2 percent and AUM grew 6 percent annually through 2030,[55] that would result in $8.6 trillion of additional investment from 2015 to 2030. On average this would translate to an additional $575 billion in average annual investment, although most investment would accrue toward the end of the time period. If current investors increased allocations to 6 percent (the average level institutions say is their target) and AUM growth was stable, that would add a further $150 billion per year. If allocations from current investors were increased to 8 percent, it would mean another $325 billion a year. Finally, if 60 percent of investors who are not investing in infrastructure began to invest at the current allocation level of 5.2 percent, that would add another $175 billion a year (Exhibit 12).[56] This analysis relates to potential increases in infrastructure financing in general. To increase spending on sustainable infrastructure in particular, however, requires doing more (see Part 5).

All told, increased institutional private-sector investment could close more than a third of the spending gap. To get there, though, will require concerted efforts and well-crafted approaches. Specifically, it will be difficult to increase the participation of those who are not in the sector now. These players may face restrictions on where they can invest and may not be confident in their ability to evaluate investment opportunities.

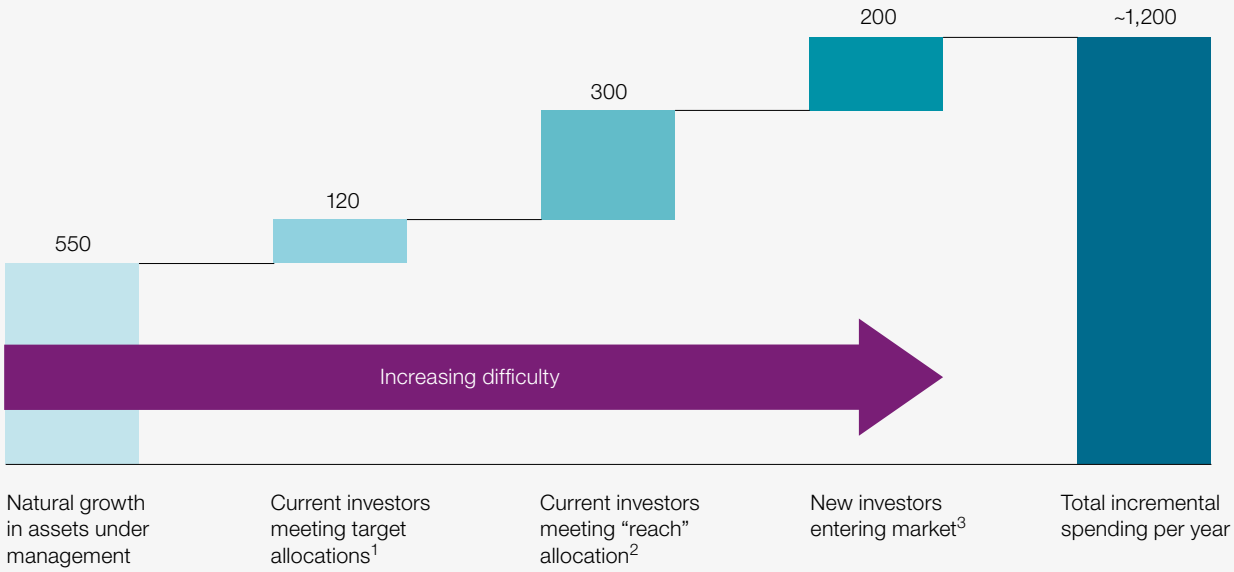
As for banks, in particular, the long tenures associated with infrastructure investments place pressure on funding and liquidity ratios, making it more challenging for them to meet increasingly strict capital requirements. That is one reason that investment from this group could actually fall. Nevertheless, sustainable-infrastructure investments can be attractive. Such projects often feature long-term returns (roads, bridges, and tunnels last about 50 years), steady cash flows, and can help investors to safely diversify their portfolios.[57] The default rate for infrastructure-project-finance debt since 1998 has been 1.5 percent, compared with 1.8 percent for rated corporate issues.[58]

Scaling up corporate investment: Corporate actors, such as energy companies, telecoms, and public utilities, make up 65 to 75 percent of private infrastructure spending. Verizon, the US-based telecom company, has invested more than $80 billion in infrastructure over the past five years.[59]

Exhibit 12

If the right levers are pulled, there is potential to increase investment from private institutional investors by ~$1.2 trillion per year.

Potential incremental annual spending from private institutional investors, $ billion (constant 2010 $)



[1]Weighted average target allocation = 5.96% across investor groups.
[2]"Reach" allocation defined as 8% weighted average across investor groups.
[3]Assumes 60% of non-infrastructure investors begin investing at level comparable to peer current allocations.

Source: Preqin Infrastructure Online, Funds and Limited Partnership Investors, June 2015; McKinsey analysis

Major oil companies can spend $20 billion to $30 billion a year on capital investments globally. American Water plans to spend $5.8 billion on capital investments from 2014 to 2018, with much of that allocated to asset renewal and capacity expansion.[60] These figures are significant when compared with the $300 billion to $400 billion in annual investment from all institutional investors.

Increasing the share of corporate spending that goes to sustainable infrastructure would be a major positive development. However, companies have the same perceptions about risks and returns that influence other investors. On average, companies whose businesses are tied to infrastructure assets require real rates of return on total capital employed of 5 to 10 percent for new investments: 5 to 6 percent for power and water utilities, 7 to 8 percent for energy companies, and 9 to 10 percent for engineering and construction companies.[61] The decision on whether to invest is based on a project's ability to meet this return requirement and its strategic fit within a company's business plans. Because companies are often both the owners and the operators of the assets, however, they may be more willing to take a full life-cycle view, for example, by considering climate-related risks. But this requires corporate leadership that can resist short-term pressures.

© FernandoAH/E+/Getty Images

The link between institutional and corporate investment: In important ways, institutional and corporate investment work together. By investing in the stock of these companies, purchasing their debt, or lending to them, institutional investors are exposed to corporate infrastructure investments. An effective way, then, for institutional investors to increase their exposure to sustainable infrastructure could be through corporate holdings.

In turn, the balance sheets of many corporations are financed via debt and equity from institutional investors. They are also devising ways to bring institutional investors into projects. In the oil and gas industry, many projects are financed through the balance sheets of the corporate partners and allow for benefits such as risk sharing. In renewables, projects are initially financed through company balance sheets and then moved off the balance sheet through later-stage divestitures so that capital may be recycled. In real estate, capital is being recycled through a combination of project financing by developers during development and construction with subsequent divestment.

Finally, companies have begun exploring listed vehicles, such as yieldcos and master limited partnerships, as means to funnel investments into infrastructure projects, including sustainable ones. These structures can offer attractive risk-return profiles and tax benefits by connecting infrastructure projects with retail and pension-fund investors who have lower costs of capital.

Part 5: Challenges to increasing financing to sustainable infrastructure

Infrastructure investments offer diversification, liability hedging, long-term horizons, fixed income, and stability. Sustainable-infrastructure investments have all of these benefits; in addition, they also sometimes feature faster construction and lower operating costs (albeit sometimes higher capital expenditures up front). So why is there still such a large gap between what is needed and what is available?

One reason is the enabling environment—the policy, regulatory, and market context in which investors operate. For example, if consumer costs are subsidized, then investors may worry about their willingness to pay more if the subsidies are reduced. Poor contract enforcement reduces investor confidence in long-term returns no matter how attractive the economics appear. In addition, if rules regarding investment are so burdensome that returns will likely be low, investors will stay away.

A further explanation for the gap in sustainable-infrastructure financing can be attributed to barriers specific to the projects. These vary, depending on the type of investor, the country, and the sector, but there are some common elements.[62] We have identified five major barriers that inhibit financing going to infrastructure in general; for sustainable infrastructure, they are even higher. There are ways to get over these problems (see Part 6), but first they need to be recognized. This report focuses on barriers that are relevant for a variety of private-sector investors and project types. We chose these five because they represent key challenges for infrastructure as an asset class, and we prioritized them based on research and discussions with institutional investors, practitioners from development-finance institutions, and public-sector actors.

Lack of transparent and "bankable" pipelines: "The challenges are as much on the side of projects as on supply of capital," the World Bank's Bertrand Badré said in October 2015. "There are simply not enough viable projects out there."[63] There are three related issues. First, governments often fail to develop long-term plans; as a result, infrastructure needs are unknown. Second, even when there are long-term plans, the pipeline may not be well communicated (only half of the G-20 publishes infrastructure pipelines, for example).[64] When it is not clear how many projects will take place in a specific geography or sector, it is difficult for investors to justify investing in diligence and credit-evaluation expertise in those areas or investing in local staff and partnerships. Third, many infrastructure projects are not "bankable," meaning they do not appear to be likely to deliver high enough risk-adjusted returns to attract private-sector equity or debt. Or costs and risks may not appear to be allocated appropriately.

Middle- and low-income countries face additional challenges. Not only do they often lack project-development resources, but their governments also may not be able to afford the funding commitments required or cannot offer sufficient guarantees to mitigate the perceived risk of the project.

These kinds of pipeline problems make it more costly for investors to raise funds and invest in infrastructure. According to the head of asset

How is sustainable infrastructure different?

In terms of defining sustainable infrastructure, one issue is that there is no agreement on standards or on what performance indicators should be used. For example, greenhouse-gas emissions come from not only the construction of infrastructure but also its use; that makes accounting for it complicated. The lack of standards can make it difficult to design, finance, and build sustainable infrastructure. There are efforts being made to fill this gap; doing so is easier in some sectors than others.[65]

The differences between sustainable and traditional infrastructure cannot be generalized; they can vary asset by asset. There are, however, some areas where substantive differences are common. Among them:

Design and planning: Sustainable-infrastructure projects incorporate criteria that seek to optimize the social and environmental impacts of a project; this may also mean using nonstandard materials and technologies. Incorporating these criteria does not have to delay a project or make it more expensive, but they do need to be thought through from the earliest stages of design and planning to keep costly changes to a minimum. In most cases, this does not require reinventing the wheel. Executives from major engineering, procurement, and construction (EPC) firms confirmed that their engineers know how to make projects sustainable and generally understand and know how to incorporate sustainable practices and technologies. For example, the changes to increase energy efficiency in a building, such as switching to LED lights, improving insulation, and orienting the building to take advantage of the sun's position, are all well known.

Procurement: During procurement, it can be difficult to find contractors with expertise in building sustainable infrastructure; this can become even more complicated when they have to comply with local-content requirements for public contracts. As the volume of sustainable infrastructure increases, there will be greater clarity around procurement and standards and more experienced contractors.

Materials and technologies: Sustainable infrastructure often incorporates more efficient materials, technologies, and systems. Incorporating new technologies, however, can introduce delays and increase costs related to finding the right products at the right price while convincing lenders and insurance providers of the value of these investments.

Integrating sustainable technology, however, can reduce operating costs. In addition, many new technologies are backed by vendor and insurance financing allowing an infrastructure developer to pay for technology from operational savings and making new sustainable technologies cost neutral (or close). Finally, as the market for sustainable materials and technologies grows, costs will fall, as has already happened in the solar industry.[66]

Capital requirements: Sustainable projects may require more capital up front than traditional ones, but less on the back end. For example, an analysis of the economics of new green districts within cities found that construction generally cost 8 to 10 percent more. Even without factoring in environmental benefits, these costs were paid back within three to five years because of lower operating costs.[67]

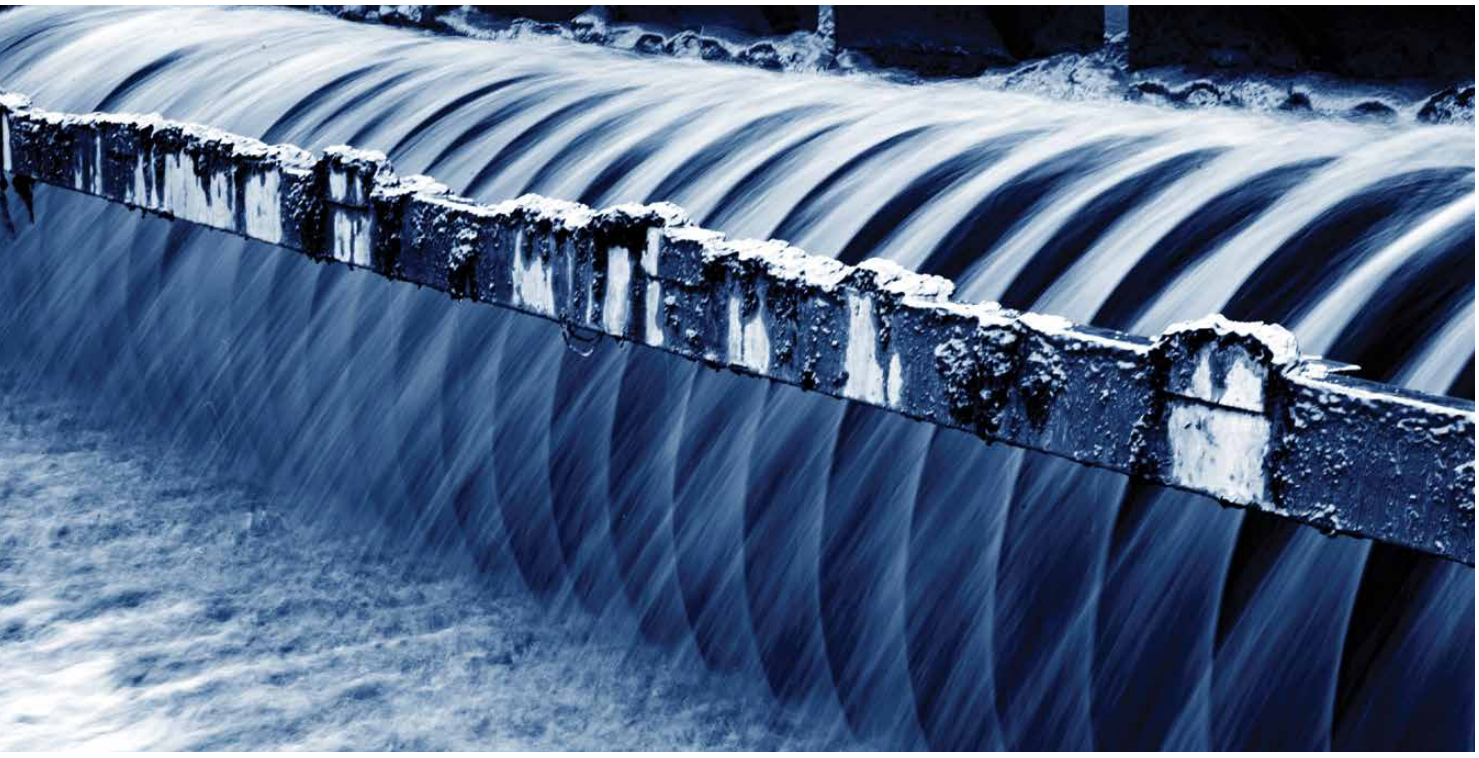
Time to delivery: Comparative time to delivery can vary, with some sustainable projects taking longer than traditional ones and some finishing faster. For example, electrification via distributed solar projects is much faster to deploy and can be delivered much more quickly than electrification via a grid-connected coal-fired power plant. In the same way, bus rapid-transit systems can be delivered much more quickly than new metro lines. Yet truly sustainable infrastructure needs to be part of overall systems-level planning, such as urban planning for compact, connected cities. This can mean multiyear planning and pipeline development.

management at a major South American investment bank, in one middle-income country where it does business, private-sector investment lags because "funds must be raised, but then with no actionable project, you're either collecting fees over and above the cost of capital or paying a deal team to not do anything while they wait for the project to materialize."

Building a sustainable-infrastructure pipeline is even more difficult when climate-change mitigation and adaptation is taken into account. Building long-term sustainable infrastructure, such as transit systems that enable compact cities, requires comprehensive, long-term planning, including coordinating with other projects. It's complicated. Even when plans are in place, a lack of defined standards for sustainable infrastructure, such as for resiliency and energy efficiency, complicates project design. The lack of standards means that even if governments are committed to sustainable infrastructure, there are technical complications in translating that goal into actual investable projects.

High development and transaction costs: Inefficient bidding and procurement processes discourage private investment. Many transactions have to be tailored to individual projects, and there can be diverse and inconsistent standards. Investors with limited resources, time, and expertise, such as pensions and insurance companies, can find it difficult to assess projects when standards are so fragmented. Having to create unique financing structures for each project and jurisdiction increases transaction time and costs. Development-bank infrastructure experts estimate that the use of lawyers, engineers, transaction specialists, and

© hxdyl/iStock/Getty Images Plus



other advisers can account for 1 to 5 percent of project costs, and these are difficult to recoup since they are not capitalized.

For sustainable-infrastructure projects, transaction and development costs may be even higher because limited data on financial and risk performance makes deal evaluation more complicated. Also, sustainable technologies can change so quickly as to make historical performance data outdated. "Institutional investors need to see a track record of performance to determine risk-return," said one experienced investor. "Right now, there is no track record of long-term investment returns" in sustainable infrastructure.

On the whole, investors are less familiar with sustainable infrastructure and associated technologies and can have difficulty incorporating elements such as climate resiliency into their cost-benefit analyses.[68] Another challenge is that sustainable infrastructure often comprises small-scale assets; in 2014, 30 percent of investments in new clean-energy capacity went to small-scale projects such as rooftop solar.[69] These projects do not justify traditional (and often fixed-price) transaction costs unless they can be bundled together.

Lack of viable funding models: Many infrastructure projects cannot deliver the 10 percent to 15 percent rates of return private investors expect. One reason that is particularly pertinent in middle- and low-income countries is that users are unwilling or unable to pay high enough charges to allow full cost recovery plus a return on investment. For example, in some sub-Saharan African countries, up to 70 percent of water does not result in revenue because it is leaked, unmetered, or stolen.[70] Even water infrastructure that generates revenue is often highly subsidized, making it subject to fiscal risk.

For sustainable projects, the matter is even more complicated. Even when sustainable infrastructure's net present value (NPV) is positive over its lifetime, such projects can incur higher up-front costs to the builder, while the savings accrue to the operator or owner. For example, developers pay more to make buildings energy efficient, but it is the homeowner or business that benefits from lower energy bills. Correctly allocating costs between these actors can make funding models more complicated. Other sustainable infrastructure costs more over the life cycle of the asset in the current policy environment. Policies that create market distortions, such as fossil-fuel subsidies, or do not address unpriced externalities, such as air pollution or greenhouse-gas emissions, make it more difficult to develop sustainable projects with attractive economics. Few models exist to capture the positive returns from lower total cost of ownership (TCO) that sustainability carries, such as resilience, lower operational costs, and fewer carbon emissions.

Inadequate risk-adjusted returns: Many investors do not invest in infrastructure simply because it does not offer competitive risk-adjusted returns. There are several private actors, such as PE firms, that appear well positioned to perform the due diligence and take on the risks associated with sustainable infrastructure. But they often require returns above what most projects can offer.[71] Other institutional investors, such as pension funds, may be willing to accept lower returns, but want relatively safe investments. If they do take on more risk, as one pension fund executive told us, they need to be "paid for that risk in additional returns."

Sustainability complicates the risk-return issue because the technologies and platforms are often new and the up-front costs higher. Inadequate risk-adjusted returns were the most

frequently cited reason in over 50 interviews with institutional investors for not investing in sustainable infrastructure. One longtime investment adviser shared that, "The biggest problem with infrastructure and sustainable projects is that they don't produce appropriate risk-adjusted returns." An investor from a large family fund noted that for many sustainable projects related to breakthrough technology, "The historical returns are not as good as future returns," which can decrease interest, since investment decisions are made based on historic returns. Sustainable infrastructure can carry significant risks related to construction, procurement, and operation; investors can mitigate these to some extent through risk sharing or broader cost allocation. When they don't, private investors will likely find the projects unattractive.

Unfavorable and uncertain regulations and policies: Regulations on investment limits, capital adequacy, reserve requirements, the valuation of assets and liabilities, and limits on foreign investment can discourage investors from making longer-term and cross-border investments. 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. Solvency II is an EU directive that codifies and harmonizes EU insurance regulation. Although this largely concerns the amount of capital that EU insurance companies must hold, Solvency II treats long-term investments in infrastructure as of similar risk to long-term corporate debt or investments. The higher capital ratios required degrade return profiles. Further, governments tend to use cash accounting standards that do not differentiate between long-term investments that add value and near-term consumption. These policies may not favor infrastructure investments that realize returns over a longer time horizon.

Uncertainty around tax policies, particularly in middle- and low-income countries, has a depressing effect on infrastructure investment because it makes it difficult to project long-term net cash flows. "Regulatory risk is the most important aspect of a renewable energy investment," says David Jones, the head of renewable energy at Allianz Capital Partners. "Therefore we seek to invest only in countries with solid political support."[72] This is borne out in analysis from the International Energy Agency, which conducted simulations with investors showing that a 50 percent risk of a change in feed-in tariffs for renewable energy within two years requires a risk premium of $0.10/kilowatt-hour—enough of an increase in price to make renewables uncompetitive in many markets.[73]

In addition, tax policies may not be structured to reward longer-term investment choices or to reflect the lower climate-related risks associated with sustainable and resilient infrastructure. The outlook for tax policies that support sustainable infrastructure is unpredictable, and many current initiatives, such as support for renewables, are short term.[74] As one global investor told us, "This type of uncertainty has stopped developers from going into certain countries where it is extremely hard to separate politics from regulatory action. Investors find it difficult to assess the chances of regulatory changes and how those changes may impact their project NPV."

These five issues relate to specific markets and concerns. There is another factor, however, that cuts across one or more of these. Even though the total volumes of financing may not differ much, the composition of the investments, financing flows, and infrastructure owners are likely to be substantially different between traditional and sustainable infrastructure. Specifically, building sustainable infrastructure can mean working with a more diverse and decentralized set of infrastructure

Urban-financing challenges

Cities are vital to creating a better economic and climate future. Urban areas are home to half the world's population, a proportion that is expected to rise to two-thirds by 2050.[75] As the world continues its rapid urbanization, how cities build the infrastructure to house, feed, transport, and provide energy for their populations will determine our climate future. Cities have the potential to be compact, connected, and climate smart if they plan, design, and finance low-emission, climate-resilient infrastructure. Harnessing this potential would generate dramatic results: urban areas are responsible for 70 percent of energy consumption and energy-related greenhouse-gas emissions, and will bear more than 80 percent of the global cost for climate-change adaptation.[76]

Financing sustainable infrastructure in cities is difficult because cities often struggle to incorporate climate goals into their infrastructure and procurement decisions. This can be especially challenging when national policies do not support city commitments. Even when cities make sustainable infrastructure a priority, they can run into difficulty because they develop relatively few projects and therefore struggle to build expert capacity for planning and developing projects.[77]

In addition, infrastructure planning often occurs at the national level, especially for projects with a regional dimension, such as railroads and power plants. In such cases, cities may have little or no influence, even though this planning directly affects their economic and environmental future. This has financial implications as well; often cities cannot capture revenues or cash flows generated by sustainable investments, which limits their ability to pay back up-front capital costs and creates misaligned incentives. Power grids, for example, are often run by national governments, which may set rates that do not recover costs. And lack of control over utility rates may then distort incentives for cities to invest in sustainable energy because they will not be able to predict cash flows.

Finally, many investors are not accustomed to lending at the municipal level and may not know how to assess such opportunities. That adds another element to the perceived risks.[78] Similarly, existing frameworks for international climate finance focus on the national level, not the city.[79]

With fewer options to draw from, cities struggle to overcome barriers related to project economics, and many are not considered creditworthy. That drives up capital costs, if they can get financing at all. According to the World Bank, of the 500 largest cities in developing countries, only 4 percent are deemed creditworthy by international financial markets, and only 20 percent in local ones.[80]

In cities that lack proper revenue management or expenditure planning, the path to creditworthiness is steep. Some cities, for example, have mandated more spending than they collect in revenue. In one east African capital, fewer than 2 percent of properties are registered for tax purposes; it is little surprise, then, that the municipal authorities do not have resources and expertise to plan and manage spending.[81] Cities in developed countries also face fiscal challenges; a number of American municipalities face ballooning pension obligations and are seeing their credit ratings decline.[82]

Figuring out how to finance sustainable infrastructure in cities is vitally important. They will continue to be a hub for infrastructure development and carbon emissions, and are often willing and able to take more aggressive action on climate change than national governments.[83]

owners. Instead of being concentrated in established creditworthy entities such as large corporations or central governments, it often includes many smaller (and sometimes less creditworthy) entities such as households, midsize industrial companies, and emerging-economy cities.

Developing bankable infrastructure pipelines is different when infrastructure assets are highly distributed or provided through "infrastructure-as-a-service" models. For example, power is traditionally provided by a centralized grid financed by the government and operated by a utility. Renewable-energy development, on the other hand, is often off-grid and financed by individual households or communities. In poor rural areas in countries such as Kenya and Tanzania, a significant share of new rural electrification is being financed by people making only a few dollars a day. New models will doubtless evolve to push down transaction costs and create attractive risk-adjusted returns for investing in small distributed assets, but right now these are lacking, although there have been notable successes in the off-grid energy market.

Part 6: Cracking the code: Creating the conditions for more investment in sustainable infrastructure

To solve these problems, countries need to create an environment that enables rather than repels investment in sustainable infrastructure; this means looking at the sectorial policies, institutions, and capital markets that form the context in which investors make their decisions.

In addition, financing should be more innovative and adapt to the needs of sustainable infrastructure; in this section, we detail six ways to improve financing for sustainable infrastructure, with an evaluation of each recommendation's feasibility and possible impact. The emphasis in all cases is on middle-income countries.

Improve the enabling environment

The enabling environment refers to the economic, social, and political context in which business is done. A poor enabling environment is a common issue in middle- and low-income countries. There is a substantial correlation between a country's income and its standing in the World Bank's rankings of ease of doing business; typically, the lower the income, the lower the ranking. That correlation is not absolute, however. Investors can find stable investments with less competition in middle- and low-income countries with better enabling environments.

Sectorial policies, institutions, and capital markets are the most important elements in creating the enabling environment that sustainable infrastructure needs.

Sectorial policies include the rules, standards, and incentives that provide the framework for specific industries, such as energy or water. Good sectorial planning can help to nurture a positive investment landscape for sustainable infrastructure. Pricing climate externalities and eliminating distorting subsidies can change the economics behind infrastructure decision making. For example, highly subsidized grid-based electricity (for example, in some Middle Eastern countries) make it more challenging to generate acceptable returns on rooftop solar power at a competitive price.

Institutions refer to the legal and regulatory policies that define how business is done, including those concerning corruption, property rights, and foreign investment. Indonesian PPP regulations offer an example of effective institutional reform. Before 2010, Indonesia allowed projects to be tendered before the acquisition of the land for the project. Time and again, the result was expensive delays. When the government rewrote the rules to require that all land be procured before the tender process, projects proceeded more smoothly.[84]

Domestic capital markets are the structures that channel domestic finance and investment. Developing domestic capital markets in middle-income countries will be an important part of closing the sustainable-infrastructure gap because domestic markets provide half of private and PPP financing for infrastructure in middle-income countries. Domestic investors are more knowledgeable about policy risk and insulated from currency risk. Effective ways to do this include removing policies and regulations that restrict investment, promoting mechanisms for investment, and creating preferences for local players (Exhibit 13).

Six ways to improve financing for sustainable infrastructure

This section discusses how to make financing more efficient and effective. We examine six approaches that have great potential, with a consideration of

Exhibit 13 **Creating a positive enabling environment in middle-income countries will be an important part of closing the sustainable infrastructure gap.**

Source: McKinsey analysis

their feasibility (cost and complexity), limitations, and possible impact (emissions and economic value). These recommendations are tailored to the needs of investors and address the barriers described above (in Part 5). Many of these policies are already in use somewhere; the opportunity is to make them more widespread (Exhibit 14). These approaches will often be even more effective when combined into packages that reduce risks across the whole project life cycle.

Development banks feature prominently in the following recommendations because they have the motivation to take actions that support sustainable infrastructure and the means to shift financing flows and shape markets. This does not mean that development banks need to accept lower returns. Indeed, many hold AAA ratings with nonperforming-loan rates close to those of the private sector and high equity returns. Instead, it means they have an opportunity to invest in sustainable infrastructure, because of their missions and mandates and their experience taking on what appear to be riskier projects. Over time, their experience could help other actors, such as private-sector and institutional investors, developers, operators, and governments to get more comfortable with taking on such projects (Exhibit 15).

Exhibit 14

Out of 19 identified potential actions to facilitate financing, 6 were prioritized based on impact and feasibility.

● Favorable ● Moderately favorable ● Not favorable

Impact: **IF** = Incremental flows **S** = Sustainability **MI** = Applicability to middle-income countries

Feasibility: **C** = Financial cost **SC** = Stakeholder-coordination complexity **PC** = Policy constraints

	Recommended action	Impact	Feasibility
International community	Increase syndication of loans that finance sustainable-infrastructure projects	IF S MI	C SC PC
	Use development capital to finance sustainability premiums	IF S MI	C SC PC
	Improve the capital markets for sustainable infrastructure by encouraging the use of guarantees	IF S MI	C SC PC
	Scale up investment in sustainable project preparation and pipeline development	IF S MI	C SC PC
	Offer grants for project design and planning preconstruction for sustainable projects	IF S MI	C SC PC
	Create best-in-class guidelines for sustainability and resilience in infrastructure to inform planning and design	IF S MI	C SC PC
	Publish requests for proposals to start sustainable infrastructure funds that MDBs[1] and DFIs[2] would capitalize	IF S MI	C SC PC
	Invest in scale-up of project development/equity units and support the creation of private-sector project developers	IF S MI	C SC PC
	Support from MDBs to pilot new models for funding streams from sustainable-infrastructure investments	IF S MI	C SC PC
	Change international regulations to make infrastructure investment more favorable	IF S MI	C SC PC
Governments	Encourage the use of sustainability criteria in procurement	IF S MI	C SC PC
	Publish a priority list of pipeline for infrastructure projects, based on need and estimated financial returns	IF S MI	C SC PC
	Encourage or require domestic institutional investors to invest a certain amount in domestic infrastructure	IF S MI	C SC PC
	Establish a price on carbon and fix market distortions	IF S MI	C SC PC
	Eliminate fossil-fuel subsidies	IF S MI	C SC PC
Private sector	Adapt financial instruments to channel investment to sustainable infrastructure and increase liquidity	IF S MI	C SC PC
	Compile data on return profiles for sustainable infrastructure and outcomes for infrastructure products globally	IF S MI	C SC PC
	Create a consortium of operators, developers, and investors in selected countries to develop a multiasset hold to reduce transaction costs and risk	IF S MI	C SC PC
	Take a country-by-country view of risk; be willing to assume greater greenfield and sovereign or counterparty risk when returns are high enough	IF S MI	C SC PC

[1]Multilateral development banks.
[2]Development-finance institutions.

Source: Expert interviews; McKinsey analysis

Exhibit 15 **Six actions have great potential to close the private-sector financing gap for sustainable infrastructure.**

Barrier	Recommended action	Actor	Incremental private financing for sustainable infrastructure, 2015–30[1]
Lack of transparent and "bankable" pipelines	**1.** Scale up investment in sustainable project preparation and pipeline development	Governments and development banks	$150 billion–$450 billion
Lack of viable funding models	**2.** Use development capital to finance sustainability premiums	Development banks	$1.7 trillion–$2.6 trillion
Inadequate risk-adjusted return	**3.** Improve the capital markets for sustainable infrastructure by encouraging the use of guarantees	Development banks	$166 billion–$260 billion
Unfavorable regulatory and tax policy	**4.** Encourage the use of sustainability criteria in procurement	Governments	$120 billion–$195 billion
High development and transaction costs	**5.** Increase syndication of loans that finance sustainable-infrastructure projects	Development banks	$35 billion–$75 billion
	6. Adapt financial instruments to channel investment to sustainable infrastructure and increase liquidity	Private sector and international community	$300 billion–$500 billion

[1]Figures are not directly additive, given that implementing all recommendations could have overlapping impact.

Source: McKinsey analysis

1. Scale up investment in project preparation and pipeline development

Many investors complain that there are not enough "bankable" infrastructure projects—those that are likely to deliver an acceptable financial return. Better project preparation, in the form of facilities that can take care of early-stage functions—from conception through financing—can help to make the case. Development institutions often play this role.

On an individual level, such facilities can perform feasibility studies and structure transactions to make them attractive to investors. On a broader level, they can help governments to set priorities and create a realistic pipeline.

The need is clear. Institutional investors allocate an average of 5.2 percent of their portfolios to infrastructure, but they say their target is 6.0 percent.

How Colombia paved the way to better roads

© Bob Balestri/iStock/Getty Images Plus

Colombia was disappointed when it received few bids for the first three rounds of its road-construction program. To do better for the Fourth Generation (4G)—40 projects expected to cost up to $25 billion—it took steps to improve the enabling environment and the provision of project-financing tools.[85] It worked: 4G has already seen a record number of private-sector bids.[86]

Enabling environment improvements: Policy changes included the creation of the Agencia Nacional de Infraestructura (ANI). The ANI was founded to strengthen the institutional framework for infrastructure. It is in charge of overseeing the smooth implementation and development of the 4G program. Colombia also passed an infrastructure law that improved the efficiency of land acquisition and streamlined the licensing process. Finally, another new law provided a legal framework for PPPs and defined a process for private-sector participation in 4G.[87]

Project-financing improvements: Before the commencement of the 4G program, the Colombian government established the Financiera de Desarrollo Nacional (FDN), a state development bank. The FDN's purpose is to promote private-sector participation in the infrastructure sector and to provide financial assistance for larger projects. FDN has worked with the finance ministry to provide senior and subordinated loans to complement commercial bank loans and capital-market offerings. The FDN is also offering increased project resources when necessary and guaranteeing liquidity. The purpose of these measures is to mitigate risk and improve the provision of project financing.

That adds up to a difference of $120 billion a year.[88] The difference suggests that if there were more bankable projects, investors would be interested in financing them.

To succeed at project preparation, participants should remember that developers have a financial stake in success; that perspective can be useful in creating a pipeline and preparing individual projects. The International Finance Corporation's (IFC) InfraVentures unit, for example, not only helps to develop projects but also takes equity stakes in them as well, which helps to attract other financing. Funds like InfraCo, a publicly funded, privately managed early-stage financier of projects in developing countries, have succeeded in such challenging markets as Kenya, Uganda, and Zambia. Governments can also assist private developers by encouraging unsolicited PPP bids for sustainable infrastructure. This allows the private sector to propose projects, which helps create a pipeline that the private sector believes is financially sound.

Preparation facilities are typically oriented "midstream"—that is, they work on projects that are already part of the government's overall plan. This is necessary, but not sufficient, particularly with regard to sustainable infrastructure, which benefits from longer-range thinking. The better approach is to get involved "upstream," in the design and feasibility stages, so that sustainability is baked into the strategy from the start. Early-stage involvement can also encourage thinking on how to meet demand with a more sustainable set of infrastructure assets. For example, if the government wants more transit, a project-preparation facility could suggest whether a bus rapid-transit system might do the job, instead of a road program. If facilities are working midstream, there are limited options to make it more sustainable.

The value of a project-preparation facility is to bring technical and financial expertise to projects and to create standards that reduce transaction costs. There are large differences between designing and financing infrastructure in different sectors and countries. Building a bridge in Toronto has almost nothing in common with a sanitation project in Tanzania. To build expertise and standardize best practices, facilities could focus on achieving scale in specific sectors or countries. For example, a facility could focus on energy projects in sub-Saharan Africa and begin to standardize legal forms and gain insight on best-practice designs and project structuring. Targeting priority sustainable infrastructure could help project-preparation facilities to achieve scale.

So could standardization; as in any other sector, establishing common legal and design standards can reduce costs and make doing business easier. Typically, though, each project creates its own legal framework each time, which adds costs. But a consensus on what works is forming; the World Bank, for example, is disseminating best-in-class practices for global PPPs. Project-preparation facilities should create standard legal frameworks, investor materials, and request-for-proposal templates that are only modified as needed.

Impact: The potential is considerable. Let's say that 10 to 15 project-preparation facilities are established. Based on the annual volume of projects considered by IFC InfraVentures, we can assume each facility develops an additional 5 to 10 sustainable, bankable, projects a year.[89] That totals 50 to 150 more projects a year. Using the IFC InfraVenture's criteria that project size must be larger than $200 million to be eligible,[90] we conservatively put each project at $200 million in value. If we assume that all the projects that go through these new facilities are financed by the private sector, that sums to additional private-sector investment of $10 billion to $30 billion a year—or up to $450 billion over 15 years.

Feasibility and limitations: To improve project preparation, what is required is scaling up and improving mechanisms that already exist. Successful facilities like the PPP Advisory Unit at the IFC have shown that it is possible to use this expertise to attract donor funding. The difficulty, though, is that such work takes resources and offers no direct return. It will be necessary to make the case that this is an effective way to spend money. The World Bank estimates that this accounts for 5 to 10 percent of total project costs, so in this scenario, preparing $10 billion to $30 billion of projects a year would cost $500 million to $3 billion.[91]

It's important to keep the larger goal in mind. Better project preparation will only contribute to sustainability if efforts are concentrated on sustainable infrastructure.

One challenge will be in establishing and maintaining standard practices, as contractual terms vary widely, even within countries.[92] There's a risk that multilateral development banks (MDBs) or other institutions will set standards that do not fit the local context or the needs of domestic investors. To guard against that, it helps to establish partnerships with national development banks and government ministries and to build the capacity of local PPP delivery units, such as Colombia's Agencia Nacional de Infraestructura (ANI).

Finally, it's important to keep the larger goal in mind. Better project preparation will only contribute to sustainability if efforts are concentrated on sustainable infrastructure. But considering that so many players are saying that they really want to invest in infrastructure but just can't find the right projects, the potential is huge: $150 billion to $450 billion by 2030.

2. Use development capital to finance sustainability premiums

Development capital includes capital from multilateral, bilateral, or national development banks as well as from climate-finance organizations. This can be repaid over time as TCO savings are captured. The use of development capital can help address the fact that few business models have generated sufficient revenue to allow full cost recovery. The business models that have been successful are typically in countries that have created highly favorable policy environments; in these areas, some renewable-energy developers have made sizable profits. Development capital could be used to pilot the business case for sustainable-

© Norbert Breuer/EyeEm/Getty Images

EBRD's Industrial Energy-Efficiency Audit program

The European Bank for Reconstruction and Development (EBRD) has built an energy-efficiency and TCO savings approach into its Industrial Energy-Efficiency Audit program. Under this program, the EBRD considers the energy-efficiency potential of industrial and commercial loan applications. It also estimates the incremental investment required to pay for efficiency upgrades and the potential return on that investment. If a client accepts the option to implement the energy-efficiency measures, as more than 60 percent do, EBRD funds a third-party energy audit to confirm the potential savings. The incremental investment required is then covered under the same loan terms as the original loan, with payback covered by the TCO savings; these often exceed the premium in less than two years.[93]

Despite the proven benefits, the program is still relatively small; if it could be scaled up, that might attract the private sector to finance sustainability premiums as well. In fact, there is some interest from the private sector in financing sustainability premiums using TCO savings, mostly in high-income countries. For example, Sustainable Development Capital LLP (SDCL) is a London-based fund-management firm that advises clients on environmental investments; among other things, it finances energy-efficiency retrofits in infrastructure and real estate.[94] Under the SDCL model, energy-efficiency improvements are delivered to the client at no up-front cost. SDCL takes on the financing and risk, earning financial returns through TCO savings. SDCL operates in Hong Kong, Ireland, and the United Kingdom, and is working on funds in the United States and China.

If officials could expand the EBRD model to demonstrate the business case for sustainability in middle-income countries, that could encourage private-sector actors like the SDCL to invest in these markets.

infrastructure investment, especially in middle-income countries, and thus demonstrate to the private sector that there are profitable opportunities.

Funding models that incorporate TCO savings are concentrated primarily in energy-efficiency projects. For example, some agencies in Asia, Europe, and the United States use energy-savings performance contracting (ESPC), in which efficiency improvements are used to repay the investment for the capital improvements; these are often carried out and owned by a third-party energy-savings company (ESCO). The ESCO, not the government, owns the risk of the project. If the energy savings do not deliver the requisite payback, the ESCO covers the difference. The ESPC model is rarely used in middle- or low-income countries at the moment, but that does not have to be the case. Development capital could help to ensure that sustainability investments using TCO savings target the right locations. One promising initiative: in 2012, India became the first developing country to create an energy-efficiency trading scheme that used market-based mechanisms.[95] Development capital could be used to pilot this model in middle-income countries and in other sectors such as water and waste.

Impact: Although this model can work across sectors, we can start to understand the possible magnitude of this approach by focusing on energy efficiency. If development banks, bilateral-aid organizations, and climate-finance groups dedicated $10 billion to $15

billion a year to finance sustainability premiums for energy efficiency, that could increase the value of energy-efficient infrastructure by up to $176 billion a year.[96] Over 15 years, that adds up to $2.6 trillion in efficiency projects that would have not otherwise been built (Exhibit 16).

Even if the financial returns are not high, this approach delivers significant social impact for relatively little money. For example, if development capital added the necessary $5 million in up-front capital to make a $100 million building energy efficient, that means that the investment leveraged 20 times its value in sustainability. Energy efficiency is just one area in which this model could be used. The overall impact would be much higher if other sectors, such as water and waste, and transport, are included.

Sustainability projects using TCO savings have worked well in many high-income countries. Middle-income countries have less experience, but considering that is where most demand will be, and that development banks have considerable experience in these markets, the potential is enormous.

Feasibility and limitations: The use of development capital in this way requires minimal policy changes; even so, putting all the different pieces together will be complex. This investment, however, would be NPV-positive and recovered through TCO payback. It is also possible that development banks could capitalize on investment funds that solicit private-sector investment to serve this purpose.

For this model to be successful, development institutions must finance enough projects to

Exhibit 16

A $150 billion to $225 billion up-front investment in sustainability premiums could make up to ~$2.6 trillion of infrastructure energy efficient.

Most likely scenario

Cumulative value of infrastructure that becomes energy efficient by using development capital to finance related investments, 2015–30

Capital deployed for up-front sustainability capital expenditure		Value of infrastructure shifted to be energy efficient[1]	
Annual	**15-year**	**Annual**	**15-year**
$5 billion	$75 billion	~$59 billion	~$885 billion
$10 billion	$150 billion	~$118 billion	~$1.7 trillion
$15 billion	$225 billion	~$176 billion	~$2.6 trillion
$20 billion	$300 billion	~$235 billion	~$3.5 trillion

[1]Sustainability premium calculated based on the highest average up-front construction cost (8.5%) required for Leadership in Energy and Environmental Design platinum certification.

Source: McKinsey analysis

demonstrate its feasibility, and then exit the space or provide financing at commercial rates to prevent crowding out the private sector. Not everything will work. Some infrastructure classes and countries will be better suited to TCO models than others, and that must be recognized and documented.[97]

3. Improve the capital markets for sustainable infrastructure by encouraging the use of guarantees

Despite the frequent use of guarantees by different types of development banks, they are often underused for sustainable-infrastructure finance. In 2014, only 5 percent of climate finance from MDBs[98] went to guarantees, with the rest distributed through loans, grants, equity, and other instruments.[99] This translates to $1.4 billion in guarantees out of $28.3 billion in climate finance from participating MDBs. These guarantees are largely used for infrastructure or related projects.

Guarantees are well suited to sustainable infrastructure because they can be precisely targeted and adapted to policy risks.[100] Policy and regulatory risks are significant factors in sustainable-infrastructure investment; for example, when some governments abruptly lowered feed-in tariffs for renewables,[101] the perception of increased risk rippled globally. Such perceptions of risk affect the cost of financing. The Climate Policy Initiative analysis found that reducing policy support for renewable energy by ten years in the United States and Europe could increase a project's financing costs by 11 to 15 percent.[102]

Increasing the use of guarantees can be done in a number of ways. First, banks could set aside a certain proportion of existing guarantees projects that met sustainability criteria. Second, banks could adapt guarantees to fill gaps in the market for specific types of risks or phases of the life cycle, such as guaranteeing power-purchase agreements or insuring against changes in feed-in tariffs for renewable-power projects. Developing such guarantee mechanisms could help to boost the investment of private capital in sustainable infrastructure.

While there could be higher policy risk, sustainable infrastructure should be less vulnerable to climate risk than traditional infrastructure, lowering the long-term risk profile of the investment. Therefore, it is possible that some guarantees for sustainable infrastructure could be priced lower than those for traditional infrastructure. Differential pricing could also give incentive to the private sector to invest in sustainable infrastructure, particularly if backed by guarantees. Guarantees make it possible for risk-averse investors to participate in a project they might otherwise avoid and then to learn from the experience.

There are limits to how much MDBs can expand guarantees because of equity-capital restrictions. As investors see that the real risk profile is actually lower than they believed, guarantees would no longer be required.

Impact: Guarantees are an effective way to "crowd in" private finance and can leverage multiples of private capital for every dollar spent. There are also a variety of helpful ripple effects, particularly in middle- and low-income countries. One is that these guarantees signal the importance of sustainability to other investors, providing an incentive for traditional projects to incorporate sustainability principles. Another is that worthwhile projects are completed that otherwise would be considered too risky. Finally, when sustainable-infrastructure projects in middle- and low-income countries succeed, that improves perceptions of risk, generates data, and builds capacity for future efforts.

Kenya's Lake Turkana Wind Power Project

The targeted application of multilateral-development-bank guarantees can make or break large-scale infrastructure projects. Such was the case with the €625 million Lake Turkana Wind Power Project (LTWP), whose success depended on a €20 million guarantee from the African Development Bank (AfDB) and the Standard Chartered Bank.

LTWP, a wind farm that covers 40,000 acres (162 square kilometers, or a little more than two Manhattans) aims to provide 310 megawatts (MW) of reliable, low-cost wind power. Total installed capacity in Kenya in 2014 was 2,294 MW. The LTWP site is more than 428 kilometers away from the nearest substation, so a transmission line must be built to deliver the power to the national grid. The state-owned Kenya Electricity Transmission Company (KETRACO) agreed in 2013 take responsibility for the $185 transmission line, which was critical to the success of the wind farm.[103]

Concerned about construction time lines, in 2012, the World Bank withdrew its guarantee from the transmission line.[104] That delayed the project for more than two years—a real-life demonstration of the integral role of guarantees in bringing projects to completion. At the end of 2014, the AfDB and Standard Chartered stepped in with guarantees to cover loss of revenue attributable to transmission-line delays.

Construction began in 2015 and is expected to finish in 2018. "By reducing the risk profile," noted the AfDB, "the partial risk guarantee will accelerate financial closure and reduce the overall cost of capital to the project."[105] In effect, by reassuring investors, this €20 million guarantee is helping the project reach its €625 million target.

In 2014, MDBs reported that climate finance totaled $28.3 billion, with $1.4 billion directed to guarantees.[106] If the total amount of climate finance were to increase 10 to 15 percent and guarantees went from 5 percent of total climate finance on average to 9 to 11 percent, MDB climate-finance guarantees would increase $20 billion to $33 billion over 15 years.

Wide variation exists in the amount of private-sector capital mobilized by guarantees. One of the more complete sets of data comes from 28 approved World Bank partial risk guarantees, partial credit guarantees, and policy-based guarantees worth $1.4 billion; they leveraged $12 billion in private-sector resources, or an 8.6 ratio.[107] Based on a leverage ratio of 8, we estimate that over 15 years, an incremental $166 billion to $260 billion in private-sector capital could be directed toward sustainable infrastructure. At a ratio of 5.0, that would still add up to $104 billion to $163 billion (Exhibit 17).

Feasibility and limitations: Increasing guarantees is relatively simple in terms of policy and execution because it is a matter of scaling up existing capabilities. Policy changes would have to occur within individual development-finance institutions to prioritize climate-finance guarantees. Stakeholder coordination is also straightforward, because it only requires banks to modify what they are doing, and to place a greater emphasis on sustainable infrastructure. Guarantees are most successful in countries with developed capital markets, which is the case in many of the middle-income countries. The majority of guarantees are already being funneled into these countries.[108]

There are several possible limitations. First, guarantees are not always an attractive option, because borrowers must pay fees that can offset the savings from improved capital ratings.[109] In many cases, governments must also agree to provide a counter-guarantee, something they may not be

Exhibit 17

Increasing guarantees could result in $100 billion to $165 billion in incremental private-sector finance over 15 years.

Incremental private-sector investment in sustainable infrastructure through guarantees 2015–30, $ billion

Most likely scenario

Increase in climate finance volume	Share of climate finance that is guarantee instruments				
	5%	7%	9%	11%	13%
0%	**0**	**43**	**85**	**128**	**170**
5%	**5**	**50**	**95**	**139**	**184**
10%	**11**	**57**	**104**	**151**	**198**
15%	**16**	**65**	**114**	**163**	**212**
20%	**21**	**72**	**123**	**174**	**225**

Source: McKinsey analysis

willing to do. Second, there may not be a sufficient number of projects that want guarantees or that meet development banks' requirements. Third, MDBs have to consider how increased use of guarantees will affect their balance sheets.

4. Encourage the use of sustainability criteria in procurement

The experts from financial institutions we interviewed agreed that including sustainability as well as cost criteria in procurement would drastically change incentives for the private sector. Adopting a TCO approach rather than a low-cost bid process could generate long-term savings and shift selection toward sustainable projects that are NPV-positive but have higher up-front costs. For sustainable infrastructure that does not have a lower TCO in the current policy environment, sustainability criteria could be added to requests for proposals (RFPs). Appropriate criteria could include such measures as TCO, greenhouse-gas emissions, water-use intensity, and climate-risk mitigation.

Governments could achieve this in two ways. First, they could incorporate sustainability criteria into public-private-partnership RFPs. Second, governments could imbed sustainability requirements into non-PPP design-bid-build projects. This would have an indirect, but positive effect because even when governments take on the full cost, they often use private capital. Going in this direction would signal to investors that there

© hugociss/Moment/Getty Images

is demand for sustainable infrastructure, and that it would be in their interest to learn how to evaluate it. Moreover, contractors, architects, and project managers would have to develop sustainability-related capabilities to win public contracts.

These approaches are at work, on a limited basis, for procurement. The European Commission has put into place a set of criteria known as Green Public Procurement that EU members can choose to incorporate into public-procurement tenders. Examples of implementation include a new sustainable hospital in Vienna, bus shelters that are sustainably sourced and low-carbon in manufacture in the United Kingdom,[110] and a green contract for the procurement of recycled paper in Sofia.

Outside the European Union, companies bidding for Australia's AU$8.3 billion North West Rail Link project were required to meet sustainability requirements pertaining to materials, transport, waste, energy, and water.[111] All works were also registered for ratings through the Infrastructure Sustainability Council of Australia. In the United States, the National Disaster Resilience Competition incorporates sustainability criteria in awarding funds to communities affected by extreme weather events to recover and rebuild resiliently.[112] As these cases demonstrate, the principle is proving effective, but it is not yet standard government practice.

Impact: Including sustainability criteria is not likely to result in increased private-sector infrastructure financing; by definition, such criteria apply to public-sector spending. Instead, the impact would be seen in a shift in public financing toward sustainable-infrastructure projects and an increase in private-sector capabilities designing, building, and operating sustainable infrastructure.

At current levels of spending, if sustainability criteria were included in 30 percent to 50 percent of all PPP RFPs, that could shift $8 billion to $13 billion a year of private-sector finance in this direction

Renewable-energy procurement in Germany and South Africa

In 2009, the German state of Brandenburg mandated that 50 percent of electricity procured by the state had to be from renewable sources, such as hydro, wind, solar, geothermal, and biomass.[113] The resulting tender achieved the 50 percent goal, so in 2011, the Parliament increased the standard to 100 percent. In 2013, the local government awarded a contract for 116 million kilowatt-hours to two local municipal utilities, which came in at a similar price to traditional sources of electricity.[114] This contract will prevent an estimated 30,508 tons of carbon emissions per year, over and above the emissions mitigated by the 2009 tender.

South Africa has created an innovative competitive bidding process to bring private finance into renewable energy. It took several efforts to streamline the process and build adequate private-sector capabilities. But the effort is paying off, and the first RFP for the Renewable Energy Independent Power Producer Procurement Program (REIPPPP) was issued in 2011. In subsequent rounds, the bidding processes have become more refined, increasing the competitiveness of bid prices and offering better local-content terms. Specifically, average solar photovoltaic tariffs have decreased by 68 percent and wind by 42 percent. The continued improvement of the REIPPPP has also drawn interest from banks and pension and insurance funds. In three rounds of bidding, more than 60 projects have been awarded, worth $14 billion in private-sector investment.[115]

($150 billion to $255 billion over 15 years). If overall PPP spending increased, as could happen as more countries develop the appropriate investment frameworks, the incremental flows would be even greater.

When sustainable criteria are incorporated into procurement, the private sector is indirectly influenced. Even when governments finance infrastructure, they sometimes use private-sector financing, leading to an indirect shift in flows. Further, sustainable requirements for private-sector bid-build or design-build processes, where private-sector actors are contractors but not financiers, builds sustainable-infrastructure capabilities (Exhibit 18).

Feasibility and limitations: Most middle-income countries have procurement processes in place, and some, as in Brazil's São Paulo state, already incorporate sustainability criteria at all stages.[116] There is every reason to believe that middle-income countries could develop sustainable procurement approaches for infrastructure.

Doing so, however, will be challenging. Some elements of sustainable procurement will be universal, and countries can adopt proven practices. Other elements, though, will need to be customized for the specific market and type of project. The basic problem to overcome is that many governments

Exhibit 18 **Incorporating sustainability criteria in PPPs could increase private-sector investment by $150 billion to $255 billion over 15 years.**

Private-sector spending shifted to sustainable infrastructure through procurement incorporating sustainability criteria
2015–30, $ billion

Most likely scenario

Share of PPPs[1] with sustainability requirement

Increase in annual PPP spend	20%	30%	40%	50%
0%	**75**	**120**	**165**	**195**
10%	**90**	**135**	**180**	**225**
20%	**90**	**150**	**195**	**240**
30%	**105**	**150**	**210**	**255**
40%	**105**	**165**	**225**	**285**

[1]Public-private partnerships.
Source: McKinsey analysis

assume that adding sustainability criteria will increase costs, increase construction time, and potentially exclude local suppliers who do not have the skills to meet the new criteria. To overcome this will require a combination of political will and regulatory skill.

There are limited examples to draw on to understand how sustainable procurement can affect infrastructure development. Even Australia, which has begun to build sustainability requirements into infrastructure contracts, does not yet have the data to evaluate results. Furthermore, few examples exist to measure initial sustainability key performance indicators against real sustainability outcomes.

5. Increase syndication of loans that finance sustainable-infrastructure projects

Syndication can help to raise private-sector capital while reducing balance-sheet exposure for development banks; that makes it a useful instrument for financing sustainable infrastructure.[117] For development banks, the standard loan-syndication process, known as the

B-loan, involves apportioning part of its project portfolio to a commercial bank or other financial institution. In other cases, private institutions may act as lead arrangers. This has the benefit of increasing competition in loan markets and taking advantage of their financial expertise in structuring deals.

Increasing loan syndication allows development banks or other primary lenders to recycle their capital for more sustainable-infrastructure investment, thus increasing the number of projects financed. Reducing transaction costs this way is particularly helpful for smaller projects as well as those that require a premium or that include new technologies. By providing a lower-risk, lower-cost way to participate, syndication gets the private sector involved, building its confidence and willingness to invest. For instance, an MDB loan to finance a $200 million bridge project might be syndicated across 20 or more secondary investors. Conversely, development banks could also choose to pool a selection of smaller loans, thus offering secondary financers more diversified exposure.

Loan syndication can help catalyze private-sector financing in developing countries and increase south-to-south lending as middle- and low-income markets and assets grow. Emerging-market financial institutions have been increasing their participation in the IFC's loan-syndication program, accounting for 29 percent of IFC loan syndication in 2013 and doubling commitments from the previous year.

Impact: Development banks can increase loan syndication for sustainable infrastructure either by increasing their overall loan-syndication rates or by increasing the share dedicated to sustainable infrastructure. Based on the available data, we assumed that total annual new loan commitments were $44.2 billion[118] for the IFC, the Asian Development Bank, European Bank for Reconstruction and Development (EBRD), Inter-American Development Bank, and African Development Bank, with 12 percent dedicated to sustainable infrastructure.[119] We also assumed a private-sector mobilization rate of 20 percent.[120]

What would happen if all MDBs increased their loan-syndication portfolio to the levels of the leading ones? The IFC has the highest syndication ratio, at 41 percent. The EBRD has the highest percentage of its portfolio dedicated to sustainable infrastructure, at 14 percent.[121] If other MDBs increased to those rates, an additional $35 billion to $75 billion could be mobilized over a 15-year period (Exhibit 19).

Increased sustainable-infrastructure loan syndication would be particularly valuable for middle- and low-income countries, where

Increasing loan syndication allows development banks or other primary lenders to recycle their capital for more sustainable-infrastructure investment, thus increasing the number of projects financed.

development-bank loans are concentrated. Though MDBs have successfully mobilized private-sector financing in middle- and low-income countries through loan syndication, the practice could also be used for sustainable infrastructure. Other actors, such as national development banks, could also increase their loan syndication in a similar manner.

Feasibility and limitations: Increasing loan syndication is not expensive and does not require policy changes, but it does require stakeholder coordination. Investors like syndicated loans because the development bank does much of the work, reducing risk. Any substantial increase, however, would place an increased burden on MDBs

Exhibit 19 **Increased loan syndication could lead to an additional $35 billion to $75 billion in private-sector investment over 15 years.**

Private-sector flows for sustainable infrastructure through increased loan syndication 2015–30, $ billion

Most likely scenario

Private-sector mobilization rate	Share of portfolio that is climate finance				
	12%	15%	20%	25%	30%
20%	**16**	**20**	**27**	**33**	**40**
25%	**20**	**25**	**33**	**41**	**50**
30%	**24**	**30**	**40**	**50**	**60**
35%	**28**	**35**	**46**	**58**	**70**
40%	**32**	**40**	**53**	**66**	**88**
45%	**36**	**45**	**60**	**75**	**90**

Source: McKinsey analysis

to streamline the administrative process, identify and structure deals, and act as a mediator between investors and borrowers.

There are some limitations to implementation. There may not be enough sustainable-infrastructure projects that meet the MDBs' high standards. Also, there may not be enough willing investors. It is important to ask why loan syndication by development banks hasn't grown more rapidly for all infrastructure projects, let alone for sustainable ones. Possible constraints include the lower profitability for commercial banks and other financial institutions of taking B-loans instead of acting as the lead arranger.

Further, it is also possible that the presence of development banks in these deals is a critical factor in risk mitigation. If that is the case, any syndication model would need to be designed in such a way that the development banks were still at the table to help mitigate risk.

6. Adapt financial instruments to channel investment to sustainable infrastructure and enhance liquidity

While infrastructure investments offer portfolio diversification, low volatility, and long-term horizons, high transaction costs and other barriers have restricted capital flows. Even for institutions that consider infrastructure part of their investment strategy, their average allocation is just 5.2 percent.[122] It follows, then, that increasing the volume of financing for sustainable infrastructure, in particular, is proving difficult. For that to happen, sustainable projects need to encourage the use of a wide array of financial instruments and also do more to attract different kinds of investors.

The right financial instruments can make sustainable-infrastructure investments more attractive to the private sector by reducing transaction costs or due-diligence requirements, mitigating risks to provide steadier, more certain cash flows, and providing additional liquidity that makes it easier to get in and out of investment.

No financial instrument can or should compensate for projects that do not have fundamentally sound economics. For projects that do make economic sense, however, the right tools can help boost investment from previously restricted investors, increase investor confidence and familiarity, and address differences in the type and duration of financing required for sustainable infrastructure.

Adapting instruments can help to cater to the requirements and capabilities of different investors. For example, institutional investors such as pension funds and insurance companies may not be able (or willing) to do the extensive due diligence required or to acquire the specialized knowledge associated with sustainable infrastructure.[123] Nor do they favor multidecade investments that can keep capital tied up for years. Private pensions, which represent more than 17 percent of total global AUM, must generate consistent returns to meet their ongoing obligations to pension holders.[124] Instruments such as green bonds and yieldcos use familiar financial instruments to enhance capital flows to sustainable infrastructure. Green bonds have had a favorable reception from investors who see them as a good way to achieve market-competitive returns while incorporating climate change as part of their institutional missions. The value of green-bond issues has grown more than 12 times since 2012, reaching $36.6 billion in 2014.[125] Yieldcos are publicly traded companies created by a parent company that bundle operating infrastructure assets to generate predictable cash flows that are then paid out in dividends to shareholders. In the United States and the United Kingdom, yieldcos raised $4.5 billion in 2014.[126]

Green bonds and yieldcos also reduce risks associated with infrastructure investments. For instance, the credit risk associated with green bonds is typically lower than that of similar project bonds because that risk is assumed by the issuing entity and not by the cash flows from the individual project.[127] Given these lower risks, green-bond yields tend to be on the lower end of the spectrum as well. Yieldcos, on the other hand, reduce risk by pooling projects, thus helping institutions to diversify their investments.

Yieldco share prices have been volatile since their inception. Initially, there was significant appreciation as the yieldco model became familiar to investors and the vehicles rapidly added assets to their portfolios. This was followed by share-price declines when investors started questioning the growth prospects of some yieldcos, given the project-constrained environment, their governance structures, and the risk profile of assets identified for inclusion.[128] However, yieldcos operated by asset managers with clear governance structures and stable growth projections in line with "steady yield" investor expectations, have seen less volatility and may emerge as more durable models.

Another option is to adapt the funding models. "Land value capture," for example, has long been used to finance railways, metros, and highways. This model seeks to capture the additional value created by infrastructure though impact fees, special assessment districts, or tax-increment financing. In essence, this allows infrastructure to be financed based on its ability to raise the value of the surrounding land once it is built. Similar models could be designed for sustainable infrastructure; if adaptation infrastructure were to make a community safer from flooding and increase property values, for instance, this value could be used to finance the up-front investment.[129] This could also be a powerful way to promote transit-oriented development in urban settings, since transportation infrastructure almost always increases the value of adjacent land.

In the short to medium term, scaling up the use of mainstream financial products provides a sense of familiarity for institutional investors. This familiarity, combined with lower transaction costs (because of project pooling or reduced diligence requirements), lower risk, steadier cash flows, and increased liquidity should result in greater institutional investment. Over the long run, the more experience that institutional investors have, the more comfortable they will be, and thus the more likely to allocate more of their portfolios to sustainable infrastructure—as long, of course, as the risk-return profiles are attractive.

Impact: "Lack of appropriate financial instruments," one climate-fund executive told us, "is one of the top two barriers hindering investment in sustainable infrastructure." With more and better instruments to work with, then, at least some investors will increase their allocations.

Public- and private-pension funds, for example, typically have asset-liability matching requirements, limited ability to perform expensive diligence, and lower management fees. If transactions were simpler and risks lower, they would likely invest more in sustainable infrastructure. If 20 to 25 percent of infrastructure investors increased their allocations from their current rate (2.9 percent) to the level of the top ten investors (12.4 percent), and if some of those who are not investing at all (10 to 15 percent) began to do so at the 2.9 percent rate, incremental flows to sustainable infrastructure from 2015 to 2030 would be $735 billion to $923 billion (Exhibit 20).[130]

The impact of new instruments would likely be even greater because they could attract investment from all institutional investors, not just pensions.

Exhibit 20 **Adapting financial investments could increase pension-fund investment by $735 billion to $925 billion over 15 years.**

Incremental pension-fund investment into sustainable infrastructure through adapting instruments
2015–30, $ billion

Most likely scenario

Share of non-infrastructure investors who begin investing	Share of current investors who increase allocation					
	5%	10%	15%	20%	25%	30%
5%	**188**	**367**	**546**	**725**	**904**	**1,088**
10%	**198**	**377**	**556**	**735**	**914**	**1,093**
15%	**207**	**386**	**565**	**744**	**923**	**1,102**
20%	**217**	**396**	**575**	**754**	**933**	**1,112**
25%	**226**	**405**	**584**	**763**	**942**	**1,121**
30%	**236**	**415**	**594**	**773**	**951**	**1,130**

Source: McKinsey analysis

Other enhancements to these instruments, such as tax credits, can also improve risk-return profiles, attracting even more investment to sustainable infrastructure.

Adapting instruments familiar to mainstream investors can help to catalyze investment into sustainable infrastructure for middle-income countries.[131] This could be particularly important because transaction costs and perceived risks are typically higher in those markets. According to a 2015 report by the Climate Bonds Initiative, middle-income countries issued over 35 percent of the $597.7 billion of outstanding climate-aligned bonds, and this figure continues to grow.[132] For example, BRF, a Brazilian food producer, placed a €500 million green-bond offering in 2015, the first of its kind in Brazil.[133]

Feasibility and limitations: Scaling up or adapting existing financial instruments is not costly, but it does require policy decisions to approve their use and to create listing criteria. In addition, getting

everyone's cooperation, including developers, investors, and regulators, could be difficult. Promoting new instruments or platforms requires coordinated action, as happened with green bonds. In 2007, the green-bond market kicked off with an AAA investment grade from the European Investment Bank and World Bank. The Environmental Defense Fund, Bank of America, and Vasakronan issued the first corporate green bonds in November 2013.[134] Development banks are still at the core of green-bond issuance, but the participation of companies and commercial banks is growing.[135]

While adopting and scaling up the range of financial instruments could be helpful, doing so does not significantly alter the risk-adjusted returns for sustainable infrastructure—the primary metric upon which portfolio managers are judged. Investors will stay away until these returns are shown to be as good as or better than other options. In addition, sustainable instruments that already exist, such as green bonds and yieldcos, are prompting questions about whether there is demand for additional instruments.

As is evidenced by the emergence of yieldcos, there will be a variety of investment opportunities with different risk profiles for different types of investors. While innovation can happen quickly, often it will take time for the market to mature and develop best practices and standards.

Conclusion

This paper has offered an overview of the barriers and opportunities for increasing private-sector investment in sustainable infrastructure. There are a number of areas that would benefit from further examination, such as how to create frameworks for blending private and public capital, how to assess existing instruments, how to develop innovative solutions, and how to work better with business.

But the larger point is that building sustainable infrastructure offers great potential to improve the quality of life of people around the world while addressing climate change and other forms of environmental degradation. In addition, with the right policies and incentives, investors can make a profit financing the infrastructure needed to make these goals a reality.

There are many challenges to changing the design, construction, financing, and operation of infrastructure. There are no simple solutions. What there should be is a sense of urgency. In the next 15 years the world is set to build more infrastructure than the value of all the infrastructure that exists today. That will dramatically remake the global landscape and profoundly shape the trajectory of efforts to deal with climate change for decades. We can secure a better future, but only if we act quickly—and wisely. ■

Endnotes

[1] CAIT Climate Data Explorer, World Resources Institute, cait.wri.org.
[2] "Delivering climate change action at scale: Our commitment to implementation," Joint Statement by the Multilateral Development Banks at Paris COP21, worldbank.org.
[3] Mission Innovation: Accelerating the Clean Energy Revolution, mission-innovation.net.
[4] Breakthrough Energy Coalition, breakthroughenergycoalition.com.
[5] "Allianz, ABP join Portfolio Decarbonization Coalition, aligning portfolios with low-carbon economy," United Nations Environment Programme News Centre, December 7, 2015, unep.org.
[6] Shannon Bouton, David Newsome, and Jonathan Woetzel, "Building the cities of the future with green districts," May 2015, mckinsey.com.
[7] Sustainable Development Knowledge Platform, United Nations, sustainabledevelopment.un.org.
[8] *Global Infrastructure Investment: Timing Is Everything (and Now Is the Time)*, Standard and Poor's, January 15, 2015, tfreview.com.
[9] César Calderón and Luis Servén, "The effects of infrastructure development on growth and income distribution," Central Bank of Chile working paper number 270, September 2004, ideas.repec.org.
[10] Neel M. Butala, Michael J. VanRooyen, and Ronak Bhailal Patel, "Improved health outcomes in urban slums through infrastructure upgrading," *Social Science & Medicine*, Volume 71, Issue 5, September 2010.
[11] *World Development Report 2012: Gender Equality and Development*, World Bank, September 2011, worldbank.org.
[12] The New Climate Economy: The Global Commission on the Economy and the Climate, newclimateeconomy.net. In practice, the average demand for infrastructure investment of $6 trillion a year probably translates to an investment of $4 trillion annually in the next few years and $7 trillion to $8 trillion a year by 2030.
[13] *Better Growth, Better Climate*, New Climate Economy: The Global Commission on the Economy and Climate, September 2014, newclimateeconomy.net.
[14] The New Climate Economy: The Global Commission on the Economy and Climate, newclimateeconomy.net. The New Climate Economy developed its infrastructure estimates based on external estimates from the Organisation for Economic Cooperation and Development and the International Energy Agency, with additional data coming from the Climate Policy Initiative.
[15] In this definition, energy includes power generation, electricity transmission and distribution, oil, gas, coal, and energy efficiency.
[16] The New Climate Economy: The Global Commission on the Economy and Climate, newclimateeconomy.net.
[17] *Economics of Adaptation to Climate Change: Synthesis Report*, World Bank, August 2010, sitesources.worldbank.org. Based on World Bank estimates of the additional investment needed to provide the same infrastructure services quality with a 2° Celsius temperature increase by 2050. These estimates are based on the average annual capital costs from 2010 to 2050. Greater temperature increases could lead to higher adaptation costs. For more, see *The Cost of Adapting to Climate Change for Infrastructure*, World Bank, August 2010, worldbank.org.
[18] World Bank income classifications can change year to year based on changes in country's economic situation. The analysis of historic spending on infrastructure in this report uses 2014 World Bank income classifications that rely on 2013 gross national income data.
[19] International Macroeconomic Data Set, US Department of Agriculture Economic Research Service, ers.usda.gov; World Development Indicators, World Bank, 2015, data.worldbank.org.
[20] International Macroeconomic Data Set, US Department of Agriculture Economic Research Service, ers.usda.gov.
[21] Projected demand by type of country is based on applying the projected shifts in share of GDP by country between 2010 and 2030 to historical spending levels.
[22] *Infrastructure productivity: How to save $1 trillion a year*, McKinsey Global Institute, January 2013, mckinsey.com.
[23] Adrian Blundell-Wignall and Caroline Roulet, "Infrastructure versus other investments in the global economy and stagnation hypotheses: What do company data tell us?" *Organisation for Economic Co-operation and Development Journal: Financial Market Trends*, 2015, oecd.org.
[24] Private Participation in Infrastructure Database, World Bank, ppiworldbank.org.
[25] Preqin Infrastructure Online, Funds and Limited Partnership Investors, June 2015.
[26] "Investment companies" include investment banks, asset managers, wealth managers, family and multifamily offices, investment trusts, and investment companies.
[27] Preqin Infrastructure Online, Funds and Limited Partnership Investors, June 2015.
[28] "Long-term investors and green infrastructure," *Institutional Investors and Green Infrastructure Investments: Selected Case Studies*, Organisation for Economic Co-operation and Development working paper, 2013, oecd.org.
[29] This 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. For more, see Greg Roumeliotis, "Analysis: Basel III rules could spell potholes, literally," *Reuters*, April 19, 2010, reuters.com.
[30] Banks and investment companies include banks, investment banks, asset managers, wealth managers, family and multifamily offices, investment trusts, and investment companies.
[31] *Global Trends in Renewable Energy Investment*, Frankfurt School, FS-UNEP Collaborating Centre for Climate and Sustainable Energy Finance, 2015, fs-unep-centre.org.

[32] Anton Eberhard, Joel Kolker, and James Leigland, *South Africa's Renewable Energy IPP Procurement Program: Success Factors and Lessons*, Public-Private Infrastructure Advisory Facility, World Bank, May 2014, ppiaf.org.
[33] Ibid.
[34] Preqin Infrastructure Online, Funds and Limited Partnership Investors, June 2015.
[35] "DONG Energy divests 50 per cent of the German offshore wind farm project Gode Wind 2 to a consortium of Danish pension funds," DONG Energy press release, July 17, 2014, dongenergy.com; *Global Trends in Renewable Energy Investment*.
[36] "Why is Allianz investing in wind farms?" Allianz Capital Partners press release, June 17, 2015, allianzcapitalpartners.com.
[37] *Bonds and Climate Change: The State of the Market in 2015*, Climate Bond Initiative in association with HSBC Climate Change Centre of Excellence, July 2015, climatebonds.net.
[38] Stanley Reed, "Norway's sovereign wealth fund ramps up investment plans," *New York Times*, June 24, 2014, nytimes.com; Thomas Mulier, "Norway wealth fund targets $3 billion in green technology stakes," *Bloomberg Business*, December 1, 2014, bloomberg.com.
[39] Preqin Infrastructure Online, Funds and Limited Partnership Investors, June 2015.
[40] Ibid.
[41] *Global Trends in Renewable Energy Investment*.
[42] *Project Finance & Infrastructure Journal*, 2000–15, ijglobal.com.
[43] Preqin Infrastructure Online, Jun 2015, Funds and Limited Partnership Investors.
[44] *The Preqin Quarterly Update: Infrastructure*, *Q1 2015*, Preqin, 2015, preqin.com.
[45] "Emerging markets: Uncharted territory," *I & PE Real Estate*, June 2015, realestate.ipe.com.
[46] "Default rates for project finance bank loans improve," Moody's Investor Service, March 3, 2015, moodys.com.
[47] Preqin Infrastructure Online, Funds and Limited Partnership Investors, June 2015.
[48] Projected "business as usual" spending is based on an extrapolation of historical data using constant 2010 dollars. Historical data reveal a real growth rate of 4.3 percent a year, resulting in projected spending from 2015 to 2030 of $54 trillion. Using this growth rate on a forward basis may be aggressive, however, as it incorporates a 13 percent annual growth in China's infrastructure spending that may prove unsustainable. In most economies, the value of infrastructure stock comprises about 70 percent of GDP. Currently, China is spending roughly 2.1 GDP percentage points more than needed to maintain this 70 percent level. A more conservative estimate uses a historical growth rate (excluding China) of 1.8 percent. This results in a projected investment level of $42 trillion.
[49] World Economic Outlook Database, April 2015, International Monetary Fund, imf.org.
[50] Tom Wright, "China's economy slows on investment spending," *Wall Street Journal*, January 20, 2014, wsj.com.
[51] Neil Gough and Cao Li, "As China reduces local spending, cities woo private investors," *New York Times*. August 7, 2015, nytimes.com.
[52] Wright, *Wall Street Journal*.
[53] Private Participation in Infrastructure Database, World Bank, ppiworldbank.org.
[54] Ibid.
[55] *Asset Management 2020: A Brave New World*, PricewaterhouseCoopers, 2014, pwc.com.
[56] Annual spending is calculated by taking the total increase in spending from each action and dividing it over a 15-year period to get the average incremental spending.
[57] *Can Infrastructure Investing Enhance Portfolio Efficiency?*, Credit Suisse, 2010, credit-suisse.com.
[58] *Global Infrastructure: How to Fill a $500 Billion Hole*, Standard and Poor's Ratings Services, January 16, 2014, standardandpoors.com. Annual default rates based on 200 rated infrastructure projects and 4,000 rated corporate issues.
[59] *2014 Annual Report*, Verizon, verizon.com.
[60] "American Water (AWK) unveils earnings guidance for 2015," Zacks Equity Research, December 16, 2014, zacks.com.
[61] Based on estimated weighted average cost of capital for representative companies in each industry.
[62] *Mapping Channels to Mobilise Institutional Investment in Sustainable Energy*, Organisation for Economic Co-operation and Development, February 9, 2015, oecd.org; Richard Dobbs et al., *Infrastructure productivity: How to save $1 trillion a year*, McKinsey Global Institute, January 2013, mckinsey.com; *Better Growth, Better Climate*, New Climate Economy.
[63] John Authers, "Bridging the gap," *Financial Times*, November 9, 2015, ft.com.
[64] *B20 Infrastructure & Investment Taskforce Policy Paper*, B20 Turkey, September 20, 2015, b20turkey.org.
[65] Nicklas Höhne et al., *Developing 2°C-Compatible Investment Criteria*, New Climate Institute with Germanwatch and 2° Investing, November 2015, newclimate.org.
[66] David Frankel, Kenneth Ostrowski, and Dickon Pinner, "The disruptive potential of solar power," *McKinsey Quarterly*, April 2014, mckinsey.com.
[67] Shannon Bouton, David Newsome, and Jonathan Woetzel, "Building the cities of the future with green districts," May 2015, mckinsey.com.
[68] *Mapping Channels to Mobilise Institutional Investment in Sustainable Energy*, Organisation for Economic Co-operation and Development; Dobbs et al., *Infrastructure productivity: How to save $1 trillion a year*, McKinsey Global Institute; *Better Growth, Better Climate*, New Climate Economy.
[69] *Global Trends in Renewable Energy Investment*, Frankfurt School.
[70] *Infrastructure productivity: How to save $1 trillion a year*, McKinsey Global Institute.
[71] Ryan Dezember, "Taking a ride on private equity," *Wall Street Journal*, May 16, 2014, wsj.com.
[72] "Why is Allianz investing in wind farms?," Allianz Capital Partners press release.

[73] Valerio Micale et al., *Risk Gaps: Policy Risk Instruments*, Climate Policy Initiative, January 2013, climatepolicyinitiative.org.
[74] *Mapping Channels to Mobilise Institutional Investment in Sustainable Energy*, Organisation for Economic Co-operation and Development; Dobbs et al., *Infrastructure productivity: How to save $1 trillion a year*, McKinsey Global Institute; *Better Growth, Better Climate*, New Climate Economy.
[75] *World Urbanization Prospects: The 2014 Revision*, United Nations, Department of Economic and Social Affairs, Population Division 2014, esa.un.org.
[76] Ari Huhtala, "Climate finance in the urban context," World Bank, November 2010, worldbank.org; *Better Growth, Better Climate*, New Climate Economy; "Why cities: Ending climate change begins in the city," C40 Cities, c40.org.
[77] O. Merk et al., *Financing Green Urban Infrastructure*, OECD Regional Development Working Papers 2012/10, Organisation for Economic Co-operation and Development, 2012, oecd.org.
[78] *Mobilizing Climate Finance: A Roadmap to Finance a Low-Carbon Economy*, Canfin-Grandjean Commission, June 2015, elysee.fr.
[79] Ibid.
[80] "Planning and Financing Low-Carbon, Livable Cities," World Bank, September 26, 2013, worldbank.org.
[81] "Financing sustainable cities: How we're helping Africa's cities raise their credit ratings," World Bank, October 24, 2013, worldbank.org.
[82] Hal Dardick, "Chicago credit rating takes major hit," *Chicago Tribune*, March 5, 2014, chicagotribune.com.
[83] "The State of City Climate Finance: 2015," The Cities Climate Finance Leadership Alliance, December 2015, sustainabledevelopment.un.org
[84] *Fostering Investment in Infrastructure*, Organisation for Economic Co-operation and Development, 2015, oecd.org.
[85] Katherine Watkins, "Record number of bids received for Colombia's latest 4G highway project," *Business News Americas*, May 30, 2014, bnamericas.org; Katherine Watkins, "Consortium in run for Colombia's Pacífico 2 hwy concession," *Business News Americas*, April 29, 2014, bnamericas.org.
[86] Luis Fernando Andrade Moreno, "ANI lead Colombian road expansion," *World Finance*, October 31, 2013, worldfinance.com.
[87] Watkins, "Record number of bids received for Colombia's latest 4G highway project"; Watkins, "Consortium in run for Colombia's Pacífico 2 hwy concession"; Moreno, "ANI lead Colombian road expansion."
[88] Preqin Infrastructure Online, Funds and Limited Partnership Investors, June 2015.
[89] *IFC's FY2013 Business Plan & Budget*, International Finance Corporation, June 18, 2012, ifc.com; *Aligning Resources for Impact: IFC FY15 Budget*, International Finance Corporation, June 24, 2015, ifc.com.
[90] *IFC InfraVentures: The IFC Global Infrastructure Project Development Fund*, International Finance Corporation, April 2015, ifc.com.
[91] *Financing for Development Post-2015*, World Bank, October 2013, worldbank.org.
[92] *B20 Infrastructure & Investment Taskforce Policy Paper*, B20 Turkey.
[93] Patrick D'Addario, "The European Bank for Reconstruction and Development's Industrial Energy Efficiency Audit Program," Institute for Industrial Productivity, November 2013, iipnetwork.org.
[94] Sustainable Development Capital, sdcl-ib.com.
[95] "Creating market support for energy efficiency: India's Perform Achieve and Trade scheme," Climate Development Knowledge Network, January 2013, r4d.dfid.gov.uk.
[96] The energy-efficiency sustainability premium is based on the percentage of construction costs that is required to attain a Leadership in Energy and Environmental Design platinum certification, which is 4.5 percent to 8.5 percent.
[97] Transaction costs for development banks, bilateral aid organizations, and developers have not been included in this estimate but are important considerations.
[98] Multilateral development banks in this analysis include African Development Bank, the Asian Development Bank, the European Bank for Reconstruction and Development, the European Investment Bank, the Inter-American Development Bank, and the International Finance Corporation and the World Bank from the World Bank Group.
[99] *2014 Joint Report on Multilateral Development Banks' Climate Finance*, World Bank, June 2015, worldbank.org.
[100] *Risk Gap*, Climate Policy Initiative, climatepolicyinitiative.org.
[101] "Spain and Italy reduce feed-in tariffs," *Sun and Wind Energy*, June 26, 2015, sunwindenergy.com.
[102] Micale et al., *Risk Gaps: Policy Risk Instruments*.
[103] "Lake Turkana gets up to speed," *Project Finance International Yearbook 2015*, pfie.com.
[104] "AfDB approves another Sh2 bn for wind power," *Business Daily Africa*, October 3, 2013, businessdailyafrica.com.
[105] "AfDB approves another Sh2 bn for wind power," *Lake Turkana Wind Power*, October 3, 2013, ltwp.co.ke.
[106] *2014 Joint Report on Multilateral Development Banks' Climate Finance*, World Bank, June 2015, worldbank.org.
[107] *Innovative Finance for Development Solutions*, World Bank Group, worldbank.org.
[108] Chris Humphrey and Annalisa Prizzon, *Guarantees for Development*, Overseas Development Institute, 2014, odi.org.
[109] Ibid.
[110] "Designing green, low carbon bus shelters," *Green Public Procurement in Practice*, European Commission, issue number 28, 2013, ec.europa.eu.
[111] *Sustainability Plan*, North West Rail Link, New South Wales Transport, November 15, 2013, test.nwrl.com.au; "2014 Organisational Leadership in Infrastructure Sustainability Award," Infrastructure Sustainability Council of Australia, September 2, 2014, isca.org.au.
[112] "National Disaster Resilience Competition," Phase 2 Fact Sheet, US Department of Housing and Urban Development, June 2015, portal.hud.gov.

[113] "Procurement of 100 percent green electricity in Brandenburg," *Green Public Procurement in Practice*, European Commission, issue number 37, 2013, ec.europa.eu.
[114] "Prozent Ökostrom für Landesbehörden," LAND Brandenberg, July 11, 2013, blb.brandenburg.de.
[115] Eberhard et al., *South Africa's Renewable Energy IPP Procurement Program: Success Factors and Lessons*.
[116] Martin Dietrich Brauch, "Sustainable public procurement in the São Paulo state government," International Institute for Sustainable Development, July 2012, iisd.org.
[117] International Finance Corporation, ifc.com; "Loan syndication 'should take higher priority' in AfDB lending strategy," African Development Bank Group, October 31, 2011, afdb.org.
[118] The total loan portfolio number of $44.2 billion comes from adding the 2014 annual loan totals of the African Development Bank, the Asian Development Bank, the European Bank for Reconstruction and Development, the Inter-American Development Bank, and the International Finance Corporation.
[119] This figure is the average share of climate financing multiplied by the average share of projects that are infrastructure. Share for climate financing was taken as a percent of loans if available; otherwise climate finance as a share of overall financing was used as a proxy. The assumption is that the climate-finance share for overall loans is consistent for infrastructure loans. For the sake of simplicity, we use the term "sustainable infrastructure" throughout this section even though some of the numbers are pulled from climate-financing data. We recognize that climate financing does not completely overlap with sustainable infrastructure, but it was the best available proxy.
[120] The private-sector mobilization rate is 20 percent. This figure is calculated based on a weighted average of annual 2014 private-sector flows mobilized from loan syndication divided by the total annual loan flows. These figures are based on data from the Asian Development Bank, the European Bank for Reconstruction and Development, and the International Finance Corporation. We apply this weighted average to the total annual loan flows from the other major multilateral development banks to calculate potential impact.
[121] The 14 percent portfolio share for sustainable infrastructure is calculated based on 34 percent of loan portfolio for climate finance and 42 percent of portfolio for infrastructure. This assumes that the share of the portfolio for climate finance is consistent across infrastructure and non-infrastructure projects.
[122] Preqin Infrastructure Online, Funds and Limited Partnership Investors, June 2015.
[123] *Infrastructure Spotlight*, Preqin, Volume 7, Issue 7, September 2015, preqin.com.
[124] Preqin Infrastructure Online, Funds and Limited Partnership Investors, June 2015; *Mapping Channels to Mobilise Institutional Investment in Sustainable Energy*, Organisation for Economic Co-operation and Development.
[125] *Bonds and Climate Change: The State of the Market in 2015*, Climate Bond Initiative.
[126] Mike Cherney, "'Green bond' sales struggle," *Wall Street Journal*, June 24, 2015, wsj.com; *Mapping Channels to Mobilise Institutional Investment in Sustainable Energy*, Organisation for Economic Co-operation and Development.
[127] *Mapping Channels to Mobilise*, Organisation for Economic Co-operation and Development.
[128] Tracy Alloway, "Investors are asking tough questions about 'yieldcos,'" *Bloomberg Business*, October 2, 2015, bloomberg.com.
[129] Holly K. Williams, *Financing Sustainable Infrastructure*, International Development Finance Club, Sustainable Infrastructure Working Group, October 2014, idfc.org.
[130] This assumes that changes in allocation levels are met in the first year and that they stay constant as assets under management experience 6 percent growth.
[131] *Bonds and Climate Change: The State of the Market in 2015*, Climate Bond Initiative.
[132] This calculation is based on 33 percent of green bonds for projects in China and 6 percent for projects in India and Russia.
[133] "Food producer BRF raises $549 million in Brazil first green bond," *European Supermarket Magazine*, May 30, 2015, esmmagazine.com.
[134] "History: Explosive growth in green bonds market," Climate Bonds Initiative, climatebonds.net.
[135] Climate Bonds Initiative, climatebonds.net.

Acknowledgments
This paper is released as a contribution to the "Better Finance, Better Development, Better Climate" project, under the auspices of the New Climate Economy. This project 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.

The authors would like to thank the following McKinsey colleagues for their contributions: Jonathan Bailey, Jackie Bass, Ryan Davies, Tyler Duvall, Alastair Green, Shelbi Hendricks, Danielle Imperato, Jan Mischke, Rob Palter, and Ishanaa Rambachan.

The authors are also grateful to Amar Bhattacharya, Joshua Meltzer, Helen Mountford, Shilpa Patel, James Rydge, and Lord Nicholas Stern.

Authors
Aaron Bielenberg is an associate principal in McKinsey's Washington, DC, office, where Melissa Roberts is a consultant; Mike Kerlin is a principal in the Philadelphia office; and Jeremy Oppenheim is a director in the London office.

Copyright © 2016 McKinsey & Company. All rights reserved.

Contact for distribution: Shannon Bouton
Phone: +1 313 202 5274
E-mail: Shannon_Bouton@mckinsey.com

January 2016
Designed by Global Editorial Services
Copyright © McKinsey & Company