

Working Paper

Investing at Least a Trillion Dollars a Year in Clean Energy

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Overview

Energy demand is projected to grow by a third in the next 15 years. A rapid scale-up of low-carbon energy sources and energy efficiency is essential to drive global growth, reduce the air pollution and greenhouse gas emissions (GHGs) associated with fossil fuel use and help provide reliable access to modern energy for those who lack it. This need has become more urgent following the global commitment made in the UN Paris Agreement in December 2015 to reducing net GHG emissions to zero in the second half of the century.

There has been significant progress in recent years, partly due to sharp declines in the cost of renewables. Solar PV modules, for example, are about 80% cheaper than they were in 2008. Clean energy is increasingly cost-competitive with fossil fuels. In 2013, for the first time, the world added more low-carbon electricity capacity than fossil fuel capacity. According to IRENA, the share of renewable energy in total electricity generation can reach as much as 36% by 2030 with technologies that are available today, if the right conditions and investments are secured.¹ Given an estimated 1.1 billion people currently without access to electricity and 2.9 billion lacking modern cooking facilities, increasing international financing for energy access is also a key priority.

International cooperation coordinated by development finance institutions is helping improve the risk-reward profile of clean energy projects, particularly for renewables and energy efficiency, lowering the cost of capital for investment, increasing its supply, and facilitating access to energy services. It is also starting to drive a shift in investments away from new coal-fired power and fossil fuel exploration; this needs to be accelerated, starting with developed and emerging economies.

The Global Commission on the Economy and Climate recommends that, to bring down the costs of financing clean energy and catalyse private investment, multilateral and national development banks scale up their collaboration with governments and the private sector, and their own capital



Photo credit: DFID / Abbie Trayler-Smith

About this working paper

This New Climate Economy Working Paper was written as a supporting document for the 2015 report of the Global Commission on the Economy and Climate, *Seizing the Global Opportunity: Partnerships for Better Growth and a Better Climate*. It reflects the research conducted for Section 2.3 of the full report and is part of a series of 10 Working Papers. It reflects the recommendations made by the Global Commission.

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commitments, with the aim of reaching a global total of at least US\$1 trillion of investment per year in low-carbon power supply and (non-transport) energy efficiency by 2030.

Donors and development finance institutions should phase out the financing of high-carbon energy systems, except where there is a clear development rationale without viable alternatives. They should significantly increase financing for energy access, including a global fund for connectivity. National governments should commit to clear, stable policy and regulatory frameworks that properly reward clean energy and reduce risks. The private sector should work with governments and regulators to scale up the use of finance and industry models that lower financing costs for low-carbon energy and energy efficiency investment, particularly for institutional investors. Private investors should also consider expanding their own commitments to financing clean energy and shifting away from coal.

Scaling up clean energy financing to at least US\$1 trillion a year could reduce annual GHG emissions by 2030 by 5.5–7.5 Gt CO₂e.

1. Introduction

The world faces three energy challenges in one. Energy supply needs to substantially increase to power global economic growth and provide modern energy services to the roughly two-fifths of the world's population who lack them.² Overall, energy demand is likely to rise by more than a third by 2040.³ At the same time, energy systems around the world need to shift away from fossil fuels towards clean energy, to reduce air pollution and to mitigate climate change. Expanding the use of renewables and improving energy efficiency is also important for energy security, as it allows countries to reduce their dependence on imported fossil fuels, which are subject to volatile prices and supply disruptions.

Meeting this triple challenge will require a significant increase in clean energy investments. The good news is that, globally, there is no shortage of capital. In the countries of the Organisation for Economic Co-operation and Development (OECD), high savings rates and historically low interest rates have led to a “search for yield” among many investors. But attracting private finance to clean energy projects, particularly in developing countries, will require a concerted international effort to improve the risk-reward profile of these projects, and thus reduce the cost of capital.

Given their convening power, technical expertise and their ability to mitigate risks, multilateral and national development banks are particularly well placed to coordinate these activities, globally, and at the regional and country levels. This paper focuses on strategies to facilitate increased investment in clean energy – in particular, in low-carbon electricity supply and energy efficiency in buildings and industry. The paper begins by examining the global energy challenge. Section 3 explores the risks commonly perceived to be associated with clean energy projects, and how they can be mitigated. Section 4 discusses the challenges of financing energy efficiency and energy access. Section 5 highlights the key opportunities for international cooperation, and Section 6 offers some recommendations.

2. The energy challenge

Securing a reliable energy supply is vital to modern economies. It drives economic growth and improves living standards. As countries' incomes rise, so does energy use: high-income countries consume on average 14 times more energy per capita than Least Developed Countries, and seven times as much as lower-middle-income countries.⁴ Globally, energy use has grown by more than 50% since 1990, much of this in emerging economies such as China, Brazil and India.⁵ Yet in the same period, the world economy has more than doubled in size, demonstrating another powerful key trend: rising energy productivity (GDP per unit of energy used). Over the next 15 years, global economic output is expected to double again, as up to an extra 3 billion people enter the world's “middle class”,⁶ but energy demand is projected to grow by only around a third.⁷ By 2040, the world's energy systems will need to serve around 9 billion people, with two-thirds in urban areas.⁸

It is particularly important to deliver affordable, modern energy services to those who lack them: around 1.1 billion people without access to electricity and 2.9 billion people without access to clean cooking facilities. Almost all of this unmet energy need is in sub-Saharan Africa or developing Asia, with 84% in rural areas.⁹ In many urban and peri-urban areas in the developing world, large numbers of people have only partial or unreliable access to a grid connection, which affects both quality of life and economic productivity. To combat these challenges, the United Nations has set, as part of the Sustainable Development Goals agreed in September 2015, an objective of achieving universal modern energy access by 2030. This will require a major

increase in investment: from the roughly US\$9.1 billion invested in 2009, to US\$48 billion per year by 2030, according to the International Energy Agency (IEA).¹⁰

Energy choices also have significant impacts on public health. Globally, the use of fossil fuels in power generation, industry and transport is closely linked to an estimated 3.7 million premature deaths due to ambient air pollution.¹¹ Air pollution is particularly acute in fast-urbanising developing countries. In China, mortality from air pollution has been the major driver behind the recent decisions to cap national coal consumption. But air pollution is not simply a developing-country phenomenon: the World Health Organization (WHO) estimates that ambient air pollution caused more than 480,000 premature deaths in Europe in 2012.¹² In addition, more than 154 million working days were lost due to pollution-related illnesses in Europe in 2010.¹³

Energy use is also the source of around two-thirds of global greenhouse gas (GHG) emissions.¹⁴ The energy choices that countries make over the next 15 years – a period when around US\$45 trillion is likely to be invested in the world's energy systems – will therefore play a major role in determining the future course of the global climate system.¹⁵ Decarbonising the energy system to align with a 2°C pathway will require a significant shift in investment, away from fossil fuels and towards renewables, nuclear power and energy efficiency. Of the US\$1.6 trillion invested annually in the global energy supply between 2011 and 2013, 70% was related to fossil fuels.¹⁶ As *Better Growth, Better Climate* argued, the continuing expansion of coal-fired power generation – which accounted for 41% of global electricity production and 73% of power sector GHG emissions as of 2014¹⁷ – remains a key barrier to addressing climate risk.

Yet such a shift towards cleaner energy is now technologically and economically feasible in a way that would have been unthinkable just a few years ago, due to three significant developments.

The first is the dramatic reduction in the cost of wind and solar power in particular. The cost of wind power has decreased by about 40% over the last 25 years.¹⁸ The cost of solar PV modules has fallen by around 80% since 2008, with that of utility-scale solar PV halving in just four years.¹⁹ As a consequence, solar and onshore wind can now compete with fossil fuels in an increasing number of countries with low or no subsidy. In turn, these cost reductions have led to a significant increase in investment in renewables over recent years. While the headline figures invested in renewables increase only by small amounts yearly, in 2014 the amount invested actually purchased 35% more wind and solar capacity than the amount invested in 2011.²⁰ In 2015, clean energy investment surged in China, Africa, the US, Latin America and India, driving the world total to its highest ever figure, of US\$328.9bn, up 4% from 2014's revised US\$315.9bn and beating the previous record, set in 2011 by 3%.²¹ In 2013, the world added more clean power than fossil fuel power generation capacity, and this shift is expected to continue²² – albeit not fast enough.

Second, there has been an increasing recognition of the role that energy efficiency investment can play in a low-carbon energy system. In developed economies, it is already the biggest source of new energy “supply”, having reduced by 40% the energy supply needs of OECD countries in the 40 years since the first oil crisis in 1973.²³ Yet there remains huge untapped potential to manage energy demand, particularly in developing countries.²⁴

Third, energy consumption is becoming more flexible due to advances and cost reductions in smart grid, information technology systems, and energy storage technologies.²⁵ By shifting peak load to off-peak times, these technologies are capable of stabilising demand throughout the day and thus optimising the use of energy assets. The IEA has demonstrated the potential of smart grid technologies to separate total electricity growth from peak time growth.²⁶ The recent emergence of advanced low-cost batteries for homes, industry and utilities,²⁷ and the rapid development of smart systems using digital and information technologies, are enabling the sophisticated management of demand at every level, from the grid as a whole to individual homes. Radical new energy business models are now in prospect, with the potential to lead to a step-change in overall energy productivity.²⁸

Some commentators have argued that the rapid emergence of shale gas provides another option for replacing coal and reducing emissions, as it has done in the US over the last decade. Yet the US shale gas revolution has not been replicated elsewhere so far due to disappointing results of exploration efforts, and public concerns.²⁹ Serious question marks remain over local environmental impacts, leading to a ban of hydraulic fracturing in several countries. Shale gas requires a large amount of water during its extraction phase and generates large quantities of wastewater, raising concerns over its sustainability. Further, concerns have been raised over leakages of the gas and chemicals used in its extraction into drinking water. The IEA and others, however, believe that these impacts are manageable.³⁰

As argued in *Better Growth, Better Climate* and discussed further in the New Climate Economy report *Natural Gas: Guardrails for a Potential Climate Bridge*,³¹ strong policies need to be implemented if gas is to play the role of a reliable “bridge” away from a high-carbon energy system, in particular by replacing coal. Successfully using gas as a bridge would require environmental safeguards

to limit fugitive methane emissions (such as a price on greenhouse gas emissions) and production efficiency standards. Even with these protections, gas can only serve as a “bridge” for 15–20 years before gas-fired generation will need to be phased down to meet decarbonisation goals, unless carbon capture and storage can be scaled up rapidly. To be a bridge “towards” a low-carbon energy system, energy policy will need to ensure that gas capacity supports renewable capacity expansion in the next two decades rather than competing with it, and cedes to it by the end of that timeframe.³² This is shorter than the typical useful lifetime for natural gas infrastructure or gas-fired power plants, raising the question of how much new gas investment could be financially viable under a 2°C pathway.

In order to stay within the 2°C target, the IEA estimates in its most recent *World Energy Investment Outlook* that total investments in low-carbon power supply (solar, wind, hydropower, bioenergy and nuclear, as well as carbon capture and storage) will need to grow to an average of about US\$520 billion between 2014 and 2035.³³ Energy efficiency investment in buildings and industry also needs to grow, to average about US\$250 billion per year over the same period.³⁴ In total, the world needs to reach at least US\$1 trillion per year in annual investment in low-carbon power supply and (non-transport) energy efficiency by 2030. At the same time, a low-carbon future requires substantially less investment in fossil fuels, particularly coal: under the IEA’s low-carbon scenario, coal investment shrinks by more than one-third between 2014 and 2035.³⁵ Box 1 discusses opportunities for international collaboration to realise this shift away from coal.

Box 1

International cooperation on shifting away from coal

Reducing coal consumption is identified as a key goal in *Better Growth, Better Climate*, with sizeable economic and health benefits in addition to emission reductions.³⁶ In the 15 countries with the highest greenhouse gas emissions, premature deaths from poor air quality, largely associated with the burning of fossil fuels, is valued at an average of more than 4% of GDP, with coal being the most polluting fuel.³⁷ Even without considering the health benefits of shifting away from coal, the recent dramatic decreases in the costs of solar and other renewable energy components mean that new renewable electricity generation is increasingly cost-competitive with coal generation. Analysis conducted for *Better Growth, Better Climate* suggests that, when the potential cost of stranded assets as a result of increasingly stringent climate policies is included, shifting away from coal and towards renewable energy could have a net benefit to the global economy of US\$1.8 trillion over 20 years.³⁸

International cooperation on financing can help to propel the shift away from coal, both by supporting cost-effective alternatives and by using finance as leverage to retire coal assets or avoid new coal investments. The investors with the most leverage are those that make significant direct investments in coal assets (including upstream mining as well as coal-fired power plants) or provide other critical financing components that can determine whether a proposed project is built (such as a guarantee from a development finance institution or DFI).

The World Bank, European Investment Bank, European Bank for Reconstruction and Development (EBRD), the Export-Import Bank of the United States, and various European bilateral donors have all made commitments to stop financing unabated coal power, except in cases where there are no viable alternatives to expand energy access.³⁹ The government of Norway announced in May 2015 that the country’s sovereign wealth fund, the second-largest institutional investor in the world, would divest from coal-reliant companies.⁴⁰ In recent months, private investors have also made high-profile decisions to retire existing coal assets or avoid building new ones.⁴¹ Finance ministers agreed in May 2014 to continue discussions on how export credits can contribute to addressing climate change.⁴² OECD members agreed in December of 2015 to new rules sharply limiting the availability of export credit finance for conventional coal-fired power plants and committed to strengthening these limits in 2019.⁴³

In the phase-out of coal-fired power, the challenge is financing alternatives to planned coal plants in developing countries. Building new coal-fired power plants adds to the risk of either locking in a high-carbon system or stranding assets in the future. This dilemma underlines the urgency of improving and expanding clean energy financing, in particular in low-income countries. Collaboration among national governments, DFIs, donors, and private finance providers will be necessary to ensure that developing countries can shift away from coal and expand access to clean energy.

If some new investment in coal is unavoidable in developing countries with truly no viable economic alternatives, donors and institutions should commit to ensuring that only the cleanest coal generation possible is built, to minimise the health impacts on local populations and greenhouse gas emissions, and limiting plant size to avoid the long-term “lock in” of energy pathways. Another intermediate step would be to exclude coal from funds earmarked for clean energy investment, including the Green Climate Fund, which as yet has no exclusion for fossil fuels.⁴⁴

This US\$1 trillion figure represents total investment from both public- and private-sector sources, including investment by businesses and households in improving the efficiency of their own buildings and facilities. Most of this investment will likely continue to come from within countries, with only a minority coming from international funds.

Achieving such a large shift and unlocking large-scale finance for clean energy will require new approaches in both policy and finance.

With respect to policy, fossil fuel subsidies and unpriced carbon continue to impede the development of low-carbon energy and energy efficiency in many regions. Furthermore, in most countries energy markets and their regulatory frameworks, as well as business models for utilities and other energy companies, were designed for fossil fuel generation and have very different characteristics from those required for clean energy. At the same time, technical challenges persist in integrating large quantities of large-scale renewables into electricity grids (see Box 2). Despite these obstacles, investment in and deployment of clean energy are growing, but there is still a long way to go in increasing the supply and reducing the cost of capital for clean energy sufficiently to meet both growth and climate challenges.

Box 2

The 21st Century Power Partnership

An electricity system dominated by low-carbon energy, with a much larger share generated by variable renewable energy, will require a smarter, more responsive grid and various flexible resources, including demand response, storage, and smart electric vehicle (EV) charging. Innovations from the private sector, policy-makers, regulators and system operators will be needed to enable this transformation. With many countries facing similar challenges in these areas, international cooperation can help to accelerate these innovations.

The 21st Century Power Partnership, an initiative of the Clean Energy Ministerial (CEM), aims to support such cooperation. CEM, founded by 8 governments, and now including the participation of 23 countries and the European Commission, produces technical analysis and provides applied technical assistance to governments, drawing on government and private-sector expertise.⁴⁵ For example, experts are working with Mexico's energy ministry to support implementation of a broad energy reform agenda, including a restructuring of the state-owned electricity utility company and establishment of an independent system operator. In India, the partnership has helped to develop a national renewable energy roadmap and, in conjunction with the Indian grid operator, is researching solutions to integrate greater wind and solar deployment. Faced with a severe power crisis, South Africa is working with the partnership to design new regulations that incentivise low-cost, scalable distributed solar generation.

3. Improving the risk-return profile of low-carbon energy projects

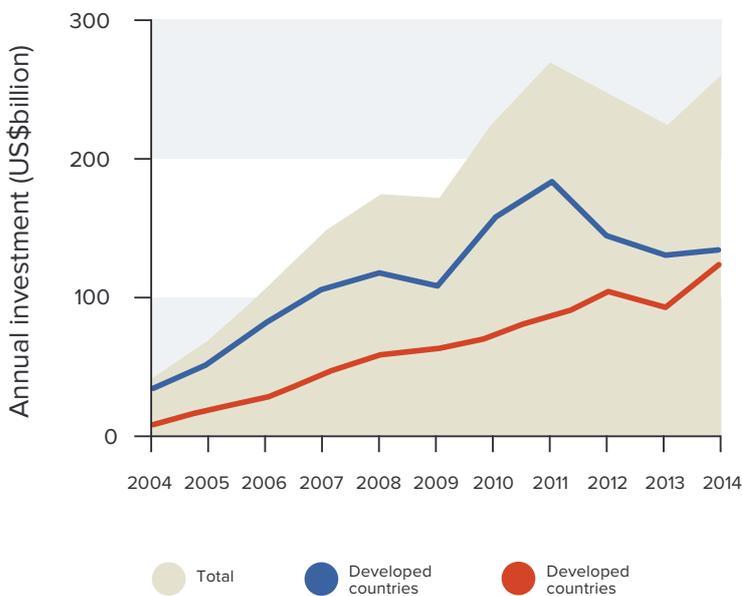
Meeting the clean energy financing challenge will require greater investment from both public and private sources, as well as targeted public financing interventions to reduce risks and lower the cost of capital so as to unlock large-scale private investment.

Global investment in renewable energy was US\$270 billion in 2014, according to the most recent data from the United Nations Environment Programme (UNEP) and Bloomberg New Energy Finance.⁴⁶ While total investment has risen dramatically – and deployment of clean energy technologies has grown even faster, as costs have fallen – it is still far short of the IEA's estimate of what is needed to reach a 2°C pathway.⁴⁷ Figure 1 illustrates these trends.

3.1 SOURCES OF FINANCE FOR CLEAN ENERGY

In general, there is no shortage of capital available for investment. Total savings and investment continue to grow worldwide, boosted by growth in emerging markets.⁴⁹ Public investment has slowed in developed countries, but interest rates remain very low; private investors are seeking higher returns, presenting an opportunity to direct new private flows

Figure 1
Global renewable energy investment, 2004–2014



Source: McCrone et al. (2015).⁴⁸

in authorised capital) and the New Development Bank (NDB BRICS) announced by Brazil, India, Russia, China and South Africa (US\$100 billion in authorised capital).⁵³

For all countries, but particularly those without development banks, closing the financing gap will require mobilising more capital from a range of sources. In high-income and middle-income countries, private capital markets are likely to provide most of the new investment in clean energy generation. In low-income countries, the scale of investment needed for development, as well as the underdeveloped capital markets, continue to demand a major role for public capital. DFIs, including multilateral, bilateral and national development banks, committed US\$126 billion of their own capital to climate-related investments in 2013.⁵⁴ The multilateral development banks (MDBs), made up of the World Bank Group and regional development banks, provided US\$24 billion of this in 2013, and US\$75 billion in total in the three years from 2011.⁵⁵ Within this total, the Climate Investment Funds (CIF) channelled US\$8 billion from donor countries for climate-related investments in middle-income and developing countries, including US\$6 billion for clean energy.⁵⁶

While these trends reflect an impressive shift towards clean energy investment, it is still far from what is needed. The pressing question for clean energy financing is not the total amount of capital available, but whether the particular risk-return profile of clean energy investments matches the risk-return outcome that is desired by the available capital. When there is a poor match between investors' needs and the risk-return profile of a clean energy investment, the result is either a higher cost of capital (which in turn raises the cost of clean electricity) or a lack of available capital altogether.

3.2 THE NEED TO REDUCE FINANCING COSTS

Low-carbon energy projects using well-established technologies, such as onshore wind and solar, have relatively little intrinsic risk once they begin operation. They have no fuel costs, and operating costs are low as they are relatively simple to operate. But these projects are often forced into financing and market arrangements that introduce risk, which in turn raises the cost of capital for low-carbon energy.⁵⁷ In electricity markets where marginal prices are set by fossil fuel power plants, all market participants – including low-carbon generators – are effectively exposed to fossil fuel price volatility. And renewable energy is often owned by the same investors and financed through the same structures as conventional energy projects, meaning that the cost of capital faced by renewables is based on the cost of capital for utilities, independent power producers and fossil fuel plants. Unpredictability in subsidies for renewable energy introduces further risk.

into clean energy infrastructure investment. The International Monetary Fund (IMF) has argued that, given the decline in the quality of infrastructure and the continuing low government interest rates, this is a particularly opportune moment for public investment in infrastructure.⁵⁰

The nature of the clean energy financing challenge, and the size of the gap between available capital and the capital needed for a low-carbon transition, vary across different regions and countries. Most investment is domestic rather than international,⁵¹ so a country's circumstances make a big difference to the amount and sources of available capital. In countries with large development banks, for example, these banks already tend to provide low-cost capital for clean energy infrastructure. As of 2012, the German development bank KfW had already invested close to US\$150 billion in clean energy infrastructure, the China Development Bank close to US\$80 billion, and the Brazilian Development Bank (BNDES) close to US\$50 billion.⁵² New DFIs based in emerging economies are poised to become major sources of infrastructure financing; this includes the Asian Infrastructure Investment Bank (US\$50 billion

Mitigating and reallocating risks could therefore substantially improve both the availability and the cost of capital for clean energy projects, which in turn would reduce the cost of clean energy. Financing costs are particularly important for clean energy because it is so capital-intensive; capital costs can make up 90% of the total lifetime cost of a renewable energy project. If clean energy projects could access low-cost, long-term financing reflecting its intrinsic production profile, analysis conducted for *Better Growth, Better Climate* estimates that the cost of low-carbon electricity could be reduced by as much as 20% in developed economies.⁵⁸ Developing countries could potentially see even larger savings; for example, changes to policy and financing models that reduce the cost of debt could lower the total cost of renewable energy support policies in emerging economies by as much as 30%.⁵⁹

Institutional investors, such as pension funds, insurance companies and sovereign wealth funds, are prime candidates to provide the needed increase in low-cost capital for clean energy investment. This is not just because of their large size, but because many institutions have relatively predictable long-term liabilities that are a good match for the predictable, long-term cash flows of clean energy projects. Institutional investors control over US\$71 trillion of assets,⁶⁰ making them one of the largest pools of capital in the world.⁶¹ But the OECD estimates that less than 1% of assets under management by these institutions are currently allocated to direct infrastructure investment, of which clean energy infrastructure is a small fraction.⁶² The Global Investor Coalition's registry lists examples of low-carbon investments made by institutional investors. Although the registry is not by any means comprehensive, it values the investments reported by the 45 institutional investors involved at only US\$24 billion, well below the potential.⁶³

A range of internal and external barriers limit institutional investors' ability to invest in clean energy projects.⁶⁴ For example, direct investment (owning a project outright, rather than holding tradable shares or bonds) can be an efficient way for investors to hold assets that are a good match for their needs. But the illiquidity of direct investment, the need for portfolio diversification, and the staff capacity required to evaluate specific projects mean that in practice only the largest institutions can make direct investments. Revenue and market risk can also limit the ability of clean energy projects to provide liability matching for institutions – for example, if a renewable energy project is subject to a feed-in premium instead of a feed-in tariff, it will no longer provide predictable cash flows to investors over the long term. Internal organisation presents a barrier as well: many investors categorise clean energy infrastructure as a private equity or “alternative” investment, with expectations of high risks and high returns.⁶⁵

In terms of other private investors, banks have historically been a major source of capital for clean energy infrastructure, but their investments are now increasingly constrained because of illiquidity concerns. The recent Basel III regulations have codified liquidity risk for banks, requiring them to hold more reserves to offset long-term, illiquid assets, thus limiting their ability to invest in long-term infrastructure projects.⁶⁶

At the same time, the appetite of other private players to invest in clean energy has increased. A number of private-sector initiatives to mobilise clean energy investments have emerged. Finance for Resilience, an initiative by Bloomberg New Energy Finance, focuses on removing barriers to such investments in the private sector.⁶⁷ Through its Clean Trillion campaign, the non-profit organisation Ceres brings together investors, businesses and policy-makers to mobilise greater investment in clean energy, manage climate risks and reduce emissions in their own activities, and support development of policies that level the playing field for and stimulate investment in clean energy.⁶⁸ Several private players have, indeed, made public commitments to increasing their investments in environmental and climate-related projects, including Bank of America, Citigroup and the Investor Platform for Climate Action, which represents more than 400 investors holding US\$25 trillion in assets.⁶⁹

Other types of investments, with different risk-return profiles, will also be needed in the transition to a low-carbon electricity system. In many countries, transmission and distribution systems need to be upgraded, requiring significant investment in assets that are typically regulated and relatively low-risk. At the same time, a low-carbon grid is likely to require more innovative flexible resources, such as energy storage. In a system dominated by low-carbon supply, some fossil fuel power plants may also need to be repowered to provide flexible power for fewer hours of the year.⁷⁰ While investors comfortable with higher-risk, higher-return investments may see opportunities in these resources, these are not always the same investors who currently engage in regulated energy markets. Greater collaboration among energy companies, regulators and outside investors can help ensure the right incentives are in place to engage these investors.

3.3 STRATEGIES TO CATALYSE INVESTMENT

What can governments and DFIs (including both national and multilateral institutions) do to attract more low-cost capital for clean energy projects? Previous studies of the financing gap have concluded that the primary barrier to expanding clean energy investment is a shortage of projects that meet investors' criteria.⁷¹ Investors look at risks and returns together; thus, the core challenge of clean energy financing is to improve the risk-return profile of clean energy investments and to make more projects attractive prospects for financing.

To improve the risk-return profile for clean energy projects, policy interventions can either increase returns or reduce risks, or work on both together. The first step in improving returns is to level the playing field between clean energy and fossil fuels, by removing fossil fuel subsidies and implementing and strengthening carbon pricing policies.⁷²

Governments can further increase the returns on clean energy projects by increasing subsidies or other forms of support for clean energy. However, continuing to increase subsidies is a costly solution and may not be fiscally or politically sustainable in the long term. Recent changes in renewable energy subsidies in several countries, some retroactively, have significantly raised uncertainties about these policies among investors and caused a dramatic slowdown in investment.⁷³

Given the cost of generating higher returns, it is at least as valuable to focus on risks – reducing risks where possible, and reallocating unavoidable risks to the parties best equipped to manage them at the lowest cost. There are ongoing efforts in both the public and private sectors to address risks associated with clean energy investments, but in order to make sufficient capital available at a reasonable cost, these efforts need to be scaled up and better coordinated.

DFIs can use a wide range of instruments to mitigate and efficiently allocate risk. Table 1 lists some of the instruments that reduce the cost of capital for clean energy projects, including instruments that decrease the risk investors face when investing in a project, as well as those that change the form of the investment itself. Many of these instruments are common tools for DFIs, including concessional loans and risk mitigation instruments.⁷⁴ Expanding the use of these instruments, and targeting them to the specific needs of clean energy infrastructure, could reduce the cost of capital paid by clean energy projects and allow them to attract the needed increase in investment.

A recent OECD report provides a detailed classification of channels for investment in renewable energy, with special attention to the options available to institutional investors.⁷⁵ It recommends several strategies for governments and DFIs to address barriers to institutional investment in renewable energy, including: improving policy and governance to reduce policy risk; providing market structures that allow a predictable return for renewable energy; developing pipelines of projects at the national level; facilitating the development of liquid instruments, such as green bonds and listed funds, as well as risk mitigation instruments that can “crowd in” private investment; and promoting transparency and standardisation. Achieving this set of objectives requires strong collaboration among DFIs, governments and private investors.

Green bonds and YieldCos

Two investment vehicles that have grown rapidly in the last few years – green bonds and “YieldCos” – merit further discussion.

Green bonds can be corporate, municipal or institutional bonds where the proceeds are earmarked for environmentally friendly projects, typically clean energy, or project bonds that are issued specifically with the backing of a clean energy project or set of projects.⁷⁶ An investor buying a green bond for a clean energy project receives a predetermined stream of payments based on the project's revenues, but does not own a share of the project itself. Green bonds have seen exponential growth in recent years, from less than US\$5 billion in annual issuances in 2007–2012 to US\$11 billion in 2013 and almost US\$37 billion in 2014.⁷⁷

Table 1
Instruments for reducing financing costs for clean energy projects

Type of instrument	Instrument	Channel for reducing financing costs
Financing vehicles	Listed equity investment vehicle (e.g. infrastructure fund, YieldCo) <i>Tradable instrument providing an ownership stake in a group of clean energy projects</i>	Reduces liquidity risk for investors
	Bond (e.g. bond fund, corporate bond, project bond) <i>Investment that yields a stream of payments backed by a project's revenues, without ownership stake</i>	Reduces liquidity risk for investors; investors are not exposed to risks that become relevant after the term of the bond (e.g. value of the project after initial useful life is over)
	Concessional loan <i>Direct loan at below-market rate</i>	Lowers cost of capital directly
Risk mitigation instruments	Insurance <i>Offers protection against specific risks; can include policy/political risk</i>	Shields investors from specified risks
	Performance contract <i>Protects against risk of technology failure or underperformance; often offered by equipment manufacturers</i>	Shields investors from performance risk
	Currency swap <i>Agreement on a specified exchange of currencies in the future; counterparty assumes the risk that the exchange rate will fluctuate</i>	Shields investors from currency risk by transferring it to the counterparty
	Loan/credit guarantee <i>Agreement to cover some or all of an obligation to a borrower in the case of default</i>	Reduces the potential losses that investors may face; can cover all types of risk
	First-loss protection <i>Specialised insurance or cash reserve used to shield investors from a predetermined amount of loss</i>	Decreases the likelihood that investors will be exposed to losses; can cover all types of risk
	Co-financing <i>Can describe a range of financial arrangements where DFIs invest alongside private investors</i>	Participation of DFI may lower private investors' perceptions of the riskiness of a project, including policy/political risk
	Securitisation <i>Pooling multiple projects into a single vehicle for investment</i>	Reduces investors' exposure to performance risk, which is lower for a pool of similar projects than for any single one
Revenue sources	Power purchase agreement <i>Long-term contract to sell power at a fixed price (or with a minimum price or price collar)</i>	Provides revenue certainty; avoids exposing renewables to fossil fuel price risk
	Feed-in tariff <i>Long-term revenue support from government, at a fixed level</i>	Provides revenue certainty; avoids exposing renewables to fossil fuel price risk
Capital cost subsidy	Credit enhancement <i>Upfront subsidy to lower the interest rate paid by the borrower</i>	Lowers cost of capital directly

Subsequently, a number of standardisation initiatives are under way in order to provide confidence to investors. The Climate Bonds Initiative is developing a certification scheme for green bonds.⁷⁸ Further, in 2014, a group of commercial banks launched the Green Bond Principles in order to standardise the process of issuing green bonds and improve transparency. The initiative already has over 100 members and an independent secretariat run by the International Capital Market Association.⁷⁹ Several leading investors convened by Ceres's Investor Network on Climate Risk sought to expand on the Principles in February 2015 by including new criteria on issues such as eligibility, independent assurance and reporting.⁸⁰

YieldCos and similar closed-end investment funds (the terminology varies across countries) are publicly-traded companies that own portfolios of operational renewable energy projects, paying dividends to shareholders from the projects' revenues. Most funds aggregate solar and wind assets. Some also include hydropower, biomass and cogeneration assets. Most YieldCos have been created by renewable energy developers, which sell their projects into the YieldCo upon completion. For an investor, a YieldCo or similar pooled investment vehicle can be a way to achieve the same cash flow that would come from directly owning a renewable energy project, but through a liquid, publicly traded instrument. The first renewables-focused YieldCos went public in 2013, although similar funds have existed for longer; in 2015, there were already 15 in the United States, Canada and Europe, with a total market capitalisation of well over US\$20 billion.⁸¹ The solar company SunEdison has also announced plans for a YieldCo focused on projects in emerging markets, with an initial portfolio consisting of solar, wind and hydro projects, among others.⁸²

Because these instruments are exchange-traded, they avoid some of the liquidity risk and transaction costs associated with direct clean energy investments; they therefore have the potential to open up clean energy infrastructure investments to a wider range of investors, increasing the supply and reducing the cost of capital. They are not without drawbacks: green bonds backed by larger institutions may not be generating additional emission reductions relative to business as usual, and YieldCos do not yet have a long track record from which to judge their performance, while some of the larger YieldCos have developed an expectation of rapid future growth, which would make them riskier investments.⁸³ However, the growing market for these instruments demonstrates that there is high demand among private investors for liquid investment opportunities in clean energy. Scaling up the use of pooled investment vehicles, and extending their use across different markets and technologies, appears to be a promising strategy to draw more private investment into clean energy. Section 5 discusses opportunities for international cooperation to scale up financing for clean energy, using these and other instruments.

4. Financing energy efficiency

Alongside renewable energy supply, energy efficiency is a key element of a low-carbon transition, but it poses unique finance challenges. Energy efficiency investments generate energy savings – a reduction in spending or avoided cost, rather than new revenue from an external source. Unlike the revenues for a renewable energy project, energy savings often cannot be directly measured or segregated from other revenues. This makes it difficult for an investor to lend to an energy efficiency project in isolation from the building or its owner. While project finance for energy efficiency does exist, most energy efficiency loans are tied to the creditworthiness of the building owner, which increases transaction costs and reduces the supply of external finance for energy efficiency. In addition, many energy efficiency investments are not purely for energy efficiency, but are integrated into more general investments, such as in the construction or refurbishment of buildings and facilities. Accordingly, a large portion of energy efficiency investments are made by building owners (households or businesses) from their own resources, not from external financial investors. Behavioural barriers and transaction costs can be significant for both individuals and institutions.

There are a wide range of approaches that aim to channel more financing into energy efficiency, often by reducing the initial cost of an energy efficiency investment, lowering the cost of capital, and/or mitigating risk. These include traditional approaches like rebates, public loan funds, credit enhancements for private lenders, and energy performance contracting; newer yet established models like on-bill and property-assessed clean energy programmes; and emergent models such as energy service agreements, securitisation of loan pools, and energy performance insurance.⁸⁴ Because the revenues from an energy efficiency project come in the form of avoided energy costs, the economics of an energy efficiency investment depend in part on the price of energy. This means that, beyond dedicated financing programs, energy prices, retail rate design and carbon prices all have a direct impact on the finances of energy efficiency investments. In particular, energy efficiency

investments are much less attractive if energy is subsidised, or if its price is less than its true cost (e.g. if the energy price does not factor in a carbon price).

Given the importance of information deficits, inattention and other behavioural barriers in limiting energy efficiency investment, demand for energy efficiency financing may be as big an obstacle as supply. There is broad consensus in the energy efficiency literature on the importance of reducing transaction costs as part of a strategy to drive energy efficiency investment.⁸⁵

Removing barriers to energy efficiency investment around the world can be assisted by collaboration at an international level among public and private stakeholders. Many of the non-financial barriers to energy efficiency investment (e.g., where the payback period for energy efficiency investments extends beyond the timeframe of those deciding about the investment, or where transaction costs for individual building owners are too high) are common to many countries. International collaboration can also provide a forum for developing and scaling up instruments designed to mitigate risks that are specific to energy efficiency investments, thereby mobilising more public and private investment.

The Energy Efficiency Financial Institutions Group, an expert group convened under the UNEP Finance Initiative, has concluded that “a historic level of public-private collaboration is required to deliver multiples of existing energy efficiency investment flows by 2030”.⁸⁶ Among the group’s recommendations is that data and contracts be standardised to reduce transaction costs and facilitate investment. It has also recommended targeting financial support at project development and at well-designed instruments for risk mitigation, so as to attract private capital. For example, the Global Innovation Lab for Climate Finance is launching a pilot programme of energy savings insurance (an insurance product that pays out if an efficiency project fails to achieve a targeted level of savings) in developing countries.⁸⁷ Energy savings insurance has existed for some time as a niche product in some countries, but international cooperation is required to expand this to developing countries.

Two promising approaches are engaging financial institutions and investors in efforts to reduce transaction costs and increase both the supply and demand for energy efficiency financing.

First, DFIs can increase financing for energy efficiency by building the capacity of retail banking and other financial intermediaries, and then by leveraging this capacity. One example of a successful DFI programme is EBRD’s Sustainable Energy Initiative, which provides financing in conjunction with local capacity-building, to develop and lend to a pipeline of high-quality projects. Through its Sustainable Energy Financing Facilities in 22 countries, EBRD extends a credit line to local financial institutions and at the same time establishes a project implementation team to assist with project development, underwriting, monitoring and other technical issues.⁸⁸ The local financial institutions then on-lend funds to residential and commercial borrowers, with guidance provided by the project implementation team. This targeted, on-the-ground technical assistance helps overcome transaction costs for both the local financial institutions and the recipients of funds, and enables more projects than would be possible through financing alone. This programme has been operational for nearly 10 years; in that time, EBRD has partnered with 80 local financial institutions, providing €2 billion in financing to more than 40,000 recipients.⁸⁹

A second way to reduce transaction costs for financiers is securitisation, or the bundling of energy efficiency investments into assets that can be traded. Standardisation is a critical first step towards securitisation and scaling up private finance, particularly for smaller-scale projects, such as energy efficiency and distributed renewable energy. Standardised projects, with established underwriting criteria and methods of measurement, are necessary to lower transaction costs and allow investors to lend to smaller projects at large scale. The recent rapid growth in leased rooftop solar systems in the United States, where soft costs can represent up to 64% of the total price for residential solar systems,⁹⁰ demonstrates the potential of standardisation. By standardising project evaluation, installation and financing, solar leasing companies have been able to turn a complex investment into a simple operational decision for building owners, significantly expanding the market for distributed solar.⁹¹ Standardisation has also led to securitisation for distributed solar: the largest solar leasing company, SolarCity, has sold asset-backed securities backed by its leased systems.

Energy efficiency projects have not reached the same level of standardisation as distributed solar, but there are efforts to move in that direction. The first securitisation of energy efficiency loans took place in 2014, with two bond issuances in the United States. Both drew on programmes in which efficiency loans are repaid through the property tax bill and tied to the building.⁹² Bringing together energy efficiency project developers, finance providers, building owners, governments and other stakeholders, the Environmental Defense Fund’s Investor Confidence Project is a growing effort to promote standardisation

and lower this barrier to investment.⁹³ The project has developed a set of protocols for project documentation and energy savings calculation, as well as a standard set of credentials for project developers, based on existing industry standards and best practices. It is currently active in North America and Europe.

Both of these models are ripe for expansion and replication. Both methods – financing coupled with information provision, and standardisation of projects to enable securitisation – target some of the persistent obstacles to energy efficiency financing. They also demonstrate the power of international collaboration. By bringing together public- and private-sector stakeholders across multiple countries, they are able to more efficiently identify and share solutions to common problems, while the involvement of regional partners helps ensure that solutions are tailored to local markets and policies. Both are currently limited in geographic scope, meaning that there is a significant opportunity to expand these models to more regions.

Box 3

Turning Energy Ambition into Universal Access

Financing US\$1 trillion in clean energy will be critical for better growth and a better climate. Most developing economies with high levels of poverty also face investment shortfalls in the energy generation capacity needed to provide an affordable, reliable, resilient power supply to maintain growth, expand employment and boost incomes. Yet ambitious expansion of generation capacity alone will not guarantee universal energy access. The IEA estimates that even under aggressive scenarios of power expansion, a third of the global population will remain without access to modern cooking services and 12% without access to electricity by 2030.⁹⁴ This would represent less than halfway to providing access for the 1.1 billion people worldwide who currently lack access to electricity and the 2.9 billion people without access to clean and modern cooking services.⁹⁵ For the energy poor, universal access will require harnessing domestic economic growth, international cooperation and technological innovation to deliver energy services that meet their needs.

Estimates of annual investments required over the period 2010/2011 for universal access range from US\$15 billion to US\$279 billion for electricity and from US\$4.5 billion to US\$64 billion for clean cooking, with the majority of investment required in Sub-Saharan Africa and developing Asia. The existing annual financial flows are estimated at US\$9 billion.⁹⁶ Financing access to clean energy in each of its forms – cooking technologies, distributed electricity and on-grid power – creates unique challenges with unique solutions.

Access to clean cooking technologies

The majority of households in energy poverty lack access to clean and modern cooking facilities. Energy-poor households tend to burn charcoal and fuelwood over open fires. This accounts for most of the energy consumed in developing economies, as well as 4.3 million deaths per year worldwide from indoor air pollution.⁹⁷ Cooking with currently available electric stoves is energy-intensive and costly, so in the majority of contexts rapid improvement in the quality of cooking facilities and the health of users requires accelerating access outside of the power sector. To improve energy services for cooking will require scaling up the distribution of non-solid fuel sources (e.g. LPG, LNG and biogas) and clean cookstoves.

Improved cookstoves and fuels are small consumer goods. Financing access to them requires corporate debt and equity investments to enterprises that are efficient at manufacturing and distributing these technologies and at making them affordable to households. Financial support to energy-poor consumers and the provision of working capital will be also required to spread the high upfront costs of these technologies over time. However, access to clean cooking is not just about financing the technology. There is some evidence that cultural and behavioural preferences for more traditional forms of cooking slow the rate of adoption of new cooking equipment, since households do not always perceive the harmful effects on health of existing technologies, as these are delayed, or are sceptical about the safety and reliability of new technologies.⁹⁸ Investing in energy access, therefore, also requires public health campaigns to provide information on the negative impacts of traditional cooking facilities, as well as the adaptation of technologies to local preferences.

Access to clean electricity through off-grid distribution

For universal electricity access, recent low-carbon innovations offer the potential to overcome the greatest barrier to universal access: ensuring affordable energy services to populations remote from the grid. Access to the grid remains beyond the financial means of many households in Africa. Connection fees (excluding other charges such as security deposits and inspection fees) can reach between US\$50 in Ethiopia (where 70% of population lives on less than US\$2 a day) to US\$200 in Uganda (where 63% of population lives on less than

US\$2 a day).⁹⁹ Improving energy services for about 60% of the world's 1.1 billion electricity poor will require the dramatic expansion of affordable distributed electricity services, from technologies such as household solar systems and standalone power systems such as mini-grids powered by solar, wind and micro-hydro power.¹⁰⁰ The modular nature of these technologies makes them capable of reaching communities beyond the grid faster and more cheaply than conventional sources of energy distributed via the grid. The decreasing cost of batteries also allows solar and other renewables to make an even greater impact, enabling electricity storage off-grid in rural areas and more efficient management of grid electricity, balancing demand and providing backup during blackouts.

The financing challenges for getting distributed electricity to households are similar to those for providing cookstoves. For the 60% of energy-poor households that are remote from centralised grids, access is likely to be achieved through stand-alone distributed technologies at the household and building level, and through mini-grids.¹⁰¹ Distribution of household-level technologies requires capitalising enterprises (public or private) that deliver consumer goods, and financing the purchase of those goods by poor consumers. Global cooperation initiatives like USAID-led Power Africa are devoting resources to the financing barriers specific to distributed energy systems.¹⁰²

In its 2015 report, the Africa Progress Panel called for the creation of a “global fund for connectivity” to remove the barrier of high initial capital costs for off-grid energy access. The fund would require participating governments to draw up national action plans for achieving universal access by 2030, detailing financing requirements, delivery mechanisms and reporting systems. The proposed fund would comprise US\$3 billion of development assistance and US\$5 billion of concessional finance. The goal of such a fund would not just be to provide aid but also to deliver innovative approaches that can turn the financing challenge into an opportunity for both investors and consumers. In particular, the Panel proposes drawing on the experiences and practices of global health funds.¹⁰³

New players are showing that, despite the small transaction sizes of distributed energy installations, financing can be scaled up if institutions are tailored to the financing needs of these technologies. For example, the Bangladeshi Infrastructure Development Company Ltd (IDCOL) delivers financing of rooftop solar installations to help meet the country's goal of reaching universal electricity access by 2021. Owned and funded by the state and managed by the private sector, this public-private partnership has delivered 3.6 million solar systems since its inception in 2003, and expects to reach 6 million by 2016.¹⁰⁴ IDCOL provides low-cost financing and technical capacity-building to 47 partner organisations, ranging from NGOs to the private sector and multilateral financial institutions. In turn, these organisations install and finance systems with customers.

Mini-grids have the benefit of reaching more households at lower cost per connection than household systems, but have unique financing challenges: they are more capital-intensive than household units, but each project is often too small for traditional forms of non-recourse project financing. UNEP has therefore proposed a mini-grid pooling facility, whereby individual mini-grid projects are assembled in a portfolio, thus diversifying risk and sharing the costs. UNEP estimates that this portfolio approach would reduce the costs per project by 16% for a portfolio of two projects, and by 31% for a portfolio of 10 projects. Such a portfolio would have a complex risk profile, comparable with those increasingly used by investors in small on-grid power plants. It would require careful management in order to prevent any potential drawbacks associated with bundling the risk profiles of individual projects.¹⁰⁵

Access to clean electricity through expanding the electricity grid

The remaining 40% of electricity-impooverished households can best be reached by grid expansion.¹⁰⁶ Here, the ambition to scale up clean power generation will need to be matched by electrifying communities and connecting households in a more equitable manner. The “last mile”, not only getting the grid to reach a community, but actually connecting each poor household to the grid, remains one of the greatest hurdles to equitable access.¹⁰⁷

Simple grid expansion does not guarantee immediate access to electricity for poor households due to high connection costs. When a town is electrified, evidence shows that wealthier households are able to connect long before poor ones, and it can take decades before the majority of houses are connected without financial support.¹⁰⁸

Ensuring equitable electricity tariffs is also critical in ensuring that clean power generation can reach those most in need. Subsidising electricity consumption will only support households already connected; subsidising and financing connection is needed to reach new households. For example, in Senegal connection costs have been incorporated into the monthly electricity bill to ensure that the high upfront cost of connection does not exclude new consumers.

Since individuals in most energy-poor households live on less than US\$2 a day,¹⁰⁹ subsidising consumption in the poorest households may also be necessary, even after connection. However, electricity consumption subsidies intended for the poor may end up going mostly to richer customers who use more electricity, as has happened in India.¹¹⁰ To address this, some countries have only subsidised the first increment of consumption. In Tunisia, and in many other countries, consumers who use less than 50 kWh of electricity per month pay a cheaper “lifeline tariff”.¹¹¹ In South Africa, very low levels of consumption are free, while those with high levels of consumption receive no subsidy. Ultimately, unconditional cash transfers may be even more effective in raising the income of poor households, once connected, so they can choose to consume electricity as part of a broader basket of goods and services that they value.

5. The role of international cooperation

Attracting the additional capital needed for both renewable energy and energy efficiency, and reducing the cost of that capital, will require a significant expansion of policies and instruments to improve these projects’ risk-return profiles. There are now major opportunities for international cooperative initiatives to scale up these efforts, building on the progress made to date.

Effective cooperation will require the successful alignment of goals and priorities across institutions. Many of the barriers to clean energy financing are common across countries, and many of the solutions will be shared as well. But common solutions are unlikely to arise unless there is agreement on the nature of the problem to be solved. Cooperation among governments, DFIs and other policy-responsive investors, such as sovereign wealth funds, offers the best chance to shift and mobilise the US\$1 trillion in annual investment needed for a low-carbon energy system. These institutions will need to collaborate with private-sector investors to achieve a goal of this size.

While many of the issues in mobilising finance are common across countries, there are also important local differences that warrant regionally specific approaches. For example, in an emerging economy with high debt costs, typical policy instruments for supporting clean energy will be more expensive, and less effective, unless the cost of debt can be addressed.¹¹² Similarly, the clean energy financing challenge differs significantly in countries where national development banks or sovereign wealth funds are major sources of capital for infrastructure. Given this regional variation, it would be valuable for the next wave of international cooperation to be focused at the level of regions and large countries. New and expanded regional initiatives could serve as a forum for developing projects, identifying and allocating risks, bringing together public and private finance sources, and designing policy frameworks optimised for local markets and investment potential.

DFIs, including both national and multilateral development banks, are particularly well equipped to lead this collaboration. DFIs operate at a scale that few other actors can match, and they have experience playing many roles in infrastructure financing, including making direct loans, creating targeted risk mitigation instruments, and providing technical assistance. They are well connected with public- and private-sector actors, both within and across regions, and they can draw on their own capital to meet specific needs.

Five key forms of cooperation need to be scaled up to meet the clean energy financing challenge – convening, risk mitigation, standardisation, technical assistance for project development, and policy support. There is existing activity in each area, including some very successful current initiatives and promising new ones, but these activities require greater coordination and focus, as well as concerted expansion, over the next few years.

5.1 CONVENING INITIATIVES

Closing the clean energy financing gap will require public and private institutions across the financial system to communicate and share best practices and innovative new instruments and approaches. Different approaches will be required across countries and regions, given the different financing environments and unique set of risks for clean energy projects in each market.

Cooperation among governments, DFIs and private-sector actors can also be a forum for innovative ideas that might be too risky for one institution to take on alone. Several DFIs participate in the newly launched Global Innovation Lab for Climate Finance, where they cooperate with donor governments and representatives from the private sector to explore and test innovative ideas for climate finance instruments. The aim is to steer finance – in the range of multiple billions of dollars – towards climate mitigation and adaptation projects in developing countries.¹¹³ Another example is the UNEP Finance Initiative, a partnership

between UNEP and over 200 financial institutions, which provides a forum for discussion, sharing of best practices and research, leading to new standards, principles and tools.¹¹⁴ At the same time the new Sustainable Energy Marketplace of the International Renewable Energy Agency (IRENA) is bringing together project owners, financiers, governments and service providers in an online marketplace to make investment opportunities, financing sources and other relevant market players visible, enhance interaction between these, and to support the initiation, development and financing of renewable energy projects.¹¹⁵

5.2 RISK MITIGATION INITIATIVES

A common collaborative platform can be an opportunity to find creative solutions to mitigate and hedge risk across different stakeholders – including those that may not have existing relationships with each other. DFIs, national governments, commercial banks, institutional investors and other private investors all have different priorities and risk appetites; by working together, they can mitigate and allocate risks effectively to achieve more efficient, lower-cost financing for all components of a low-carbon energy system. Collaboration among all of these actors can not only help to increase collective ambition and commitment to financing clean energy, but can also ensure that this finance is channelled in the most efficient ways possible, so that the transition to low-carbon energy can happen at the lowest possible cost.

DFIs have a vital role in mitigating risk, which is already a focus of their work; in many cases, these institutions take on the risks that no other actor is willing or able to take. In addition to expanding the risk mitigation instruments they offer, DFIs can also expand the use of their balance sheets for direct investment in clean energy projects, especially in countries where private finance is not forthcoming.

Cooperation among leading investors, governments and DFIs is needed to explore options for expanding institutional investment in clean energy. New investment vehicles have the potential to help unlock institutional investment by addressing barriers relating to liquidity and transaction costs. Collaboration among governments, DFIs, investors and project developers could help investors to assemble portfolios to meet their risk-return and liquidity requirements, as well as support development of the stable long-term policy and contracting arrangements that make clean energy a better fit for institutional investment. Mobilising greater institutional investment in renewable energy will also require collaboration with energy market regulators and financial regulators.

This cooperation has the potential to create new clean energy investment vehicles tailored to the needs of investors, which can eventually attract capital from a broad base of institutional investors, whether they have environmental sustainability goals or not. There is a further role for coalitions of governments, regulators and financial institutions (including DFIs) to help to bring markets for clean energy investment vehicles to maturity.

It is similarly important for governments and DFIs to engage with commercial banks, project developers and other private-sector actors, so that all parties can understand and respond to each other's needs. An example of this engagement is Bank of America's Catalytic Finance Initiative, partnering with DFIs and institutional investors to develop new financing structures that reduce investment risk for clean energy projects.¹¹⁶ The bank is committing US\$1 billion in capital to these investment structures and de-risking tools.

5.3 STANDARDISATION INITIATIVES

Standardisation – of data, methods of measurement, projects and qualifications – is a crucial step towards reducing transaction costs and enabling large-scale financing. Standardisation lowers transaction costs for both borrowers and lenders – particularly important for energy efficiency, where transaction costs are often prohibitively high. Standardisation is also critical to enabling securitisation, which increases liquidity and brings access to many more potential investors. Certification from an outside party can offer greater confidence to both investors and DFIs that the bond is supporting low-carbon activities and delivering emission reductions.¹¹⁷

Multilateral development banks can be important drivers of global standardisation as well as financing, thanks to their uniquely interconnected position in the global economy. The International Development Finance Club (IDFC), comprised of 20 major and sub-regional national development banks, is already working with the MDBs to develop and use a common set of principles for tracking of climate mitigation finance.¹¹⁸ This is essential in order to understand how much and what kind of financing is flowing, from and to which countries, and to begin to assess the efficacy of policies aimed at scaling up international public finance and leveraging private finance. A smaller group of major MDBs issues joint reports on their climate finance activities in developing countries.¹¹⁹ The IDFC shares knowledge among its member development banks on targeted investment topics, including

renewable energy, energy efficiency and sustainable infrastructure, in order to improve their collective and individual efforts in these areas. This group also carries out a mapping exercise to provide an integrated view of members' investments in clean energy and other "green finance", focusing on developing countries.¹²⁰

5.4 TECHNICAL ASSISTANCE FOR PROJECT DEVELOPMENT

A lack of financially viable, bankable projects has been identified as the main constraint to increasing low-carbon investments by DFIs and development banks.¹²¹ There is an important role for governments in establishing forward pipelines of projects to reduce market risk to developers and manufacturers. In high-income and some middle-income countries, a pipeline of projects will flow from a stable regulatory and policy framework that offers sufficient support for clean energy. However, in many low-income and middle-income countries, where less mature capital markets and banking sectors make clean energy more costly and riskier, more direct government action is required to establish a project pipeline. In addition, national governments and development banks have to balance clean energy alongside other priorities such as job creation, which can increase costs. For example, local content requirements for renewable energy investments have been shown to increase costs and make cross-border investment more difficult.¹²² Analysis conducted by the OECD found that, among a range of policy indicators, the one most strongly correlated with increased cross-border financing was renewable energy support policies in the destination country.¹²³

Providing technical assistance to help to develop a pipeline of projects is an important complement to financing, and offers an opportunity for DFIs to collaborate with national governments and private finance providers. EBRD's model of financing for energy efficiency, where financing is paired with technical assistance to develop a high-quality pipeline of projects, is one example demonstrating the value of this approach. IEA's Climate Technology Initiative Private Financing Advisory Network (CTI PFAN) provides another example. The network selects clean energy projects with high potential and assists them during the development and investment pitch phase in order to improve their chances of obtaining funding.¹²⁴ The Global Infrastructure Facility under the auspices of the World Bank brings together institutional investors, multilateral development banks and donor countries in order to assist developing countries in overcoming the infrastructure financing gap and in building a global pipeline of infrastructure investments.¹²⁵ IRENA's Sustainable Energy Marketplace, mentioned above, is an example of a tool to support project development by providing technical assistance at a project and market level.

5.5 SUPPORTIVE NATIONAL POLICY FRAMEWORKS

International cooperation also has a role to play in improving the regulatory and policy environments for clean energy investments at the national level, which would also facilitate the development of a project pipeline. Over the last few years, many countries have begun to redirect their energy policy towards lower-carbon systems. But obstacles continue to stand in the way of faster progress.

Policy actions can improve the investment environment for clean energy – for example, by ensuring non-discriminatory treatment of international investment; designing open and transparent procurement processes; improving the governance and regulatory quality of electricity markets; and coordinating the development of the electricity grid with deployment of clean energy generation.¹²⁶ Institutional capacity-building is also often needed. Other important mechanisms include: stable clean energy subsidies and power purchase agreements that provide long-term revenue certainty for projects; designing electricity markets that do not expose low-carbon energy to fossil fuel price risk; reforming energy utilities and improving their credit ratings; and streamlining permissions and approval processes.¹²⁷

International collaboration among governments, DFIs and private finance providers can help to disseminate best practices in clean energy policy more quickly around the world, and allow DFIs and national governments to work together to arrive at the best possible risk-return profile for the projects they support. A number of such forums already exist. The World Bank has recently launched a policy platform called Readiness for Investment in Sustainable Energy (RISE), which provides indicators assessing a country's policy and regulatory environment for sustainable energy investments. These indicators will allow decision-makers to identify opportunities for change at a national level.¹²⁸ The OECD, with collaboration from the World Bank, IEA and the United Nations Development Programme (UNDP), has developed a tool to help governments improve policy and market conditions to better foster investment in clean energy infrastructure.¹²⁹ The G20 Climate Finance Study Group provided a toolbox of actions that ministers and leaders could undertake in order to mobilise climate finance. The new G20 Green Finance Study Group, established under China's 2016 G20 Presidency and co-led by the Bank of England and the People's Bank of China, will also provide critical insights and recommendations to member governments.¹³⁰

Box 4

The Africa Clean Energy Corridor (ACEC)

Fossil fuels dominate Africa's electricity production, leaving the continent's vast renewable energy potential largely untapped. Although the region has seen a 48% increase in its total renewable energy capacity since 2000, Africa only uses 34.3 GW of renewable energy today.¹³¹ Sub-Saharan Africa utilises about 10% of its technical potential for hydropower,¹³² while across the continent as a whole the installed wind power amounts to only 2.5 GW, far below its estimated potential of 1,300 GW.¹³³ Estimates place geothermal capacity at 7–15 GW, while the largest potential is for solar at 10,000 GW.¹³⁴ IRENA estimates that Ethiopia, for example, has the potential to produce more than 1,050 GW of wind, hydro and geothermal power, although its 2011 national master plan aims for only 12GW by 2030.¹³⁵ The rapidly falling costs of renewable energies give countries in the region the opportunity to capitalise on their renewable energy potential.

In order to accelerate the expansion of renewable electricity production in the Southern African and Eastern Africa power pools regions, IRENA, in consultation with stakeholders from these regions, has developed an action agenda for an Africa Clean Energy Corridor (ACEC) linking the national markets of 22 countries across the two regions. The corridor builds upon ongoing initiatives in the region, including a transmission grid linking the two power pools, which is a priority project under the African Union's Programme for Infrastructure Development in Africa (PIDA), to be completed by 2020.¹³⁶

The corridor's action agenda was formally endorsed by ministers and heads of delegation from the power pool countries at the IRENA Assembly in January 2014.¹³⁷ Under the action agenda, zones of project opportunity areas with a high resource potential for renewable power development have been identified, which can facilitate coordinated planning for cost-effective renewable energy resources and inform long-term transmission planning. The ACEC aims to create enabling environments for renewable energy investment and to develop skills and strengthen institutions to plan, operate, maintain and govern power grids and markets with higher shares of renewable electricity generation.

To support the acceleration of renewable energy development in Africa, the ACEC also aims at reforming local power markets to ensure a level playing field for renewable energies and the correct pricing signals.

This approach will allow consumers in neighbouring countries to benefit from economies of scale. IRENA estimates that the initiative could catalyse the investments needed to meet as much as 50% of power demand in the two regions by 2030 and cut annual CO₂ emissions by 310 Mt compared with a business-as-usual scenario.¹³⁸

5.6 STRENGTHENING THE MDBS

In scaling up these five forms of international cooperation, multilateral and national DFIs have the potential to bring together private and public players to develop new low-carbon energy projects and to reduce the costs of capital for them. At the same time DFIs, and the MDBs in particular, could direct more of their own investments towards low-carbon priorities. In their paper for the New Climate Economy, the Brookings Institution and the LSE, Bhattacharya, Oppenheim and Stern estimate that MDBs would need to increase their overall infrastructure lending five-fold over the next decade, from the current US\$30–40 billion a year to around US\$200 billion a year, in order to help meet overall infrastructure financing needs.¹³⁹ Given that MDBs can leverage up to 20 times the amount of money they invest (depending on the instrument used, the region and the purpose of the investment), such an increase would have a catalytic effect on private sector investment.¹⁴⁰

Increasing the MDBs' infrastructure lending could be achieved in a number of ways. First, it could come from a shift in the priority given to sustainable infrastructure within the MDBs' lending portfolios, as the importance of such investment is increasingly recognised. Second, it could be achieved by an increase in the gearing ratios used by the MDBs of loans to subscribed capital. MDBs are extremely secure banking institutions whose 'call-in capital' from their country shareholders has never been called-upon, and whose bonds are held not just by private investors but central banks and official institutions. Even with gearing ratios of 1:1, the World Bank can mobilise US\$28 from international markets for every dollar of paid-in capital.¹⁴¹ Higher gearing ratios could significantly increase the MDBs' ability to leverage private capital. Third, MDBs could seek new call-in and paid-in capital from their shareholders. For developed countries seeking to meet their climate finance obligations, the high leverage achieved by MDBs makes this a potentially attractive option.

Increasing MDB infrastructure lending will require more than an expansion of their capital commitments. In many cases there are opportunities to make their decision-making and governance frameworks more effective and flexible. Projects carried out by

MDBs can take almost twice as long to complete as projects carried out in the private sector.¹⁴² While the additional scrutiny and standards necessarily required of public institutions is part of the cause of this, procedures and requirements are in some cases overly cumbersome and could be reformed.

In addition, cooperation among MDBs and other actors could be made more efficient. The evidence suggests that in many countries there is a lack of coordination among national and international climate finance actors, which is further aggravated by their increasing number. A recent study for example highlighted a lack of coordination among climate finance providers in countries including Brazil, Costa Rica, Indonesia, Mexico and Peru, resulting in “overlapping objectives and dispersion of efforts”. Better coordination would require a number of improvements, including joint preparation of national climate strategies, project pipelines and investment plans.¹⁴³

6. Conclusion and recommendations

Meeting international goals on access to energy and tackling climate change will require a rapid expansion of financing for clean power supply and (non-transport) energy efficiency – to reach at least US\$1 trillion per year by 2030. This target is achievable, but it will require a concerted effort to shift and scale up public capital commitments and, even more importantly, to mobilise private capital. There are many promising instruments and initiatives already available, but they need to be scaled up to match the clean energy financing challenge.

Most important is for collaboration among diverse stakeholders – including DFIs, governments and regulators, institutional investors, private finance providers, project developers and others – to develop solutions that meet the needs of a diversity of stakeholders. There is a central role for DFIs in convening stakeholders, mitigating risk, supporting the development of more projects ready for investment, and supporting effective policy that reduces risk for clean energy investments.

In order to scale their collaboration, improve the risk-return profile of and facilitate more investment in clean energy projects, DFIs should:

- Increase their capital commitments to sustainable infrastructure, through re-prioritisation, higher gearing ratios, and where possible an increase in paid-in and callable capital from their shareholders.
- Focus on scaling up the use of instruments that can reduce costs and make the risk-return profile of clean energy projects a better fit for investors.
- Build on and coordinate existing collaborative initiatives that convene public- and private-sector actors, mitigate and reallocate risks, achieve standardisation to facilitate investment, improve government policy frameworks, and provide technical assistance to develop projects and build capacity within local financial intermediaries.
- Focus at the level of regions or large countries, in order to account for the substantial variation in markets and policy around the world and to ensure that solutions reflect local needs and priorities.
- Significantly increase financing for energy access, including the establishment of a global fund for connectivity focused on reaching households and communities without energy access by lowering the financial barriers to distributed energy technologies.
- Phase out the financing of high-carbon energy systems, except where there is a clear development rationale without viable alternatives.

National governments should commit to clear, stable policy and regulatory frameworks that properly reward clean energy, reduce risks and support market integration.

The private sector should work with governments and regulators to scale up the use of finance and industry models that lower financing costs for low-carbon energy and energy efficiency investment, particularly for institutional investors.

The global emissions reduction potential of these actions would be significant. Analysis produced for the report *Seizing the Global Opportunity: Partnerships for Better Growth, and a Better Climate* and for this paper estimates that achieving US\$1 trillion of annual investments in clean power and (non-transport) energy efficiency by 2030 – under conservative scenarios for a gradual increase in investment flows – could avoid between 5.5 and 7.5 Gt CO₂e in annual emissions by 2030.¹⁴⁴

ENDNOTES

- 1 IRENA, 2014. REmap 2030. A Renewable Energy Roadmap. Available at: http://www.irena.org/remap/IRENA_REmap_Report_June_2014.pdf.
 - 2 1.1 billion people lacked access to electricity and 2.9 billion people did not have access to non-solid fuels for cooking in 2012. The World Bank, 2015. *Global Tracking Framework 2015*. The World Bank Group, Washington DC. Available at: <http://trackingenergy4all.worldbank.org/reports>.
 - 3 IEA, 2014. *World Energy Outlook 2014*. International Energy Agency, Paris. Available at: <http://www.worldenergyoutlook.org/publications/weo-2014/>.
 - 4 The World Bank, 2012. Energy use (kg of oil equivalent per capita). *World Development Indicators*. Available at: <http://data.worldbank.org/indicator/EG.USE.PCAP.KG.OE>. The data refer to energy consumption and pollution in 2011.
 - 5 BP, 2013. *BP Statistical Review of World Energy* June 2013. Available at: <http://www.bp.com/statisticalreview>.
 - 6 Kharas, H. and Gertz, G., 2010. The New Global Middle Class: A Cross-Over from West to East. Wolfensohn Center for Development at Brookings. Available at: http://www.brookings.edu/~media/research/files/papers/2010/3/china%20middle%20class%20kharas/03_china_middle_class_kharas.pdf.
 - 7 IEA, 2014. *World Energy Outlook 2014*. International Energy Agency, Paris. Available at: <http://www.worldenergyoutlook.org/publications/weo-2014/>.
 - 8 UN, 2014. *World Urbanization Prospects: The 2014 Revision*. United Nations Department of Economic and Social Affairs, Population Division, New York. Available at: <http://esa.un.org/unpd/wup/>.
 - 9 Sustainable Energy for All, 2015. Progress Toward Sustainable Energy: Global Tracking Framework 2015. Available at: <http://trackingenergy4all.worldbank.org/>.
 - 10 IEA, 2011. *World Energy Outlook 2011*, Energy for All.
 - 11 WHO, 2014. *Burden of Disease from Ambient Air Pollution for 2012*. World Health Organization, Geneva. Available at: http://www.who.int/phe/health_topics/outdoorair/databases/FINAL_HAP_AAP_BoD_24March2014.pdf.
 - 12 WHO, 2014. *Burden of Disease from Ambient Air Pollution for 2012*.
 - 13 Holland, M., 2014. *Cost-benefit Analysis of Final Policy Scenarios for the EU Clean Air Package*. Version 2, corresponding to IIASA TSAP Report #11, Version 1. Ecometrics Research and Consulting, Reading, UK. Available at: http://www.iiasa.ac.at/web/home/research/researchPrograms/MitigationofAirPollutionandGreenhousegases/TSAP_CBA_corresponding_to_IIASA11_v2.pdf. The numbers also include working days lost in Ukraine and Russia.
 - 14 IEA, 2014. *World Energy Outlook 2014*.
 - 15 See Chapter 4 in *Better Growth, Better Climate*.
 - 16 IEA, 2014. *World Energy Investment Outlook 2014*. International Energy Agency, Paris. Available at: <http://www.iea.org/publications/freepublications/publication/WEIO2014.pdf>.
 - 17 IEA, 2014. *World Energy Outlook 2014*.
 - 18 McCrone, A., Moslener, U., Usher, E., Grüning, C. and Sonntag-O'Brien, V. (eds.), 2015. *Global Trends in Renewable Energy Investment 2015: Dataset*. Frankfurt School-UNEP Collaborating Centre for Climate & Sustainable Energy Finance, United Nations Environment Programme, and Bloomberg New Energy Finance. Available at: <http://fs-unep-centre.org/publications/global-trends-renewable-energy-investment-2015>.
- Lantz, E., Hand, M. and Wisser, R., 2012. *The Past and Future Cost of Wind Energy*. National Renewable Energy Laboratory. Available at: <http://www.nrel.gov/docs/fy12osti/54526.pdf>.
- Staff calculations.
- 19 Module costs: IEA, 2014. *Energy Technology Perspectives 2014*. International Energy Agency, Paris. Available at: <http://www.iea.org/etp/etp2014/>.

- Utility-scale PV costs: Liebreich, M., 2014. Keynote address, Bloomberg New Energy Finance Summit 2014, New York, 8 April. Available at: <http://about.bnef.com/video/summit-2014-michael-liebreich/>.
- 20 McCrone et al., 2015. *Global Trends in Renewable Energy Investment 2015*.
- 21 BNEF, 2016. Available at: <http://about.bnef.com/content/uploads/sites/4/2016/01/BNEF-2015-Annual-Investment-Numbers-FINAL.pdf>.
- 22 Liebreich, M., 2015. State of the Industry Keynote. Presented at the Bloomberg New Energy Finance Annual Summit, New York, 14 April. Available at: <http://about.bnef.com/presentations/liebreich-state-industry-keynote/>.
- 23 See Chapter 4 in *Better Growth, Better Climate*. Based on IEA, 2013. *Energy Efficiency Market Report 2013 – Market Trends and Medium Term Prospects*. International Energy Agency, Paris. Available at: https://www.iea.org/publications/freepublications/publication/EEMR2013_free.pdf.
- 24 For further discussion of this topic, see: Bishop, R., 2015. *Raising Energy Efficiency Standards to the Global Best*. A New Climate Economy contributing paper for *Seizing the Global Opportunity: Partnerships for Better Growth and a Better Climate*. Available at: <http://newclimateeconomy.report/misc/working-papers>.
- 25 Smith, N., 2015. Clean Energy Revolution is Ahead of Schedule. Bloomberg View, 8 April. Available at: <http://www.bloombergvew.com/articles/2015-04-08/clean-energy-revolution-is-way-ahead-of-schedule>.
- 26 Heinen, S., Elzinga, D., Kim, S.-K. and Ikeda, Y., 2011. *Impact of Smart Grid Technologies on Peak Load to 2050*. International Energy Agency, Paris. Available at: https://www.iea.org/publications/freepublications/publication/smart_grid_peak_load.pdf.
- 27 Tesla Motors, n.d. Tesla Energy press kit. Available at: <http://www.teslamotors.com/presskit/teslaenergy> [accessed 29 July 2015].
- See also: Naam, R., 2015. Why energy storage is about to get big – and cheap. Blog post, 14 April. Available at: <http://rameznaam.com/2015/04/14/energy-storage-about-to-get-big-and-cheap/>.
- 28 Smith, N., 2015. Clean Energy Revolution is Ahead of Schedule.
- 29 Neslen, A., 2015. Poland's shale gas revolution evaporates in face of environmental protests. *The Guardian*, 12 January. Available at: <http://www.theguardian.com/environment/2015/jan/12/polands-shale-gas-revolution-evaporates-in-face-of-environmental-protests>.
- 30 IEA, 2011. *World Energy Outlook 2011: Are We Entering a Golden Age of Gas?* International Energy Agency, Paris. Available at: <http://www.worldenergyoutlook.org/goldenageofgas/>.
- 31 Lazarus, M., Tempest, K., Klevnäs, P. and Korsbakken, J.I., 2015. *Natural Gas: Guardrails for a Potential Climate Bridge*. New Climate Economy contributing paper. Stockholm Environment Institute, Stockholm, Sweden, and Seattle, WA, US. Available at: <http://newclimateeconomy.report>.
- 32 Granoff, I., Pickard, S., Doczi, J. Calow, R., Hou, Z. and D'Alañon V., 2015. *Can fracking green China's growth? Opportunities, risks and recommendations for unconventional gas in China's environmental transformation*. The Overseas Development Institute, London. Available at: <http://www.odi.org/publications/9297-can-fracking-green-chinas-growth>.
- 33 IEA, 2014. *World Energy Investment Outlook 2014*. Note that even in the IEA's New Policies Scenario, investment in all these categories would also rise, but much more slowly. Renewable power investment rises by 50% more in the 450 Scenario than in the New Policies Scenario, while investment in nuclear power is 63% higher.
- 34 Ibid. The IEA notes that the nature of energy efficiency investments – involving numerous actors across different sectors – makes them difficult to track, and others have estimated the value of the current global efficiency market at US\$124–712 billion per year, including investments in transport efficiency. As with renewables, energy efficiency investment would also rise in the New Policies Scenario, but is 69% higher in the 450 Scenario.
- 35 Ibid.
- 36 See Chapter 4 in *Better Growth, Better Climate*.
- 37 Hamilton, K., Brahmbhatt, M., Bianco, N. and Liu, J. M., forthcoming. *Co-Benefits and Climate Action*. New Climate Economy Contributing Paper. World Resources Institute, Washington, DC.
- 38 See Chapter 1 in *Better Growth, Better Climate*.
- 39 Morales, A., 2013. EBRD Scraps Most Financing for Coal Power Plants. *Bloomberg*, 10 December. Available at: <http://www.bloomberg.com/news/articles/2013-12-10/ebrd-scraps-most-financing-for-coal-power-plants>.

- Drajem, M., 2013. Obama's Overseas Coal Pledge to Curb Ex-Im Bank Financing. *Bloomberg*, 25 June. Available at: <http://www.bloomberg.com/news/articles/2013-06-25/obama-s-overseas-coal-pledge-to-curb-ex-im-bank-financing>.
- 40 Ministry of Finance of Norway, 2015. New Climate Criterion for the Exclusion of Companies from the Government Pension Fund Global (GPF). Press release, 10 April. Available at: <https://www.regjeringen.no/en/aktuelt/nytt-klimakriterium-for-utelukkelse-av-selskaper/id2405205/>.
- 41 Reuters, 2015. Big French banks spurn contested Australian coal mine projects. 8 April. Available at: <http://www.reuters.com/article/2015/04/08/us-australia-coal-france-banks-idUSKBN0MZ1EG20150408>.
- Doom, J., 2015. NextEra Plans to Buy Florida Coal-Power Plant Just to Close It. *Bloomberg*, 6 March. Available at: <http://www.bloomberg.com/news/articles/2015-03-06/nextera-plans-to-buy-florida-coal-power-plant-just-to-close-it>.
- 42 OECD, 2014. *2014 OECD Ministerial Statement on Climate Change*. Meeting of the OECD Council at Ministerial Level, Paris, 6–7 May. Available at: <http://www.oecd.org/mcm/MCM-2014-Statement-Climate-Change.pdf>.
- 43 OECD, 2016. February 2016 Arrangement on Officially Supported Export Credits. Available at: <http://www.oecd.org/trade/exportcredits/theexportcreditsarrangementtext.htm>.
- 44 Goldenberg, S., 2015. UN green climate fund can be spent on coal-fired power generation. *The Guardian*, 29 March. Available at: <http://www.theguardian.com/environment/2015/mar/29/un-green-climate-fund-can-be-spent-on-coal-fired-power-generation>.
- 45 The members are Chile, Denmark, Finland, India, Mexico, South Africa, Spain and the United States. See: <http://www.21stcenturypower.org/>.
- 46 McCrone et al., 2015. *Global Trends in Renewable Energy Investment 2015*.
- 47 IEA, 2014. *World Energy Investment Outlook 2014*.
- 48 McCrone et al., 2015. *Global Trends in Renewable Energy Investment 2015*.
- 49 The World Bank, 2015. *Global Economic Prospects: Having Fiscal Space and Using It*. Available at: <http://www.worldbank.org/en/publication/global-economic-prospects>.
- 50 IMF, 2014. Chapter 3: Is It Time for an Infrastructure Push? The Macroeconomic Effects of Public Investment. In: *World Economic Outlook 2014*. International Monetary Fund, Washington, DC. Available at: <http://www.imf.org/external/pubs/ft/weo/2014/02/pdf/c3.pdf>.
- 51 CPI, 2014. *The Global Landscape of Climate Finance 2014*. Climate Policy Initiative, San Francisco. Available at: <http://climatepolicyinitiative.org/publication/global-landscape-of-climate-finance-2014/>. Note that this total includes funding for adaptation, transport and other climate-related investments not within the scope of this section.
- 52 BNEF, 2013. *Development Banks: Breaking the US\$100 billion a year barrier*. White paper: Bloomberg New Energy Finance, New York. Available at: <http://about.bnef.com/white-papers/development-banks-breaking-the-100bn-a-year-barrier/>.
- 53 Morris, S. and Gleave, M., 2015. *The World Bank at 75*. Center for Global Development Policy Paper 58. The World Bank, Washington, DC. Available at: <http://www.cgdev.org/publication/world-bank-75>.
- 54 CPI, 2014. *The Global Landscape of Climate Finance 2014*.
- 55 AfDB, ADB, EBRD, EIB, IDB, IFC and World Bank, 2014. *Joint Report on MDB Climate Finance 2013*. African Development Bank, Asian Development Bank, European Bank for Reconstruction and Development, European Investment Bank, Inter-American Development Bank, International Finance Corporation and World Bank Group. Available at: http://www.afdb.org/fileadmin/uploads/afdb/Documents/Publications/Joint_Report_on_MDB_Climate_Finance_2013_-_16_09_2014.pdf.
- 56 See: <http://www.climateinvestmentfunds.org/cif/aboutus>.
- 57 CPI, 2014. *Roadmap to a Low Carbon Electricity System in the U.S. and Europe*. Climate Policy Initiative, San Francisco. Available at: <http://climatepolicyinitiative.org/publication/roadmap-to-a-low-carbon-electricity-system-in-the-u-s-and-europe/>.
- 58 See Chapter 6 in *Better Growth, Better Climate*.
- See also: Climate Policy Initiative, 2014. *Roadmap to a Low Carbon Electricity System in the U.S. and Europe*. Available at: <http://climatepolicyinitiative.org/publication/roadmap-to-a-low-carbon-electricity-system-in-the-u-s-and-europe/>.

⁵⁹ CPI, 2014. *Finance Mechanisms for Lowering the Cost of Renewable Energy in Rapidly Developing Countries*. Climate Policy Initiative, San Francisco. Available at: <http://climatepolicyinitiative.org/publication/finance-mechanisms-for-lowering-the-cost-of-renewable-energy-in-rapidly-developing-countries/>.

⁶⁰ CPI, 2013. *The Challenge of Institutional Investment in Renewable Energy*. Climate Policy Initiative, San Francisco. Available at: <http://climatepolicyinitiative.org/publication/the-challenge-of-institutional-investment-in-renewable-energy/>. By some measures as much as US\$92 trillion, depending on how the category is defined.

⁶¹ *ibid.*

This number represents an estimate of assets under management in OECD member countries as of 2010. This figure aggregates total assets managed by pension funds, insurance companies, investment funds and other forms of institutional savings including foundations and endowment funds, non-pension fund money managed by banks, private investment partnership and other forms of institutional investors. It adjusts for double-counting of assets managed by pension funds and insurance companies that are invested in mutual funds. Updated estimates are not available for all categories of investors but would increase the total by at least US\$5 trillion.

OECD, 2014. *Annual Survey of Large Pension Funds and Public Pension Reserve Funds*. Organisation for Economic Co-operation and Development, Paris. Available at: http://www.oecd.org/daf/fin/private-pensions/2014_Large_Pension_Funds_Survey.pdf.

⁶² Kaminker, C. and Stewart, S., 2012. *The Role of Institutional Investors in Financing Clean Energy*. OECD Working Papers on Finance, Insurance and Private Pensions, No. 23. Organisation for Economic Co-operation and Development, Paris. Available at: http://www.oecd.org/pensions/WP_23_TheRoleOfInstitutionalInvestorsInFinancingCleanEnergy.pdf.

⁶³ The list is being constantly updated, the total investment value as of September 2014. Institutional Investors Group on Climate Change, 2014. *Low Carbon Investment Registry Report*. Available at: <http://www.iigcc.org/publications/publication/low-carbon-investment-registry-report>.

⁶⁴ CPI, 2013. *The Challenge of Institutional Investment in Renewable Energy*.

Kaminker and Stewart, 2012. *The Role of Institutional Investors in Financing Clean Energy*.

⁶⁵ CPI analysis based on Preqin Infrastructure database and institutional investor publications.

⁶⁶ World Economic Forum, 2014. *Infrastructure Investment Policy Blueprint*. Available at: <http://www.weforum.org/reports/infrastructure-investment-policy-blueprint>.

⁶⁷ See <http://www.financeforresilience.com/>.

⁶⁸ Ceres, n.d. *Clean Trillion: Closing the Clean Energy Investment Gap*. Available at: <http://www.ceres.org/issues/clean-trillion> [accessed 28 May 2015].

Note that the “clean trillion” discussed by Ceres is different from the US\$1 trillion discussed in this chapter. The “clean trillion” referred to by Ceres is based on IEA’s estimate of the difference in total energy-related investment from 2014 to 2050 in a low-carbon scenario compared with a high-carbon scenario, based on IEA’s *Energy Technology Perspectives 2012*.

⁶⁹ Bank of America, 2014. *Bank of America Announces \$10 Billion Catalytic Finance Initiative to Accelerate Clean Energy Investments that Reduce Carbon Emissions*. Press release, 23 September. Available at: <http://newsroom.bankofamerica.com/press-releases/corporate-and-investment-banking-sales-and-trading-treasury-services/bank-america-ann>.

Citi, n.d. *Environmental Finance*. Available at: <http://www.citigroup.com/citi/environment/opportunities.htm> [accessed 4 June 2015].

Investor Platform on Climate Change, n.d.. Available at <http://investorsonclimatechange.org> (accessed 18 January 2016)

⁷⁰ CPI, 2014. *Roadmap to a Low Carbon Electricity System in the U.S. and Europe*.

⁷¹ Ceres, 2014. *Investing in the Clean Trillion: Closing the Clean Energy Investment Gap*. Ceres, Boston, MA. Available at: <http://www.ceres.org/resources/reports/investing-in-the-clean-trillion-closing-the-clean-energy-investment-gap/view>.

⁷² For further discussion, see: Rydger, J., 2015. *Implementing Effective Carbon Pricing*. A New Climate Economy contributing paper for *Seizing the Global Opportunity: Partnerships for Better Growth and a Better Climate*. Available at: <http://newclimateeconomy.report/misc/working-papers>.

⁷³ McCrone, A. et al., 2015. *Global Trends in Renewable Energy Investment 2015*.

- 74 CPI, 2013. *Risk Gaps*. Climate Policy Initiative, San Francisco. Available at: <http://climatepolicyinitiative.org/publication/risk-gaps/>.
- 75 OECD, 2015. *Mapping Channels to Mobilise Institutional Investment in Sustainable Energy*. Organisation for Economic Co-operation and Development, Paris. Available at: <http://dx.doi.org/10.1787/9789264224582-en>.
- 76 Climate Bonds Initiative, n.d. Explaining green bonds. Available at: <http://www.climatebonds.net/market/explaining-green-bonds> [accessed 6 May 2015].
- 77 Climate Bonds Initiative, n.d. History: Exploding growth in green bonds market. Available at: <http://www.climatebonds.net/market/history> [accessed 20 April 2015].
- Berger, L., 2014. What You Need to Know About How Clean Energy YieldCos Work. *Greentech Media*, 10 July 2014. Available at: <http://www.greentechmedia.com/articles/read/what-you-need-to-know-about-how-yieldcos-for-clean-energy-work>.
- 78 Climate Bonds Initiative, n.d. Standards. Available at: <http://www.climatebonds.net/standards> [accessed 29 July 2015].
- 79 ICMA, n.d. Available at: <http://www.icmagroup.org/Regulatory-Policy-and-Market-Practice/green-bonds/membership/> [accessed 18 January 2016] Membership number as of 6 January 2016.
- 80 Ceres Investor Network on Climate Risk, 2015. *A Statement of Investor Expectations for the Green Bond Market*. Available at: <http://www.ceres.org/files/investor-files/statement-of-investor-expectations-for-green-bonds>.
- 81 Calculations undertaken for this paper by Climate Policy Initiative staff, at the time of writing in 2015.
- 82 Goossens, E., 2015. SunEdison Plans Second Yieldco With Emerging Markets Focus. *Bloomberg*, 7 May. Available at: <http://www.bloomberg.com/news/articles/2015-05-07/sunedison-buys-757-megawatts-of-wind-solar-and-hydro-projects>.
- 83 CPI, 2014. *Roadmap to a Low Carbon Electricity System in the U.S. and Europe*.
- 84 CPI, 2015 (forthcoming). *Energy Efficiency Finance Framework*.
- 85 For further discussion on barriers to energy efficiency investments, see: Bishop, R., 2015. *Raising Energy Efficiency Standards to the Global Best*.
- 86 EFIG, 2015. *Energy Efficiency – the first fuel for the EU Economy*. Energy Efficiency Financial Institutions Group. Available at: http://www.unepfi.org/fileadmin/documents/EnergyEfficiency-Buildings_Industry_SMEs.pdf.
- 87 The Global Innovation Lab for Climate Finance, 2015. *Energy Savings Insurance*. Available at: <http://climatefinancelab.org/idea/insurance-for-energy-savings/>.
- 88 EBRD, n.d. Sustainable Energy Financing Facilities (SEFFs). European Bank for Reconstruction and Development. Available at: <http://www.ebrd.com/what-we-do/sectors-and-topics/sustainable-resources/seffs.html> [accessed 13 April 2015].
- 89 See: <http://www.ebrdseff.com/en/home.html>.
- Updated figures provided via communication from EBRD, 16 April 2015.
- 90 CleanTechnica, 2013. NREL: Soft Costs Now Largest Piece of Solar Installation Costs. 12 December. Available at: <http://cleantechnica.com/2013/12/12/nrel-soft-costs-now-largest-piece-solar-installation-costs/>.
- 91 CPI, 2013. *Improving Solar Policy: Lessons from the solar leasing boom in California*. Climate Policy Initiative, San Francisco. Available from: <http://climatepolicyinitiative.org/publication/improving-solar-policy-lessons-from-the-solar-leasing-boom-in-california/>.
- 92 Lombardi, M., 2014. In a 'Watershed' Deal, Securitization Comes to Commercial Efficiency. *Greentech Media*, 19 May. Available at: <http://www.greentechmedia.com/articles/read/the-first-known-commercial-efficiency-securitization>.
- 93 Environmental Defense Fund, n.d. Investor Confidence Project. Available at: <http://www.eepformance.org/> [accessed 21 April 2015].
- 94 IEA, 2011. *World Energy Outlook 2011*.
- 95 Sustainable Energy for All, 2015. Progress Toward Sustainable Energy: Global Tracking Framework 2015. Available at: <http://trackingenergy4all.worldbank.org/>.
- 96 The World Bank, 2015. *Global Tracking Framework 2015*. The World Bank Group, Washington DC. Available at: <http://trackingenergy4all.worldbank.org/reports>.
- 97 WHO, 2014. *Burden of disease from household air pollution for 2012*.

- ⁹⁸ See, for example: The World Bank, 2008. *The Welfare Impact of Rural Electrification: A Reassessment of the Costs and Benefits*. An IEG Impact Evaluation. The World Bank, Washington, DC. Available at: http://siteresources.worldbank.org/EXTRURELECT/Resources/full_doc.pdf.
- Peck, M., Gerebreg, E., Kruger, G., van der Merwe, A., Godakumbura, W. and Ahuja, R., 2008. Burns and fires from flammable non-electric domestic appliances: Part I. The scope of the problem. *Burns Journal*, 34(3). 303–311. DOI:10.1016/j.burns.2007.08.014.
- ⁹⁹ Africa Progress Panel, 2015. *Power, People, Planet: Seizing Africa's Energy and Climate Opportunities*, Africa Progress Report 2015. Available at: http://app-cdn.acwupload.co.uk/wp-content/uploads/2015/06/APP_REPORT_2015_FINAL_low1.pdf.
- World Bank, n.d. Development Indicators. Available at: <http://data.worldbank.org/indicator/SI.POV.2DAY>.
- ¹⁰⁰ IEA, 2011. *World Energy Outlook 2011*.
- ¹⁰¹ IEA, 2011. *World Energy Outlook 2011; Hogarth R and Granoff I (2015). Speaking truth to power: Why energy distribution, more than generation, is Africa's poverty reduction challenge*. Overseas Development Institute, London, UK. Available at: <http://www.odi.org/publications/9406-truth-power-energy-poverty-ambition-africa>.
- ¹⁰² USAID, 2016. *Power Africa Roadmap: A Guide to Reaching 30,000 Megawatts and 60 Million Connections*. USAID, Washington, DC.
- ¹⁰³ Africa Progress Panel, 2015. *Power, People, Planet: Seizing Africa's Energy and Climate Opportunities*, Africa Progress Report 2015. Available at: http://app-cdn.acwupload.co.uk/wp-content/uploads/2015/06/APP_REPORT_2015_FINAL_low1.pdf.
- ¹⁰⁴ IRENA, 2015. *Renewable Energy and Jobs: Annual Review 2015*. International Renewable Energy Agency, Masdar City. Available at: http://www.irena.org/DocumentDownloads/Publications/IRENA_RE_Jobs_Annual_Review_2015.pdf.
- ¹⁰⁵ UNEP, 2015. *Increasing Private Capital Investment into Energy Access: The Case for Mini-Grid Pooling Facilities*. United Nations Environment Programme. Available at: http://apps.unep.org/publications/pmtdocuments/-Increasing_private_capital_investment_into_energy_access__The_case_for_mini-grid_pooling_.pdf. UNEP puts forward three different types of structures for the pooling facility. All the designs suggested rely on an international cooperation of a multitude of stakeholders. Several of the stakeholders, including commercial banks, institutional investors, philanthropists, venture capitalists and development finance institutions, would provide debt and/or equity, the government would be responsible for the correct regulatory framework, while technology providers and installers would look after the technical side of mini-grids.
- ¹⁰⁶ Ibid.
- ¹⁰⁷ The World Bank, 2008. *The Welfare Impact of Rural Electrification*.
- ¹⁰⁸ The World Bank, 2008. *The Welfare Impact of Rural Electrification*.
- ¹⁰⁹ GEA, 2012. *Global Energy Assessment - Toward a Sustainable Future*. Cambridge University Press, Cambridge, UK and New York, NY, USA and the International Institute for Applied Systems Analysis, Laxenburg, Austria. Available at: <http://www.globalenergyassessment.org>.
- ¹¹⁰ Mayer, K., Banerjee, S.G. and Trimble, C., 2014. *Elite Capture: Subsidizing Electricity Use by Indian Households*. World Bank Studies, Washington, DC. Available at: <http://elibrary.worldbank.org/doi/abs/10.1596/978-1-4648-0412-0>.
- ¹¹¹ The World Bank, 2008. *The Welfare Impact of Rural Electrification*.
- ¹¹² CPI, 2014. *Finance Mechanisms for Lowering the Cost of Renewable Energy in Rapidly Developing Countries*.
- ¹¹³ See: <http://climatefinancelab.org/about/frequently-asked-questions/>.
- ¹¹⁴ See: <http://www.unepfi.org/about/>.
- ¹¹⁵ See: <http://www.irena.org/marketplace>.
- ¹¹⁶ Bank of America, 2014. Bank of America Announces \$10 Billion Catalytic Finance Initiative to Accelerate Clean Energy Investments That Reduce Carbon Emissions.
- ¹¹⁷ For example, the Investor Confidence Project's standardised certifications and knowledge-sharing for energy efficiency project developers are also valuable models to replicate – greater standardisation of technical knowledge among project developers can increase investor confidence and make more projects investable.
- ¹¹⁸ Forum Climate Finance, 2015. Editorial. Paris, 31st March. Available at: <http://climatefinanceforum.com/pro/fiche/quest.jsp?jsessionid=GdVJimqF-fidps4cz4hYFwI8.gI2?locale=1&pg=presentation>.
The World Bank, 2015. *Mobilizing the Billions and Trillions for Climate Finance*. The World Bank Group, Washington, DC. Available at: <http://www.worldbank.org/en/news/feature/2015/04/18/raising-trillions-for-climate-finance>.

The World Bank, 2015. *Developing Common Principles for Tracking Climate Finance*. The World Bank Group, Washington, DC. Available at: <http://www.worldbank.org/en/news/feature/2015/04/03/common-principles-for-tracking-climate-finance>.

119 European Investment Bank, 2014. *Joint Report on MDB Climate Finance 2013*. Available at: <http://www.eib.org/projects/documents/joint-report-on-mdb-climate-finance-2013.htm>.

120 See: <https://www.idfc.org/Our-Program/our-program.aspx>.

121 CPI, 2013. *The Role of Development Finance Institutions and Development Banks in Scaling Up Green and Climate Investments*. Climate Policy Initiative, San Francisco. Available at: <http://climatepolicyinitiative.org/wp-content/uploads/2014/04/CPI-Brief-for-DFI-DB-meeting.pdf>.

122 OECD, 2015. *Overcoming Barriers to International Investment in Clean Energy, Green Finance and Investment*. Organisation for Economic Co-operation and Development, Paris. Available at: <http://dx.doi.org/10.1787/9789264227064-en>.

123 Hašćic, I., Cárdenas, M., Jachnik, R., Silva, J. and Johnstone, N., 2015. *Public Interventions and Private Climate Finance Flows*. OECD Environment Working Papers, No. 80. Organisation for Economic Co-operation and Development, Paris. Available at: <http://dx.doi.org/10.1787/19970900>.

124 See: <http://www.cti-pfan.net/about>.

125 See: <http://www.worldbank.org/en/programs/global-Infrastructure-facility>.

126 For examples of supportive measures in the domestic arena, see: OECD, 2015. *Policy Guidance for Investment in Clean Energy Infrastructure: Expanding Access to Clean Energy for Green Growth and Development*. Organisation for Economic Co-operation and Development, Paris. Available at: <http://dx.doi.org/10.1787/9789264212664-en>.

OECD, 2015. *Overcoming Barriers to International Investment in Clean Energy, Green Finance and Investment*.

127 Varadarajan, U., Nelson, D., Pierpont, B. and Hervé-Mignucci, M., 2011. *The Impacts of Policy on the Financing of Renewable Projects: A Case Study Analysis*. Climate Policy Initiative, San Francisco. Available at: <http://climatepolicyinitiative.org/publication/the-impacts-of-policy-on-the-financing-of-renewable-projects-a-case-study-analysis/>.

See also: UNDP, 2015. *Derisking Renewable Energy Investment*. United Nations Development Programme. Available at: <http://www.undp.org/drei>.

128 See: <http://rise.worldbank.org/about-us>.

129 OECD, 2015. *Policy Guidance for Investment in Clean Energy Infrastructure*.

130 G20 Climate Finance Study Group, 2014. *Report to the Finance Ministers*. Available at: http://www.g20australia.org/official_resources/g20_climate_finance_study_group_report_ministers_2014.

131 IRENA, 2015. *Renewable Energy Capacity Statistics 2015*. International Renewable Energy Agency, Masdar City. Available at: http://www.irena.org/DocumentDownloads/Publications/IRENA_RE_Capacity_Statistics_2015.pdf.

132 IEA, 2014. *Africa Energy Outlook*. International Energy Agency, Paris. Available at: <https://www.iea.org/publications/freepublications/publication/africa-energy-outlook.html>.

133 IRENA, 2015. *Renewable Energy Capacity Statistics 2015*.

IEA, 2014. *Africa Energy Outlook*.

134 Africa Progress Panel, 2015. *Power, People, Planet: Seizing Africa's Energy and Climate Opportunities*.

135 IRENA, n.d. *Africa Clean Energy Corridor: Concept Overview*. International Renewable Energy Agency, Masdar City. Available at: http://irena.org/DocumentDownloads/events/2013/July/Africa%20CEC%20session%20IRENA_Singh_220613.pdf [accessed 29 July 2015].

136 IRENA, 2014. *Analysis of Infrastructure for Renewable Power in Africa*. International Renewable Energy Agency, Masdar City. Available at: <http://www.irena.org/DocumentDownloads/Publications/ACEC%20Document%20V19-For%20Web%20Viewing-Small.pdf>.

137 IRENA, 2014. *IRENA Communiqué on the Africa Clean Energy Corridor*. International Renewable Energy Agency, Masdar City. Available at: http://www.irena.org/DocumentDownloads/events/IRENA_ACEC_Communique_2014.pdf.

138 IRENA, unpublished 2015. *Impact Assessment for ACEC*.

139 Bhattacharya et al., 2015. *Driving Sustainable Development through Better Infrastructure: Key Elements of a Transformation Programme*.

¹⁴⁰ Smallridge, D., Buchner, B., Trabacchi, C., Netto, M., Gomes Lorenzo, J.J. and Serra, L., 2013. *The Role of National Development Banks in Catalyzing International Climate Finance*. Inter-American Development Bank, New York. Available at: <http://publications.iadb.org/handle/11319/3478?locale-attribute=en>.

¹⁴¹ Bhattacharya et al., 2015. *Driving Sustainable Development through Better Infrastructure: Key Elements of a Transformation Programme*.

¹⁴² Ibid.

¹⁴³ The Nature Conservancy, 2012. *Climate Finance Readiness: Lessons Learned in Developing Countries*. The Nature Conservancy, Washington, DC. Available at: <http://www.nature.org/media/climatechange/climate-finance-readiness.pdf>.

¹⁴⁴ New Climate Economy, 2015 *Estimates of Emissions Reduction Potential for the 2015 Report: Technical Note*.

ABOUT THE NEW CLIMATE ECONOMY

The Global Commission on the Economy and Climate, and its flagship project The New Climate Economy, were set up to help governments, businesses and society make better-informed decisions on how to achieve economic prosperity and development while also addressing climate change.

In September 2014, the Commission published *Better Growth, Better Climate: The New Climate Economy Report*. Since then, the project has released a series of country reports on the United States, China, India and Ethiopia, and sector reports on cities, land use, energy and finance. In July 2015, the Commission published *Seizing the Global Opportunity: Partnerships for Better Growth and a Better Climate*. It has disseminated its messages by engaging with heads of governments, finance ministers, business leaders and other key economic decision-makers in over 30 countries around the world.

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