



Climate Investment Opportunities in Emerging Markets

An IFC Analysis



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Foreword



Philippe le Houerou
Executive Vice President, IFC

A handwritten signature in blue ink, appearing to read 'P. Le Houerou'.

There has never been a better time to invest in climate solutions. The cost of clean technologies has fallen dramatically, governments are embracing policies that encourage climate investment, and the Paris Agreement has galvanized support for measures that keep global warming under two degrees Celsius.

This report shows that the historic Paris Agreement on climate change that has recently come into force will help to open up nearly \$23 trillion in opportunities for climate-smart investments in certain emerging markets between now and 2030. Based on the national climate-change commitments and underlying policies of 21 emerging-market economies, representing 48 percent of global emissions, it identifies sectors in each region with the greatest potential for investment—from climate-resilient infrastructure in South Asia to clean energy in Africa.

As a result of massive cost reductions, solar photovoltaic (PV) and wind power are now mainstream. Global investment in clean energy last year was nearly \$350 billion—more than twice the amount invested in coal- and gas-fired power generation. At the same time, farmers are investing in more productive, climate-resilient agricultural practices and the green buildings market has doubled every three years for the past decade.

IFC stands ready to support the private sector in its quest to invest more in industries that will improve the climate and yield healthy returns on investment. Our six decades of experience have shown that we can create and develop new markets for clean, efficient solutions.

Since 2005, IFC has built up experience in private sector climate solutions, project by project. We have invested more

than \$15 billion in long-term financing for renewable power, energy efficiency, sustainable agriculture, green buildings and private sector adaptation to climate change, while further mobilizing an additional \$10 billion from other entities. IFC is one of the world's largest financiers of renewable energy for developing countries. In fiscal year 2016, IFC invested and mobilized \$776 million in renewable energy generation and component manufacturing. IFC's cumulative financing for green buildings has now surpassed \$2 billion.

We are not stopping there. IFC has pledged to step up its climate investments to 28 percent of annual commitments to a goal of \$3.5 billion a year by 2020, and leverage an additional \$13 billion of private sector cofinancing annually by 2020, while also managing climate risk and increasing impact. We are helping the private sector confront climate change through investments, innovative financing, and advisory services, and we are working closely with our World Bank colleagues and other partners to address regulatory and policy obstacles to green growth.

We invite you to join us in seizing the climate investment opportunity. Businesses can develop new financial and business models to deliver the next wave of climate solutions in transport, waste, agriculture and energy storage. Governments have made a great start by bringing the Paris Agreement so quickly into force. They must now make good on the promise of Paris by implementing a set of clear, investment-friendly policies. We need more partnership and coordinated action between government, business and civil society.

Working together, we can reduce climate's impact on the poor, while creating new markets for the private sector. IFC's commitment to step up as an advisor, investor and partner has never been stronger.

Executive Summary

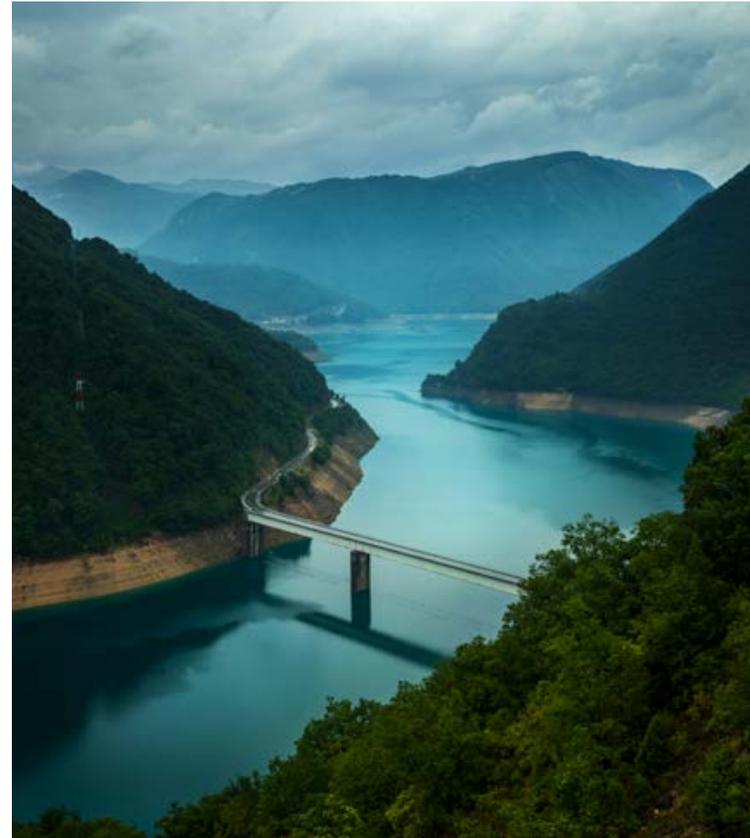
Climate-smart investment is mainstream investment

A dramatic drop in the price of clean technologies and the rise of smart policies are driving businesses to climate-smart investments. 2015 was another record-breaking year for investment in new wind power, solar power, and hydropower plants: 152 gigawatts (GW) of renewable energy became operational, and global investment in clean energy increased to \$348.5 billion – more than twice as much as coal- and gas-fired power generation. Global energy-efficiency potential is large and growing – governments and business invest more than \$300 billion each year to improve the efficiency of power grids, transport, industry, and buildings. The global green buildings market continues to double in size every three years. Climate-smart agriculture is also a growing private sector opportunity, as companies seek to increase crop resilience and food productivity, as well as their profits.

The Paris Agreement accelerates opportunities for climate-smart investment

The growth in greenhouse-gas emissions is expected to come mainly from emerging markets – which require \$4 trillion per year to build and maintain infrastructure. How these rapidly growing middle-income nations respond to their infrastructure needs will directly affect whether we can achieve the promise of the Paris Agreement. The good news is that these economies can invest in new, climate-resilient infrastructure and offset higher upfront costs through efficiency gains and fuel savings.

The Paris Agreement will help to accelerate climate-smart market growth. Growing awareness of climate risks and opportunities has seen the private sector urging governments to use the Agreement to provide the clear framework and signal needed to enable investment. The



unprecedented pace at which the Agreement has been ratified and come into force, sends a clear signal of the low carbon trajectory for future growth and opportunities. A total of 189 countries submitted national plans that target aggressive growth in climate solutions, including renewable energy, low-carbon cities, energy efficiency, sustainable forest management, and climate-smart agriculture. IFC assessed the national climate change commitments and other policies in 21 countries and

SHADES OF GREEN: INVESTMENT POTENTIAL BY REGION AND SECTOR (\$ BILLION)

	Wind	Solar	Biomass	Small Hydro	Geothermal	All Renewables	Electric Transmission & Distribution	Industrial Energy Efficiency	Buildings	Transport	Waste	Subtotal	
East Asia Pacific	231	537	48	34	16	866	392	143	13,235	1,357	53	16,046	>1000
Latin America and Caribbean	118	44	45	11	14	232	0	21	901	1,460	26	2,640	>500<1000
South Asia	111	211	16	0	0	338	0	85	1,543	255	13	2,234	>250<500
Europe and Central Asia	51	39	6	7	6	109	0	57	410	78	11	665	>100<250
Sub-Saharan Africa	27	63	3	3	27	123	0	0	153	499	8	783	>50<100
Middle East and North Africa	50	46	0	1	0	97	21	1	92	50	4	265	>25<50
Total Climate-Smart Investment Potential by Sector (\$ billion)	588	940	118	56	63	1,765	413	307	16,334	3,699	115	22,633	<25

finds an initial investment opportunity of \$23 trillion from 2016 to 2030 in key sectors (see table above).

An estimated \$23 trillion in climate-smart investment opportunities exists in the emerging markets outlined in this report

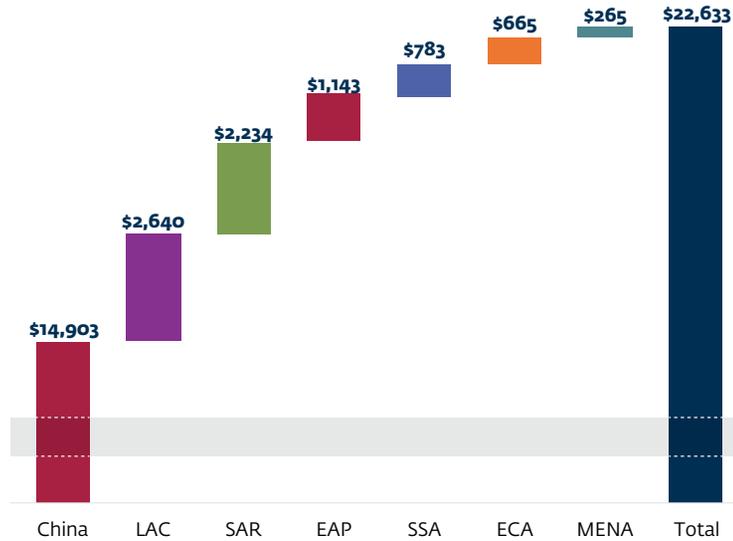
IFC assessed the national climate change commitments and other policies in 21 emerging markets, representing 62 percent of the world's population and 48 percent of global GHG emissions. Based on this information, IFC estimates that key sectors in these countries have an

initial investment opportunity of nearly \$23 trillion from 2016 to 2030 (see graph on next page). This figure is likely an underestimate as there are data gaps for important sectors like climate-smart agriculture.

Key climate-smart investment opportunities in these countries include:

- **Green buildings in the East Asia:** China, Indonesia, the Philippines, and Vietnam have a climate-smart investment potential of \$16 trillion, most of which is concentrated in the construction of new green buildings.
- **Sustainable transport in Latin America:** Argentina, Brazil, Colombia, and Mexico have an investment potential of \$2.6 trillion, almost 60 percent of which is for transport infrastructure.

Climate-Smart Investment Potential 2016 - 2030 (\$ billion)



Note: EAP = East Asia Pacific; ECA = Europe and Central Asia; LAC = Latin America Caribbean; MENA = Middle East and North Africa; SA = South Asia; SSA = Sub-Saharan Africa.

- **Climate-resilient infrastructure in South Asia:** Bangladesh and India have an investment potential of about \$2.2 trillion, which is concentrated in the construction of green buildings, ports and rail transport infrastructure, and energy efficiency.
- **Clean energy in Africa:** Côte d’Ivoire, Kenya, Nigeria, and South Africa’s total investment potential is nearly \$783 billion, which is spread across renewable energy generation (\$123 billion) and buildings and transportation (\$652 billion).
- **Energy efficiency and transport in Eastern Europe:** Russia, Serbia, Turkey, and Ukraine’s estimated climate-smart investment potential is \$665 billion, with over half focused on new green buildings. Energy

efficiency is a priority sector, while renewable energy investments are only beginning to accelerate.

- **Renewables in the Middle East and North Africa:** Egypt, Jordan, and Morocco’s total climate-investment potential is \$265 billion, over one-third of which is for renewable energy generation (\$97 billion), while 64 percent (\$169 billion) is for climate smart buildings, transportation, industrial energy efficiency, electric transmission and distribution, and waste solutions.

Unlocking private investment for climate solutions

To unlock private investment, governments must prioritize the following actions:

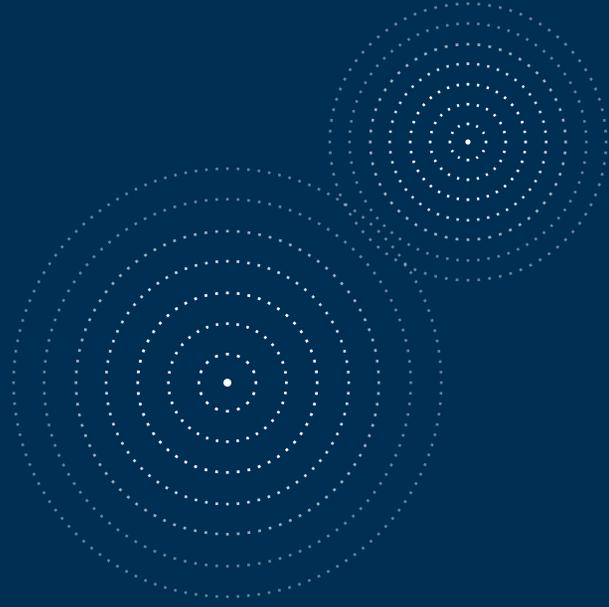
- **Achieve NDC goals.** Countries should act quickly to integrate their NDC commitments into national development strategies and budget processes. Governments must put in place clear and consistent policies – such as carbon pricing, performance standards, and market-based support – and ensure that climate considerations are integrated into other sector policies.
- **Strengthen the private sector investment climate.** Attracting private investment will require a robust domestic enabling environment, with reduced risks, strong competition, and measures to promote investment and capital flows.
- **Strategically use limited public finance.** Government budgets will not be enough to address climate change. Governments should use public funds strategically to mobilize private capital by, for example, reducing risk and providing project support.

Although many countries are making good progress on amending policies and improving investment climates, more can be done to set comprehensive long-term targets, provide targeted public finance, eliminate counterproductive policies (including fossil fuel subsidies), and provide the right incentives, such as carbon pricing and market-responsive support mechanisms.



Targeted country dialogues between government, the private sector, and civil society could help identify and remove the barriers preventing investment, test elements of NDCs, and offer suggestions for private finance and business models – as well as policy changes and public finance tools – that are needed to unlock private investment.

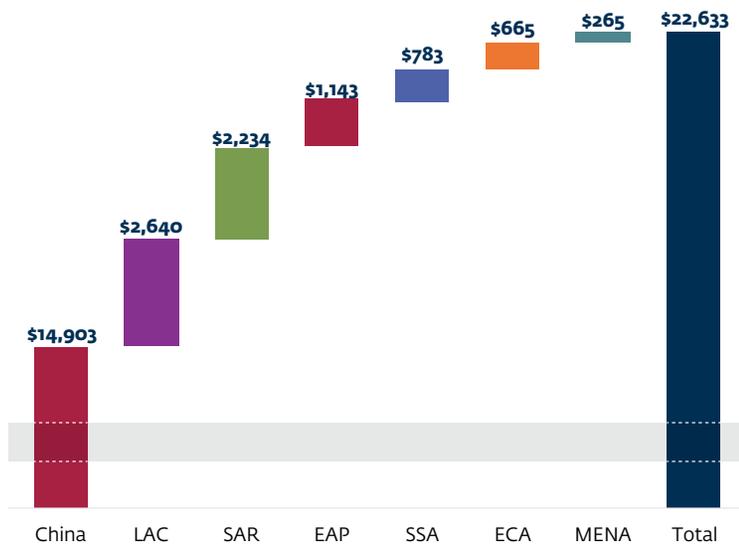
This report is just the first step. In order to make real progress and unlock the world's climate-smart investment potential, additional research, information exchange, and public-private dialogue are needed. IFC stands ready to work with like-minded partners to turn the investment potential identified in this report into reality, and to expand this analysis to other countries and regions.



Climate-Smart Investment Opportunity after the Paris Agreement

Climate-Smart Investment Opportunity after the Paris Agreement

Climate-Smart Investment Potential 2016 - 2030 (\$ billion)



Note: EAP = East Asia Pacific; ECA = Europe and Central Asia; LAC = Latin America Caribbean; MENA = Middle East and North Africa; SA = South Asia; SSA = Sub-Saharan Africa.

Climate-smart investment is mainstream investment.¹

For years, companies around the world resisted the idea of going green, arguing that they could not afford it. But a dramatic drop in the price of climate-smart technologies – especially renewable energy – and the rise of smart policies like carbon pricing, which charges firms for releasing greenhouse gases, are refuting that argument. Companies are also increasingly recognizing the need to ensure that their operations are resilient against supply chain disruptions and other effects of climate change. As a result, forward-looking businesses are moving quickly to climate-smart investments because it is good for the bottom line. Wall Street stalwarts like Morgan Stanley report that investing in sustainability usually meets, and often exceeds, the performance of comparable traditional investments.²

Renewable energy is increasingly the choice for rapidly growing countries seeking to meet their economic growth, energy access, and climate change goals. The year 2015 was another record-breaking one in new wind, solar, and hydro plant investment: 152 gigawatts (GW) of renewable electricity became operational, equal to Africa’s total power-generating capacity. Global clean energy investment increased to \$348.5 billion.³ Overall, more than twice as much was invested in renewable energy than in coal and gas-fired power generation (\$130 billion in 2015).⁴

Renewable energy is not the only climate-related sector primed for growth. Despite lower oil and gas prices, investments in energy efficiency continue to grow, driven by assertive and comprehensive policies.⁵ The International Energy Agency estimates that more than \$300 billion is invested annually to improve the efficiency of power grids, transport, industry, and buildings.⁶ To put this into perspective, this is equal to or higher than annual investments in coal, oil, and natural gas power generation.⁷ Existing investments in energy efficiency continue to yield multiple benefits including through returns to energy consumers valued at \$5.7 trillion over the last 25 years and reduced emissions.⁸ By 2050, more than 6 billion people will live in cities, creating a pressing need for a host of infrastructure services, such as water, waste and sanitation, and urban transport solutions. Global green building activity has doubled every three years for over a decade, with more growth expected,

particularly in developing countries.⁹ This creates opportunities for eco-friendly construction and helping cities prepare for climate change.

Climate-smart agriculture – measures that increase productivity, enhance resilience, reduce greenhouse gases, and address food security – is also a growing business, as companies around the world seek to enhance resilience, food productivity, and their bottom line.¹⁰ A recent study found 14 major business opportunities worth US\$2.3 trillion annually by 2030 in the sector, with developing countries capturing more than two-thirds of the estimated economic value due to their large shares of arable land, high future consumption growth and large potential efficiency gains.¹¹ Adaptation investments in 2015 amounted to \$7 billion globally, and multilateral development banks have started to increase private investment in climate resilience, with promising opportunities for growth.¹² There are also good opportunities in the area of climate-smart financial solutions. These can range from green bonds issued by governments and international institutions to microloans for entrepreneurs. The value of new green bonds issued tripled three years in a row, and reached \$42 billion in 2015.¹³

The Paris Agreement accelerates opportunities for climate-smart investment.

Private investment in climate solutions is set to grow following the Paris Agreement of December 2015. The unprecedented pace at which the agreement has been ratified and come into force, just 11 months later in November 2016, sends a clear signal of the low carbon trajectory for future growth and opportunities.

"The Paris Agreement is a historic turning point, as it sends a decisive market signal that the transition to a thriving clean economy is inevitable, irreversible, and irresistible." —We Mean Business Coalition

For the first time, 195 nations have agreed to keep a global temperature rise below 2 degrees Celsius (°C) and to drive efforts to limit the temperature increase to 1.5°C above pre-industrial levels. One of the most noteworthy aspects of the Paris Agreement is that it includes 189 voluntary country-level commitments – called nationally determined



What is a Nationally Determined Contribution?

Nationally Determined Contributions are country-driven targets that were invited for submission by the United Nations Framework Convention on Climate Change, without strict instructions on the format. NDCs have become part of Article 4 of the Paris Agreement since it entered into force. For a list of all nationally determined contributions, see:

http://unfccc.int/focus/indc_portal/items/8766.php

Growing climate risks

Despite the large number of NDCs that have been put forward, the global average temperature rise resulting from their implementation is still expected to reach 2.7°C,¹⁴ falling short of the goal to maintain warming at or below 2°C.¹⁵ If we fail to address climate change and global temperatures rise by 4°C by 2100 – the direction we are heading in now – frequent and intense droughts, flooding, and storms will affect small businesses and large companies alike.¹⁶ This could cost the global economy \$150 billion each year.¹⁷ We are already seeing the physical and financial effects of climate change. Reinsurer Lloyd’s reports that damage and weather-related losses around the world have increased from an annual average of \$50 billion in the 1980s to close to \$200 billion in the past 10 years.¹⁸

If we keep the average temperature rise below 2°C, three-quarters of proven coal, oil, and gas reserves must remain in the ground.¹⁹ Increasingly, asset managers, investors, and regulators are concerned that these assets could be “stranded”, losing value as countries start implementing the Paris Agreement. Blackrock Investment Institute recently released a report²⁰ asking all investors to incorporate climate change risks and opportunities into their investment processes. The Financial Stability Board’s Task Force on Climate-Related Financial Disclosures will issue a report in late 2016 that aims to increase transparency about how companies are managing their exposure to climate risk.²¹ This will further raise awareness of climate risks and opportunities among corporate leaders, and hence accelerate action.

contributions or NDCs – to reduce greenhouse-gas emissions in the coming decades. These collective commitments set the global path forward for climate-smart investment.

The Paris Agreement is designed to gradually ratchet up ambition in the future through a five-year revision cycle to meet the long-term temperature stabilization goal (see box on Growing climate risks). National plans will start becoming more ambitious in the next four years as the first “stocktaking” review takes place in 2018, with new and updated pledges from countries due in 2020.

The private sector played an important role in urging governments to reach an agreement in Paris. The World Economic Forum’s CEO Climate Leadership effort includes CEOs from 79 companies and 20 economic sectors with operations in more than 150 countries and territories that generated more than \$2.1 trillion of revenue in 2014. These CEOs demanded bold government action to reach an agreement in Paris.²² More than 600 global businesses and investors made voluntary pledges to reduce environmental and carbon footprints, setting targets to reduce greenhouse-gas emissions and/or energy consumption and collaborating at a supply chain and sectoral level (see box to the right).

These trends represent a growing climate investment opportunity in emerging markets.

Nearly all projected greenhouse-gas emissions growth is expected to come from developing countries, due to their rapidly growing and industrializing economies.²³

“Investing in sustainable infrastructure is the growth story of the future.”
—Global Commission on the Economy and Climate

Developing countries also account for about two-thirds of global infrastructure investment, offering a \$4 trillion investment opportunity per year.²⁴ The Global Commission on the Economy and Climate has found that it does not need to cost more to ensure that this new infrastructure is compatible with climate goals, and that additional upfront costs can be offset by efficiency gains and fuel savings. Some



Private sector taking climate action

Business leaders are taking heed of the strong signal sent by the Paris Agreement. More than 1,000 companies have made commitments to tackle climate change as part of the We Mean Business Coalition’s campaign.

The most progressive companies – those that realize the growth opportunity that tackling climate change presents – are setting science-based emissions-reduction targets. As of September 2016, 179 companies across all sectors have committed to set an emissions-reduction target that supports the global effort to limit warming to below 2°C. Setting a science-based target sends a clear message to investors and consumers that a company is forward-thinking, innovative, and prepared for the transition to a low-carbon economy.

There is also significant momentum driving the commitment to source 100 percent renewable power, with 81 companies now working to create demand for more than 100 terawatt-hours of renewable electricity. Apple, which already uses 93 percent renewable electricity, has committed to work with its manufacturing partners to install more than 4 GW of new clean energy worldwide by 2020; General Motors has set a goal to use 100 percent renewable electricity by 2050; and Bank of America aims to be carbon neutral and source 100 percent renewable electricity by 2020.

www.wemeanbusinesscoalition.org



The World Bank NDC platform

This new platform is a useful, easy-to-use, interactive tool that aims to inform a wide range of development initiatives and engagements about countries' economy-wide and sectoral commitments, how they translate into implementation, and support needs. The website presents data in a uniform structure, which enhances the transparency of available information and helps to identify information gaps and opportunities to support NDC implementation. It also helps to foster mutual learning among countries. All data collected in this database comes strictly from the NDCs; all implementation cost estimates are self-reported in these statements.

indc.worldbank.org

climate-smart solutions require higher upfront financing, with the savings and other benefits accruing later. To deliver these solutions at scale, financing and investment will be needed from governments, multilateral and other development banks, private companies, and institutional investors.²⁵

How countries across the globe – especially growing middle-income nations – respond to these infrastructure needs will play a major role in whether we can avoid lock-in of fossil-intensive assets and achieve the promise of the Paris Agreement. It will be critical to deliver on the NDCs in the short term, to give countries and business confidence that they can continue to increase their targets and avoid the significant effects of climate change. The first step is to assess the potential for private sector investment contained in countries' NDCs.

Private sector highlights from NDCs

A total of 189 countries, representing 96 percent of global greenhouse-gas emissions and 98 percent of the world's population,²⁶ have submitted NDCs.²⁷ NDCs aim to provide a clear, ambitious goal that leads to transformation in carbon-intensive sectors, as well as a process to track progress to ensure that countries are meeting their goals. Many countries followed a transparent NDC development process to build trust and accountability with stakeholders, including the private sector. The private sector was involved directly in preparing 43 NDCs.

According to the World Bank's NDC platform (see box to the left), as of the date of this report, 162 NDCs have been submitted (note: the European Union submitted one NDC on behalf of 28 countries, bringing the total number of countries submitting NDCs to 189). A total of 132 countries prioritized making their **agricultural sector** more resilient and less carbon intensive. This includes 61 countries specifically targeting climate-smart agriculture investment. Other countries will focus on improved, more resilient crops, more efficient irrigation, improved animal and fisheries management, and enhanced fertilizers, among other things. The NDCs will drive more climate-smart investments. For example, IFC's \$50 million Biosev project in Brazil provided financing to one of the largest renewable biomass electricity producers in the world, aiming to increase the volume of crushed sugarcane for sugar,

IFC: Ramping up climate investments

IFC has been working for over a decade to identify and advance private sector finance for climate-smart investments. Since fiscal year 2005, IFC has led a cumulative total²⁸ of more than \$25 billion in long-term climate financing for renewable power, energy efficiency, sustainable agriculture, green buildings and private sector adaptation projects. This includes \$15.3 billion in own account financing and \$10.1 billion in core mobilization (syndicated loans, and public-private partnerships, for example). During fiscal year 2016, IFC's climate-related long-term investments from own account were nearly \$2 billion, including 73 projects across the globe. IFC further mobilized \$1.28 billion from institutional investors and other actors. In FY16, IFC Advisory Services enabled more than \$1.2 billion in climate-related investments in power, resource efficiency, green buildings, and public-private partnerships.²⁹

Other international financial institutions are seeing similar success in catalyzing private finance for climate investment. The *2015 Joint Report on Multilateral Development Banks' Climate Finance*³⁰ reported that MDBs committed US\$6.9 billion of climate finance to the private sector, evidence of the growing demand for climate finance from emerging market private sector clients.

But this is not enough – there is much more that must be done to scale up private finance for climate change solutions. IFC's **2016 Climate Implementation Plan**³¹ was approved in spring 2016 with four objectives to increase climate investments and maximize impact:

- **Scale climate-related investments** to reach 28 percent of IFC's annual new commitments by 2020;

- **Catalyze \$13 billion in private sector capital** annually by 2020 to climate sectors through mobilization, aggregation, and de-risking products.
- **Maximize impact** through GHG emissions reduction and resilience; and
- **Account for climate risk** – both the physical risk of climate impacts and the carbon asset risk in IFC's investment selection.

To reach these goals – and our collective global goals to scale up climate investment – IFC will continue its existing business and create new climate markets, create new investment vehicles and increase internal tools and support. IFC also seeks to increase partnerships with other international financial institutions, governments and other stakeholders.

NUMBER OF NDCS BY REGION, HIGHLIGHTING KEY SECTORS MOST RELEVANT TO PRIVATE SECTOR INVESTMENT

	Renewable energy	Agriculture	Forestry	Energy efficiency	Transport	Waste	Water	Industries	Buildings	Urban
All	130	126	120	107	107	101	101	70	66	51
EAP	24	18	19	19	18	15	13	7	7	9
ECA	10	13	12	10	9	12	5	12	8	3
LAC	26	27	27	19	24	19	23	15	13	7
MENA	17	14	12	17	14	14	15	12	14	3
SA	7	7	7	6	7	5	5	3	5	5
SSA	46	47	43	36	35	36	40	21	19	24

Note: EAP = East Asia Pacific; ECA = Europe and Central Asia; LAC = Latin America Caribbean; MENA = Middle East and North Africa; SA = South Asia; SSA = Sub-Saharan Africa. This table accounts only for World Bank Group client countries. As a result, numbers in the table may differ from numbers throughout chapter 1, which take into consideration NDCs from all countries.

ethanol and co-generation.³² This project was driven in part by Brazil’s efforts to advance climate-smart agriculture and will become even more attractive as Brazil implements its NDC. **Sustainable forest and land management**—covering a wide range of business activities such as construction materials, paper and specialty chemicals to watershed and soil conservation—is included in 88 NDCs.

The global clean energy marketplace is rapidly shifting south and east – 2015 was the first year that renewable energy investments in emerging economies (\$156 billion, up 19 percent from 2014) surpassed those in developed countries (\$130 billion, down 8 percent from 2014). China now accounts for 36 percent of the global total. Other countries showing increased investment include India (up 22 percent to

\$10.2 billion), South Africa (up 329 percent to \$4.5 billion), Mexico (up 105 percent to \$4 billion), and Chile (up 151 percent to \$3.4 billion). Morocco, Turkey, and Uruguay all joined the list of countries investing more than \$1 billion in clean energy.³³ Clean energy financing originating from developing countries in 2012 exceeded the amount coming from developed countries. About 74 percent of total climate finance flows, and up to 92 percent of private investments, was raised and spent within the same country, highlighting the importance of using targeted policies to attract private investment.³⁴

A total of 138 countries prioritized various types of **renewable energy** in their NDCs, with 91 targeting solar power, 64 wind energy, 23 geothermal power, and 62 hydropower. Several countries included capacity targets, leading to a total solar market potential from NDCs of more than 232 GW (China and India each targeted 100 GW) and a wind power market size of 280 GW (China targeted 200 GW and India 60 GW). Due to the NDCs, investment opportunities are expected to accelerate in places like Panama, where IFC is part of a consortium building the Penonome wind farm, a 215-megawatt (MW) plant that will be Central America’s biggest. The government will build on this project by providing more policy support: by 2050, Panama plans to increase its renewable energy capacity by 30 percent compared to 2014 levels. To reach this target, wind and solar capacity would need to increase by over 400 percent and 1000 percent respectively, each with a capacity of 4GW.³⁵

In Morocco, IFC and private partners are playing a key role in the construction of a 510 MW solar plant that will provide power to 1.1 million people. With the help of NDC implementation, the project, worth \$2.6 billion, could help turn the North African kingdom into a renewable energy powerhouse and serve as a model for future public-private partnerships. In Nepal, IFC has invested in the 37.6 MW Kabeli plant, the first project-financed hydropower facility in the country. The project will generate about 200 gigawatt-hours (GWh) of electricity, helping address power shortages and driving industrial progress. This investment is part of Nepal’s wider ambition to scale-up renewable energy by 2030 to meet increasing demand. Estimates by Nepal’s Ministry of Water Resources show over 40 GW of economically attractive hydropower potential.³⁶



A total of 110 countries listed different **energy-efficiency** investments in their NDCs. Focus areas included energy supply efficiency solutions like cogeneration; efficient appliances; buildings (74 countries); and efficient industrial processes such as cement, iron and steel, chemicals, and pulp and paper. One example of an energy-efficiency investment project is IFC's China Utility Energy Efficiency (CHUEE) program, which provides Chinese banks with a risk-sharing facility and advisory services to help them implement climate-smart energy projects. The program started in 2006 with two Chinese banks and has grown to incorporate six partner banks with \$300 million in financing.³⁷ It has directly promoted sustainable energy investments through local banks worth about 11 billion Chinese yuan, or nearly \$2 billion. CHUEE has been successful due, in part, to China's Action Plan for Addressing Climate Change (2012-2020) in Industry. Since 2012, China has issued over 60 energy savings standards targeting energy intensive industries; created an evaluation system to track energy savings; and invested close to \$800 million across more than 2,000 projects.³⁸ Under this plan, efficiency improvements are required for close to 15,000 energy intensive industrial enterprises covering two thirds of China's total energy consumption.³⁹

Through their NDCs, 53 countries aim to grow **low-carbon, resilient cities** (see box on page 40) by targeting improved solid waste management, efficient street lighting, and sustainable urban planning, among other investments. A total of 111 countries focused on **transport**, targeting public transport (39), bus rapid transit (6), rail (26), and clean vehicle fleets (40). An example of the type of private sector investment included in these NDCs is a light-rail network project in Izmir, Turkey. IFC provided a \$25 million loan and mobilized another \$60 million through the Multilateral Investment Guarantee Agency's involvement as the guarantor of a parallel loan provided by ING Bank. This project, as part of a suite of investments, will support Izmir Metropolitan Municipality's work to increase metro ridership through the acquisition of 85 light-rail transit vehicles. The success of this project started with the issuance of Turkey's four strategic priorities for transport, which included plans to create a rail freight corridor, strategic reorientation of the primary national railway transport corporation to improve services, and integrating national and regional networks.⁴⁰ In large urban areas, the government will continue to expand rail systems across the main transit corridors with the objective to offer high-capacity railway systems for areas with a city population of greater than 1 million inhabitants.⁴¹

Estimating climate investment potential

In order to predict climate-smart investment potential, it is first necessary to define its scope. Efforts to date have focused on measuring and tracking past mitigation and adaptation investments⁴², yet there is no comprehensive, bottom-up forecast for climate-smart investment. While some sectors—notably renewable energy—have good investment forecasts,⁴³ there are substantial data gaps in areas such as climate-smart agriculture and forestry, energy efficiency, transportation and waste.

This report quantifies the potential for low-carbon investment in 21 initial countries where IFC operates. IFC began its analysis by identifying the targets established by these countries in their Nationally Determined Contributions and, where available, supplemented these data with sector-specific policies

as needed (e.g., national transportation plans). IFC used the World Bank's NDC database (<http://indc.worldbank.org>) to help filter the sector priorities and unconditional targets for each country of focus. IFC then determined the climate-smart investment potential for key sectors where consistent data was available (power, transport, buildings, waste and industry)⁴⁴ by assessing how the NDC targets would affect the market size over the time period of NDC implementation (2016-2030). Note that this estimate is for both public and private investment—there are no agreed-upon metrics for dividing up the investment opportunity between public and private funding.

Investment or capital costs (\$/MW) were used to derive the final investment potential figures. As this metric

varies between technologies and countries, a variety of sources were used to improve the accuracy of the final results (see Annex 1). For example, in certain countries where renewables are still in their infancy, IFC used individual project-level data to project future investment potential. In other countries, however, IFC relied on IFC staff, publicly available data, or private subscription-based references.

IFC looks forward to engaging with our clients, governments and data providers in the future to improve the quality of climate-smart investment potential estimates. IFC hopes that this first report will catalyze new work to close these data gaps going forward.

SHADES OF GREEN: INVESTMENT POTENTIAL BY REGION AND SECTOR (\$ BILLION)

	Wind	Solar	Biomass	Small Hydro	Geothermal	All Renewables	Electric Transmission & Distribution	Industrial Energy Efficiency	Buildings	Transport	Waste	Subtotal	
East Asia Pacific	231	537	48	34	16	866	392	143	13,235	1,357	53	16,046	>1000
Latin America and Caribbean	118	44	45	11	14	232	0	21	901	1,460	26	2,640	>500<1000
South Asia	111	211	16	0	0	338	0	85	1,543	255	13	2,234	>250<500
Europe and Central Asia	51	39	6	7	6	109	0	57	410	78	11	665	>100<250
Sub-Saharan Africa	27	63	3	3	27	123	0	0	153	499	8	783	>50<100
Middle East and North Africa	50	46	0	1	0	97	21	1	92	50	4	265	>25<50
Total Climate-Smart Investment Potential by Sector (\$ billion)	588	940	118	56	63	1,765	413	307	16,334	3,699	115	22,633	<25

IFC estimates that there is a \$23 trillion private climate investment opportunity in the 21 countries studied for this report.

IFC assessed the national climate change commitments and other policies in 21 countries that represent 48 percent of global greenhouse-gas (GHG) emissions, and finds an initial investment opportunity of \$23 trillion from 2016 to 2030 in key sectors (see chart above). A significant portion of this estimate is for green buildings and this is likely an underestimate—there are large data gaps for important sectors like climate-smart agriculture and transportation. Going forward, significant effort is needed to close these data gaps and IFC looks forward to partnering with relevant stakeholders to address the information needs for climate-smart investment potential. See box on Estimating climate

investment potential for a summary of the approach and Annex I for a detailed description of the methodology.

The report

The following chapters take a closer look at six individual regions, focusing on an initial set of countries in each region, to explore investment potential in targeted sectors. Global themes of interest to the private sector are also featured throughout the report. The report concludes with a discussion on priority policy actions, public finance strategies and the next steps that are needed to unlock this potential for private investment – and to deliver on the promise of the NDCs and the Paris Agreement.

Endnotes

- 1 Note that all investment figures cited in this report are presented in US dollars.
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East Asia Pacific Climate-Smart Investment Potential

Investment Spotlights

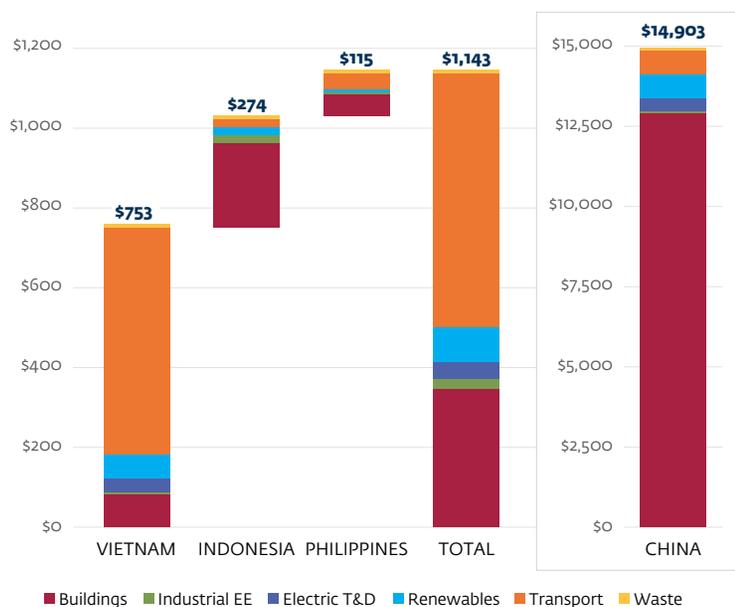
East Asia Pacific Climate-Smart Investment Potential

Investment Spotlights

The Asia-Pacific region hosts more than half of the global population and is home to some of the world’s most climate-exposed territories. The unprecedented pace and scale of economic development is transforming the natural environment and contributing to climate change—the share of coal in power generation is expected to rise from 32 percent to 50 percent to help meet energy needs in ASEAN countries^{1,2} The region has been disproportionately hit by the effects of climate change, with 45 percent of the world’s natural disasters occurring here in the past three decades.³ As a result, the region’s economies must grow, while reducing greenhouse-gas intensity and addressing climate resilience. Several economies in the region are making significant progress in advancing green growth and low-carbon innovation, which is attracting large private investment.

The region’s projected population growth and infrastructure needs create significant opportunities for generating renewable energy, improving green buildings, and building sustainable cities.

Climate-Smart Investment Potential
2016 - 2030 (\$ billion)



Investment potential

Based on IFC’s analysis of the climate pledges made by the region’s four countries studied for this report – China, Indonesia, the Philippines, and Vietnam – the total estimated climate-smart investment potential is more than \$16 trillion by 2030. Nearly 81 percent of this potential is construction of new green buildings in China (\$12.9 trillion)—this is the result of China’s aim to move 250 million people into cities by 2025 and is reflected in their NDC.⁴ Beyond China’s green buildings sector, the opportunity to develop the region’s urban areas is immense and is largely composed of three primary sectors: Buildings, Transport and Waste. The commercial investment potential in climate-smart urban transport for the four countries is almost \$1.4 trillion, and for the municipal solid waste sector the opportunity is over \$53 billion. Construction of new green buildings is a \$345 billion opportunity in Indonesia, Philippines and Vietnam. Opportunities for investment in climate-smart agriculture, forestry, and land-use projects across the region are also important; but the current lack of data availability for these sectors hindered IFC’s ability to produce investment estimates of sufficient quality.



Sustainable cities

The region's rapidly growing urban centers will define its energy future and the world's carbon footprint. Increasing standards of living and rapid urbanization offer major opportunities for climate-smart investors. Specific private sector investment opportunities exist in enhanced public transportation, green buildings, clean vehicles, and distributed generation. To unlock this investment, city governments need to work on reforming institutions, building capacity, and strengthening energy planning and governance.⁵ If cities take this proactive approach, they have an opportunity to serve as global engines of green growth by choosing energy-efficient solutions to suit their infrastructure needs.

Adaptation and resilience

The region is increasingly feeling the effects of climate change, including drought in Indonesia, which contributed to the country's costly fires and haze of 2015. Extreme rainfall has caused damaging floods in China in 2016 and increased the frequency and intensity of tropical cyclones in

Climate Investment Spotlights



INDONESIA—HYDROPOWER

IFC provided a \$280 million loan to Indonesian independent power producer PT Bajradaya Sentranusa. The deal will support the long-term operation of Asahan 1, a hydroelectric power plant in North Sumatra province, to provide low-cost, renewable, and reliable power. More than a quarter of Indonesia's population is not connected to the national grid, leaving about 66 million people without access to electricity. About 60 percent of Indonesia's electricity supply in 2012 came from coal and oil, both of which produce high greenhouse-gas emissions.



VIETNAM—GREEN BUILDINGS

In 2015, Vietnam became the first market in East Asia to introduce IFC's EDGE Green Buildings program. Over the next six years, IFC's partner SGS Vietnam expects to award EDGE certifications to 20 percent of new construction projects in the country, equivalent to about 70,000 housing units. This will help cut 19,000 metric tons of greenhouse-gas emissions per year, avoid 43,500 megawatt-hours of energy use, and save \$8 million per year by 2021. IFC is now working with the government to green building codes in the future.



the Philippines, causing substantial damage to the economy. Adapting to the effects of climate change will help reduce future economic losses in the region. Southeast Asian countries should work with the private sector to adapt agricultural practices to changes in temperature and precipitation, design water management to manage greater risk of floods and droughts, and ensure coastal zone management can withstand higher sea levels, among other priorities.⁶

Renewable energy

China dominated the world's investment activity in renewable energy in 2015, exceeding the \$100 billion threshold and accounting for about two-thirds of all developing-country investment.⁷ Solar power attracted more than half of China's investment, widening the lead that it had established against wind energy in the previous year.⁸ Vietnam, the Philippines, and Indonesia together accounted for about \$2.3 billion in investments.⁹ Two of the region's key challenges are secure and affordable energy access and fossil-fuel subsidy reform. Energy policy varies considerably across the region, reflecting differences in political direction, economic development, and natural resources.¹⁰

Climate Investment Spotlight



SOUTH PACIFIC—DISTRIBUTED SOLAR FOR ISLAND NATIONS

In May 2014, IFC invested \$2 million in Sunergise International Limited, a company that supplies solar rooftop energy in the Pacific. IFC's investment will allow Sunergise to expand solar installations in Fiji and across the region, including the Solomon Islands and Papua New Guinea, where businesses lack a stable and affordable power supply. The investment supports an innovative business model that offers less expensive, cleaner power to customers with no up-front investment required.

Spotlight countries – Priority sectors for climate investment

CHINA

China's estimated climate-smart business investment potential is \$15 trillion by 2030. This includes \$773 billion in new renewable energy, \$12.9 trillion for low-carbon buildings and more than \$725 billion for transport.

INDONESIA

Indonesia's estimated climate-smart business investment potential is over \$274 billion. In the sectors considered, investment in renewable energy accounts for almost \$23 billion by 2030, with under half of this (\$9 billion) for biomass and the other half for geothermal energy (\$10 billion) and small hydropower (\$3 billion). Investments in transport are estimated at nearly \$20 billion for low-carbon, resilient ports, rail, roads, and other critical infrastructure by 2030, while construction of new green buildings will require almost \$209 billion.

THE PHILIPPINES

The Philippines's climate-smart business investment potential is nearly \$115 billion by 2030. This includes investment in renewable energy of \$11 billion, while new green buildings, waste, and transport will see investment of \$57 billion, \$2 billion and \$41 billion, respectively. This total reflects only a small portion of the 5.4 GW national hydropower target that is designated for small hydro. The investment opportunity associated with the remaining large hydro focus of the target is up to \$22.7 billion by 2030.¹¹

VIETNAM

Vietnam's climate-smart business investment potential is an estimated \$753 billion, with the majority (\$571 billion) going towards the country's transportation infrastructure needs by 2030. Potential investment in renewable energy totals \$59 billion, with over half of this (\$31 billion) in solar PV and another \$19 billion for small hydropower projects. New green buildings represent an almost \$80 billion investment opportunity.



Venture capital for clean transport technologies

China sold 200,000 electric vehicles in 2015, accounting for 36 percent of global sales and making China the largest market for electric vehicles that year.¹² This trend will continue to grow as the Chinese government actively invests in transport technology and infrastructure to help domestic automakers put more than 20 million clean, fuel-efficient, and other alternative energy vehicles on the road by 2020. Of these vehicles, 1 percent will be electric buses, with a network of nearly 4,000 bus charging stations.

In 2011, IFC invested \$25 million in Microvast, a technology company that develops and manufactures advanced batteries for the electric vehicle market. In

Central and Western China, Microvast expanded its business to increase the number of electric city buses (e-buses) running on its innovative battery technology. The technology is based on lithium titanium oxide chemistry, allowing the battery to last twice as long as lithium iron phosphate batteries. The new batteries can be fully charged within five to 10 minutes.¹³ This offers the opportunity for e-buses to quickly charge between shifts without affecting operations.¹⁴ Microvast's batteries are ideal for city e-buses because bus route patterns have fixed destinations, short travel distances per loop, and an average of 15 to 30 minutes resting time between each loop, allowing the batteries to fully recharge.¹⁵

IFC's investment has enabled Microvast to accelerate its entry into the Chinese market, test its solutions in a live market environment, and offer a strong demonstration showcase for other prospective bus clients.¹⁶ Microvast has continued to develop its global business and, as of March 2016, the company has more than 10,000 electric vehicles in six countries and 100 cities powered by its battery technology.¹⁷ Recently, Microvast received the Financial Times/IFC Transformational Business Award for the use of its innovative battery technology in a rapidly urbanizing country like China.





CHINA

China's estimated climate-smart investment potential in selected sectors is \$15 trillion from 2016-2030.

China's NDC pledges to lower the carbon intensity of GDP by between 60 percent and 65 percent below 2005 levels, increase the share of low-carbon energy to total energy supply to about 20 percent, and increase its forest stock volume by 4.5 billion cubic meters, by 2030.¹⁸ The country is entering the first year of its 13th Five-Year Plan (FYP) in 2016 and is implementing significant policies to address climate change, including restricting coal consumption. According to a new report, *Green Finance for Low-Carbon Cities*, more than \$1 trillion

in new investment is needed by 2020 to keep Chinese cities on a low-carbon path.¹⁹ Of this amount, between 85 percent and 90 percent is available for the private sector.

China is still rapidly urbanizing, with 60 percent of the country's population projected to live in cities by 2020. Just 10 years later, in 2030, more than 1 billion people are expected to live in Chinese cities – roughly one in eight people on Earth.²⁰

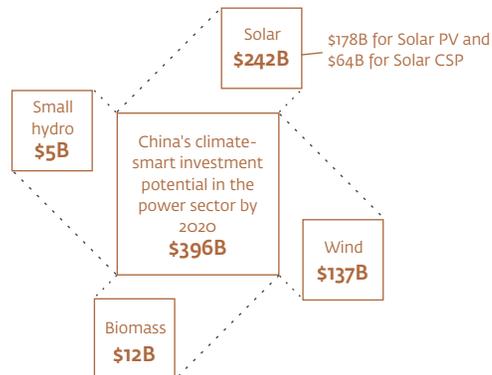
The buildings sector consumes half of the total energy in Beijing. Opportunities for new green buildings and energy-efficient retrofits for millions of existing buildings are massive. China has also experienced explosive growth in car use and ownership. As a result, motorized transportation has become one of the country's fastest growing major emission sources.



NEAR-TERM CLIMATE-SMART INVESTMENT POTENTIAL BY 2020

⚡ Renewable energy

China has the largest power-generation fleet in the world, installing 142 GW of new renewable energy in 2015, including 33 GW of wind power and 18 GW of solar PV power.²¹ Overcapacity of renewable energy is a serious issue for the country at the moment, but based on China's current renewable energy targets and anticipated economic growth IFC estimates the country will invest at least \$773 billion between 2016 and 2030. By 2020, nearly \$400 billion of this amount will be invested in solar, wind, small hydro, and biomass energy.



⚙️ Industrial Energy Efficiency

China's 13th FYP establishes a target to reduce energy intensity by 40 – 45 percent from 2005 levels by 2020 and 60 - 65 percent by 2030. The investment opportunity to meet China's 2020 target for industrial energy efficiency improvements is estimated at over \$35 billion by 2020. China has already made considerable progress over the past five years, but ample opportunities to improve energy efficiency in the country's industrial sector exist. The private sector already plays a large role in terms of investment in the sector and will continue to do so by bringing on more market-based solutions from ESCOs to dedicated credit lines and risk guarantees.²²

🏠 Urban infrastructure

Chinese cities contribute 70 percent of the country's total energy-related greenhouse-gas emissions, making urban areas a clear priority for climate-smart investment. IFC estimates \$2 trillion will be invested in new low-carbon buildings by 2020. China will need to accelerate the development of green modes of urban transport and waste management with minimum investments of \$218 billion and \$12 billion by 2020, respectively to reduce emissions and satisfy its growing urban population.. China plans to integrate low carbon development into the entire process of urban planning, emphasizing improvements in fuel efficiency, increasing public transport use to 30 percent, and increasing the number of electric vehicles on the road.



🍂 Priorities for China to attract more climate-smart investment

EXPAND THE MARKET FOR ENERGY EFFICIENCY AND GREEN BUILDINGS

Enhance the implementation of green building regulations and standards by increasing their ease of use and expanding coverage to include retrofits.

ALIGN GREEN FINANCE WITH THE NDC

Align China's NDC priorities with its Green Bond Guidelines and Guidelines for a Green Financial System to direct more private finance towards the implementation of national climate strategies.

ALLEVIATE POWER GENERATION OVERCAPACITY

Significantly reduce coal-fired power plant use by providing incentives to replace coal with gas or other cleaner fuels; provide economic stimulus packages to ease the transition.

CHINA INDICATORS (2015)

Population: 1.37 billion
 GDP: \$10.9 trillion
 GDP growth: 6.9%
 Inflation: 1.4%
 Ease of Doing Business rank: 84
 S&P credit rating: AA-
 FDI, net inflows: \$249 billion
 GHG emissions rank: 1 (2012)
 Renewable energy capacity: 79 GW

LOW CARBON TARGETS

- Reduce carbon intensity by 60%–65% below 2005 levels by 2030.
- Cap primary energy consumption at 5,000 metric tons of coal equivalent by 2020.
- Increase non-fossil fuel's share of primary energy consumption to 15% by 2020.
- Connect 210 GW of wind, 150 GW of PV, and 10 GW of solar thermal power to grids by 2020.

IFC CLIMATE BUSINESS (FY2010 – 2016)

Total climate finance: \$1.2 billion

- Renewable energy: \$326 million
- Energy efficiency: \$400 million
- Other mitigation: \$504 million

Climate finance, selected NDC sector:
 Waste: \$221 million; agribusiness & forestry: \$79 million

INDONESIA

Indonesia's estimated climate-smart investment potential in selected sectors is more than \$274 billion from 2016–2030.

Indonesia's NDC includes a greenhouse-gas emissions reduction target of 29 percent below business-as-usual emissions. Indonesia is the fourth most populous country in the world after China, India, and the United States. With an expanding middle class, Indonesia's economy has grown rapidly over the past 10 years.

Indonesia has ambitious infrastructure improvement plans, with a focus on expanding access to energy, building roads, ports, railways, and airports, as well as improving agricultural production.²³ Indonesia can be a challenging environment for businesses, but its stable economy makes it an attractive destination for investors looking to make climate-smart investments.

The country aims to generate 23 percent of its primary energy consumption from renewable energy by 2025, up from its current levels of between 5 percent and 6 percent. There is also a 2019 interim target of 19 percent, which looks difficult to achieve given the sector's current levels of financing²⁴

Indonesia's NDC does not elaborate as to which sectors it intends to focus on in order to achieve its targets. The country's biennial update report (BUR), however, provides a list of mitigation actions for most sectors including budget estimates for each activity. Indonesia also has several Nationally Appropriate Mitigation Action (NAMA) projects for which it requires private sector financing to help implement.

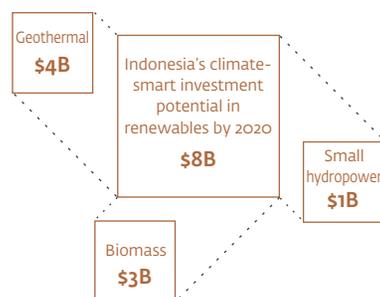
The government has taken significant steps over the past few years to improve its policy framework for climate investments, passing 13 separate pieces of legislation from 2012 to 2015 in areas such as permitting, licensing, purchasing policies, and feed-in-tariffs for renewable sources of energy, along with support for green buildings.²⁵



NEAR-TERM CLIMATE-SMART INVESTMENT POTENTIAL BY 2020

⚡ Renewable energy

Indonesia has large geothermal power potential; its biomass and hydro resources are also considerable.²⁶ IFC estimates that solid biomass power projects will present nearly \$3 billion in investment potential by 2020 and \$1 billion will be needed for small hydropower projects. The government aims to install 7.2 GW of geothermal energy by 2025, but the full amount is considered unlikely to materialize by this date.²⁷ Nonetheless, IFC estimates the commercial potential for geothermal power in Indonesia to be a minimum of \$4 billion by 2020.



🏠 Urban infrastructure

Indonesia's population is expected to exceed 300 million by 2030, with half of the country's people living in urban areas. Provinces with more than 50 percent of their inhabitants living in urban areas are DKI Jakarta (100 percent), Riau (83 percent), Banten, Yogyakarta, and West Java (each more than 60 percent).²⁸ The low-carbon buildings sector in Indonesia should grow as a result of new green building codes and energy efficiency incentives, representing a \$23 billion investment opportunity by 2020, while the transport and waste sectors are expected to require \$7 billion in investment combined. The largest sales by transport mode are in the motorcycle market with an anticipated 8.1 million expected sales by 2030.



🍃 Priorities for Indonesia to attract more climate-smart investment

CHAMPION RETROFITTING OF EXISTING BUILDINGS

Green standards are being introduced for new buildings being built in certain municipalities (e.g. Jakarta, Bandung), but further regulations are required including mandatory guidelines on increasing efficiency in existing buildings.

ALIGN LAND DEVELOPMENT POLICIES WITH CLIMATE GOALS

Develop comprehensive land law, replacing overlaps, contradictions and ambiguities in existing laws, regulations and procedures, on ownership and acquisition to facilitate priority infrastructure investment projects.

COMBINE SUSTAINABLE FINANCE AND CLIMATE CHANGE EFFORTS

Align efforts to implement Indonesia's NDC with the sustainable finance roadmap being developed by OJK to unlock more green finance across the financial sector. Foster increased coordinated market awareness through OJK-led training, supplemented by regulations that enable increased green portfolios among banks.

INDONESIA INDICATORS (2015)

Population: 258 million
 GDP: \$861.9 billion
 GDP growth: 4.8%
 Inflation: 6.4%
 Ease of Doing Business rank: 120
 S&P credit rating: BB+
 FDI, net inflows: \$15.5 billion
 GHG emissions rank: 9 (2012)
 Renewable energy capacity: 8.8 GW

LOW CARBON TARGETS

- Increase renewable energy share to 23% by 2025.
- Decrease energy intensity by 1% per year from 2014 to 2025.
- Encourage distributed renewable energy to achieve 100% electrification by 2020.

IFC CLIMATE BUSINESS (FY2010 – 2016)

Total climate finance: \$162 million

- Renewable energy: \$89 million
- Energy efficiency: \$68 million
- Other mitigation: \$5 million

Climate finance, selected NDC sector:
 Agribusiness and forestry: \$5 million

Achieving green growth in emerging economies

The World Bank Group defines green growth as “maximizing economic growth and development while decoupling upward trends in resource use, carbon emissions and environmental degradation”. It focuses on the synergies and trade-offs between the environmental and economic pillars of sustainable development.

Green growth discards the old model of “grow first, clean up later”. It discourages investment decisions that lock countries in to environmentally damaging, carbon-intensive systems. Instead it relies on a broad mix of policy instruments, including environmental standards and policies to create new markets, encourage technological innovation, and contribute to economy-wide efficiencies and sustainable growth.

Green growth requires actions to reduce pollution and emissions through cleaner consumption and production patterns, to manage natural capital (land, forests, water, and so on) more sustainably and efficiently, and to reduce vulnerability to climate and disaster risks. It will require moving away from supporting fossil

fuel investments, particularly new coal-based power generation to avoid long-term entrenchment of high carbon energy infrastructure. One key policy decision governments must take is to phase out subsidy support for fossil fuels. Many countries, including India, Indonesia and Mexico, have already started down this path by implementing fossil fuel subsidy reforms in 2015 and 2016, as oil prices bottomed-out.

Such policies and green growth strategies produce resilient growth models, more capable of withstanding external shocks – whether related to climate, energy, food, resources, or sudden demographic changes. However, there is no one-size-fits-all strategy for implementing green growth; rather, specific policies and actions need to respond to national priorities and circumstances.

Many low- and middle-income countries have incorporated green growth into their national development programs and action plans through specific green growth (or green economy) strategies/ roadmaps.²⁹

Other countries have outlined green growth actions through low-carbon development plans and/or their NDCs.

Depending on their circumstances and priorities, countries can choose between different policy actions and priority sectors to achieve green growth. China’s 13th Five-Year Plan for 2016–2020 reflects a shift in its growth model to promote environmental sustainability. It includes binding targets for key environmental parameters on air quality, water quality, and forest cover. Key measures include strengthening enforcement authorities, building environmental administrative capacity, and boosting incentives for polluters to comply with environmental regulations and switch to cleaner technologies.³⁰

China is also investing more in renewable energies than any other country in the world and has adopted stringent energy efficiency standards, in particular in the industry and transport sectors.



Ethiopia's strategy involves changes in crop and livestock production and soil management, while protecting and restoring forests.³¹ In Latin America, which has a large urban population, city development and greener transport systems are critical areas for achieving green growth.³² Vietnam, with its large population and centers of economic activity located in low-lying coastal areas and river basins, is focusing on increasing the resilience of its coastal zones, water resource management, and agricultural production.

Private sector engagement in many of these sectors is already growing. Aligning NDCs with green growth

strategies and policy frameworks will create even more investment opportunities. The World Bank Group is helping Colombia, India (Himachal Pradesh), Morocco, Lao PDR, and Vietnam, develop and implement policy frameworks to enable investments for a green growth transition in selected sectors. Investments in projects related to pollution management, recycling and waste management, low-carbon energy production, energy efficiency, renewable energy, green transport and urban planning, water resource management, sustainable forestry and fisheries, and nature-based tourism are also directly contributing to these green growth plans.





THE PHILIPPINES

The Philippines' estimated climate-smart investment potential in selected sectors is nearly \$115 billion from 2016–2030.

The Philippines' NDC establishes a conditional greenhouse-gas reduction target of 70 percent below business-as-usual levels by 2030. Analysis has shown that if the planned National Renewable Energy Program and the Energy Efficiency and Conservation Roadmap are fully implemented, the country would only be able to meet its NDC target halfway.³³

The Philippines' main source of electricity in 2015 was coal (44 percent), followed by gas (25 percent).

Geothermal and hydropower each generated about 12 percent, while the markets for both wind and solar power do not currently play a major role in the island's green development. However, through the Philippines Energy Plan 2012–2030, the country plans to add 9.9 GW of new renewable capacity by 2030, including 5.4 GW will be from hydropower (including large hydropower), 2.3 GW from wind power, and 1.5 GW from geothermal energy.³⁴

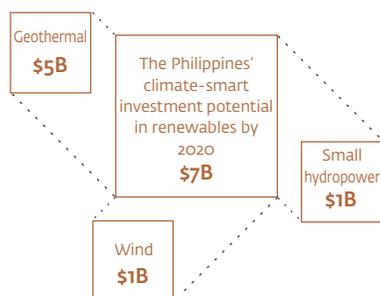
The Philippines is becoming an attractive investment destination. The country's growing middle class and stable political environment have helped the economy grow over the past six years at an average of 6.2 percent. The government is eager to increase investments in several key sectors, including infrastructure, agriculture, manufacturing, green buildings and power generation.³⁵



NEAR-TERM CLIMATE-SMART INVESTMENT POTENTIAL BY 2020

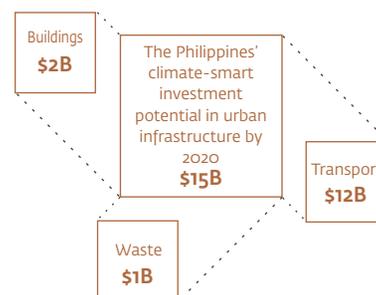
⚡ Renewable energy

Along with Indonesia, the Philippines is the region's geothermal heavyweight. The country has nearly 2 GW of installed geothermal capacity. IFC estimates \$5 billion in commercial potential for geothermal investments by 2020. In addition, the Philippines's Energy Plan will drive investments of \$1 billion for new wind power and \$1 billion for small hydropower.



🏠 Urban infrastructure

As a result of the country's archipelagic geography, cities in the Philippines have not been able to match the economic growth of its neighbors in the region. The *National Dream Plan for Manila and Surrounding Areas* estimates the country's investment needs for transport infrastructure to be about \$12 billion by 2020. In addition, the country's Energy Plan projects a need to replace 7,000 public buses to run on compressed natural gas, and a market penetration increase of hydrogen and fuel cell vehicles by 2030. The investment opportunity for low-carbon buildings and waste will be about \$2 billion and \$1 billion by 2020 respectively.



🍃 Priorities for the Philippines to attract more climate-smart investment

ENSURE A SUSTAINABLE AND EQUITABLE ENERGY MIX

Establish an effective regulatory/policy framework and network infrastructure to promote the use of renewable/clean energy and achieve a sustainable & equitable energy mix.

PROMOTE GREEN URBANIZATION AND CONNECTIVITY

Enable investment in water/sanitation management, green buildings, smart grid/distributed generation, energy efficient inter and intra-city mass-transportation, and energy efficient vehicles through a coordinated and effective regulatory framework.

ENHANCE NATIONAL CLIMATE RESILIENCE

Develop hard climate resilient infrastructure through e.g. retrofitting critical infrastructure such as reservoirs, power transmission and distribution networks etc., and soft climate resilient infrastructure including catastrophic insurance, risk pools etc., targeted in particular towards SMEs and farmers.

PHILIPPINES INDICATORS (2015)

Population: 101 million
 GDP: \$292 billion
 GDP growth: 5.8%
 Inflation: 1.4%
 Ease of Doing Business rank: 97 (2015)
 S&P credit rating: BBB
 FDI, net inflows: \$5.7 billion
 GHG emissions rank: 48 (2012)
 Renewable energy capacity: 6.6 GW

LOW CARBON TARGETS

- Increase renewable energy in primary energy mix to 50% by 2030, up from 34% in 2010.
- Add net renewable energy capacity of 1.5 GW by 2030.

IFC CLIMATE BUSINESS (FY2010 – 2016)

Total climate finance: \$313 million

- Renewable energy: \$250 million
- Energy efficiency: \$63 million

VIETNAM

Vietnam's climate-smart investment potential for selected sectors is more than \$753 billion from 2016–2030.

Vietnam's NDC pledges to reduce greenhouse-gas emissions by 8 percent from business-as-usual levels by 2030 and to reduce greenhouse-gas intensity per unit of GDP by 20 percent by 2030 from 2010 levels. The country has nine categories of mitigation measures within its NDC (with multiple activities in each) and is already working to produce an implementation plan for its NDC.

Vietnam's geographic proximity to global supply chains, and its political and economic stability, make it an especially attractive investment destination for infrastructure projects such as power generation,

roads, railways, and water treatment. Vietnam needs an estimated \$170 billion in additional infrastructure development to meet growing economic demand.³⁶

In energy alone, the Vietnam General Statistics Office estimates that electricity demand will continue to grow at a rate of between 10 percent and 12 percent per year.³⁷

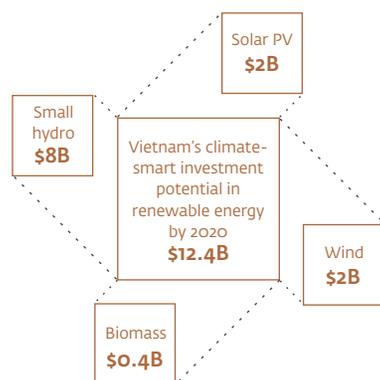
In March 2016, the prime minister approved the revised Power Development Plan VII for 2016–2030, which emphasizes renewable growth, fuel diversification, and transmission reliability. Most importantly, it increases the renewable generation target to 6.5 percent by 2020 and 10.7 percent by 2030.³⁸ It also adds technology-specific targets for biomass and solar power, in addition to previously set wind power goals. At the same time, however, the plan calls for another 40 GW of new coal-fired capacity to be built by 2030, along with several liquefied natural gas import facilities.³⁹



NEAR-TERM CLIMATE-SMART INVESTMENT POTENTIAL BY 2020

⚡ Renewable energy

Vietnam's recently updated Power Development Plan will have a major effect on the country's future deployment of renewable energy (currently just 5 percent of installed capacity). IFC estimates that the country will present nearly \$12.4 billion in new renewable investment potential by 2020. The bulk of this amount will be for small hydropower (\$8 billion), followed by wind and solar PV power (\$2 billion and \$2 billion, respectively).



🏠 Urban infrastructure

Vietnam has East Asia's sixth most populous urban population with 23 million people. Between 2000 and 2010, its urban population increased at a rate of 4.1 percent per year – one of the highest rates in the region. The rapid growth in Hanoi and Ho Chi Minh City, for example, means that if they continue to grow at current rates both cities will be twice as large as they were in 2000.⁴⁰ The need for low-carbon transport infrastructure in Vietnam is significant, at an estimated \$171 billion through 2020, while the investment opportunity for low-carbon buildings and waste management in Vietnam is about \$8 and \$0.3 billion respectively by 2020. The national priorities for low-carbon transport focus on developing sustainable public transport systems specifically rapid transit in large urban areas, and the design of new policies around fuel quality, emissions standards and vehicle maintenance.



🍃 Priorities for Vietnam to attract more climate-smart investment

BUILD UP CLIMATE-SMART CAPACITY IN BANKS

Provide clearer guidance and incentives to enable financial intermediaries to play a greater role in supporting climate related investments.

GREEN INDUSTRIAL SECTORS

Remove barriers to greater utilization of renewable energy in sugar sector through advanced regional biomass energy planning and developing new financing mechanisms and business models to transform the grid-connected biomass power industry.

SUPPORT GREATER WIND POWER

Revise the wind feed-in tariff to align with the effective tariffs that were introduced for the biomass and waste-to-energy sectors in 2014.

VIETNAM INDICATORS (2015)

Population: 91.7 million
 GDP: \$193.6 billion
 GDP growth: 6.7%
 Inflation: 0.6%
 Ease of Doing Business rank: 93
 S&P credit rating: BB-
 FDI, net inflows: \$11.8 billion
 GHG emissions rank: 35 (2012)
 Renewable energy capacity: 16.7 GW

LOW CARBON TARGETS

- Add wind power of between 710 MW and 800 MW by 2020 and 6 GW by 2030.
- Add solar PV power of 850 MW by 2020 and 12 GW by 2030.
- Add biomass, biogas, or geothermal power of 1 GW by 2020 and 3.4 GW by 2030.

IFC CLIMATE BUSINESS (FY2010 – 2016)

Total climate finance: \$59 million
 • Renewable energy: \$13 million
 • Energy efficiency: \$46 million

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Latin America and the Caribbean Climate-Smart Investment Potential

Investment Spotlights

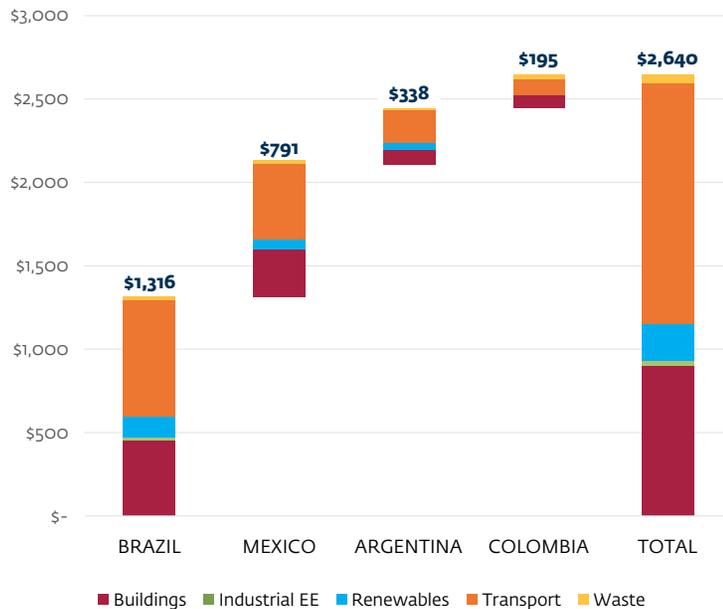


Latin America and the Caribbean Climate-Smart Investment Potential

Investment Spotlights

The Latin American and Caribbean region, which stretches from Mexico to Panama to Argentina, is experiencing unprecedented increases in energy demand, population growth, and urbanization, exacerbated by an acute need for improved infrastructure for more efficient industry, transport, and power. The region's economies are ripe to move to the next level of climate-smart development. Its greenhouse-gas footprint has reduced by about 11 percent since the start of the century, while maintaining gross GDP growth at an annual rate of about 3 percent.¹ The decline in emissions is the result of growing renewable energy and energy-efficiency investments. Brazil, Chile, and Mexico have used innovative, market-based auctions and other policy approaches to bring significant private investment in renewable energy into the region. However, the region remains vulnerable to climate change due to its reliance on fragile natural resources – such as the coral reefs in the Caribbean – for economic activities and livelihoods.

Climate-Smart Investment Potential
2016 - 2030 (\$ billion)



Investment potential

Based on IFC's analysis of the climate pledges of Argentina, Brazil, Colombia, and Mexico, the region's total climate-smart investment potential is over \$2.6 trillion by 2030. Almost 60 percent of this amount is for improvements and new investments in transport infrastructure (\$1.5 trillion), while a third (\$901 billion) will go towards developing new green buildings for Latin America's future sustainable cities. Due to policy changes and growing business interest, opportunities for investment in climate-smart agriculture are significant, but no valid estimates exist.

The LAC region occupies a highly enviable position in terms of attracting significant climate finance for sectors such as renewable energy generation, energy efficiency and green urban infrastructure

The low-carbon policies and plans that reinforce the Latin American and Caribbean region's NDCs reflect the region's decades of experience in generating electricity from carbon-friendly power sources. The



region uses hydropower extensively, giving it the highest rate of clean energy penetration in the world.

Our assessment of selected renewable energy opportunities in Argentina, Brazil, Colombia, and Mexico reveals a conservative estimate of \$232 billion in investment potential by 2030. The rest of the Latin American and Caribbean region demonstrates strong investment potential of nearly \$200 billion for renewable energy, bringing the region's cumulative investment opportunity for renewable energy to \$432 billion, excluding traditional investments in large-scale hydropower.

Urban infrastructure

Latin American cities are already serving as models for innovative, low-carbon transport systems. The region's dense populations and widespread use of public transport means its greenhouse-gas emissions per capita are significantly lower than other parts of the world. Transport electrification is an important next step in decarbonizing the sector, but this will require considerable infrastructure investments.²

Climate Investment Spotlights



COLOMBIA – BUS RAPID TRANSIT

In November 2012, IFC facilitated a \$176 million financing package to Recaudo Bogota – Bogota's bus operator – to develop and operate fare collection and fleet management and real-time monitoring via information technology. The financing resulted in improved public transportation for 6 million passengers, with more efficient bus routing and lower GHG emissions.



BRAZIL - RENEWABLE ENERGY

In July 2013, IFC provided \$71 million in equity to CPFL Renovaveis (CPFLR), a company that develops, constructs, and operates wind, small hydro, and biomass projects in Brazil. This project involves the financing of 530 MW of renewable energy projects in CPFLR's 3.8 GW pipeline in advanced stages of development. The project will result in significant growth in CPFLR's operating capacity and contribute to Brazil's energy diversification.



In Bogotá, Colombia, public and private transport systems consume 67 percent of energy. There are more than 1.5 million vehicles in the city, along with bus rapid transit systems and an extensive network of bike lanes.

Air and maritime transport solutions are also needed in the region and offer considerable potential for emissions reductions. Several ocean and airfreight companies, for example, as well as commercial airlines, have already pledged to reduce carbon emissions.³

Renewable energy

In 2015, more than \$17 billion was committed in renewable energy investments in the Latin American and Caribbean region, driven heavily by Brazil (\$6.9 billion, or 40 percent of total investment). Three other countries set records: Mexico (\$3.9 billion) and Chile (\$3.4 billion) more than doubled their previous year's investment, while Uruguay's investment (\$1.1 billion) increased by 25 percent between 2014 and 2015. Most renewable energy investment was in wind energy (\$10.7 billion), followed by solar power (\$3.8 billion). The region's vast renewable energy resources and high targeted shares for renewable energy deployment enabled successful tenders in several countries, which resulted in some of the world's lowest bid prices.⁴ Recent legislative changes that allow small-scale generators to enter the electricity market, along with the growing role of cooperatives in delivering renewable energy solutions for rural electrification, are further improving the region's outlook.

Adaptation and resilience

The region also has the opportunity – and imperative – to increase private investment in climate-resilient infrastructure. The region faces serious challenges, including threatened drinking water resources, the potential for reduced crop yields, and flooding caused by rising sea levels. Caribbean islands are particularly susceptible to climate change and are expected to suffer natural disasters such as hurricanes and floods with increasing intensity in the coming decades. Climate change also poses a risk to Latin America's energy systems. In 2015, for example, Brazil experienced a severe drought that reduced water levels to below 37 percent of capacity – in a country that generates nearly 80 percent of its electricity from hydroelectric dams. The drought almost dried up one of Brazil's most iconic natural treasures, Iguazu Falls.⁵



ARGENTINA

Argentina's estimated climate-smart investment potential is more than \$338 billion in selected sectors from 2016–2030.

The country's NDC aims to reduce its greenhouse-gas emissions by 15 percent by 2030, relative to business-as-usual projections. Argentina is one of Latin America's largest and wealthiest countries but the country is still emerging from a monetary crisis. Several recent reforms

by the country's new government are improving the investment climate, including removing energy and transportation subsidies. Investors are seeing rising construction volumes and opportunities for building upgrades, transport, and waste management.

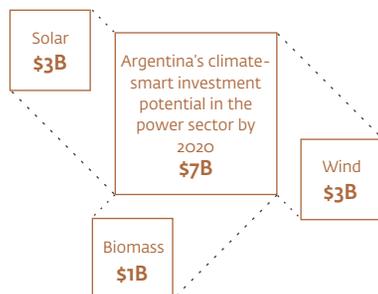
As part of new legislation passed in March 2016, the country has introduced a renewables mandate, feed-in tariffs, and tax incentives to help support the development of renewable energy.⁶ Greenhouse-gas intensive sectors such as agriculture and cattle-ranching are important to Argentina's economy, offering investors opportunities for climate-smart solutions.



NEAR-TERM CLIMATE-SMART INVESTMENT POTENTIAL BY 2020

⚡ Renewable energy

Argentina passed legislation that establishes mandatory renewable energy generation targets: 8 percent by 2017 and 20 percent by 2025. This will require about 11 GW of new capacity over the next 10 years.⁷ IFC estimates the investment potential in Argentina for wind projects in 2020 to be \$3 billion, while solar PV and biomass energy represent opportunities of \$3 billion and \$1 billion, respectively.



🏠 Urban infrastructure

IFC estimates that more than \$9 billion will be invested in new low-carbon buildings in Argentina by 2020. To help reduce greenhouse-gas emissions from the country's transport sector, green infrastructure for rail and roads is projected to be a \$64 billion opportunity by 2020 and waste presents a \$1 billion opportunity.⁸ The country plans to increase urban rail capacity to 4 million passengers by 2023 and to modernize the public rail transport system by incorporating efficient technologies and services.⁹



🌿 Priorities for Argentina to attract more climate-smart investment

UNLOCK THE POTENTIAL OF RENEWABLES

Follow through in implementing new law and improve integration of clean energy with the grid.

INCREASE CLIMATE-SMART AGRICULTURE POTENTIAL

Increase irrigated crop area and improve water resource management. There is also large potential for improved livestock practices and no-tillage/fertilizer recycling.

LEVEL THE PLAYING FIELD FOR CLEAN ENERGY

Consider introducing a carbon price and follow up on 2013 commitment to remove inefficient fossil fuel subsidies.

ARGENTINA INDICATORS (2015)

Population: 43.4 million
 GDP: \$583.2 billion
 GDP growth: 2.4%
 Inflation: 10.6% (2013)
 Ease of Doing Business rank: 117
 S&P credit rating: B-
 FDI, net inflows: \$11.9 billion
 GHG emissions rank: 29 (2012)
 Renewable energy capacity: 11.3 GW

LOW CARBON TARGETS

- 8% renewable energy in final energy consumption by 2017
- 20% renewable energy in final energy consumption by 2025

IFC CLIMATE BUSINESS (FY2010 – 2016)

Total climate finance: \$48 million

- Renewable energy: \$6 million
- Energy efficiency: \$17 million
- Other mitigation: \$25 million

Climate finance, selected NDC sector:
 Agribusiness & forestry: \$26 million



BRAZIL

Brazil's estimated climate-smart investment potential for selected sectors is \$1.3 trillion from 2016–2030.

Brazil, the world's ninth largest economy, has pledged to reduce greenhouse-gas emissions by 37 percent by 2025 from 2005 levels, and by 43 percent by 2030. Brazil's economy contracted 3.8 percent in 2015, setting GDP back to 2011 levels. Despite these difficulties, Brazil's

large economy and vast middle class continue to make the country an important destination for long-term investment.¹⁰

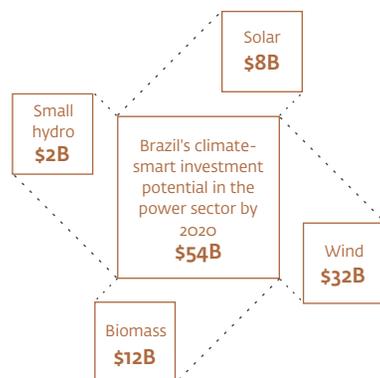
Brazil has the largest power market in Latin America, with a total installed capacity of more than 140 GW in 2015. The country's size, resources, and proactive policies have made it the main renewable energy market in the region and one of the top 10 in the world.¹¹ In December 2015, Brazil approved its latest 10-Year Energy Expansion Plan. The plan includes new targets for 7 GW of utility-scale solar power and 1.3 GW of distributed solar PV capacity to be installed by 2024.¹²



NEAR-TERM CLIMATE-SMART INVESTMENT POTENTIAL BY 2020

⚡ Renewable energy

Large hydropower remains the principal source of electricity generation in Brazil (74 percent in 2015), but energy from wind projects has reached price parity with conventional sources and has now become one of the main providers of new capacity.¹³ In 2015, Brazil installed over 2.5GW of wind power alone. By 2020, wind power's estimated investment potential is \$32 billion, followed by \$12 billion for biomass-generated electricity projects. Solar PV in Brazil will also present major opportunities for investment (\$8 billion by 2020), as well as small hydro, to a lesser extent (\$2 billion).



⚙️ Industrial energy efficiency

The government of Brazil has yet to establish a comprehensive national energy efficiency policy but the country's NDC does cover a proposed goal to reduce electricity consumption by 10 percent by 2030. The potential for investment in Brazil's industrial sector is significant. For example, the amount of electricity generated by CHP in Brazil's industrial sector is currently less than one percent.¹⁵ IFC's assessment of investment potential for measures to improve energy efficiency in Brazil's industrial sector by 2020 is \$6.4 billion.

🏠 Urban infrastructure

Almost 85 percent of Brazil's 208 million citizens live in urban centers, offering climate-smart investment opportunities to develop and refresh city infrastructure. IFC estimates that more than \$50 billion will be invested in new low-carbon buildings and \$5 billion in the waste sector by 2020. To help reduce Brazil's transport emissions, green infrastructure investment in rail and roads will require \$209 billion by 2020. Plans to promote efficiency in urban transport include growing the share of biofuels in the national transport matrix, and increasing energy efficient vehicles on the road.¹⁴



🍃 Priorities for Brazil to attract more climate-smart investment

DIVERSIFY RENEWABLE ENERGY INVESTMENTS

Move renewable generation away from primarily hydropower; incentivize more distributed generation such as solar PV through policies like net metering. This will help address high costs and allow more finance to flow.

UNTAP THE ENERGY EFFICIENCY RESOURCE

In spite of vast potentials in all sectors, Brazil's focus on energy efficiency has mainly been on buildings. The industrial sector has strong potential for energy efficiency that could be achieved through a focused sector-specific approach.

LEVEL THE PLAYING FIELD

The government should capitalize on growing interest in the Brazilian corporate sector to support carbon pricing and investigate options that would both raise revenues and level the playing field for clean energy.

BRAZIL INDICATORS (2015)

Population: 208 million
 GDP: \$1.8 trillion
 GDP growth: -3.8%
 Inflation: 9%
 Ease of Doing Business rank: 111
 S&P credit rating: BB
 FDI, net inflows: \$75.1 billion
 GHG emissions rank: 4 (2012)
 Renewable energy capacity: 113 GW

LOW CARBON TARGETS

- National voluntary, non-hydro, clean energy generation target of 20% by 2030
- National greenhouse-gas emissions reduction target of 36.1% to 38.9% by 2020, compared to a 2005 baseline (non-binding)

IFC CLIMATE BUSINESS (FY2010 – 2016)

Total climate finance: \$591 million

- Renewable energy: \$406 million
- Energy efficiency: \$115 million
- Other mitigation: \$70 million

Climate finance, selected NDC sector:
 Agribusiness & forestry: \$96 million

Sustainable Cities

In 1900, London was the only city in the world with a population of more than 5 million people. Today, there are over 70 cities with at least as many people. The world's urban population is growing by between 60 million and 70 million people a year, and 70 percent of the emerging market population is expected to live in cities by 2050. Urbanization is particularly prevalent in developing markets and the time is now to capitalize on this trend.

Cities are a profitable and scalable business. IFC is pursuing comprehensive city engagements with Istanbul, Bogotá, Medellín, Buenos Aires, and Belgrade, focusing on urban transport, energy efficiency, water and sanitation, solid waste, and various aspects of preserving and strengthening the financial health of these cities. Research shows that the bigger the city, the more the average citizen owns, produces, and consumes. On average, as city size increases, per capita quantities such as wages, GDP, number of patents produced, and number of educational and research institutions all increase by about 15 percent more than expected linear growth.

But urbanization does not automatically breed economic and social success. If growth is not managed properly, the negative effects of rapid urbanization may slow or even reverse economic development. This means that the choices we make today will have lasting consequences. Cities generate 70 percent of carbon dioxide emissions. Carbon reduction and infrastructure efficiency are often linked; urban planning that seeks low-carbon solutions in the most carbon-intensive sectors (housing, transport, waste, water, and street lighting) will often have benefits for citizens and the climate.

Mayors play a critical role in determining the policies and investments that will shape the long-term carbon footprint of a city. It is their role to develop a city's vision and strategy. But this is not always easy – mayors have conflicting priorities and limited time, budgets, and human resources to identify and implement climate-smart infrastructure solutions. Within this context there is a growing need for private sector interventions.

Climate-Smart Cities IFC Project Examples



SUSTAINABLE SKYLINES, COLOMBIA

IFC provided technical support and helped to address barriers for the construction sector in the development of Colombia's new green buildings codes. Buildings are expected to consume up to 45 percent less water and energy, and this will reduce construction sector emissions by 28 percent by 2021.



URBAN WATER SYSTEMS EXPANSION, CHINA

IFC provided a \$16 million loan to a private company investing and operating in the water supply and wastewater treatment sector in China's second and third-tier cities.



The growing role of the private sector in climate-smart cities

While private companies have often been the implementers or managers of municipally funded projects, there is growing opportunity for mayors to shift the investment outlay for such projects to companies through public-private partnerships. Infrastructure concessions that define project parameters and issue tenders for the lowest price can foster competition among private players to maximize efficiency and reduce costs. This often results in lower overall financial outlays for governments and shifts payments from their capital budget to expenses.

The private sector also brings technology solutions. Competitive tendering allows city mayors to tap into private sector innovations for solutions to city challenges. These may include technologies in building materials that have a lower carbon footprint; “smart” technology for water, waste, and transport that improve efficiency and effectiveness; and innovative ways to address a historical problem (for example, Uber and Lyft). By issuing tenders that define the project’s objective instead of the technology to be used, municipalities can receive the most affordable, effective solution available.



METRO EXPANSION, TURKEY

IFC provided a \$68 million loan to the Metropolitan Municipality of Istanbul to expand the metro system to the Asian side of the city.



STREET LIGHTING, INDIA

Through an advisory project, IFC helped India’s Orissa State upgrade its street lighting network under a public-private partnership that will improve energy efficiency and increase safety in areas currently without street lights.



COLOMBIA

Colombia's estimated climate-smart investment potential for selected sectors is more than \$195 billion from 2016 – 2030.

Colombia's NDC targets a 20 percent greenhouse-gas reduction by 2030. In 2015, the country had the fourth largest GDP in the region after Brazil, Mexico, and Argentina. Colombia has sustained a healthy average growth rate of more than 4 percent for the past decade.¹⁶ The economy has been boosted by improvements to the business environment, sound macroeconomic management, and investment growth. The country is highly urbanized, with 75 percent of the population

living in cities, 30 percent of which are concentrated in Bogotá, Cali, Medellín, and Barranquilla.¹⁷

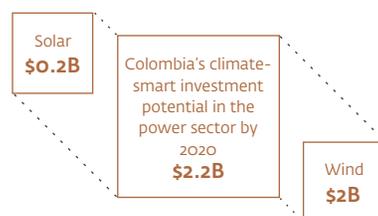
The country aims to meet its climate target through eight sectoral mitigation action plans. Transportation is a major area of growth for investors. Only 14 percent of Colombia's roads are paved, the rail system is small and ageing, and transportation costs are some of the highest in South America. The Colombian National Infrastructure Agency, created in 2011, announced an ambitious plan of public-private partnerships to attract between \$20 billion and \$50 billion in funding from 2011 to 2021.¹⁸ Adaptation is also important to Colombia and its NDC sets out goals to build climate resilience by 2030 in key sectors, such as transport, energy, agriculture, housing, tourism, and industry.



NEAR-TERM CLIMATE-SMART INVESTMENT POTENTIAL BY 2020

⚡ Renewable energy

Colombia has some of the highest energy potential in the Latin American and Caribbean region because of its favorable climate and geography. The majority of Colombia's renewable energy generation is large hydropower, with only 3.3 percent coming from non-hydropower sources. The government seeks to nearly double that number by 2020¹⁹, increasing the amount of renewable energy in the total energy mix. Colombia's estimated investment potential for wind projects is \$2 billion by 2020 and solar PV projects should see a more modest \$200 million.



🏠 Urban infrastructure

IFC estimates almost \$8 billion of investments will be made in new low-carbon buildings in Colombia by 2020. The country has been an active leader in investing in urban transportation solutions—such as bus rapid transit—and another \$34 billion is expected to be invested as well as \$1 billion in the waste sector by 2020. In transport, the country plans to continue increasing energy efficiency in the aviation sector and improving transport connectivity with construction of additional roads (19,561 km), rail (1,769 km) and waterways (5,065 km)²⁰. Colombia is also ramping up green buildings through new building codes.



🌿 Priorities for Colombia to attract more climate-smart investment

GROW THE MARKET FOR CLIMATE-SMART AGRICULTURE

Support new technologies and research in new crop varieties that are resistant to increasing temperatures, while also providing funds and technical assistance to build the market.

DIVERSIFY THE RENEWABLE ENERGY BASE

Given its reliance on large hydropower and the risk of drought, Colombia could use the 2014 law to provide regulation and incentives to other forms of renewable energy.

GET THE PRICES RIGHT

Colombia's Finance Ministry has recently announced that it is interested in exploring options for carbon pricing as a way to help implement the country's climate goals. Industry is supportive, as this would help level the playing field for renewables against traditional fossil energy and make renewables more competitive.

COLOMBIA INDICATORS (2015)

Population: 48.2 million
 GDP: \$292.1 billion
 GDP growth: 3.1%
 Inflation: 5%
 Ease of Doing Business rank: 54
 S&P credit rating: BBB
 FDI, net inflows: \$11.9 billion
 GHG emissions rank: 47 (2012)
 Renewable energy capacity: 11.6 GW

LOW CARBON TARGETS

- 6.5% on-grid and 30% off-grid consumption by 2020.
- Cut greenhouse-gas emissions by 20% relative to business as usual by 2030 compared to 2010 levels.

IFC CLIMATE BUSINESS (FY2010 – 2016)

Total climate finance: \$148 million
 • Renewable energy: \$15 million
 • Energy efficiency: \$108 million
 • Other mitigation: \$25 million
 Climate finance, selected NDC sector:
 Transport: \$13 million



MEXICO

Mexico's estimated climate-smart investment potential for selected sectors is \$791 billion from 2016–2030.

Mexico's NDC establishes a 25 percent reduction in greenhouse-gases by 2030 relative to business-as-usual projections. Alongside Mexico's NDC commitments, the government has initiated reform efforts in the power sector. In December 2015, Mexico's Congress approved the Energy Transition Law, affirming a 35 percent increase in the use of clean energy by 2024. Also, Mexico's 2012 General Climate Change Law established a goal to reduce GHG emissions by 30 percent by 2020 and 50 percent by 2050.

Private sector interest in Mexico is high – the country possesses world-class potential for renewable energy and its industrial, transport, buildings, waste, and agricultural sectors are all ripe for energy efficiency and climate-smart measures. In 2015, Mexico was among the top 10 countries in the world attracting new clean energy investment, with a total of \$4 billion in investments.²¹ Mexico's status as a low-carbon investment destination is due in part to its major reforms to liberalize power markets, which are expected to be completed in 2018.

Despite this positive momentum, investors are still experiencing challenges. The oil sector in Mexico carries considerable political weight and the government is prioritizing the installation of new natural gas-fired thermal plants in order to take advantage of cheap supply from the United States.



NEAR-TERM CLIMATE-SMART INVESTMENT POTENTIAL BY 2020

⚡ Renewable energy

Mexico held its first reverse power auction in March 2016. A total of 18 projects were awarded 1,691 MW in solar power and 394 MW in wind power. The auction's average contract price (\$47.6/MW-hour) was one of the lowest and most competitive worldwide.²² Mexico's wind sector is expected to provide an \$11 billion investment opportunity by 2020 and solar PV power will present a \$6 billion opportunity. The country is also a global leader in developing geothermal projects, with sector investments of \$1 billion by 2020. Small hydro presents a \$2 billion opportunity for would-be investors.



⚙️ Industrial energy efficiency

IFC's assessment of investment potential for measures to improve energy efficiency in Mexico's industrial sector by 2020 is \$400 million. Despite the country's climate change efforts in other sectors, Mexico currently has no national target for energy efficiency improvements for its industrial sector nor does it provide many incentives for improving energy efficiency to companies in the manufacturing sector.²³ The country does have numerous policies and mechanisms to help drive investment in energy efficiency overall, but to date the priorities have been lighting, appliances and energy efficiency in buildings for the residential and commercial sectors.

🏠 Urban infrastructure

Like much of the region, Mexico is urbanizing and 75 percent of the population lives in urban areas. However, urban transport infrastructure is generally poor and emissions-intensive. IFC estimates that Mexico's low-carbon transport sector will present \$132 billion in investment opportunity by 2020 that emphasizes a system-wide change to increase connectivity and improve maintenance of roads, bridges, and major highways. Mexico has been a leader in green buildings; this sector and the waste sector offer \$33 billion and \$3 million respectively in investment opportunities by 2020.



🍃 Priorities for Mexico to attract more climate-smart investment

LEVERAGE MEXICO'S ENERGY EFFICIENCY RESOURCE

Extend successful efforts in the buildings sector to areas like HVAC and lighting, as well as transport and industry.

IMPROVE RESOURCE EFFICIENCY

Mexico's fertilizer use is especially high in the north, and can be made more efficient through soil nutrient tests, precise fertilization, and use of organic or less impactful inputs. Water use can be optimized through increasing investment in greenhouses and drip irrigation. Agricultural insurance also holds promise.

GET THE PRICES RIGHT

Mexico should build from its existing carbon tax and implement a national carbon market. This will help level the playing field for low-carbon options, as electricity prices are quite low.

MEXICO INDICATORS (2015)

Population: 127 million
 GDP: \$1.14 trillion
 GDP growth: 2.5%
 Inflation: 2.7%
 Ease of Doing Business rank: 42
 S&P credit rating: BBB+
 FDI, net inflows: \$30.3 billion
 GHG emissions rank: 13 (2012)
 Renewable energy capacity: 17.3 GW

LOW CARBON TARGETS

- 35% electric generation from non-fossil sources (hydro & nuclear) by 2024.
- 30% reduction of greenhouse-gas emissions by 2020 compared to base year 2000.
- 50% reduction of greenhouse-gas emissions by 2050 compared to base year 2000.

IFC CLIMATE BUSINESS (FY2010 – 2016)

Total climate finance: \$399 million

- Renewable energy: \$164 million
- Energy efficiency: \$173 million
- Other mitigation: \$62 million

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South Asia Climate-Smart Investment Potential

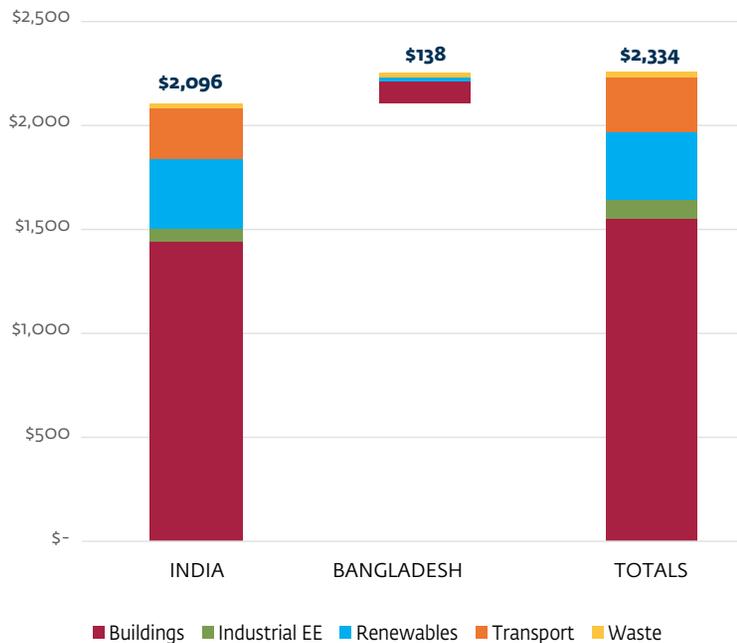
Investment Spotlights

South Asia Climate-Smart Investment Potential

Investment Spotlight

South Asia was the world's fastest growing region with 7 percent GDP growth in 2015, led by India. Although the region comprises 3 percent of the world's land area, it is home to more than 23 percent of the world's population and at least 14 percent of its urban population.¹ The region is particularly vulnerable to climate change because of its large population and vast low-altitude agricultural and economic activities. In addition, despite South Asia's rapid growth, the region continues to suffer from a significant lack of modern, sustainable infrastructure (500 million people remain without access to electricity). Rapid urbanization is placing significant demands on infrastructure, driving the need for power, transport, water, waste management, and sustainable cities. This has been met with surging consumption of coal in power generation and industry making India the largest source of growth in global coal use.² A proactive approach is needed for the region – one that combines investments in adaptation and resilience with low-carbon infrastructure and services. The expansion of new technologies is leading to changing business models and innovation in service delivery. This is most apparent in the booming renewable energy marketplace in India in particular, where recent tenders have resulted in some of the most competitively priced projects in the world.

Climate-Smart Investment Potential
2016 - 2030 (\$ billion)



Investment potential

Based on IFC's assessment of opportunities for climate-smart investments in the NDC plans of Bangladesh and India, the region will nearly have an estimated \$2.2 trillion in investment potential by 2030, 69 percent of which is for new construction of green buildings. In India, infrastructure investments for transportation (ports and rail especially) will reach \$250 billion by 2030, while critical investments in clean energy, including energy efficiency, will reach close to \$400 billion. Opportunities for investment in climate-smart agriculture, forestry, and land-use change projects across the South Asia region are also significant, but estimates have not been made for this report due to data and resource availability.

The region's projected population growth and energy demand offer a significant opportunity for resilient infrastructure and renewable energy investment.



Adaptation and resilience

South Asia is one of the regions most vulnerable to the effects of climate change because of its large population and degraded natural resources (for example, damaged and depleted aquifers, degrading forests and soils). It also has the highest poverty rate in the world. Fortunately, the synergies between development progress and the opportunities to invest in resilient and low-carbon projects mean South Asia will remain at the center of the climate finance landscape for years to come.

Bangladesh's NDC highlights the urgent need to enhance adaptive capabilities and livelihood options for its citizens. Climate change is already affecting water supply, hydro and thermal power, transport, and agribusiness.

Renewable energy

The renewable energy sector in South Asia receives both local and foreign investment. India's clean energy investment reached \$10.1 billion in 2015.³ For the first time,

Climate Investment Spotlight



NEPAL – CLIMATE-SMART AGRICULTURE

IFC is working with agribusiness firms in Nepal to promote improved agricultural and water management practices. This will help small farmers producing rice, maize, and sugarcane to improve their resilience against climate change. The \$9 million project was funded by the Pilot Program for Climate Resilience and is expected to help 15,000 people improve their climate resilience. By starting small and proving the viability of a climate-smart business model, IFC lays the foundation for future investments that promote resilience without sacrificing productivity. The Pilot Program for Climate Resilience Nepal has already been replicated on a larger scale in Bangladesh.



investments in solar energy surpassed those in wind power, reflecting higher government targets and lower auction bids for solar energy. Indian renewable energy companies also attracted the world's second highest venture capital funding in 2015. Its total of \$548 million surpassed all of Europe (\$301 million), and the outlook is good for future large transactions.⁴

Although India leads the region in investment volumes, its neighbors are increasing their investments. Pakistan, for example, attracted a record \$720 million in wind and solar investment in 2015. The country's Alternative Energy Development Board believes it is on the verge of crossing the \$1 billion-a-year threshold.⁵ After installing millions of small solar home systems, Bangladesh plans to add 3.1 GW of renewable energy capacity by 2021. This will be met mainly by grid-scale solar and wind projects, for which it has received proposals from North American, Chinese, Korean, Japanese, German, and Indian companies.⁶

Spotlight countries – Priority sectors for climate investment

Bangladesh and India submitted comprehensive NDCs that clearly outline their climate policies and priorities for the next 15 years. Bangladesh's unconditional NDC pledged a 5 percent reduction in greenhouse-gas emissions by 2030 from key emitting sectors, while India committed to cutting its emissions intensity by a third by 2030.

BANGLADESH

Bangladesh's NDC focuses on the energy sector to mitigate emissions in the power, transport, and industry sectors – each representing opportunities for future private sector investment. Bangladesh, however, is a minor contributor to global emissions (0.35 percent of total emissions) and the greatest investment opportunities are to be found in adaptation and resilience solutions.

Overall, IFC's 2030 estimates put Bangladesh's climate-smart business investment potential at over \$138 billion, with the bulk of this opportunity lying in the green buildings sector (\$113 billion). Renewable energy presents a \$17 billion investment opportunity while transport measures will need a conservative investment of \$5 billion over the NDC timeframe.

INDIA

Few countries in the world are more important to solving the climate crisis than India. The sheer size of the country alone – with a population expected to reach 1.6 billion by 2040 – means India will present enormous opportunities for the private sector to invest in climate-smart projects. Although India's per capita emissions are comparatively low, its current commitments mean it will become the world's second largest emitter after China, surpassing both the European Union and the United States in terms of total emissions by 2030. India's NDC pledge includes commitments to nearly triple its renewable energy capacity by 2022, to raise the share of non-fossil-based power generation capacity to 40 percent of installed capacity by 2030, and to increase its carbon sink – more carbon absorbed than released – to 2.5–3 gigatonnes of equivalent carbon dioxide through additional tree cover by 2030.

Overall, India's climate-smart business investment potential is an estimated \$2.1 trillion. In the sectors IFC considered, investment in renewable energy accounts for more than \$320 billion, with nearly two-thirds of this (\$201 billion) going to solar PV projects and the other third going to wind power (\$104 billion) and biomass projects (\$15 billion). Low-carbon, climate-resilient investments in the transportation sector (ports, rail, roads, and other critical infrastructure) will present a \$250 billion opportunity by 2030. The green buildings market in India presents an opportunity of more than \$1.4 trillion by 2030.

Climate Investment Spotlight



INDIA – UTILITY-SCALE SOLAR

The Azure project involves development of a 40 MW solar power plant in the State of Rajasthan by Azure Power India Private Ltd. The off-taker will be Solar Energy Corporation of India, a Government of India entity. When fully functioning, the project will avoid close to 20,000 tons of greenhouse-gas emissions annually. IFC's portfolio in Indian wind and solar power exceeds \$700 million and includes 3 GW of solar and wind—about 10 percent of the country's installed renewable energy capacity. IFC was an early investor in Azure Power, which is now a leading player in grid-connected solar power. Today, the company has a portfolio of solar plants across several states and is on track to reach 500 MW of operational capacity this year. This was the first solar project under IFC's new clean technology investment program.

BANGLADESH

Bangladesh's estimated climate-smart investment potential is nearly \$138 billion from 2016 – 2030.

Bangladesh's unconditional NDC establishes a 5 percent reduction from business-as-usual levels in 2030. As the world's eighth most populous country, Bangladesh offers promising opportunities for climate-smart investment.

With more than 6 percent annual growth sustained over the past two and a half decades; a large, young, and diverse workforce; strategic location; and vibrant private sector, Bangladesh is likely to attract increasing investment in coming years.⁷ The power generation sector, for example, has made substantial progress in recent years but still requires significant investment to meet growing demand.

Opportunities for off-grid renewable energy solutions are abundant – many of the people without access to

reliable electricity in Bangladesh live in poor, rural areas. For example, its off-grid solar program is the largest market for solar home system kits in the world (more than 4 million sold).⁸ According to its NDC, the government also plans to shift 20 percent of current road transport users to trains. Bangladesh has designed a plan for a 10 percent reduction in energy consumption by industries, with similar targets in the agriculture and building sectors.

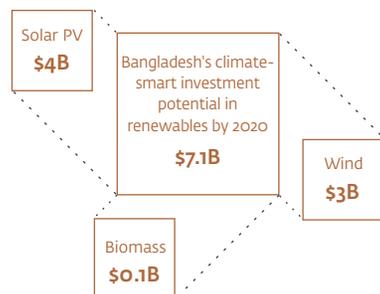
Access to finance, however, is still a challenge for small-scale projects. Commercial interest rates typically range between 11 percent and 14 percent for renewable energy projects, although the government sometimes provides loans at lower rates for the purchase of capital equipment.⁹ Apart from a range of financing programs for off-grid solar, solar irrigation, mini-grids, biogas, and biomass projects, the country does not have specific incentives for larger projects. A draft feed-in tariff for wind and solar projects stalled in 2015. In its NDC submission, Bangladesh estimated that \$27 billion is needed for mitigation and \$42 billion for adaptation measures between 2015 and 2030.



NEAR-TERM CLIMATE-SMART INVESTMENT POTENTIAL BY 2020

⚡ Renewable energy

Bangladesh is one of the most densely populated countries in the world (1,015 people per square kilometer).¹⁰ The availability of land has been cited as a major constraint to growing the renewables sector enough to meet the country's power demand. Despite the country's serious need for grid expansion, aggressive incentives for renewables, and limited access to financing, IFC estimates Bangladesh will attract \$7.1 billion for renewables by 2020. Government targets will help drive commercial investments in solar PV (\$4 billion), wind (\$3 billion), and biomass (\$100 million) by 2020.

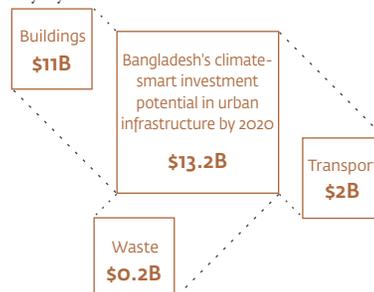


⚙️ Industrial Energy Efficiency

There is good opportunity for investment in Bangladesh's industrial sector, primarily in high growth sectors such as its Textiles and Ready Made Garments industries. By 2020, IFC estimates the climate-smart investment potential for energy efficiency to be \$600 million.¹³ This figure is a conservative estimate of the energy efficiency options for Bangladesh's industrial sector and does not capture the full technical potential available.

🏠 Urban infrastructure

Bangladesh aims to reach middle-income status by 2021 – the 50th anniversary of its independence. To achieve this milestone, the country needs to accelerate growth and urban transformation in parallel.¹¹ IFC estimates \$11 billion of investment in new construction of green buildings in Bangladesh by 2020. There are also many opportunities for low-carbon transportation investments, and our estimate of \$2 billion by 2020 only covers a small portion of the expected overall sum. Additional plans in low carbon transport include growing the high efficiency vehicles market, constructing three bus rapid transit corridors and three metro corridors by 2030, and expanding the railway network by 120 km by 2021.¹² Lastly, waste management presents a \$200 million opportunity by 2020.



🍃 Priorities for Bangladesh to attract more climate-smart investment

PROMOTE CLIMATE SMART AGRICULTURE

Advance agribusiness through supporting seed resilience and climate insurance initiatives.

EXPAND RESOURCE EFFICIENCY

Establish energy use benchmarks and compliance mechanisms in energy-intensive sectors to stimulate industrial energy efficiency investments.

TRANSITION TO A CLEANER POWER GRID

Introduce robust commercial framework with transparent policies on PPAs, convertibility etc., to facilitate private sector participation in utility scale projects. Regulations on metering and grid interconnection are needed to capitalize on the large market opportunity in industrial and commercial rooftop solar.

BANGLADESH INDICATORS (2015)

Population: 161 million
 GDP: \$195.1 billion
 GDP growth: 6.6%
 Inflation: 6.2%
 Ease of Doing Business rank: 172
 S&P credit rating: BB-
 FDI, net inflows: \$3.4 billion
 GHG emissions rank: 43 (2012)
 Renewable energy capacity: 230 MW

LOW CARBON TARGETS

- 10% renewable energy sources by 2020
- 3.1 GW of renewable capacity by 2021

IFC CLIMATE BUSINESS (FY2010 – 2016)

Total climate finance: \$29 million
 • Energy efficiency: \$29 million

Green buildings

The global momentum to build green buildings is growing, as global green building activity continues to double every three years.¹⁴ The International Energy Agency estimates¹⁵ that the building sector alone needs an additional investment of up to \$296 billion each year if average global temperatures are to be capped at 2°C. This is in addition to the \$358 billion that already goes into the sector each year. The Intergovernmental Panel on Climate Change finds that the building sector accounts for 32 percent of total energy use and 19 percent of GHG emissions.¹⁶ Population growth, combined with urbanization and rising incomes, will substantially increase the number of buildings we currently have, and it is expected that this in turn will double global GHG emissions from the buildings sector to 40 percent.

The biggest growth in green buildings is expected in developing countries, and the percentage of firms expecting to have more than 60 percent of their projects certified green worldwide is anticipated to more than double from 18 percent in 2016 to 37 percent by 2018.¹⁷ It is notable that green building decisions are no longer

triggered mainly by a sense of duty – the top trigger today is client demand, closely followed by regulations – which, given the NDCs, is likely to intensify. Meeting the increasing demand for building-related energy consumption will have significant implications for planning, management, and investments in the energy sector. **Brazil** expects sixfold growth in green buildings (from 6 percent to 36 percent); fivefold growth is expected in **China** (from 5 percent to 28 percent); and fourfold growth is expected in **Saudi Arabia** (from 8 percent to 32 percent). This is expected to grow further, as over half of the NDCs (74 developing countries) reference buildings as a key climate investment opportunity.

The building sector is one of the main consumers of energy and resources, using about 35 percent of global energy (and 60 percent of electricity), 25 percent of global water, and 40 percent of materials extracted globally. In addition, it emits about one-third of greenhouse-gas emissions.¹⁸ However, according to the International Energy Agency, the building sector is the least exploited source of energy efficiency, with only 20

percent of the commercially viable potential expected to be captured.

The good news is that home buyers are increasingly demanding green¹⁹ and that energy-efficient houses are important for consumers. Furthermore, developers in the United States and Europe can command higher sales prices for green-certified homes, ranging from 4 to 9 percent higher; green homes sell as much as four times faster; occupants save 15 to 20 percent on lower utility bills for green homes; re-sale value is 4 to 10 percent higher; and banks enjoy a default rate of up to 33 percent lower from buyers of green homes. These numbers are certainly large enough to motivate banks to invest in green buildings.

However, in order for lenders to recognize the value of a property's green measures, large-scale adoption of a universal **green performance standard** with a focus on areas of cost savings in homes is needed. This is an important driver, especially in the developing world, where utility costs can consume up to 20 percent of a moderate-income family's disposable income. The



standard needs to be defined by a **certification system** that is inexpensive, quick, and simple, thus making it accessible to the majority of the market. The standard needs to be supported by a well-understood calculator that can benchmark and measure energy and water savings. The IFC EDGE certification standard and software tool allow developers and investors to choose the lowest cost options that will help them reach the green standard. Policy enabling environments, including building codes, are also critical.

The following examples demonstrate green building projects in developing countries that are making good progress:

- **Mexico's public bank, Infonavit, changes the low-income housing market to green.** In 2007, Infonavit piloted green mortgages. This involved providing an extra credit (about \$1,250) to homeowners for a set

of preset green technologies. The product became extremely popular, especially for low-income housing finance. By 2011, 75 percent of all home mortgages were green. In 2014, Infonavit decided to issue only green mortgages. The bank's market share also increased significantly (over 12 percent) during the period. To date, Infonavit has granted over 1 million green mortgages, benefiting over 3 million people.

- **India: Metrics-driven, scalable voluntary standards bring together market players and prove the business case for building green.** The Green Business Certification Inc. launched EDGE India in August 2015. In just one year, about 20,000 housing units and 10 million square feet of commercial space met EDGE standards (energy, water, and materials consumption reduced by 20 percent each). EDGE India attracted financing for green construction through developers such as VBHC, XANDER, TATA, Shapoorji, and

hotel clients such as SAMHI. It also stimulated capital markets products and the creation of the Sustainable Housing Leadership Consortium. State governments (such as Tamil Nadu) are beginning to offer incentives to the private sector to go green. The EDGE program aims to achieve 20 percent market penetration of green buildings in seven years²⁰.

Indonesia leads with green building codes to cut greenhouse gases. The government of Jakarta issued green building regulations to all large new and existing buildings on April 23, 2013. To date, 200 large projects in Jakarta have met the green building regulations requirements. On completion, these buildings will reduce carbon dioxide equivalent emissions by more than 250,000 tons per year and save over \$30 million in electricity costs. National government has also introduced a green building code²¹.



INDIA

India's estimated climate-smart investment potential for selected sectors is \$2.1 trillion from 2016 – 2030.

India's NDC includes a pledge to reduce the country's greenhouse-gas intensity by between 33 percent and 35 percent by 2030, based on 2005 levels. The nation's economy is expected to triple in size between now and 2040, and its population is projected to surpass China's around the year 2030, making India the world's most populated country.²² India's infrastructure financing needs will range between \$1.5 trillion and \$2 trillion over the next seven years, offering the private sector excellent opportunities for climate-smart investment.²³

In addition to rapid growth in electricity demand, India experiences high power grid losses. According to the Institute for Energy Economics and Financial Analysis, the country has the world's highest aggregate grid-loss rate in the world, estimated at 26 percent. In May 2015, India approved a "National Smart Grid Mission" to improve power supply efficiency and reduce grid losses and outages.²⁴

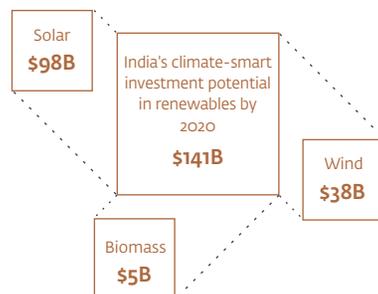
India has set an ambitious target of developing 175 GW of renewable energy by 2022. At the end of 2015, the country had over 80 GW of renewable energy installed (including large hydro), representing almost 30 percent of its total power generation capacity and accounting for about 18 percent of total power generation.²⁵ Aside from large hydro, the largest contribution of renewable energy by 2020 – 100 GW – is expected from solar power, followed by 60 GW from wind, 10 GW from biomass, and 5 GW from small hydropower.



NEAR-TERM CLIMATE-SMART INVESTMENT POTENTIAL BY 2020

⚡ Renewable energy

India's economic growth over the next 15 years will play a pivotal role in the global fight against climate change. The opportunities for climate-smart investments in the power sector are substantial and IFC estimates that India will attract \$1,411 billion for renewable energy alone by 2020. The government has provided a clear trajectory for specific technologies in its NDC, with solar PV leading the way (\$98 billion); of which \$13.5 billion will be in rooftop solar²⁶. Wind energy is also set to make significant gains (\$38 billion). Biomass power will require a smaller, but substantive, figure of \$5 billion.



⚙️ Industrial Energy Efficiency

India has made progress in improving energy efficiency and boasts a number of initiatives to tackle the issue, yet still requires massive investments in industry given growth forecasts for manufacturing. One innovative example is the country's 2012 market-based program *Perform, Achieve and Trade (PAT)*. Now in its second cycle, PAT attempts to improve energy efficiency across over 900 companies—representing over half of industry's GHG emissions—by implementing an energy savings certification and trading scheme for industry. The investment potential for industrial energy efficiency in India by 2020 is \$28 billion.²⁹

🏠 Urban infrastructure

An additional 250 million people will be living in Indian cities by 2030. A reliable and affordable transport system is needed to accommodate this new growth.²⁷ This trend is reflected in IFC's investment estimate of \$75 billion for modern, climate-friendly transportation by 2030. National low carbon transport plans include constructing two dedicated freight corridors Mumbai-Delhi and Ludhiana-Dankuni, 600 km of metro lines, and solar powered toll plazas. National plans also promote the growth of coastal shipping and inland water transport, accelerating use of hybrid and electric vehicles, and developing policies on biofuels and green highways.²⁸ The commercial market for investment in green buildings is an estimated \$89 billion by 2020. Waste management presents an opportunity of \$3 billion.



🍃 Priorities for India to attract more climate-smart investment

IMPROVE EFFICIENCY OF THE ELECTRICITY SYSTEM

Implement the Ujwal DISCOM Assurance Yojana program to improve the operational efficiency of electricity distribution companies and introduce a robust payment security mechanism to ensure off-takers pay renewable energy project developers in a timely way.

STRENGTHEN THE TRANSMISSION GRID

This will minimize curtailment risks for renewable energy power generators and enable increased equity investments in the sector.

UNLOCK MORE FINANCING

Support greater use of credit enhancements to enable increased refinancing of underlying assets thereby freeing up balance sheets and attracting investor capital.

INDIA INDICATORS (2015)

Population: 1.31 billion
 GDP: \$2.07 trillion
 GDP growth: 7.6%
 Inflation: 5.9%
 Ease of Doing Business rank: 134
 S&P credit rating: BBB-
 FDI, net inflows: \$44.2 billion (2015)
 GHG emissions rank: 3 (2012)
 Renewable energy capacity: 81.8 GW

LOW CARBON TARGETS

- 175 GW of renewable energy by 2022: 100 GW (solar), 60 GW (wind), 10 GW (biomass), and 5 GW (small hydro).
- Aspirational target of 20% blending of biofuels, both for biodiesel and bio-ethanol, by 2017.

IFC CLIMATE BUSINESS (FY2010 – 2016)

Total climate finance: \$1.7 billion

- Renewable energy: \$929 million
- Energy efficiency: \$744 million
- Other mitigation: \$51 million

Climate finance, selected NDC sector:
 Agribusiness & forestry: \$24 million;
 transport: \$69 million

EDGE – Excellence in Design for Greater Efficiencies

EDGE Green Building Certification is an IFC innovation that provides builders, bankers, and buyers with a simple, quick, and affordable quantification of a building’s energy and water efficiency in developing countries. The EDGE certification system presents designers with green options relevant to local climates, construction customs, and building usage patterns, allowing them to experiment with different options to improve capital costs, aesthetics, and efficiency. The EDGE software application instantly quantifies a design’s expected energy, water, and carbon dioxide footprint, as well as its incremental cost and payback period. In minutes, this allows a designer to see whether a design meets the EDGE standard of 20 percent efficiency in energy and water consumption and embedded energy in materials, and how much additional investment a green design requires. The certification process takes between one and two weeks and the cost is about a tenth of other options. Users generally report capital cost increases of about 2 percent and paybacks of between two and three years. This has led to strong market uptake, with almost a million square meters certified and the adoption of EDGE as a green asset definition for green bonds and financial intermediaries in India, South Africa, Turkey, and Costa Rica.

www.ifc.org/EDGE

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Sub-Saharan Africa Climate-Smart Investment Potential

Investment Spotlights



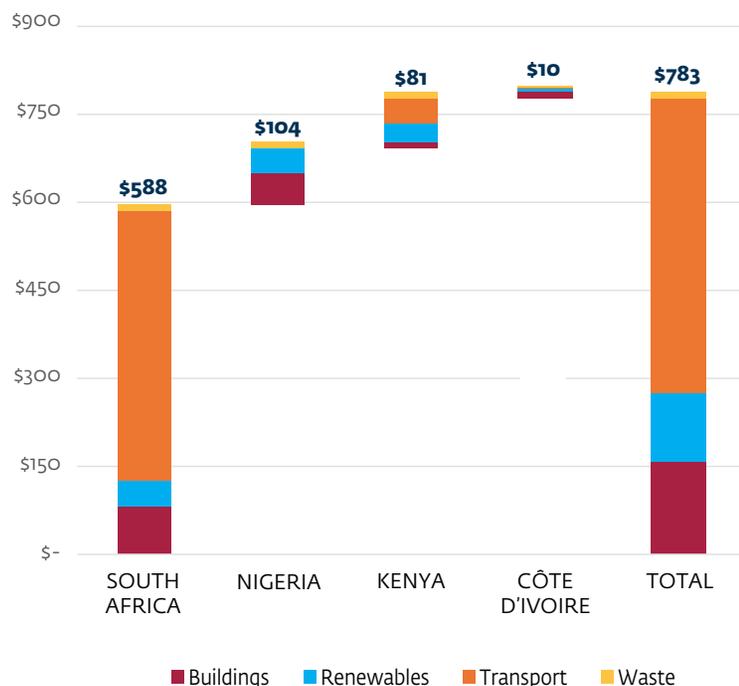
Sub-Saharan Africa Climate-Smart Investment Potential

Investment Spotlights

Africa's projected growth represents a huge economic and development opportunity, as well as a key focal area for global action to adapt to and address climate change. Energy demand is rising rapidly in the region, as is the population and the rate of urbanization. These trends exacerbate the region's acute need for improved infrastructure. The region has fueled growth through investments in technology, media and telecommunications, retail and consumer products, financial services and natural resources.¹ Due to the recent depreciation of several currencies and rising inflation, investing in some parts of Africa has become more challenging. Africa's extreme vulnerability to climate change impacts threatens to undermine major developmental gains, exacerbate existing weaknesses, and stifle growth prospects. Accelerating investment in resilient infrastructure and energy access is an immediate priority.

Africa's top priority to address projected growth and climate vulnerability is to invest in resilient infrastructure and clean energy access

Climate-Smart Investment Potential
2016 - 2030 (\$ billion)



Investment potential

The estimated total investment potential for the climate-smart needs of Côte d'Ivoire, Kenya, Nigeria, and South Africa is \$783 billion by 2030. Sixteen percent of this potential is for renewable energy generation (\$123 billion), while well over half (\$499 billion) is for the transportation sector. By 2030, the commercial investment potential in the construction of low-carbon buildings is estimated at nearly \$153 billion. Opportunities for investment in climate-smart agriculture projects across Sub-Saharan Africa are important in all of the four countries profiled, but currently no valid estimate exists for the size of this potential.

Adaptation and resilient infrastructure

Warming in the range of three to four degrees Celsius would have disastrous consequences for Sub-Saharan Africa, including heat extremes affecting the vast majority of the continent's land area, heightened risks of extreme drought (particularly in southern Africa), crop failures and reduced yield, and flooding.² Furthermore, by 2050, almost 60 percent of people (800 million) in the region will live in cities,

increasing demand for transport, building, and energy infrastructure.³ It is thus imperative to invest in resilient infrastructure, including water management (irrigation, hydropower, water supply, or flood control), roads, bridges, and other transport infrastructure. According to the World Bank Africa Climate Plan, these investments amount to \$5 billion to \$10 billion per year.⁴

Clean energy access

An estimated 600 million people in the region have no access to basic electricity services, and this number will increase with a projected 2.3 percent annual population growth.⁵ Only seven Sub-Saharan countries presently have electricity-access rates exceeding 50 percent;⁶ the rest have an average grid access rate of just 20 percent. The annual investment in the Sub-Saharan African power system is currently estimated at around \$8 billion per year, or 0.5 percent of GDP.⁷ As a result, energy access is a priority. At the same time, electricity demand in Africa is projected to triple by 2030, representing huge potential for investment in renewable energy.

Africa's power sector requires investments of \$70 billion per year, on average, between now and 2030.⁸ This can be split into about \$45 billion per year for generation capacity and \$25 billion for transmission and distribution. Renewables could account for two-thirds of the total investments in generation capacity, or up to \$32 billion per year.⁹ Realizing this opportunity will create significant business opportunities in Africa. In the power sector, the share of renewables could grow to 50 percent by 2030. In the same time period, hydropower and wind capacity could reach 100 GW each, followed by a solar capacity of over 90 GW.¹⁰

In order to unlock the region's immense energy access potential, governments and businesses need to address governance, institutional, policy, and implementation challenges; different levels of financial market maturity; political instability; and an underdeveloped private sector. The power sector's financial viability will be enhanced if prices begin to reflect the true cost of electricity. A range of financing tools is needed to attract private finance for new electrical capacity. Governments in the region can help by providing clear regulatory frameworks and using domestic or international public finance to guarantee risks.

Climate Investment Spotlights



SOUTH AFRICA – CONCENTRATED SOLAR POWER

In 2012, IFC financed the first concentrated solar power plants in the region. The 50MW Khi Solar One project and 100MW KaXu Solar One projects help diversify South Africa's electricity away from coal-fired power. IFC invested \$143 million in direct financing and blended \$41.5 million in concessional loans through the multi-donor Clean Technology Fund. Combined, Kaxu's 100 MW parabolic trough CSP plant and Khi's 50 MW steam receiver power tower reduce annual GHG emissions by more than 260,000 tons, while providing reliable and affordable energy.



CÔTE D'IVOIRE – ENERGY SUPPLY EFFICIENCY

In 2012, IFC helped finance an efficiency upgrade and expansion of the Azito Thermal Power Plant, allowing it to generate 50 percent more electricity for 2.3 million additional customers without using any additional gas. This reduces annual GHG emissions by over 270,000 tons. The plant's upgrade to combined-cycle technology makes it one of the largest independent power producers in Sub-Saharan Africa. IFC arranged a \$350 million financing package with a group of other investors, including \$125 million from its own account.



CÔTE D'IVOIRE

Côte d'Ivoire's estimated climate-smart investment potential for select sectors is \$10 billion from 2016-2030.

In its NDC, the Ivorian Government pledges to reduce greenhouse-gas emissions by 28 percent from business-as-usual levels by 2030. Côte d'Ivoire's NDC outlines mitigation actions in the power, transport, waste and agriculture sectors. The country currently has very little renewable energy capacity beyond large hydro, but has set targets to incorporate 20 percent of renewables into its total energy mix by 2030.

Following an election in October 2015, the country is focusing intently on economic growth. The government is keen to consolidate its place as an economic engine

for West Africa by attracting private investors through a \$49 billion 2016–2020 National Development Program. The main drivers of this sustained growth are expected to be public and private investments in infrastructure, including an extension of Abidjan's port, construction, and natural resource extraction.¹¹

The government and private industry have also made investments in agriculture and agricultural product value-added processing.¹² Côte d'Ivoire is a major producer of some of the world's most desired agricultural products – cocoa, coffee, and sugar. The potential for private sector investments in climate-smart agriculture projects – particularly as they relate to corporate supply chains – is huge. This will require a government focus on land and water management and production capacity improvements. The country's NDC estimates that the cost of adaptation (which includes agriculture and forestry) will be about \$1.75 billion.



NEAR-TERM CLIMATE-SMART INVESTMENT POTENTIAL BY 2020

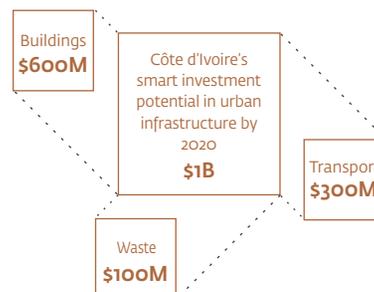
⚡ Renewable energy

Power generation in Côte d'Ivoire is currently based on natural gas (70 percent) and large hydropower (30 percent). The country has good solar potential in the North, but costs remain difficult to overcome compared to current grid alternatives. Where solar installations do exist, they're either dispersed in isolated villages or being used by industrial or wealthy energy consumers.¹³ Despite renewables' lack of penetration in the country to date, the government's priority to provide universal access to electricity means the sector is well-placed for growth. Furthermore, given the country's position as a major producer of agricultural products, strong opportunities exist for biomass energy projects that can take advantage of sector feedstocks. IFC estimates the investment potential for renewable energy in Côte d'Ivoire is \$1 billion through 2020.

🏠 Urban infrastructure

High population growth, strong momentum in income growth, and demand for higher living standards in Côte d'Ivoire present major investment opportunities for building upgrades, transport, and waste management. The investment potential up to 2030 for constructing new green buildings in Côte d'Ivoire amounts to \$6 billion.

Côte d'Ivoire's NDC also highlights policy priorities for transport, including upgrading and expanding public transportation infrastructure, improving the efficiency of freight transportation (railways, construction of specialized terminals and freight corridors, and information systems), and using more biofuels in the production of gasoline.¹⁴ To reach these low-carbon transport goals, it will be necessary to support the country as it plans to design and implement transport policies, specifically in urban areas. IFC estimates the current investment potential in transport at \$300 million.



🍃 Priorities for Côte d'Ivoire to attract more climate-smart investment

MODERNIZE THE ELECTRICITY GRID TO MAXIMIZE RENEWABLE POTENTIAL

The ongoing expansion in power generation capacity should be matched with investment in transmission and distribution infrastructure to unlock much greater investment in renewables. Implement the new electricity law and open competitive markets, and explore incentives to catalyze more renewable energy development. Also work to reduce electricity losses in the distribution system.

LEVEL THE PLAYING FIELD FOR CLEAN ENERGY

The government is considering putting a price on carbon emissions to generate revenues; this is a good step as it will help to make renewables and energy efficiency more attractive when compared to traditional alternatives.

CREATE THE FINANCIAL INFRASTRUCTURE

Strengthen domestic financial markets, the banking system and attract more foreign investment.

CÔTE D'IVOIRE INDICATORS (2015)

Côte d'Ivoire indicators (2015)

Population: 22.7 million

GDP: \$31.7 billion

GDP growth: 8.4%

Inflation: 1.2%

Ease of Doing Business rank: 142

S&P credit rating: n/a

FDI, net inflows: \$0.43 billion

GHG emissions rank: 108 (2012)

Renewable energy capacity: 604 MW

Renewable energy capacity: 185.9 MW, 2.2% of installed capacity of 1.7 GW

Total clean energy investments 2009–2014: \$69.9 million

LOW CARBON TARGETS

- 28% emissions reduction compared to business as usual by 2030.
- 42% of electricity mix from renewable energies by 2030.
- 32% of electricity mix from natural gas combined-cycle plants by 2030.
- 15% of renewable energy in the supply mix by 2020 and 20% by 2030.
- 42% of electricity mix from renewable energy by 2030.

IFC CLIMATE BUSINESS (FY2010 – 2016)

Total climate finance: \$280 million

- Energy efficiency: \$280 million

Adaptation and the private sector

Climate change impacts on natural resources, infrastructure, and society are already creating demand for climate-smart products and services. Although companies are responding, more work needs to be done to make the private sector an active partner in helping countries to build resilience and adapt to climate change. To date, discussions on adaptation have had little engagement with the business community, and instead have focused on what governments need to do.

Globally, it is estimated that tens of billions of dollars need to be invested in adaptation. The UNFCCC estimates that between \$28 billion and \$67 billion in additional investment for adaptation is needed for developing countries alone.¹⁵ Engaging the private sector is essential for several reasons. It can mobilize financial resources and technical capabilities, leverage the efforts of governments, engage civil society and community efforts, and develop innovative climate services and adaptation technologies. In addition, private businesses dominate many investments that are vulnerable to climate change impacts, such as infrastructure investments.

Investors have made significant investments in sectors and resources that will be significantly affected by climate change, such as agribusiness. The water sector is a particular focus of the private sector, specifically developing technologies that provide or recycle water, or use water more efficiently. The private sector also delivers a growing number of adaptation services, such as weather observation technology and early warning systems. Companies are pursuing innovations such as placing low-cost weather observation systems on cellphone towers, at a fraction of the cost of radar systems, with better performance. Companies that offer farmers highly targeted weather and soil information, meanwhile, can help improve yields and reduce vulnerability to climate change. For example, the Climate Corporation, a subsidiary of Monsanto, is developing a network of in-field sensors to expand the scope of farming data available on its digital agriculture platform. It will also expand its software infrastructure to allow third-party developers to build farm data tools for its platform.

Climate Adaptation IFC Project Examples



ROYA RENOVATION, NICARAGUA: COFFEE PLANTATIONS THAT ARE CLIMATE-RESILIENT

Coffee plantations in Nicaragua are increasingly being affected by coffee rust (a fungus that kills coffee plants), which is proliferating with increasing temperatures and changing precipitation patterns. To address this, IFC is providing \$12 million for replanting with rust-resilient coffee varieties. Most Central American coffee plantations are, or will increasingly be, affected by coffee rust. A similar model can be used for other crops, such as cocoa and tea.



MODERN KARTON, TURKEY: CLEANER PRODUCTION LENDING FOR PAPER PRODUCTS

Groundwater levels are diminishing in Turkey due to decreasing precipitation – a trend that is projected to continue. Modern Karton, a producer of cardboard, relies mainly on groundwater for its paper production. To make the company's facility more resilient, IFC is providing \$8 million for reverse osmosis water recycling equipment, which decreases the company's dependence on groundwater. There is large potential for replication, as many water-intensive industries are located in areas with diminishing water resources, particularly those with limited groundwater supplies.



There is, however, little information about current demand for adaptation investments by the private sector at regional or sectoral levels, especially short-term investments addressing adaptation needs that produce rates of return above a certain threshold. One of the few studies that provides this information is the IFC/European Bank for Reconstruction and Development Adaptation Market Study in Turkey, which identified \$20 billion in private adaptation investments in key sectors.¹⁶

Recent and projected impacts and risks for businesses indicate the diversity of impacts and need for adaptation initiatives and investments. These include a snow-free

winter putting financial strain on the Lebanese tourism sector, which traditionally generates 10 percent of the country's GDP; droughts in southeast Brazil signaling a drop in coffee and soybean production, which will reach 10 percent and 20 percent respectively by 2020; and coffee rust disease, which is hurting coffee yields in Central America. Fortunately, the private sector is beginning to respond (see case study on left).

To ensure that businesses integrate adaptation into their strategies and investments, incentives from government and other sectors are needed. The financial sector can help by recognizing the relevance of climate risk as a factor when it evaluates the expected future performance

of companies, for example, by offering a financial premium to companies that pro-actively address climate adaptation.

Governments play a key role in making businesses more aware of climate risks and boosting private sector engagement through stronger public-private partnerships. It is particularly important for the public sector to create an enabling environment for private sector adaptation through policy and regulation.¹⁷



KENYA

Kenya's estimated climate-smart investment potential in selected sectors is \$81 billion from 2016–2030.

Kenya's NDC pledges to reduce greenhouse-gas emissions by 30 percent from business-as-usual levels by 2030. It details mitigation and adaptation activities, including priorities for increased use of renewables, options for clean transportation, and achieving 10 percent tree cover.

In 2016, Kenya was the third most improved country in the World Bank's *Doing Business* rankings, moving 21 places to 108 out of the 189 economies reviewed. Kenya's GDP is projected to increase in the coming

years; however, significant investment in infrastructure is needed. In 2013, Kenya passed the Private Public Partnership Act to help address this, in part by enabling public-private partnerships.¹⁸

Kenya plans to make clean energy a significant part of its ambitious Least Cost Power Development Plan 2013–2033, which aims to have 50 percent of a total of 22.7 GW of capacity coming from renewables by 2033.¹⁹

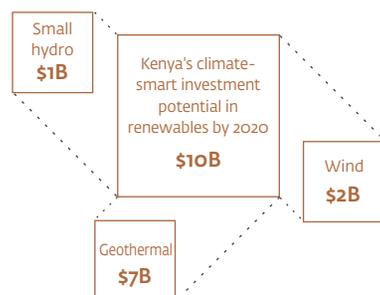
Progress on similar renewable energy targets has been slow and difficult to achieve, yet the country continues to persevere. In late 2015, Kenya established a 20-year fixed tariff for most renewable project types, alongside a standardized power-purchase agreement to help spur momentum in the sector.²⁰ The tariff, together with the country's aggressive renewable energy targets, its stable policy framework, and a suite of tax incentives for investors, can help realize Kenya's climate ambitions.



NEAR-TERM CLIMATE-SMART INVESTMENT POTENTIAL BY 2020

⚡ Renewable energy

Kenya's electrification rate rose from 26 percent in 2012 to 47 percent in mid-2015, and clean energy (excluding large hydro) accounted for 46 percent of total generation in 2015 – with geothermal accounting for 27 percent of installed capacity.²¹ Geothermal will continue to serve as a major source of energy for Kenya. By 2020, geothermal will be a \$7 billion opportunity. Wind energy over the next five years is a \$2 billion opportunity and small hydro \$1 billion. Kenya has excellent solar PV potential – off-grid solar PV currently serves 30 percent of Kenyans with no grid access – but uptake for the grid-tied solar has proven difficult, and the government has prioritized other resources. Plummeting global prices for solar may, however, help Kenya's solar market take off.

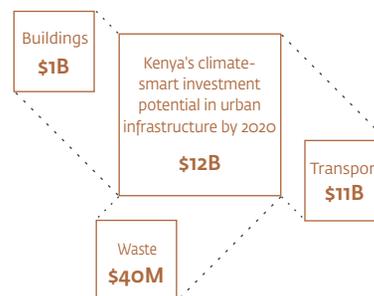


🌾 Agriculture

Kenya's agricultural sector is a major contributor to its economy. Innovative climate-smart solutions are needed, such as the recently launched Kenya National Agricultural Insurance Program. The program is a partnership between government and the private sector that compensates farmers and livestock owners when climate-related shocks, such as droughts and floods, impact production.²⁴ Other private sector opportunities to enhance resilience include agricultural and livestock waste for energy generation, improved crop productivity, water resource and more use of sustainable fertilizers.

🏠 Urban infrastructure

Kenya's national development program, Vision 2030, establishes a goal for the country to reach upper middle-income status by 2030. Kenya is, however, still a rural country, with the majority of poor people living in remote areas. The benefits of urbanization have not yet been fully captured in Kenya to help it meet its 2030 target.²² Given Kenya's ambition to urbanize, IFC estimates that the climate-smart investment potential for new green buildings in Kenya will be \$1 billion by 2020. IFC estimates that the investment potential for airports, seaports, railways, rapid light rail, roads and overall transport efficiency by 2020 will be about \$11 billion,²³ while the waste sector will require \$40 million in investments.



🍃 Priorities for Kenya to attract more climate-smart investment

IMPROVE THE AVAILABILITY OF LOCAL FINANCING

Raise awareness among local commercial banks and financial intermediaries about renewable energy opportunities in grid-connected and off-grid markets.

ENHANCE ENERGY ACCESS VIA RENEWABLE ENERGY

Encourage competition, and innovative business and financing models by unbundling the power market, investing in transmission and distribution and updating renewable energy incentives and policies. Introduce net metering to allow for more distributed generation and energy access with off-grid renewable power.

LOW CARBON TRANSPORT

Accelerate investments in roads, rapid light rail, improvements in airport infrastructure efficiency, port development, and traffic management systems.

KENYA INDICATORS (2015)

Population: 46.1 million
 GDP: \$0.063 trillion
 GDP growth: 5.6%
 Inflation: 6.6%
 Ease of Doing Business rank: 108
 S&P credit rating: B+
 FDI, net inflows: \$1.437 billion
 GHG emissions rank: 90 (2012)
 Installed power capacity: 2.2 GW
 Renewable share: 32.8%
 Total clean energy generation: 2.8 TWh
 Renewable energy capacity: 1.7 GW

LOW CARBON TARGETS

- 30% greenhouse-gas reduction compared to business as usual by 2030.
- 10% of land area covered by trees by 2030.
- Reach 20 GW of power capacity by 2030, comprising 51% renewable energy.
- Reach 100% electrification by 2020.
- 5 GW new generation capacity built by end of 2016 (1.6 GW geothermal, 630 MW onshore wind, and 18 MW cogeneration).

IFC CLIMATE BUSINESS (FY2010 – 2016)

- Total climate finance: \$81 million
- Renewable energy: \$19 million
 - Energy efficiency: \$62 million

Scaling Solar: unlocking private investment in large scale solar

Solar power has enormous potential as a quick-to-build electricity source in emerging markets, where needs are great. It is also increasingly affordable—the cost of solar photovoltaic (PV) technology has fallen more than 80 percent in the past six years—solar PV can now deliver power less expensively and with more long-term price certainty, than other sources of power including coal-fired, hydro etc. Still, many countries have struggled to develop utility-scale solar plants due to challenges that include:

- **Institutional capacity:** Many governments have limited capacity to manage, structure and negotiate private power concessions.
- **Lack of scale:** Navigating small and distinct power markets can deter investors and small grids can only absorb small projects.
- **Lack of competition:** Many power projects are not competitively tendered.
- **High transaction costs:** Individually negotiated contracts have high transaction costs.

- **High perceived risk:** Poor credit utility off-takers and political risks increase the cost of capital, driving up tariffs.

Scaling Solar²⁵ brings together a suite of World Bank Group services under a single umbrella aimed at creating viable low cost markets for solar power in each client country through competitive tendering. This “one stop shop” program can make privately funded grid-connected solar projects operational at competitive tariffs within two years. When implemented across multiple countries, the program will create a new regional market for solar investment.

The program offers a package of support to government, utilities, project developers, and investors to realize the investments at the desired scale in a short time frame, including:

- **Advice** to assess the right size and location for solar PV power plants in a country’s grid.
- **Simple and rapid tendering** to ensure strong participation and competition from committed industry players.

- **Fully developed templates** of bankable project documents that can eliminate negotiation and speed up financing.
- **Competitive financing and insurance** attached to the tender and available to all bidders, delivering competitive bidding and ensuring rapid financial close.
- **Risk management and credit enhancement** to lower financing costs and deliver power at lower tariffs.

By providing a comprehensive suite of documentation and services, which can be tailored to the needs of individual countries, the World Bank Group is enabling the standardization necessary to speed up the investment process. In contrast to the feed-in tariff schemes currently being used in some countries, Scaling Solar is a competitive process intended to create markets and drive down costs. Bidders will be offered a partial risk guarantee as standard from the World Bank, and in some cases political risk insurance from MIGA. IFC will underwrite the financing of all qualifying bids, with bidders free to replace this lending with cheaper alternatives if available.



Zambia was the first country to sign onto the program. With IFC support, Zambia's Industrial Development Corporation ran a tender in 2016 to quickly develop and install 100 megawatts of solar power through public-private partnerships (PPPs) to diversify Zambia's power generation which suffered from dependence on drought-affected hydroelectric plants. This initially attracted 48 developers from around the world, including EDF, Marubeni, Scatec, SolarReserve, Abengoa, Solar Capital, Shanghai Electric Power and Sun Edison. The winning bids were by Neoen S.A.S. and First Solar Inc. for 6.02 cents per kilowatt hour and by Enel S.A. for 7.84 cents per kilowatt hour – this represents the cheapest solar

power to date in sub-Saharan Africa, and one of the lowest solar tariffs globally (because the Zambia prices are fixed for 25 years and will not rise with inflation, they are on par with recent record-breaking solar auction tariffs in Mexico and Peru). This is expected to be the first of several procurement rounds to deliver up to 600 MW over a short period of time, with the second round being currently underway.

Scaling Solar has also delivered on its promise of speed: Zambia's results come just 9 months after the government engaged the IFC to advise on the transaction. Zambia's two 50-megawatt solar power plants will increase the country's available generating

capacity by 4 percent, but will make up for nearly 18 percent of the current power deficit resulting from the droughts²⁶, and will help to restore water levels in the country's dams. The projects are slated to reach financial close in three months, with construction completed a year later. This timeline will achieve Scaling Solar's ambition to enable generation of cheap solar power within two years of engagement. Senegal and Madagascar have also signed up for the program, with other countries expected to join in the coming months.

www.scalingsolar.org



NIGERIA

Nigeria's estimated climate-smart investment potential is over \$104 billion from 2016–2030 in selected sectors.

Nigeria's NDC pledges to reduce greenhouse-gas emissions by 20 percent from business-as-usual levels by 2030. The country's priorities include improving the power system, increased use of renewables, enforcement of energy efficiency and gas flaring controls, developing power plants at gas flare sites, implementing climate-smart agriculture, adopting green industrial technologies and implementing transportation reforms.

While Nigeria has the largest population and economy (\$568 billion) on the African continent, 46 percent of its citizens live below the poverty line. Nigeria's economy is highly dependent on fossil fuels as it is endowed with abundant oil and gas resources. Consistently strong GDP growth over the past decade has developed a growing consumer class and attracted investor interest, but

impediments to new flows of investment persist, such as high energy costs, an inconsistent regulatory and legal environment, and corruption.²⁷

Power cuts are a common occurrence for the 58 percent of the Nigerian population that has access to grid electricity. Among the rural population, this drops to less than 20 percent. The country's electrification target is 75 percent by 2020 and 100 percent by 2030. Renewables have not really begun to address these challenges – after major power sector reform (including a feed-in tariff for renewable energy) and elections in 2015, Nigeria has yet to deploy grid-scale renewable energy projects.²⁸

Nigeria's NDC outlines the investment needs for basic infrastructure services across all economic sectors. Vast sums of private finance are needed to help Nigeria meet its development goals and transition to a low-carbon, climate-resilient country.²⁹ Significant resources will need to be used to implement adaptation programs, including disaster management planning, water and power system planning, river basin management, sustainable urban planning, and capacity building.

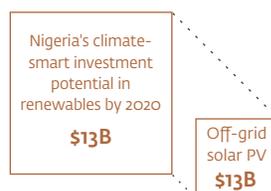


NEAR-TERM CLIMATE-SMART INVESTMENT POTENTIAL BY 2020

⚡ Renewable energy

Nigeria has embarked on ambitious electricity sector reforms to improve efficiency, attract private participation, and strengthen power sector performance. Nigeria currently has a target for 40 GW of installed power capacity by 2020, of which 10 percent must come from renewable energy. New draft regulations (published in July 2015) introduce another renewable energy target of 2 GW by 2020.³⁰ In addition, the country has committed to installing 13 GW of PV (scalable power plants of 20 MW to 50 MW each), switching from liquid fuels to natural gas, and improving power generation efficiency by using gas-powered combined-cycle turbines.

The development of renewable energy would help diversify the country's energy mix away from thermal sources, reduce the carbon footprint of power generation, and boost the reliability of supply. However, renewable energy has not gained traction and there are currently no grid-connected plants other than the three large hydropower plants. A Renewable Energy Master Plan, which was released in 2006 (and updated in 2011), identified considerable potential for renewable energy.³¹



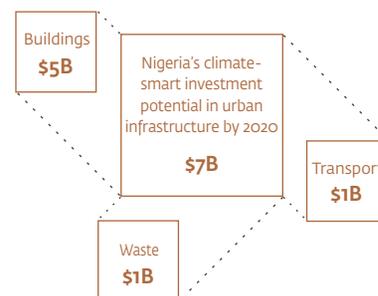
🌾 Agriculture

Nigeria still imports most of its food. The country's NDC aims to use climate-smart agriculture to improve productivity while reducing carbon dioxide equivalent emissions by 74 million tons per year in 2030. This will be done by using agro-livestock waste for energy generation, increasing crop productivity, improving water resource and energy efficiency, extending rotation, and using more cover crops and sustainable fertilizers.

🏠 Urban infrastructure

Nigeria has been rapidly urbanizing. Nigeria's NDC highlights some policy priorities for cities, including upgrading and expanding public transportation infrastructure, improving the efficiency of freight transportation (railways, construction of specialized terminals and freight corridors, and information systems), and using more biofuels in the production of gasoline. It is expected that the Federal Ministry of Power, Works, and Housing will work with other line ministries to develop a plan to tap into climate-smart opportunities for cities.

The investment potential up to 2020 for the upgrade of roads, waste management and building infrastructure in Nigeria amounts to \$7 billion.



🍃 Priorities for Nigeria to attract more climate-smart investment

TAP INTO GAS AS A BRIDGE TO CLEANER ENERGY

Implement the Gas Master Plan to develop networks and markets and put in place pricing strategies to incentivize cost-effective exploitation.

BUILD CAPACITY FOR NEW POWER SYSTEMS

Ensure support services and skills are in place to implement and maintain new power systems, including assembly plants for equipment e.g. smart meters and provision of equipment testing, calibration and logistics services.

INVEST IN CLIMATE-SMART AGRICULTURE

Increase access to drought resistant crops and livestock feeds, adopt better soil management practices, and improve weather forecast information. Develop better irrigation infrastructure and help increase efficient allocation of water.

NIGERIA INDICATORS (2015)

Population: 182.2 million
GDP: \$0.481 trillion
GDP growth: 2.7%
Inflation: 9%
Ease of Doing Business rank: 169
S&P credit rating: B+
FDI, net inflows: \$3.064 billion
GHG emissions rank: 35 (2012)
Renewable energy capacity: 1.9 GW
Total clean energy investments, 2009–2014: \$358.7 million
Installed power capacity: 10.7 GW
Renewable share: 0.6%
Total clean energy generation: 68.0 GWh

LOW CARBON TARGETS

- 45% emissions reduction compared to business as usual by 2030, 20% of which is unconditional.
- 2% energy efficiency improvement per year by 2030.
- 40 GW (5%) of renewable and conventional power by 2020, which includes 13 GW of PV, a mandate to blend 10% ethanol with gasoline and 20% biodiesel with diesel by 2020, and end gas flaring by 2030.
- Achieve 75% national electrification rate by 2020.

IFC CLIMATE BUSINESS (FY2010 – 2016)

Total climate finance: \$20 million
• Renewable energy: \$1 million
• Energy efficiency: \$18 million
• Other mitigation: \$1 million

SOUTH AFRICA

IFC estimates South Africa's climate-smart investment potential in selected sectors to be more than \$588 billion from 2016–2030.

South Africa's NDC includes a "Peak, Plateau, and Decline trajectory" that caps emissions between 2025 and 2030. Opportunities for climate-smart investment abound in South Africa as its economy relies heavily on mining and heavy industry. Furthermore, energy consumption in the industrial and buildings sectors relies largely on electricity generated from fossil fuels (90 percent of South Africa's electricity is from coal).³² Additional emissions come from industrial-process emissions, especially steel and cement production. In

2010, South Africa released its Integrated Resource Plan, which outlines the country's energy build-out strategy to 2030. Under the plan, the country seeks to increase its power capacity from 43 GW to 89.5 GW, with renewables making up as much as 20 percent of the mix. Wind (9.2 GW) and solar PV (8.4 GW) make up the largest portions of the renewables mix.

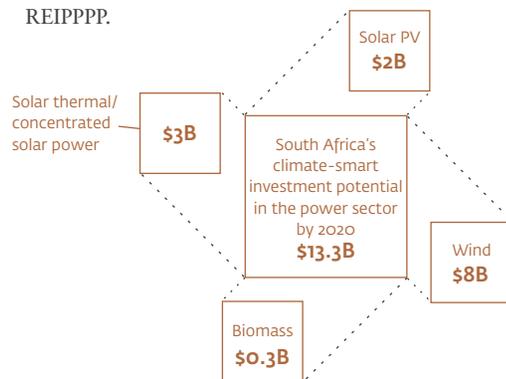
South Africa is developing a tradable carbon tax as a policy mechanism, which when combined with electricity price adjustments, is expected to help bring renewable technologies in line with the cost of existing generation sources. These policies, coupled with a government push to reach a 97 percent electrification rate by 2025, means that renewable technologies will play an increasing role in the energy mix of the country.³³ A demand-side management scheme obliges the state power utility Eskom to implement efficiency measures either directly or through third parties.



NEAR-TERM CLIMATE-SMART INVESTMENT POTENTIAL BY 2020

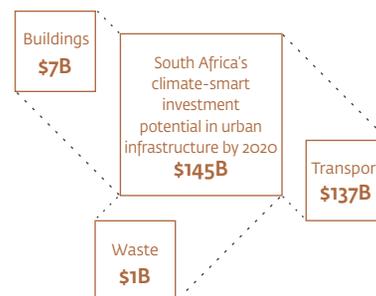
⚡ Renewable energy

South Africa's Renewable Energy IPP Procurement Program has approved 79 renewable energy independent power producer projects, increasing investments in renewables to 5.2 GW, with private investment at about \$16 billion (another 6.3 GW will follow).³⁴ After more than four bid rounds, the cost of wind and solar technology has declined more than 70 percent and is now cost-competitive with new-build coal and gas. The REIPPPP has procured 6.3 GW of renewables, with the majority under construction or yet to be financed. South Africa is on track to reach its 2030 target under the Integrated Resource Plan. The NDC refers to \$3 billion per year needed to implement the REIPPPP.



🏠 Urban infrastructure

A growing middle class has led to increasing urbanization and a rise in demand for housing, infrastructure, and water resources. There are major investment opportunities for smart mini-grid systems, large-scale cogeneration and renewable energy projects, new transport infrastructure (such as rail and electric vehicles), green buildings and waste management. The NDC estimates \$1 trillion in investment potential in the electric and hybrid vehicle market by 2050 with close to 40% of this invested by 2030. Within the NDC plans, the country aims to integrate electric vehicles into the government fleet, increase the number of efficient vehicles on the roads to 20 percent by 2030, and promote urban mobility through a non-motorized transport network.³⁵



🍃 Priorities for South Africa to attract more climate-smart investment

BECOME WATER-SMART

The country's water transmission infrastructure is fragmented and is losing significant amounts of water. This will require improved management of the water sector, including better planning, investment and incentives to recapture wastewater for reuse.

LEVEL THE PLAYING FIELD FOR CLEAN ENERGY

Move forward with the proposed carbon tax, which will begin to level the playing field between renewable energy resources and coal while also driving new energy efficiency opportunities – particularly in heavy industry.

GO TO THE NEXT LEVEL ON RENEWABLES

Continue the successful REIPPPP, while removing barriers for selling distributed power back into the grid – some cities are running pilot projects; these could be accelerated. Also address transmission losses by improving the national power grid. There has been a lack of investment that has contributed to renewable energy project delays.

SOUTH AFRICA INDICATORS (2015)

Population: 54.9 million
 GDP: \$313 billion
 GDP growth: 1.3%
 Inflation: 4.6%
 Ease of Doing Business rank: 73
 S&P credit rating: BBB-
 FDI, net inflows: \$1.58 billion
 GHG emissions rank: 22 (2012)
 Renewable energy capacity: 1.3 GW
 Total clean energy investments: \$16 billion
 Installed power capacity: 44.9GW
 Renewable share: 4.5%
 Total clean energy generation: 3.3 TWh

LOW CARBON TARGETS

- 17.8 GW new built renewable energy capacity, 8.4 GW of which will be wind power, by 2030.
- Greenhouse-gas reductions of 34% below business-as-usual scenario by 2020, 42% by 2025.
- Decarbonization of electricity sector by 2050.
- 20% hybrid electric vehicles by 2030.
- Carbon pricing and carbon budgeting for industry to limit emissions.
- Proposed mandate to blend up to 10% ethanol with gasoline and 5% biodiesel with diesel from 2015.

IFC CLIMATE BUSINESS (FY2010 – 2016)

Total climate finance: \$315 million

- Renewable energy: \$265 million
- Energy efficiency: \$50 million

Climate finance, selected NDC sector:
 Transport: \$22 million

Endnotes

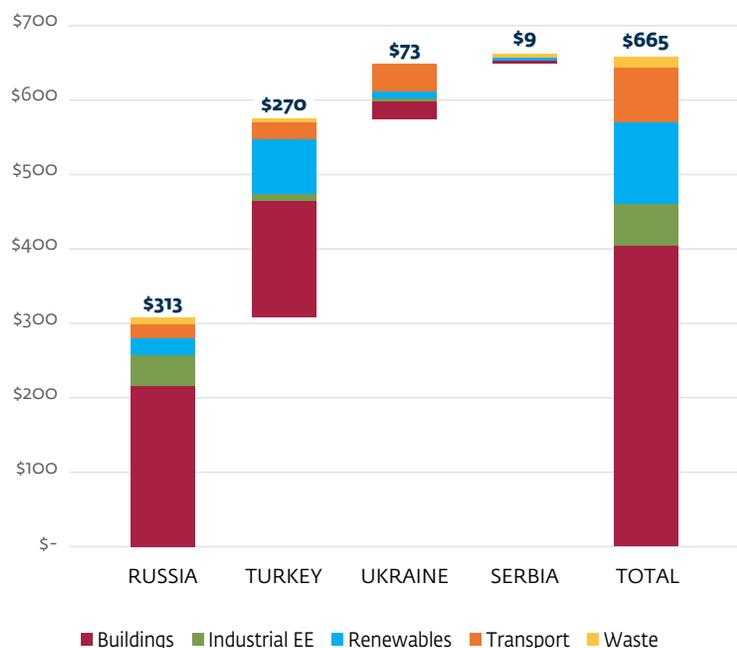
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- 5 United Nations, Department of Economic and Social Affairs, Population Division, 2015. *World Population Prospects: The 2015 Revision, Key Findings and Advance Tables*. Working Paper No. ESA/P/WP.241.
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- 25 See http://www.ifc.org/wps/wcm/connect/industry_ext_content/ifc_external_corporate_site/industries/infrastructure/power/scaling+solar for more information.
- 26 Zambia has a power capacity of 2,500MW, mostly hydropower. But at present, severe drought means the hydropower is operating at a third of normal capacity, and there is a national power generation deficit of about 560MW resulting in rolling 8-hour blackouts.
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Europe and Central Asia Climate-Smart Investment Potential

Investment Spotlights

Although countries in Europe and Central Asia contain abundant human and natural resources, they are adjusting to the new reality of subdued growth, capital outflows, declining energy prices, and increasing geopolitical tensions. Development challenges still exist, including inadequate access to finance, large infrastructure gaps, lack of competitiveness, and weak investment climates. The region is responsible for 10 percent of global greenhouse-gas emissions, but emits more greenhouse gas per unit of GDP than any other region. Outdated industrial technologies cause energy wastage and unnecessary fossil fuel use, leading to higher greenhouse-gas emissions. Climate change impacts are already being felt in the agricultural sector, with production decreasing in some areas; scarce water resources are also at risk.¹ Russia and Ukraine – both major greenhouse-gas emitters – have significant untapped opportunity to improve energy efficiency. The private sector can profit hugely from climate-smart investments in the region and governments are eager to see investments flowing again.

Climate-Smart Investment Potential
2016 - 2030 (\$ billion)



Improving energy and resource efficiency offers the best opportunity for climate-smart investment

Investment potential

Despite the region’s challenges, climate-smart business is likely to grow in the region. Based on our analysis of the climate pledges made by the four countries in Europe and Central Asia studied for this report – Russia, Serbia, Turkey, and Ukraine – our estimate for the total investment potential for their climate-smart needs is \$665 billion by 2030. Well over half of this potential is for commercial investments in the construction of green buildings (\$410 billion). Transport infrastructure needs measure approximately 12 percent of total investment opportunity (\$78 billion). In general, renewable energy investments in the region don’t track global trends of high growth—with the exception of Turkey—but still amount to over \$110 billion in investment opportunities through 2030.



Energy efficiency

Much of the region's infrastructure – buildings, industry, power generation, and transmission equipment – is old and inefficient. Investments in upgrades and resource efficiency thus have the potential to be highly lucrative. Yet economic incentives that would encourage efficiency, such as cost-recovering energy and water prices, are largely absent. Russia has by far the largest industrial energy efficiency investment potential, estimated at \$41 billion by 2030.²

Renewable energy

There is also significant investment potential in renewables (particularly, solar and wind energy) and green buildings, particularly in countries tackling unsustainably subsidized energy prices. Although there is variability between countries, in general, rising energy demand, policy support, and in some cases a good investment environment have resulted in significant growth of the renewable energy and green building sectors, which is expected to continue for the foreseeable future.³ For example, \$1.9 billion was invested in renewables in Turkey in 2015, a 46 percent increase on the previous year. This included \$941 million invested in wind energy, as well as 2015's largest asset financing for geothermal power (the 170 MW-capacity Efeler geothermal plant).⁴ The country is on track to meet its target of 37 percent renewable energy share in electricity generation by 2023, from a base of 27 percent in 2012.⁵ The Russian Federation, whose power mix remains predominantly coal and gas based, added 144 MW of new renewable energy capacity in 2015. This includes a 25 MW solar PV plant that was connected to the national grid in late December.⁶

Climate Investment Spotlights



TURKEY – GREENER CEMENT

In January 2014, IFC provided a \$58 million financing package to Cimko—one of Turkey's major cement firms—and a joint venture between Sanko Group in Turkey and Italy's Cementerie Aldo Barbetti SPA. The project invests in ready-mix concrete and energy efficiency, including waste-heat recovery. The project increases employment in the Southeast Anatolia region, gives Cimko sizeable energy savings, and reduces greenhouse-gas emissions by over 63,000 tons per year.



CROATIA – WIND POWER

IFC joined forces with independent power producer RP Global and UniCredit Bank Australia to invest over €42 million to build a 34.2 MW wind farm near Dubrovnik to expand Croatia's renewable energy production. The project will supply clean power to thousands of homes and businesses, reducing nearly 26,000 tons of greenhouse-gas emissions each year.



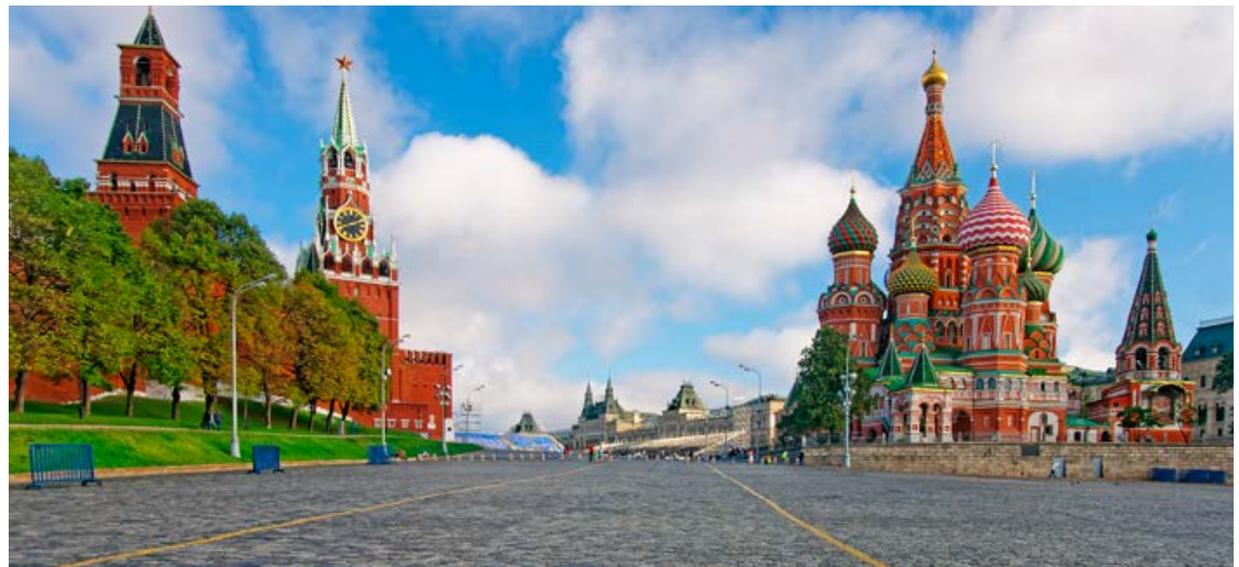
RUSSIAN FEDERATION

The Russian Federation's estimated climate-smart investment potential in selected sectors is almost \$313 billion from 2016–2030.

Russia's NDC pledges to reduce its emissions of net greenhouse-gas emissions by 25 percent to 30 percent below the 1990 level by 2030. At more than 2.5 times the world average, Russia's high level of energy intensity means the country loses more than 40 percent of the energy it generates yearly, which is equivalent to the

annual primary energy consumption of France. This wasted energy is the equivalent of \$84 billion to \$112 billion in lost export revenues and \$3 billion to \$5 billion in federal and municipal spending on energy subsidies.⁷ If its energy efficiency potential were fully realized, Russia's carbon dioxide emissions in 2030 would be about 20 percent below 1990 levels.⁸

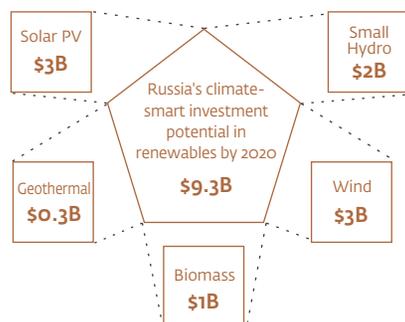
To boost Russia's weak economy, authorities are pledging much-needed reforms to attract investors. In addition, the ruble's weakening by almost 50 percent against the dollar is invigorating the market for renewables as local content requirements – once seen as a barrier – are now helping to stimulate manufacturing growth and create jobs.⁹



NEAR-TERM CLIMATE-SMART INVESTMENT POTENTIAL BY 2020

⚡ Renewable energy

Established in 2013, Russia's renewable energy goals aim to have 4.5 percent of electricity production from renewables and 5.9 GW of installed capacity of renewables commissioned by 2020.¹⁰ Based on these goals — which are mirrored in the country's NDC — IFC estimates that Russia will attract nearly \$9.3 billion for renewables by 2020. Government targets for renewables will help drive commercial investments in solar PV (\$3 billion), small hydro (\$2 billion), and wind (\$3 billion) by 2020. Although the potential for using biomass to create power is much higher than either solar or wind, it will likely attract investment of only about \$1 billion by 2020.



⚙️ Industrial Energy efficiency

Russia has the largest industrial energy-efficiency investment potential in the ECA region, valued at \$14 billion for selected sectors by 2020. Across all sectors, the annual energy cost savings for investors and end users could be worth \$80 billion.¹⁴

🍃 Priorities for Russia to attract more climate-smart investment

EXPAND COMPETITION FOR CLIMATE-SMART SOLUTIONS

Eliminate cross subsidies in energy and utilities sectors; increase transparency and competition in energy, gas and heat supply markets.

PRIORITIZE RENEWABLE ENERGY DEVELOPMENT

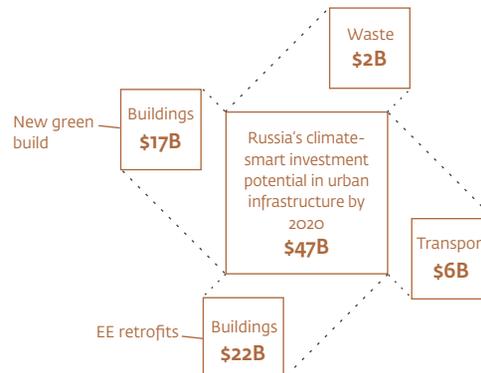
Simplify procedures and provide subsidies for solar panel installation by network connected individual energy consumers to increase use.

ENGAGE CUSTOMERS TO ACCELERATE ENERGY EFFICIENCY

Introduce public environmental awareness programs and measures that stimulate individual behavioral change, including property tax benefits for higher energy efficiency buildings and other mechanisms.

🏠 Urban infrastructure

The Russian government's macroeconomic crisis is partly due to the economy's dependency on revenue from oil and gas. Fortunately, investment in infrastructure projects can help create jobs and boost the economy. For example, investment opportunities in green buildings in Russia is an estimated \$17 billion over the next five years. In transport, Russia has seen car ownership double since 2000 and problems such as traffic congestion and air pollution are common in the country's larger metro areas.¹¹ Although not mentioned in its NDC, the Russian government has plans to address its transportation infrastructure, which is a conservative investment opportunity estimate of \$6 billion by 2020.¹² Within the national plan, the country emphasizes the formation of a unified transport system, with national and regional connectivity of rail systems, and focusing on transport energy efficiency, improving transport logistics, and increasing the availability of urban transport systems generally.¹³



RUSSIAN FEDERATION INDICATORS (2015)

Population: 144 million
 GDP: \$1.3 trillion
 GDP growth: -3.7%
 Inflation: 15.5%
 Ease of Doing Business rank: 51
 S&P credit rating: BB+
 FDI, net inflows: \$6.4 billion
 GHG emissions rank: 5 (2012)
 Renewable energy capacity: 48 GW

LOW CARBON TARGETS

- 6 GW of renewable capacity by 2020
- 40% energy intensity reduction by 2020
- Limit emissions between 70% and 75% of 1990 levels by 2030

IFC CLIMATE BUSINESS (FY2010 – 2016)

Total climate finance: \$329 million

- Renewable energy: \$7 million
- Energy efficiency: \$322 million

SERBIA

Serbia's estimated climate-smart investment potential for selected sectors is almost \$9 billion from 2016–2030, the bulk of which is from new construction of green buildings (\$6 billion) and renewable energy (\$3 billion).

Serbia has committed to reduce its 1990 greenhouse-gas emissions levels by 9.8 percent by 2030. Although it plans to finalize its climate change strategy and NDC

implementation plan in 2017, Serbia's NDC does outline mitigation opportunities for priority sectors such as increased energy efficiency and use of renewables.

Serbia's government approved new legislation in June 2016 that supports the renewables sector. Serbia has good wind potential and the government plans to add onshore wind capacity – the country's first wind farm was built in 2015 – but has a 500 MW capacity cap in place up to 2019.¹⁵

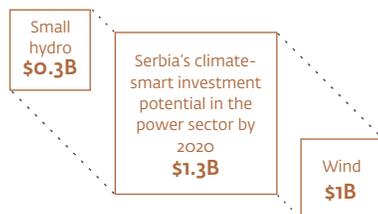
The Serbian government's top priority is economic growth and the country has made progress on improving the environment for investors and businesses. Looking westward, the government is aligning its domestic legislation and standards with those of the EU as it is a candidate country for membership, while eastward the government has strong economic ties with Russia, Turkey, and others.¹⁶



NEAR-TERM CLIMATE-SMART INVESTMENT POTENTIAL BY 2020

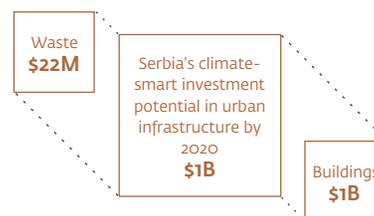
⚡ Renewable energy

IFC estimates that Serbia will attract \$1.3 billion for renewables as government targets help to drive commercial investments in wind energy (\$1 billion) and small hydropower (\$300 million) by 2020.



🏠 Urban infrastructure

An estimated \$1 billion will be invested in the construction of new green buildings in Serbia by 2020. Investment calculations for the industrial energy efficiency and transport sectors were not completed for this report. National transport plans emphasize port development through the modernization of the national fleet, and a growth rate of volume of transport on inland waterways including 1,364 passenger ships in Belgrade by 2025. The waste sector presents an investment opportunity of \$22 million to 2020.



🍃 Priorities for Serbia to attract more climate-smart investment

INVEST IN GOVERNMENT CAPACITY

Introduce cost recovery tariffs, strengthen regulators' capacity, commercialize and restructure public utilities, to increase private sector participation in modernizing electricity generation capacity.

PRIORITIZE KEY PROMISING SECTORS

Enable financing of investments in water and waste management, district heating and urban transport in medium-size cities, mindful of national and municipal level fiscal constraints.

ADVANCE LOW-CARBON POLICIES

Establish market-friendly policy frameworks and regulations to promote energy efficiency and low-carbon investments in compliance with EU environmental standards.

SERBIA INDICATORS (2015)

Population: 7.1 million
 GDP: \$36.5 billion
 GDP growth: 0.7%
 Inflation: 1.4%
 Ease of Doing Business rank: 59
 S&P credit rating: BB-
 FDI, net inflows: \$2.3 billion
 GHG emissions rank: 77 (2012)
 Renewable energy capacity: 3.3 GW

LOW CARBON TARGETS

- 27% renewable energy in final energy consumption by 2020.
- 36.6% renewable energy in electricity sector, 30% in heating/cooling sector, 10% in transport sector by 2020.
- 20% improvement in energy efficiency by 2020.

IFC CLIMATE BUSINESS (FY2010 – 2016)

Total climate finance: \$5 million
 • Renewable energy: \$3.5 million
 • Other mitigation: \$1.5 million
 Climate finance, selected NDC sector:
 Agribusiness & forestry: \$2 million



TURKEY

Turkey's estimated climate-smart investment potential for selected sectors is \$270 billion from 2016–2030.

Turkey's NDC establishes a target of up to 21 percent below business-as usual-levels by 2030. If Turkey's NDC targets are met, the country's energy mix will be 30 percent renewable. This will require huge investments in the clean energy sector, including wind, solar, hydropower, biomass, and geothermal energy.¹⁷

Although the country has recently faced significant political and social hurdles – including terrorist attacks and caution from investors – Turkey's GDP growth in 2015 (4 percent) outpaced most G20 countries. This indicates continued investor interest in Turkey.

Based on its NDC, however, Turkey's climate ambitions appear to decrease after 2023. Perhaps due to concerns of oversupply, the country's wind target from the National Renewable Energy Action Plan has been reduced in its NDC from 20 GW in 2023 to 16 GW in 2030, while the solar energy target only doubles to reach 10 GW in 2030. Neither of these targets reflect the country's technical potential for renewables.¹⁸

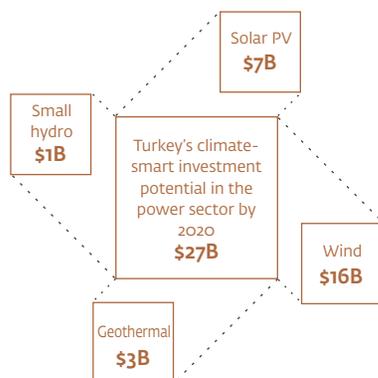
Turkey's population has expanded by 30 percent since 1990 and the rate of energy demand is expected to continue increasing at about 5.7 percent yearly.¹⁹ Supported by relatively high power prices and national policy frameworks, energy efficiency is a priority for the Turkish government, which established a target in 2012 to reduce energy intensity by 20 percent by 2023.²⁰



NEAR-TERM CLIMATE-SMART INVESTMENT POTENTIAL BY 2020

⚡ Renewable energy

Turkey is a net importer of fossil fuels and its target to meet 30 percent of its energy supply from renewables is essential for improving its energy security. Turkey is essential for improving its energy security. Turkey has a robust market for clean energy and IFC estimates the country will attract an additional \$27 billion for renewables by 2020. The country's clean energy targets will help drive commercial investments in wind (\$16 billion), solar PV (\$7 billion), and geothermal (\$3 billion) energy by 2020. Turkey also has good conditions for small hydropower, but only \$1 billion of investment potential is expected by 2020.



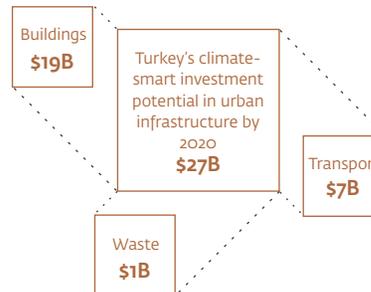
⚙️ Industrial Energy Efficiency

Turkey has a number of energy efficiency laws and incentives to help drive private sector investment in industrial energy efficiency improvements. Under the national Energy Efficiency Law in Turkey if manufacturers commit over a three-year period to reduce their energy intensity by an average of 10 percent, the government will subsidize 20 percent of their energy costs during the first year. The climate-smart investment potential for industrial energy efficiency measures in Turkey is \$3 billion by 2020.

🏠 Urban infrastructure

Turkey has rapidly industrialized and urbanized over the past 30 years. About 72 percent of Turkey's population lives in urban areas and by 2030 this number is expected to surpass 80 percent.²¹ Based on this expected growth, IFC estimates that \$19 billion in commercial investments will be made in new green buildings by 2020.

Large investments in public transport are also taking place in the country's larger, traffic-congested cities. For example, Istanbul has an approved investment program for metro expansion of more than \$2 billion. Although there are many opportunities for low-carbon transportation investment in Turkey (for example, seaports, airports, and light rail), comprehensive estimates are difficult to make. As such, IFC's estimate of \$7 billion by 2020 covers only a small portion of the expected overall total. Existing low-carbon transport plans emphasize developing implementation plans for sustainable transport systems in urban areas, promoting the use of alternative fuels and electric vehicles and completing existing high-speed railways projects. The waste sector also presents an investment opportunity of \$1 billion by 2020.



🍃 Priorities for Turkey to attract more climate-smart investment

REALIZE STRONG GREEN BUILDINGS POTENTIAL

Stronger building regulations and incentives are needed to drive more energy efficiency investment in new and existing buildings.

USE MORE PUBLIC-PRIVATE PARTNERSHIPS

Support development of more efficient and sustainable urban infrastructure through promotion of municipal PPPs, and greater resources devoted to urban planning and project development.

TAKE AN INTEGRATED POLICY APPROACH TO CLIMATE CHANGE

Prioritize short-term actions in updated National Climate Change Action Plan to 2030, including air pollution and adaptation measures, and integrate with long-term goals to ensure cost-effective mitigation policies.

TURKEY INDICATORS (2015)

Population: 78.7 million
 GDP: \$718.2 billion
 GDP growth: 4%
 Inflation: 7.7%
 Ease of Doing Business rank: 73
 S&P credit rating: BB+
 FDI, net inflows: \$16.8 billion
 GHG emissions rank: 23 (2012)
 Renewable energy capacity: 29.3 GW

LOW CARBON TARGETS

- 37.57% share of renewable energy in power generation by 2023.
- Add 20 GW of wind power by 2023.
- Add 5 GW of solar installations by 2023.
- Add geothermal capacity of 600 MW by 2023.

IFC CLIMATE BUSINESS (FY2010 – 2016)

Total climate finance: \$1.6 billion

- Renewable energy: \$634 million
- Energy efficiency: \$642 million
- Other mitigation: \$329 million
- Adaptation: \$8 million

Climate finance, selected NDC sector:

- Agribusiness & forestry: \$58 million
- Waste: \$37 million



UKRAINE

Ukraine's estimated climate-smart investment potential for selected sectors is \$73 billion from 2016–2030.

Ukraine's NDC includes a greenhouse-gas target to reduce emissions by 60 percent by 2030 from 1990 levels. Ukraine's economy is the world's fifth most energy-intensive in the world,²² and energy efficiency is a major opportunity for low-carbon investments across multiple sectors. Over two-thirds of the country's infrastructure is outdated due to a lack of modernization since the Soviet era, and energy efficiency measures are financially attractive. For example, the payback time of changing an inefficient boiler to an efficient one is

typically less than two years, and internal rates of return can be over 50 percent for such projects.²³

Ukraine has an abundance of natural resources due to its size, and the investment potential for power generation from renewables like biomass, solar PV, and wind energy is considerable. Unfortunately, the country faces a complex geopolitical situation (for example, much of the Ukraine's wind potential is in the Crimea), which hinders the expansion of its renewables sector.²⁴

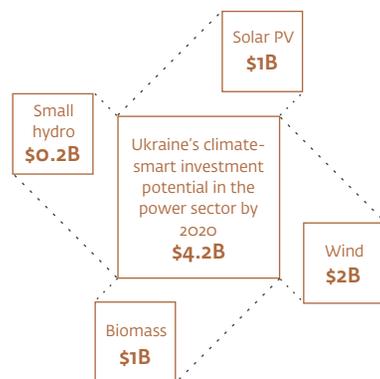
Although Ukraine faces several economic and bureaucratic problems, in 2016 the country climbed 13 spots in the World Bank's *Doing Business* rankings to 83 out of 189 countries. There are also many investment opportunities to help the country meet its new climate commitments, including renewable energy, energy efficiency and climate-smart agriculture.



NEAR-TERM CLIMATE-SMART INVESTMENT POTENTIAL BY 2020

⚡ Renewable energy

Ukraine adopted a National Renewable Energy Action Plan in October 2014, which sets a target to increase the share of renewables in its final energy consumption to 11 percent by 2020.²⁵ Renewable energy development in Ukraine is expected to continue, albeit at a slower pace. Renewable energy capacity is likely to reach 1.8 GW for onshore wind and 1.3 GW for solar PV by 2020. IFC estimates that Ukraine will attract \$4.2 billion for renewables by 2020.

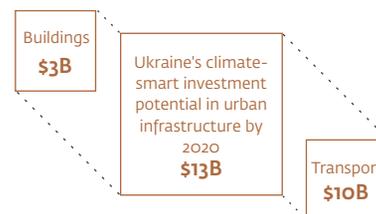


⚙️ Energy Efficiency

Ukraine has a strong industrial sector. The steep increase in natural gas prices in Ukraine has put pressure on energy-intensive sectors, such as cement and steel production, which are quite sensitive to price fluctuations. Due to the high level of energy intensity and the presence of outdated technologies, Ukraine's potential for industrial energy efficiency measures is significant; it is estimated to be \$2 billion by 2020.

🏠 Urban infrastructure

IFC estimates that \$3 billion will be invested in green buildings by 2020. Data availability to assess the opportunities for low-carbon transportation investments in Ukraine are scarce but IFC estimates a \$10 billion investment opportunity for this sector. Existing national priorities in transport emphasize improving the investment climate in this sector by increasing standards and regulations, enhancing public governance efficiency, refurbishing railways infrastructure facilities, and renewing the transport fleet.



🍃 Priorities for Ukraine to attract more climate-smart investment

TAP INTO SIGNIFICANT ENERGY EFFICIENCY POTENTIAL

Promote investments in supply-side energy efficiency through electricity tariff reforms, increasing transparency, and further expanding consumer-level metering.

INVEST IN GOVERNMENT CAPACITY

Improve governance, transparency, implementation of price regulations and accountability and controls to in the energy sector to attract foreign and domestic investment.

ESTABLISH AN ENERGY EFFICIENT ECONOMY VISION

Intensify measures for maximizing economy-wide energy efficiency gains potential, focusing on demand-side management – encouraging reduction of energy use in the residential housing and transport sectors.

TURKEY INDICATORS (2015)

Population: 45.2 million
 GDP: \$90.6 billion
 GDP growth: -9.9%
 Inflation: 48.7%
 Ease of Doing Business rank: 83
 S&P credit rating: B-
 FDI, net inflows: \$3.05 billion
 GHG emissions rank: 26 (2012)
 Renewable energy capacity: 6.2 GW

LOW CARBON TARGETS

- 11% of energy consumption to come from renewable sources by 2020

IFC CLIMATE BUSINESS (FY2010 – 2016)

Total climate finance: \$28 million

- Renewable energy: \$4 million
- Energy efficiency: \$19 million
- Other mitigation: \$5 million

Climate finance, selected NDC sector:

- Agribusiness & forestry: \$14 million

Public-private partnerships for climate investment

Well-structured public-private partnerships can help governments tap into the expertise and efficiency of the private sector, raise capital, access innovative new technologies, and spur development. They also help allocate risk across the public and private sectors to where it can best be managed and facilitate climate-related investment.

Transitioning to a low-carbon energy sector could benefit the nearly one in five people worldwide without access to modern energy services. Greater reliance on hydro, wind, solar, biomass, and geothermal sources, as well as more efficient energy use, could help create jobs and foster sustainable growth. The private sector is key to making this happen.

Areas where IFC has seen a sharp rise in government interest in public-private partnerships include waste-to-energy; grid-connected and off-grid solar power; and high-performance, energy-efficient municipal street lighting.

Many of the major cities in India have old and inefficient street lighting, which is costly and poses serious safety and security risks. In Jaipur, the municipality operates and maintains over 100,000 public street lights. The old technology was costly to maintain. To address this, IFC helped structure a public-private partnership to retrofit the public street lights²⁶ with energy-efficient LED lights and to operate and maintain the network. Thanks to the partnership, the network is run through a fully computerized centralized control and monitoring system. The partnership mobilized \$12 million in private investment. The new street lights will reduce greenhouse-gas emissions by 36,750 metric tons per year; provide fiscal savings of \$1 million per year to the city; and improve street lighting for over 1.6 million people. IFC has supported other street lighting projects in India and is helping other municipalities in Latin America and the Caribbean.

Similarly in solar power, IFC has helped develop a market for off-grid, small-scale rooftop solar projects in numerous states in India²⁷, as well as a grid-connected, utility-scale solar project in Africa through the Scaling Solar program. Zambia was the first country to sign up for the program. Within nine months, the government held the first auctions and received financial bids from seven leading renewable energy developers. The results set a new benchmark for solar power tariffs in Africa²⁸ and are among the lowest prices seen to date globally. When implemented across multiple countries, the program could help develop a new regional market for solar investment.



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Middle East and North Africa Climate-Smart Investment Potential

Investment Spotlights

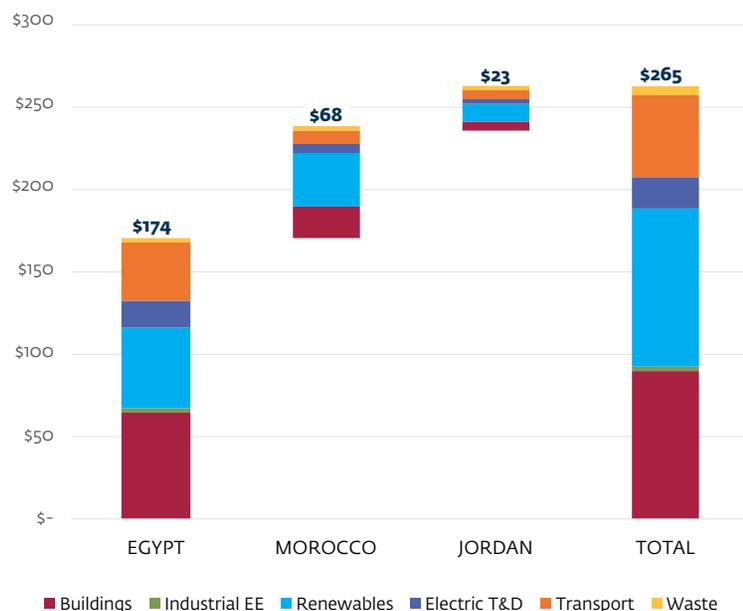
Middle East and North Africa Climate-Smart Investment Potential

Investment Spotlights

Countries in the Middle East and North Africa (MENA) are highly vulnerable to the impacts of climate change, which will only be exacerbated by surging population growth and rapid urbanization. These countries have high per capita emissions, but are interested in expanding and diversifying their energy mix. Across the region, MENA governments are adding flexibility to power markets, investing in renewable energy, and boosting energy efficiency to meet demand and alleviate fiscal pressures stemming from heavily subsidized energy prices. Several countries aim to become renewable energy development hubs, leading to growing private sector interest – and investment – in the region. Policies, including the redistribution of fossil fuel subsidies and increased taxes on oil resources, can generate revenues to help MENA countries expand their efforts to respond to climate change.

MENA countries are rapidly becoming renewable energy and resource-efficient growth centers.

Climate-Smart Investment Potential
2016 - 2030 (\$ billion)



Investment potential

Based on our analysis of the climate pledges made by the three MENA countries studied for this report – Egypt, Jordan, and Morocco – our estimate for the total climate-smart investment potential is \$265 billion by 2030. One-third of this potential is for renewable energy generation (\$97 billion), while 64 percent (\$169 billion) is for climate smart buildings, transportation, industrial energy efficiency, electric transmission and distribution, and waste solutions. By 2030, the commercial investment potential in climate-smart urban transportation solutions is estimated at \$50 billion, for new construction of green buildings \$92 billion, and for the waste sector \$4 billion. Given the policy signals that are being sent by countries, opportunities for investment in climate-smart agriculture projects across the MENA region are strong, but investment estimates are not yet available.

Renewable energy

While challenges to private investment do exist, the MENA renewables market is commercially attractive and investments are on the increase. The region has vast opportunities for climate-smart investment in

the renewable sector that are beginning to be realized—investments exceeded \$45 billion in 2015.¹ MENA’s renewables consist mainly of solar (\$29 billion) and wind (\$12 billion) projects, but small hydropower is also an area for growth. Indeed, new solar and wind capacities are coming online all the time. Egypt, Jordan, and Morocco have all expanded their installed wind capacity to 550 MW, 291 MW, and 154 MW, respectively. Ever more independent power producers feed renewable electricity into the grid at fixed tariffs, under quotas, or through power purchase agreements. Energy markets, however, are not truly open as transmission and distribution are controlled by the public sector. In fact, Egypt, Jordan, and Morocco are the only countries in the region that have privately owned distribution companies.² Countries can help to unlock bank finance by creating a better enabling environment for climate credit lines and other forms of sustainable energy finance.

Resource efficiency

The NDCs of many MENA countries highlighted low-energy and resource-efficient buildings. These buildings are now receiving considerable attention from regulators and project developers due to attractive economic and commercial benefits. There is also increasing interest in building renovation, as no-cost to low-cost upgrades can reduce building energy consumption in the region by as much as 20 percent. Public-private partnerships show promise to provide an improved water supply – but countries will need to establish regulatory and institutional frameworks.

Spotlight countries – Priority sectors for climate investment

Climate-smart business is growing in the MENA region. There is significant investment potential in renewables, particularly solar and wind power, as well as in energy efficiency improvements and green buildings, particularly in countries tackling subsidized energy prices. Although there is variability between countries, in general, rising energy demand, policy support, and in some cases a good investment environment have resulted in significant growth of the renewable energy and green building sectors, which is expected to continue in the coming years.

Climate Investment Spotlights



MOROCCO – CONCENTRATED SOLAR POWER

One of the world’s largest solar plants, the Noor-Ouarzazate I project consists of a 160 MW concentrated solar parabolic trough power plant with three-hour storage. The plant provides clean electricity to the fossil fuel-dependent country. An ongoing additional investment of more than \$3 billion will increase the total capacity of the Noor-Ouarzazate complex to 510 MW, bringing electricity to more than one million Moroccan households by 2018. When complete, the complex will reduce dependence on oil by around 2.5 million tons, lowering greenhouse emissions by 760,000 tons.



JORDAN – WIND POWER

In 2013, IFC provided \$221 million to the 117 MW Tafila wind farm, the first privately-financed wind farm in Jordan. This sets the stage for a pipeline of additional wind and solar parks over the next few years in order to help address the country’s twin challenges of dependence on imported energy and high fossil fuel prices. The project provides power to the grid at 25 percent below current wholesale electricity prices and reduces GHG emissions annually by over 177,000 tons.

EGYPT

Egypt's estimated climate-smart investment potential is nearly \$174 billion from 2016–2030.

Although Egypt's NDC does not include a formal greenhouse-gas reduction target by 2030, it does outline a suite of greenhouse-gas mitigation and adaptation goals and policy measures. Despite being Africa's largest non-OPEC oil producer (and the continent's largest oil and gas consumer), renewable energy is attracting considerable interest. The government sees clean energy as a way to secure and diversify its energy base while using its substantial natural resources.

Egypt has also taken some strides towards energy subsidy reform, but significant subsidies still exist for the

electric and industrial sectors. Egyptian energy subsidies reached about \$16 billion in 2012, representing more than 20 percent of its national budget expenditure.³

Egypt is expected to overtake South Africa in the next decade to become the largest electricity market in Africa. The country has pledged to produce 20 percent of its electricity consumption from low-carbon sources by 2022, with 12 percent coming from wind.⁴

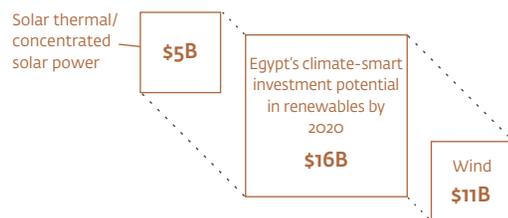
Attracting investment – both foreign and domestic – is a priority for Egypt's government. Despite pro-business reforms, the investment climate remains challenging. However, companies that have been able to navigate Egypt's challenges and complexities have been rewarded with significant returns on investment.⁵



NEAR-TERM CLIMATE-SMART INVESTMENT POTENTIAL BY 2020

⚡ Renewable energy

Egypt's renewable energy targets for 2020, along with the country's efforts to liberalize its power market and reduce some of the world's largest price subsidies, will likely lead to considerable investments in wind and solar in the near future. Egypt's estimated investment potential for wind power is \$11 billion by 2020 and \$5 billion for solar projects. Egypt also has small hydro potential, but this sector was not evaluated for this study.



🏠 Urban infrastructure

Egypt's NDC outlines several greenhouse-gas mitigation and adaptation activities that cover almost every sector of the urban economy, including energy (power generation and efficient lighting); transport (metro, railway, and inland waterways); and waste (solid waste and wastewater). IFC estimates that \$7 billion will be invested in new low-carbon buildings by 2020. To reduce emissions and improve urban transport and waste services, Egypt will need \$11 billion for an array of transportation projects and \$1 billion in waste management by 2020. Low-carbon transport priorities for the country include a shift in urban transport from single occupancy vehicles to public transport modes including railway, buses, minibuses and river passes as well as improving road transport efficiency through a switch from road to rail and river transport.⁶



⚙️ Industrial Energy efficiency

Industrial energy efficiency is a \$500 million investment opportunity in Egypt by 2020. Egypt's energy-intensive sectors, such as cement, iron and steel, chemicals, and fertilizer production, are sensitive to price fluctuations of natural gas and electricity. Due to outdated technologies, the investment potential for energy efficiency in the manufacturing industry is significant, especially through the replacement and optimization of equipment.⁷

🍃 Priorities for South Africa to attract more climate-smart investment

ADDRESS WATER SCARCITY

Address water shortages by increasing water storage capacity, network upgrades and developing new water resources, such as waste water recycling and desalination, improving water-use efficiency and initiating water demand management. This will benefit resource efficiency and more resilient agriculture.

STRONGER PUSH FOR CLEAN ENERGY

While Egypt has made some progress, more can be done to decarbonize the energy sector by improving energy efficiency and increasing the share of renewables in the electricity sector.

GET THE PRICES RIGHT

Continue to phase out inefficient fossil fuel subsidies, which represent 20 percent of the national budget—and consider introducing a carbon price to level the playing field between traditional fossil energy resources and renewables.

EGYPT INDICATORS (2015)

Population: 91.5 million
 GDP: \$330.7 billion
 GDP growth: 4.2%
 Inflation: 10.4%
 Ease of Doing Business rank: 126
 S&P credit rating: B-
 FDI, net inflows: \$6.9 billion
 GHG emissions rank: 36 (2012)
 Renewable energy capacity: 3.6 GW

LOW CARBON TARGETS

- 20% of power generation from renewables by 2022
- 7.2 GW of wind power by 2022
- 2.8 GW of solar CSP by 2027
- 700 MW of PV by 2027

IFC CLIMATE BUSINESS (FY2010 – 2016)

Total climate finance: \$111 million

- Renewable energy: \$16 million
- Energy efficiency: \$69 million
- Other mitigation: \$26 million

Climate finance, selected NDC sector:
 Agribusiness & forestry: \$26 million

Climate-smart agriculture

Agriculture, forestry, and land use are major drivers of climate change, accounting for about a quarter of all global greenhouse-gas emissions. Most of these emissions come from livestock farming and the expansion of agriculture into forested areas (deforestation). This is not only an environmental issue but a development concern: emerging markets will be the main source of projected growth in global food demand and trade at a time when farmers across the globe are experiencing more droughts, floods, and heat waves, which are increasing production variability and pushing already vulnerable populations into poverty. It is also a business issue given that climate change under a business-as-usual scenario is expected to reduce global yields by as much as half by 2030⁸. Global trends will exacerbate this scenario, including population growth, urbanization, the need to raise food production by some 70 percent by 2050 from 2007 levels, as well as a growing middle class that is demanding better quality food and more protein in their diets.

IFC has identified the following priorities: to contribute to global food security, to make environmental and social sustainability a business driver, and to improve livelihoods through its investment and advisory

activities in the agribusiness value chain. At the Paris Conference of the Parties, 94 percent of all country NDCs included greenhouse-gas reduction targets and/or adaptation objectives for the agriculture, forestry, and land use sectors⁹. Increasingly, businesses are making commitments to ensure deforestation-free supply chains, signing on to use 100 percent renewable energy, or setting other objectives to reduce their greenhouse-gas emissions and water footprint. A growing number of IFC clients are concerned that the impacts of climate change will disrupt their supply chains and their ability to grow in a sustainable and profitable manner. IFC is helping to support its clients' climate-related commitments. Clients are, for example, adopting technologies and practices that increase their productivity and resilience while reducing their carbon footprint.

In September 2016, IFC revised its climate definitions to incorporate activities and investments that contribute to climate-smart agriculture. Climate-smart agriculture is an approach to managing landscapes – cropland, livestock, forests, and fisheries – that aims to achieve three “wins”: increased productivity to improve food security and boost farmers' incomes; improved resilience to drought, pests, disease, and other shocks linked to

climate change impacts; and reduced greenhouse-gas emissions. IFC is supporting climate-smart agriculture, together with its clients and partners, by providing investments and advice that contribute to one or more of the three pillars of climate-smart agriculture. Historically, IFC has mainly supported investments in energy efficiency and clean energy solutions in the agricultural sector; however, it has now expanded its focus areas to include the following:

- **Helping animal protein producers to increase their productivity** (reduce greenhouse-gas emissions per kilogram of meat or milk or hectare) through various measures, including manure management.
- **Leveraging agriculture input suppliers** (for example, soil testing, water solutions, appropriate use of fertilizers, and pest control) as a platform to promote precision farming technologies and financing to increase the productivity and resilience of farmers.
- **Helping producers and traders reduce post-harvest losses** in the food value chain by, for example, optimizing food transport logistics and developing cold chain and storage infrastructure.



JORDAN

Jordan's estimated climate-smart investment potential is nearly \$23 billion from 2016–2030.

Jordan's NDC establishes a 1.5 percent greenhouse-gas reduction from 2006 levels compared to business as usual by 2030. Jordan imports roughly 96 percent of its energy supply from a politically unstable region. Unlike its neighbors, Jordan does not have a natural endowment of fossil fuels – this strengthens the case for efficient, climate-smart energy and infrastructure projects.

Jordan's NDC also included a conditional target of an additional 12.5 percent reduction in greenhouse-gas emissions if approximately 70 sector-specific mitigation projects worth \$5.2 billion are implemented.

As a major importer of fossil fuels, Jordan has also focused on its transportation sector by pairing its push for more renewables with an effort to accelerate the market for electric vehicles. The government signed letters of commitment in 2015 to build 3,000 solar-powered electric charging stations over the next decade. Combined with Jordan's tax and fee exemption for electric vehicles, 5 to 10 percent of the country's 1 million-plus cars could be electrified within five to seven years.¹⁰

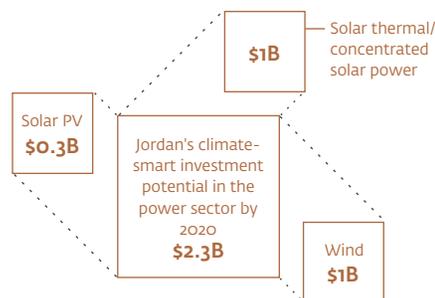
Over the past 15 years, the government has engaged in wide-scale privatization, including in the energy and transportation sectors, pointing to further opportunities in Jordan for climate-smart infrastructure projects via public-private partnerships.



NEAR-TERM CLIMATE-SMART INVESTMENT POTENTIAL BY 2020

⚡ Renewable energy

Jordan aims to have renewables comprise 10 percent of its energy mix by 2020.¹¹ The number of renewable energy projects is expected to rapidly increase in the next few years, with a pipeline of at least 200 MW of solar projects to come online in 2016 and another 1 GW by 2020. In addition, Jordan brought its first utility-scale wind farm online in 2015 and is looking to add up to 600 MW of additional wind power in line with its 2020 target.¹² Jordan's estimated investment potential for wind is about \$1 billion by 2020 and for solar projects \$1.3 billion.



🏠 Urban infrastructure

IFC estimates \$500 million will be invested in new low-carbon buildings by 2020, while about \$2 billion will be invested in the transportation sector (primarily railways) by 2020. National transport plans indicate the following priorities for transport: increasing the total number of commuters using public transport to 25 percent by 2025, developing and implementing a comprehensive transport strategy including a national bus transit system, and increasing the transport of goods via a multimodal transport network.¹³ Another \$100 million for waste management will also be open for new climate-smart investment.



🍃 Priorities for Jordan to attract more climate-smart investment

CONTINUE TO OPEN THE MARKET FOR RENEWABLES

Jordan can build its support to small-to-medium scale renewable energy installations by providing additional policy incentives and support; while also opening the grid-scale renewables market by strengthening the electricity grid.

UNTAPPED ENERGY EFFICIENCY

Jordan has strong potential to improve energy efficiency, particularly in the commercial and household sectors. More performance standards and incentives could help.

WATER RESOURCE EFFICIENCY

Strengthen water loss reduction and conservation and improve energy efficiency of water sector operations to jump-start more climate-smart agriculture.

JORDAN INDICATORS (2015)

Population: 7.59 million
 GDP: \$37.5 billion
 GDP growth: 2.4%
 Inflation: -0.9%
 Ease of Doing Business rank: 107
 S&P credit rating: BB-
 FDI, net inflows: \$1.3 billion
 GHG emissions rank: 115 (2012)
 Renewable energy capacity: n/a

LOW CARBON TARGETS

- Renewable energy target of 10% of total energy mix by 2020
- Unconditional reduction of 1.5% of greenhouse gases below a business-as-usual scenario

IFC CLIMATE BUSINESS (FY2010 – 2016)

Total climate finance: \$195 million
 • Renewable energy: \$189 million
 • Energy efficiency: \$6 million



MOROCCO

Morocco's estimated climate-smart investment potential is nearly \$68 billion in select sectors from 2016–2030.

Morocco's NDC pledges to reduce greenhouse-gas emissions by 13 percent compared to business-as-usual levels by 2030. Morocco's NDC includes a detailed list of 54 measures necessary to achieve its climate commitment. Most of these measures are already found in national legislation. For example, Morocco has an ambitious goal to increase the share of renewables in its power mix to 42 percent by 2020 and 52 percent by 2030. With very few fossil fuel resources, Morocco imports about 90 percent of its energy needs.

Morocco has also established new national agencies to encourage energy efficiency and renewable energy and aims to improve its energy efficiency by 12 percent by 2020 and 15 percent by 2030.¹⁴ According to Morocco's NDC, implementation will require total investment of \$45 billion from now until 2030, \$35 billion of which must come from new sources of climate finance.¹⁵

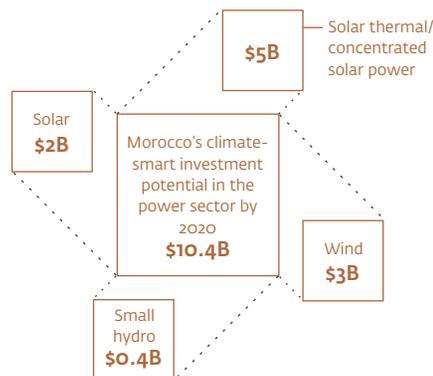
Despite the slowdown of capital flows following the Arab Spring, Morocco is an attractive destination for climate-smart investment. The country's master development plan for its economy is based on leveraging "its unique status as a multilingual nation with a tri-regional focus (toward Sub-Saharan Africa, Middle East, and Europe) to transform the country into a regional hub for shipping, logistics, finance, manufacturing, assembly, and sales."¹⁶



NEAR-TERM CLIMATE-SMART INVESTMENT POTENTIAL BY 2020

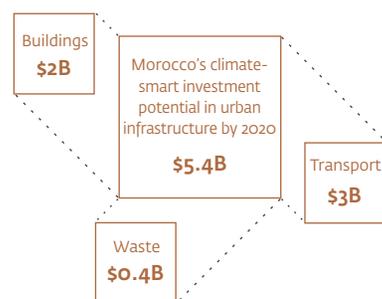
⚡ Renewable energy

The country's targets to install 2 GW of solar, 2 GW of wind, and 2 GW of hydro by 2020 are rapidly driving new investments. Morocco's flagship solar project – the Noor Concentrated Solar Thermal Plant – has been referenced as a model for the region's ability to capture its enormous solar capacity, perhaps even changing its status as an energy importer. Indeed, the Moroccan government is planning to export electricity to Spain, Portugal and Mauritania via a network of high-voltage cables.¹⁷ Over the 2020 time frame, IFC estimates commercial investment opportunity in Morocco is \$7 billion for solar projects, with \$2 billion and \$5 billion for solar PV and solar thermal technologies, respectively. Wind represents a \$3 billion opportunity, followed by \$400 million for small hydro projects by 2020.



🏠 Urban infrastructure

Morocco's rapid urbanization since independence in 1956 has been driven by its population growth. Morocco's total population has more than tripled since 1960, reaching 34.4 million in 2015. Moroccan citizens living in urban areas also rose from 29.2 percent in 1960 to 61.8 percent in 2015.¹⁸ For the green buildings sector, IFC estimates \$2 billion of investments will be made in new low-carbon buildings by 2020. Morocco's plans for the transport sector and waste management sectors represent a \$3.4 billion investment opportunity by 2020. National priorities in low-carbon transport include a focus on its port strategy to improve performance, create incentives for innovation, maximize connectivity, and integrate environmental standards into port management.



🍃 Priorities for Morocco to attract more climate-smart investment

PUBLIC-PRIVATE SOLUTIONS

Ramp up the use of public-private partnerships to generate a pipeline of street lighting, transport, buildings and other climate-friendly projects.

ACCELERATE THE GROWTH OF RENEWABLE POWER

Streamline process and standardize documentation and improve grid integration to accelerate large-scale and smaller renewable projects.

BUILD UP GREEN BANKING

Work to diversify sources of financing for renewable energy by building capacity to increase the share of commercial bank lending.

MOROCCO INDICATORS (2015)

Population: 34.4 million
 GDP: \$100.4 billion
 GDP growth: 4.4%
 Inflation: 1.6%
 Ease of Doing Business rank: 80 (2016)
 S&P credit rating: BBB-
 FDI, net inflows: \$3.2 billion
 GHG emissions rank: 71 (2012)
 Renewable energy capacity: 2.4 GW

LOW CARBON TARGETS

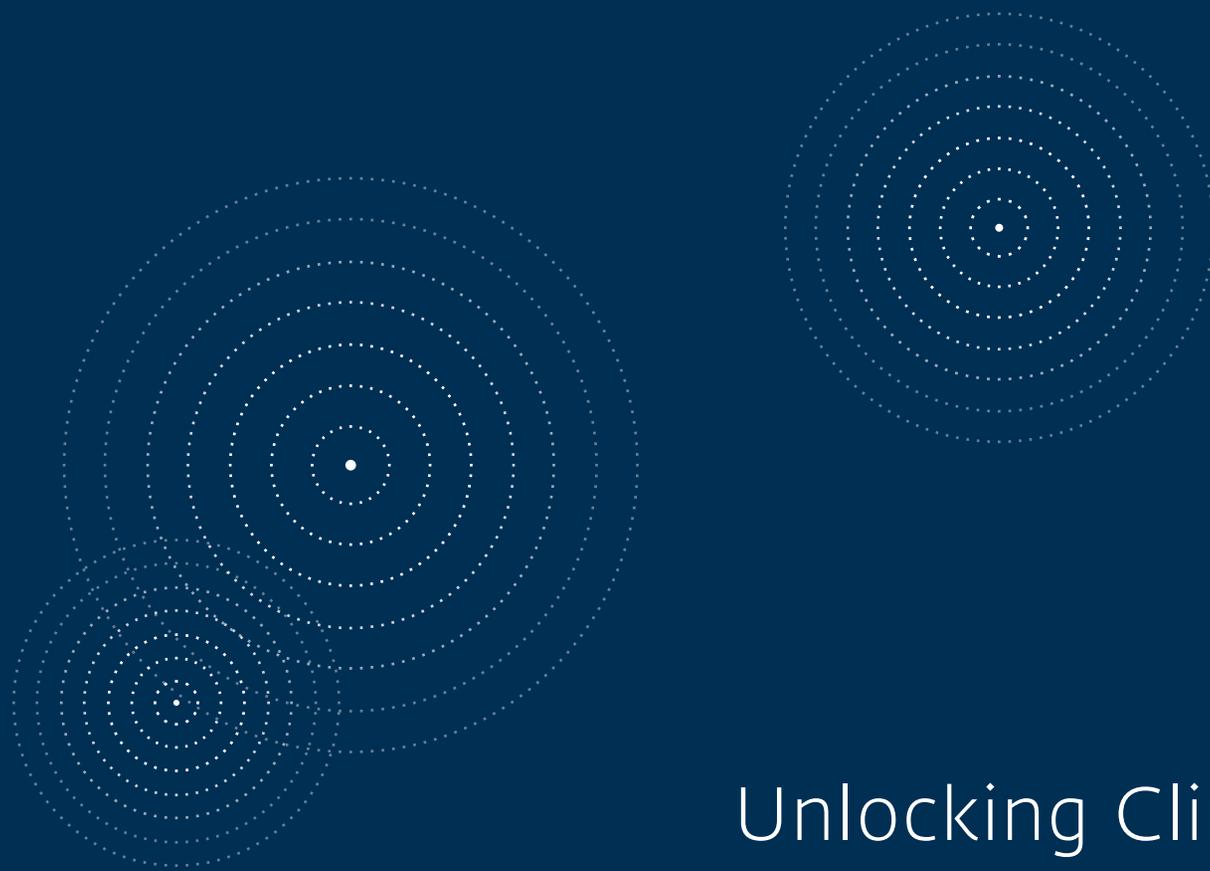
- 42% of power-generating capacity from renewables by 2020 and 52% by 2030
- Add 2 GW of solar, 2 GW of wind and 2 GW of hydro by 2020
- Improve energy efficiency by 12% by 2020 and 15% by 2030

IFC CLIMATE BUSINESS (FY2010 – 2016)

Total climate finance: \$11 million
 • Renewable energy: \$11 million

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Unlocking Climate Investment Opportunities

Unlocking Climate Investment Opportunities



The outlook for private sector investment in climate solutions is strong. With steadily declining costs for renewable energy technologies, successful green building business models, and the emergence of promising developments in climate-smart agriculture, companies and investors have up to \$23 trillion in opportunities between 2016 and 2030. The NDCs can unlock these opportunities if the right enabling conditions are created that allow the private sector to thrive. There are three key priorities for countries seeking to attract private investment to meet their climate goals:

- **Achieve NDC goals.** Act quickly to integrate NDC commitments into national development strategies and budget processes. Put in place clear and consistent policies – such as carbon pricing, performance standards, and market-based support. Also ensure that climate considerations are integrated into other sector policies (energy and agriculture, for example).
- **Strengthen the private sector investment climate.** Improve the overall enabling conditions for the private sector to operate and invest in the targeted sectors, including enhancing domestic financial markets, related regulation and capacity
- **Strategically use limited public finance.** Government budgets will not be enough to address climate change. Public funds should be used strategically to mobilize much larger sums of private capital, e.g., by reducing risk and providing project preparation support.

This section discusses each of these priorities in more detail.

Achieve NDC goals

Set a long-term framework. An important first step for any climate plan to attract private investment is to have a long-term target or goal. Many NDCs have targets related to emissions, energy, and capacity. The next step is to integrate these goals into national development strategies and budget processes by introducing the policies and measures needed to fully implement these targets.

It is critical that countries integrate climate planning – taking into account specific NDC targets and sector priorities – into their

basic development strategy and capital budgeting process, to align development and climate priorities. This helps governments to:

- Create a platform for decision makers to engage in substantive discussions on how to strengthen climate responses, in alignment with national priorities and international commitments.
- Strengthen the alignment of programs and initiatives across sectors and between national and local levels to ensure effective and efficient delivery of climate results.
- Increase the transparency of spending against climate objectives.
- Move towards the accounting of outcomes and impacts to better track spending and monitor physical achievements.

Countries can build on existing public finance management systems to better define what constitutes climate-related spending and identify the available public sources of climate finance to support these investments. Several countries have already begun to identify climate expenditure to achieve their climate policy objectives. Countries may choose to focus on monitoring climate-related spending on those programs considered most strategic or those with the largest budget allocations.

Governments also need to adjust their infrastructure needs assessments to prioritize low-carbon, climate-resilient infrastructure. It is important to recognize that climate change is not the main driver for most developing countries. However, climate change is linked closely to other development goals – such as alleviating air pollution, providing energy access, limiting health impacts, increasing livable urban areas, sustaining agriculture, and reducing vulnerability. For example, governments are increasingly designing policies to proactively support greater integration of renewable energy into the electricity sector. This is driven by several goals, including concern about rising air pollution, as well as goals for energy security, reduced imports, and diversifying the energy mix.

Policies across the sectors covered by the NDCs should be aligned to ensure that they achieve the maximum possible impact, minimize unintended consequences, and provide a clear and consistent framework for the private sector. There needs to be a greater push to slow the growth of coal in key regions – it is critical to act now to avoid lock-in of emissions-intensive assets, while laying the path for a low-carbon,



Photo: © IFC

longer-term transition through such measures as increased funding for research and development, technology demonstration, and infrastructure planning.¹

Get the prices right. To attract private investment, fiscal policy must be aligned with climate goals. This means removing subsidies that incentivize producing and using emissions-intensive fossil fuels, reforming other energy pricing, and putting a price on carbon emissions. This levels the playing field between low- and high-carbon alternatives. Fortunately, more than half of the NDCs reference carbon pricing or markets as key elements of their country climate strategies – and momentum is growing.

Provide flexible, market-based support for targeted sectors.

Governments can provide targeted subsidies or financial support to help new climate-smart investments achieve a level playing field with traditional high-emitting options. Given the increased competitiveness of solar PV and onshore wind, support may not be needed, unless there are other market barriers that need to be addressed. In the case of renewable



Carbon pricing is gaining momentum

An increasing number of governments consider carbon pricing to be good fiscal and environmental policy. Today, 40 countries and over 20 cities, states, and provinces are already putting a price on carbon. They include seven out of the 10 largest global economies. All these instruments cover 13 percent of global emissions and have a collective value of \$50 billion, allowing governments to raise about \$26 billion in revenues in 2015.² This is a threefold increase over the past decade. Governments are pricing carbon because it provides a “triple dividend”: it is good for the environment; it raises revenue efficiently, making it possible to reduce other taxes; and it drives innovation and critically needed investments in clean technologies.

From the business side, over 1,200 global businesses use an internal carbon price or plan to do so in the next two years – this is a substantial increase from just 150 companies that reported using a carbon price in 2014.³ The most rapid growth in corporate carbon

pricing is happening in regions like China, the Republic of Korea, and the EU, which have pricing in place. These progressive companies are climate-proofing their business models to be the first movers in clean energy markets.

While this momentum is encouraging, current price levels and coverage will not put us on a 2°C pathway. The majority of emissions (85 percent) are priced at less than \$10 per ton of carbon dioxide, which is lower than the price that economic models say is needed to meet global climate stabilization goals. To advance well-designed carbon pricing systems in countries around the world, the Carbon Pricing Leadership Coalition was launched at the 21st Conference of the Parties, bringing together governments, businesses, and nongovernmental organizations to help accelerate the pace of carbon pricing implementation around the world.

www.carbonpricingleadership.org

energy, support has traditionally been given in the form of tax credits or rebates, as well as feed-in tariffs, which provide a subsidy to targeted technologies per kilowatt-hour sold to the electricity grid. More recently, there has been increased use of flexible support mechanisms like reverse auctions, competitive procurements, and other processes that let market participants bid for the subsidy that they need to make their project viable.⁴

Use performance standards and mandates to drive greater adoption and demand for low-carbon options. In addition to carbon pricing, governments can use other incentives to ensure strong uptake of energy-efficient, low-carbon products and services. These include labels, performance standards, fiscal incentives, and financial instruments, which have a proven track record in countries at all income levels and can ensure that the best technologies are used to reduce energy demand and carbon emissions.⁵ These policies can help trigger consumer adoption, while also reducing the level of any carbon that might be needed.

Develop a transition plan for the most affected sectors. Implementing NDCs will inevitably result in changes in a country's industrial base. When losses are concentrated in a few sectors, gaining full industry and stakeholder support to implement the low-carbon transition will be critical. Governments can address this by designing policies to avoid concentrating losses and by compensating highly affected groups. One solution is to use regulations and incentives that apply only to new capital. This approach improves energy efficiency, creates low-carbon substitution options without hurting the owners of existing assets, and reduces vulnerability to the subsequent introduction of carbon prices. Another solution is to adopt compensation plans, using either resources from carbon pricing or the existing tax and social protection system. Overall, countries with strong social protection may be better able to support the transition of workers from declining polluting sectors to growing greener sectors.⁶

Strengthen the private sector investment climate

In addition to putting in place a strong package of climate policies, crowding in private sector funding will require a robust domestic



enabling environment for private investment, one that does not impose unnecessary costs and reduces risks faced by firms and financial institutions, strengthens competition and promotes investment and capital flows. Effective and transparent business taxation, regulation, legal enforcement of property rights, frameworks for public-private partnerships, and proactive investment policies all help to build investor confidence. Efforts to develop financial markets to finance green operations need to be synchronized with work to support green banking, foster greater penetration by insurance providers to build resilience, and incentivize the pensions sector to invest in long-term capacity. The World Bank Group's annual *Doing Business Survey* is a useful tool to assess the overall state of the investment climate in countries.⁷

Taking into account the relative newness of the green investment sector in many countries, additional institutional capacity, regulatory frameworks, and – possibly – financial incentives are needed to address the associated political, policy, technology, operational, currency and capacity risks for firms and all segments of the financial sector. This should help rebalance the risk-reward profile in favor of resilient and less carbon-intensive investments. These efforts need to be supplemented by a pipeline of marketable projects and green financial instruments.

Reducing transaction costs associated with public-private partnerships and providing certainty through simplified permitting procedures and



standardized documents like power purchase agreements, for example, are strong drivers of investments. They make projects bankable and attract funding. There is significant potential for scaling up investments when this is combined with sector-specific policies that provide opportunities and shift incentives for private investment, such as introducing fiscal incentives, well-defined feed-in tariffs, or renewable portfolio standards for clean energy.

For example, Jordan's renewable energy law was complemented by feed-in tariffs; 20-year power purchase agreements with standardized contracts, including tariff adjustment mechanisms for inflation and exchange rate variation; and a 10-year income tax holiday with a lower tax rate. The government also provided a sovereign guarantee to back-stop the buyer's payment obligations under the power purchase agreement. This mix of policies, processes, and incentives resulted in the largest private sector-led solar initiative in the Middle East and North Africa – the 117 MW \$290 million Tafila Wind Farm, which is being followed by 12 solar projects with power purchase agreements totaling 190 MW. This is transforming power generation in Jordan.⁸

"A critical gap in...successful green economy planning is financial literacy. If policy makers and project managers don't understand finance, the different risk tolerances of different types of capital, and how to raise capital they cannot be expected to put together attractive, bankable deals."

—South Africa's National Business Initiative⁹

Governments also need to align financial regulations with their climate investment goals. Often it is not project-related issues but regulatory, structural, and behavioral barriers that prevent the financial sector from being able to invest in climate action. For example, most countries put ceilings on pension funds' exposure to alternative assets – most green investment falls into this category. Central bank rules around minimum rates and short tenors for lending can significantly increase the cost of capital for developers. In Indonesia, foreigners are limited to a 49 percent stake in power plants – this has discouraged investment in smaller plants and large plants are seen to have greater risks due to unpredictable licensing procedures. As a result, Indonesia's regulator is developing a Roadmap for Sustainable Finance in Indonesia 2015–19 – a systematic plan that will be applicable to the entire financial sector, including pension funds.¹⁰ Financial regulators and ministries of finance and planning need to be aligned on NDC implementation. In particular, they need to be aware of major players in the finance sector and their degree of adaptability when considering possible actions to scale up green investment.

Strategically use public finance

Well-designed enabling policies have a critical role to play in unlocking private climate investment. Public finance plays a complementary – and equally important – role. The main challenges of mobilizing institutional investments in developing countries relate to investors' fiduciary duties, and include:

- **Risk-returns:** Lack of investment opportunities that meet institutional investors' required risk-adjusted returns and needs for sufficiently large investment size, risk diversification, and liquidity.
- **Lack of strategic policy signals and uncertain public climate finance flows:** While the Paris Agreement and the NDCs have sent a strong

Green finance

“Green finance” refers to the financing of investments that provide environmental benefits in the broader context of environmentally sustainable development. Greening the financial system goes beyond lending and investment standards by considering both the impact of environmental and social risks on the financial system, and the impact of the financial system on environmental and social risks.

While some progress has been made in green finance, only a small fraction of bank lending is explicitly classified as green according to national definitions. Less than 1 percent of global bonds are labeled green and less than 1 percent of the holdings by global institutional investors are green infrastructure assets.¹¹ There is significant potential for scaling up green finance, but there are also many challenges, including difficulties in internalizing environmental externalities, information asymmetry (for example, between investors and recipients), inadequate analytical capacity, lack of clarity in green definitions, and maturity mismatch – often associated with long-term projects.

Momentum around the role of the financial sector in supporting sustainable development and addressing climate change has been generated by the G20, and further strengthened by the Financial Stability Board and the Paris Agreement and the associated NDCs. However, there is currently no systematic approach to assessing progress on these challenges within the financial system. As countries begin to implement their NDCs, being able to compare the current supply of green finance provided by the private sector with the investment needs globally and per country would allow for the development of clear action points to close any gaps.

To effectively measure and track green finance, there needs to be a strong global push to harmonize definitions on what counts as green and develop relevant indicators by which progress on sustainability and greening investments can be measured and aggregated. Such efforts will improve our understanding of the effectiveness of policies and incentives being developed to drive green finance.





signal, predictable and transparent policies (such as carbon pricing) and credible implementation plans are essential to build market confidence.

- **Lack of climate risk management skills:** There is uncertainty among investors on how to measure and track climate risk, including a lack of data at project and portfolio levels, uncertainty about climate policy, and unfamiliarity with new technologies.
- **Below investment grade and emerging-market risks:** For example, weak operating environments or governance, exposure to volatile currencies, and the recent slowdown in economic growth.

The NDCs can help identify investment opportunities and generate a project pipeline. The path from development plan, to project idea, to investment plan, to financial close is a long, challenging one – this phase of the project lifecycle has the highest risk, and the high development and transaction costs make it difficult for the private sector. Using public finance to scale up support for project preparation and development can play a critical role in encouraging investment.

Furthermore, to attract private capital, investments must have adequate risk-adjusted returns and be of suitable size. This is particularly important in newer climate business areas where perceived risk is high, such as energy storage, or where aggregation models are unfamiliar in a developing-country context. Governments can increase their efforts to reduce risk (for example, by blending public and private finance), while also helping to aggregate smaller, de-risked assets, diversified across sectors and geographies, to attract institutional investors.

To allocate capital and provide efficient debt financing, governments should ensure that capital markets are operating well and have the necessary capacity. The financial system also needs to adjust for climate risk: banks and other financial institutions should begin to develop plans to deal with forthcoming climate impacts, new policies, and changes in technologies and markets.¹²

Finally, governments can catalyze private sector investments through targeted financing mechanisms and institutional arrangements that blend public and private interests, expertise, and resources to reduce risk and address bottlenecks preventing private investment.

Financial innovation for tackling climate change

Mobilizing private capital through financial innovation is a strategic priority for IFC.

Green bonds are a good example of an aggregation and securitization vehicle that offers investors a green investment opportunity without sacrificing returns. Since 2008, the World Bank Group has issued more than \$14 billion in green bonds. Proceeds from these bonds are used to support low-carbon projects. The World Bank Group's triple-A ratings provide security for investors, and the development mandate and safeguards provide assurance for the use of proceeds and impact. IFC's green bond program has won several industry awards, including best local currency green bond and the market's first-ever \$1 billion green bond.

The \$418 million IFC Catalyst Fund makes investments in private equity funds, providing capital to companies

that enable resource efficiency and develop low-carbon products and services in emerging markets.

IFC is also actively engaged with several financial innovation platforms established to develop new approaches to climate finance. The Global Innovation Lab for Climate Finance¹³ designs financial mechanisms and structures that have the potential to attract institutional investments.

One product under development, with support from the India Climate Finance Lab, is the India Rooftop Solar Warehousing Facility, a \$500 million revolving facility. It will help the Indian government reach its solar power target and deliver on its NDC. The warehouse will aggregate a pool of rooftop solar loans, which will be de-risked and securitized as an asset-backed green bond when the warehouse reaches a suitable size.

The World Bank Group's Pilot Auction Facility for Methane and Climate Change Mitigation is an innovative climate finance mechanism designed to stimulate private investment in projects that reduce greenhouse-gas emissions. The facility consists of two key elements. The first, a tradable put option for emission reductions, provides option holders with the right, but not the obligation, to sell future emission reductions to the Pilot Auction Facility at a predetermined price. The second element, an auction platform, transparently allocates and determines the value of the options. The facility has hosted two successful auctions to date, allocating more than \$40 million in climate funds to reduce 14.4 million tons of carbon dioxide equivalent.¹⁴



Using blended climate finance to mobilize private sector capital

In most of the countries in which IFC operates, investment opportunities for low-carbon projects face both significant barriers and uncertain returns. Barriers can range from lack of market knowledge and capacity of project developers to macroeconomic challenges and business environment risk.

To overcome some of these barriers, IFC blends small amounts of public concessional funds with IFC commercial financing to fund new projects that have a high development impact and strong potential to create a demonstration effect, but have not yet established a commercial track record.

Since FY10, IFC has supported more than 100 investment and advisory projects across 40 countries using blended climate finance. Over that period, IFC has committed \$341 million in donor finance, mobilizing \$1.2 billion in IFC financing and \$3.9 billion in other private sector investments.¹⁵ Examples of blended climate finance projects include:

- A \$15 million investment in Ghana to boost output at a 220 MW power plant by 50 percent, without incurring any additional fuel consumption. The project is expected to reduce power costs for Ghanaian consumers and businesses, as well as avoid 118,000 tons of carbon dioxide emissions per year.
- An advisory engagement with leading agribusiness companies in Nepal to promote improved agricultural and water management practices for smallholder farmers. Early results have shown that more than 75 percent of targeted farmers are adopting climate-resilient practices and crop yields in demonstration farms are improving by 58 percent.
- Investments totaling \$20 million into three Turkish banks to catalyze lending for energy-efficient equipment to energy-intensive companies. These investments are expected to directly mitigate more than 200,000 tons of carbon dioxide emissions per year.

www.ifc.org/BlendedClimateFinance



Photo: © IFC

Another promising area for unlocking private investment is the use of concessional or “blended” climate finance. Blended climate finance consists of various products and structures, including risk-sharing products, lower interest rates, longer tenors, subordinated rank in loans, or lower returns for equity investments (see box to left). However, given the limited availability of concessional funds, it is important to find an optimal risk allocation among the various players and leverage public capital and concessional money. Currently, concessional finance is too fragmented. Creating risk pools and donor financing platforms will help improve transparency and alignment.

Next steps

This report has been developed to help advance the discussions around the implementation of the Paris Agreement, with an eye on the private sector investment opportunity. This is just the first step. In order to make real progress and unlock the full private sector investment potential, additional research, thought leadership, information exchange and public-private dialogue are needed. While there is a good deal of information and market analysis for renewable energy and green buildings investment potential, there is a large data gap for many of

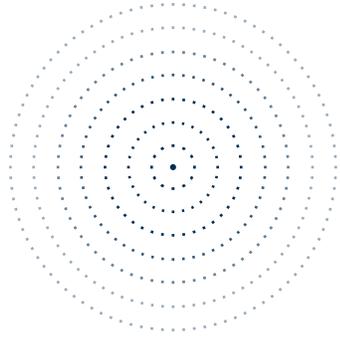
the promising new sectors, such as climate-smart agriculture, industrial energy efficiency, waste, and transport. Investors like IFC, companies, governments, civil society groups and academic institutions should create sector-specific task teams to further map the NDCs and other policies, assess specific project types, estimate the investment potential and identify policy or other barriers that need to be addressed to unlock this potential.

There is also the need to increase dialogue between investors, companies, civil society and governments in specific countries and sectors. These dialogues could test key elements of countries’ NDCs and offer private finance and business models—as well as policy changes and public finance tools—that are needed to unlock private investment. This sort of focused, pragmatic approach will help to turn countries’ NDCs and climate goals into specific investment strategies. By involving the private sector from the start in policy design, countries’ NDC implementation will have a quicker path, resulting in faster investment and realization of climate benefits.

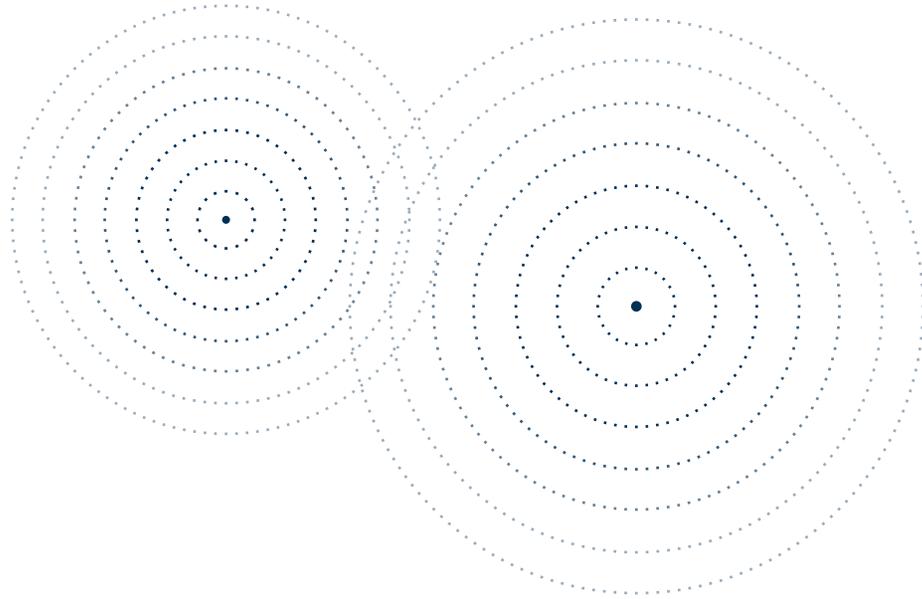
The International Finance Corporation stands ready to work with like-minded partners to turn the investment potential identified in this report into reality.

Endnotes

- 1 World Bank Group (2015), Decarbonizing Development, access at <http://www.worldbank.org/content/dam/Worldbank/document/Climate/dd/decarbonizing-development-report.pdf>.
- 2 World Bank Group (2016), State and Trends of Carbon Pricing, available at <http://documents.worldbank.org/curated/en/636161467995665933/State-and-trends-of-carbon-pricing-2015>.
- 3 CDP (2016), Embedding a Carbon Price into Business Strategy, available at https://b8f65cb373b1b7b15feb-c70d8ead6ced550b4d987d7c03fcdidd.ssl.cf3.rackcdn.com/cms/reports/documents/000/001/132/original/CDP_Carbon_Price_report_2016.pdf?1474899276.
- 4 IRENA (2013), Renewable Energy Auctions in Developing Countries, available at https://www.irena.org/DocumentDownloads/Publications/IRENA_Renewable_energy_auctions_in_developing_countries.pdf.
- 5 World Bank Group (2015), Decarbonizing Development.
- 6 World Bank Group (2015), Decarbonizing Development.
- 7 See <http://www.doingbusiness.org/>.
- 8 For more information about this project, see For more information, see <http://ifcext.ifc.org/IFCExt/pressroom/IFCPressRoom.nsf/0/41FoC8F1C2A2D62885257C30002AD206>.
- 9 National Business Initiative's Green Economy Finance work, for more information see <http://www.nbi.org.za/>.
- 10 See http://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/cb_home/publications/towards+a+sustainable+financial+system+in+indonesia for more information.
- 11 G20 Green Finance Study Group (2016), G20 Green Finance Synthesis Report, access at <http://g20.org/English/Documents/Current/201608/P020160815359441639994.pdf>.
- 12 See, e.g., Blackrock Investment Institute (2016), The Price of Climate Change: Global Warming's Impact on Portfolios, access at <https://www.blackrock.com/corporate/en-mx/literature/whitepaper/bii-pricing-climate-risk-international.pdf>.
- 13 See <http://climatefinancelab.org/> for more information.
- 14 For more information, see <https://www.pilotauctionfacility.org/>.
- 15 For more information about IFC's Blended Finance program, visit http://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/cb_home/mobilizing+climate+finance/blendedfinance.



Annex



Methodology for estimating climate-smart investment potential

The estimates in this report are based on the 21 NDCs submitted to the United Nations Framework Convention on Climate Change by IFC's countries of focus, as well as the national plans, policies, and targets that underpin them. In 2014, the United Nations Framework Convention on Climate Change provided countries with general guidance on what to consider when drafting their NDC submission; thus just like the countries themselves, no two NDCs are alike. The level of detail in each NDC varies considerably and a wide range of sectors and targets are covered. Furthermore, some countries were better equipped than others to compile their NDCs in the timeframe given for submission in advance of the 21st Conference of the Parties in Paris. Most expect the next iteration of NDCs – due in 2020 – to be better articulated, with stronger pledges that respond to climate change.

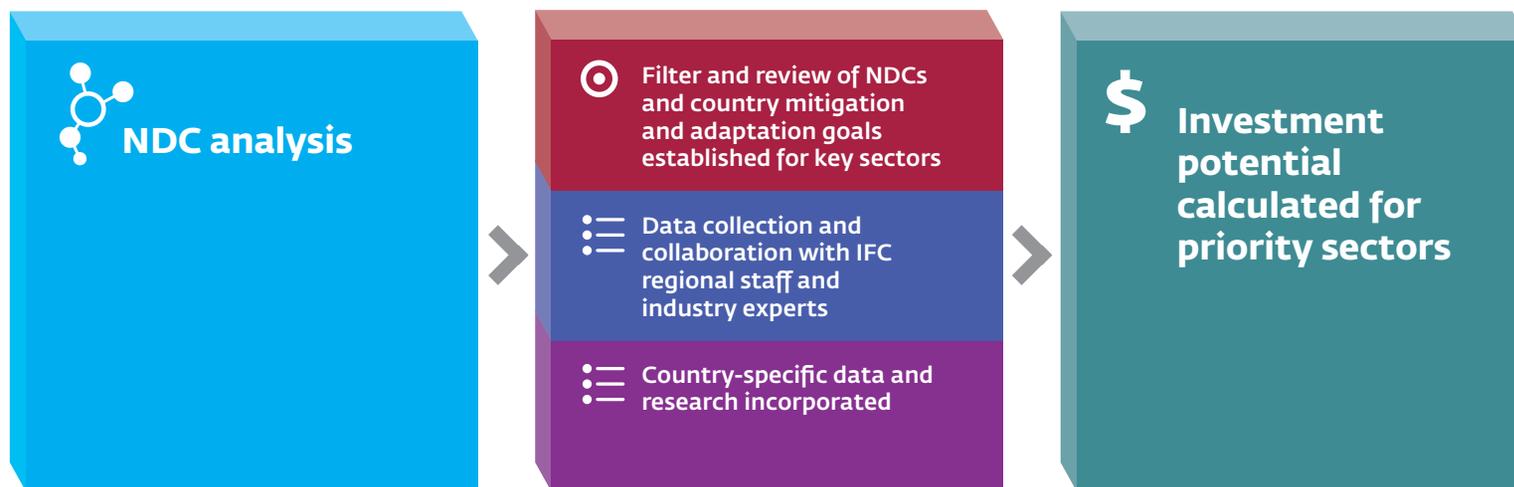
With this in mind, IFC analyzed key selected sectors mentioned in the countries' NDCs for which reliable, transparent data were publicly available and measurable. For example, data quality and availability in the renewables sector for individual countries is more easily obtainable and reliable than similar data for mitigation and adaptation measures in the agriculture, forestry, and land use sectors. Unfortunately, these

particular sectors are important for the future economic trajectory of developing countries. More work thus needs to be done to help drive and track climate investment in these sectors.

It is also important to note that few countries' NDCs mentioned every sector that provides an opportunity to mitigate greenhouse-gas emissions. For example, if a country's NDC did not include transport or transportation, IFC still examined this sector as most governments are addressing issues related to transportation given the inherent energy security, infrastructure, social, and environmental ramifications demonstrated by the sector. In these instances, IFC used the targets from the country's existing national legislation and plans to calculate their associated climate-smart investment potential, as they will be essential components to countries' NDC implementation strategies.

IFC's analysis began by using the World Bank's NDC database to filter the sector priorities and targets for each country of focus. Using these data, IFC created a map of countries' sector coverage and responses outlined in the NDCs. In addition, IFC experts were consulted to gain a better understanding of the policies and market conditions of each country.

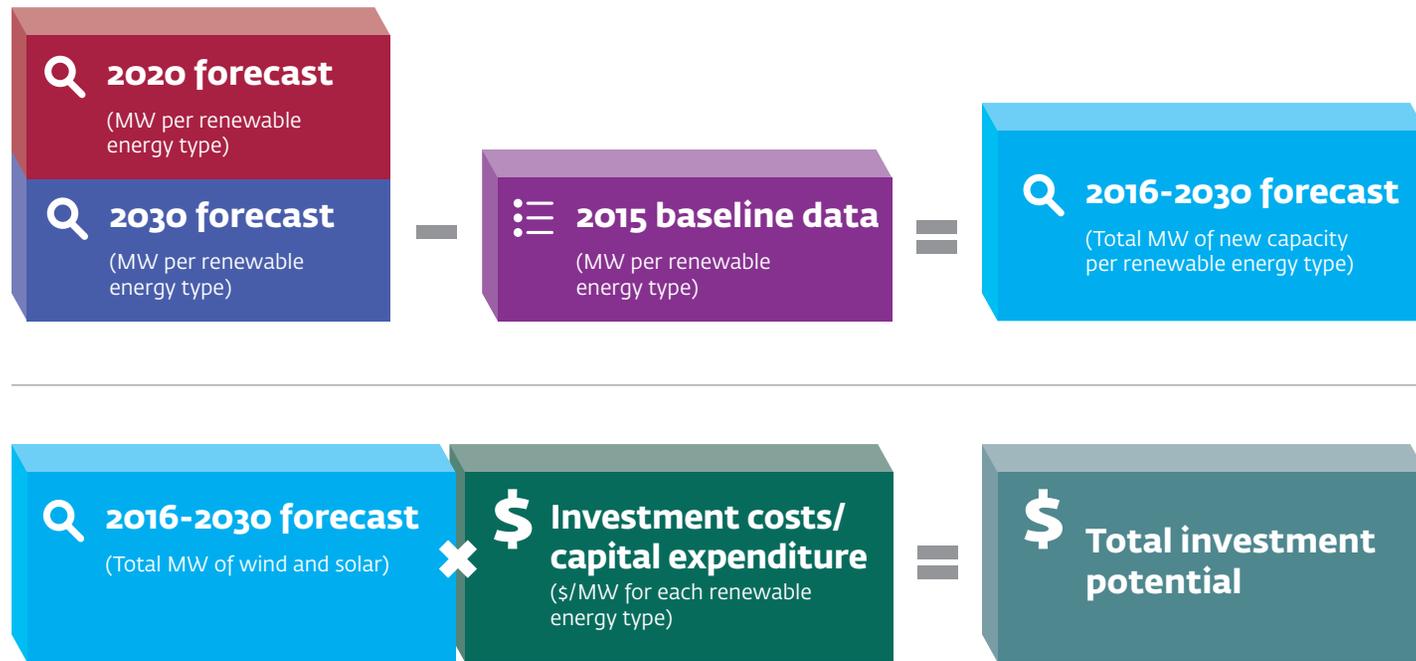
IFC then examined the key categories of greenhouse-gas emissions for each country to identify which sectors were likely government priorities for attracting investment for mitigation activities. Unsurprisingly, for most countries these sectors included power, transport, buildings, waste, agriculture, and industry. Data spreadsheets were then created and distributed to the regions to help collect "bottom-up" data from staff on the ground. This bottom-up information was then compared and combined with an array of existing studies, public and private databases, market assessment reports, and research by various associations and international organizations. Where data were not available, IFC consulted with industry experts to help verify estimates and assumptions. Data interpolation and extrapolation techniques were seldom used.



IFC determined the climate-smart investment potential for most opportunities by assessing how each specific country target would affect the size of that market (for example, MW of new installed capacity of wind energy by 2030) and then applying country-specific investment costs for technology. For example, Country A's NDC establishes a 30 percent absolute greenhouse-gas reduction target by 2030. As part of this commitment, the country included existing renewable energy targets for wind and solar PV energy. Each renewables target was to increase the installed capacity by 20 percent by 2030 from a 2015 baseline. For both wind and solar energy in this example, IFC translated the 20 percent increases into total MW of newly installed capacity for both 2020 and 2030 using 2015 data as the baseline for each country.¹

Depending on the level of country information available, IFC's estimates might indicate linear growth towards the 2030 target, or they might follow more policy-driven step changes over the 15-year timeframe. In other words, some countries will be quicker to ramp up growth than others, while countries in the middle of a renewable energy boom could see a tailing off in new installations as they approach their 2030 target.

Overall, a conservative approach was used to quantify investment potentials across technologies and regions, and only investments expected to materialize as a result of a country's own ambitions during the 2030 NDC timeframe were considered. More specifically, IFC did not use the theoretical or technical potential of investment options, but rather the demand-based potential provided by the governments



themselves, which are largely driven by the socioeconomics, demographics, and climate ambitions of their countries.

Investment or capital costs (\$/MW) used to derive the final investment potential figures vary between technologies and countries, and several sources were used for the calculations made in this report (see Annex X). For example, in certain countries where renewables are still in their infancy, IFC used individual project-level data to project future investment potential. In other countries, however, IFC relied on recent, publicly available data from sources such as the International Renewable Energy Agency, Bloomberg New Energy Finance, and, in some instances, IFC’s staff on the ground. It is important to note that IFC kept capital costs static in its calculations through the

2016–2030 timeframe and did not attempt to adjust or model future price adjustments. This was an editorial decision based on resource availability and the desire to balance rigor with simplicity.

The figures presented throughout this report are conservative estimates, which have the potential to be substantially higher if critical government policy initiatives, as discussed in Chapter X, are implemented. In particular, energy-efficiency potentials in this report often stem from an analysis of the largest sectoral opportunities within industry, but given that opportunities exist across the entire economy (such as transport and buildings), the reader can assume actual totals for energy efficiency to be considerably larger.

¹ 2015 data for renewables, for example, were derived from sources such as the International Renewable Energy Agency and Bloomberg New Energy Finance.

Data sources informing estimates of investment potential

East Asia Pacific Region

China

Renewable Energy

Wind Power

2020 potential wind capacity (MW)
China's 13th Five-Year Plan for 2020

2030 potential wind capacity (MW)
China Renewable Energy 2030 Country Roadmap, Reference Case, IRENA 2016

Investment costs (\$ million/MW)
IRENA Renewable Power Generation Costs in 2014, IRENA 2015

Small hydropower

2020 potential small hydropower capacity (MW)
China's 13th Five-Year Plan for 2020

2030 potential small hydropower capacity (MW)
China's 13th Five-Year Plan for 2020, BNEF Projections

2016
 Investment costs (\$ million/MW)
IRENA Renewable Power Generation Costs in 2014, IRENA 2015

2016
 Investment Costs (\$ million/MW)
IFC Regional Staff

Solar power

SOLAR PV

2020 potential solar PV capacity (MW)
China's 13th Five-Year Plan for 2020

2030 potential solar PV capacity (MW)
BNEF Projections 2016; China Renewable Energy 2030 Country Roadmap, Reference Case, IRENA 2016

Investment costs (\$ million/MW)
IRENA Renewable Power Generation Costs in 2014, IRENA 2015

SOLAR THERMAL/CONCENTRATED SOLAR POWER

2020 potential concentrated solar power capacity (MW)
China's 13th Five-Year Plan for 2020

2030 potential concentrated solar power capacity (MW)
BNEF Projections 2016; China Renewable Energy 2030 Country Roadmap, Reference Case, IRENA 2016

Investment costs (\$ million/MW)
Project data

Biomass

SOLID BIOMASS COMBUSTION

2020 potential biomass capacity (MW)
China's 13th Five-Year Plan for 2020

2030 potential biomass capacity (MW)
China Renewable Energy 2030 Country Roadmap, Reference Case, IRENA 2016

Investment costs (\$ million/MW)
IRENA Renewable Power Generation Costs in 2014, IRENA 2015

Energy efficiency

INDUSTRIAL ENERGY EFFICIENCY

2020 country target for energy efficiency (%)
China's 13th Five-Year Plan for 2020

2030 country target for energy efficiency (%)
China's NDC

2020 and 2030 investment costs (\$ million/MW)
IEA Energy Efficiency Market Report 2016

Green buildings

NEW GREEN BUILD

2020 green build (\$)
China's NDC, China's 13th Five-Year Plan for 2020, IFC EDGE staff

2030 green build (\$)
IFC EDGE staff

Transport

2020 and 2030 potential transportation investment (\$)
China's 13th Five-Year Plan for 2020, IFC staff

Waste

MUNICIPAL SOLID WASTE MANAGEMENT

2020 and 2030 potential solid waste management investment (\$)
IFC staff; What a Waste: A Global Review of Solid Waste Management, World Bank 2012

Electric transmission and distribution

2030 potential electric transmission and distribution investment (\$)
IFC regional staff

Indonesia

Renewable energy

Small hydropower

2020 potential small hydropower capacity (MW)
Indonesia Electricity Supply Business Plan 2016–2025 (Indonesia RUPTL)

2030 potential small hydropower capacity (MW)
Extrapolated using Indonesia Electricity Supply Business Plan 2016–2025 (Indonesia RUPTL) and BNEF Projections 2016

Investment costs (\$ million/MW)
IRENA Renewable Power Generation Costs in 2014, IRENA 2015

Biomass

SOLID BIOMASS COMBUSTION

2020 potential biomass capacity (MW)
ASEAN Renewable Energy Policies 2016, ASEAN Centre for Energy, August 2016

2030 potential biomass capacity (MW)
Indonesia Renewable Energy 2030 Country Roadmap, Reference Case, IRENA 2016

Investment costs (\$ million/MW)
IRENA Renewable Power Generation Costs in 2014, IRENA 2015

Geothermal

2020 potential geothermal capacity (MW)
ASEAN Renewable Energy Policies 2016, ASEAN Centre for Energy, August 2016; BNEF Projections 2016

2030 potential geothermal capacity (MW)
Indonesia Renewable Energy 2030 Country Roadmap, Reference Case, IRENA 2016

Investment costs (\$ million/MW)
IRENA Renewable Power Generation Costs in 2014, IRENA 2015

Energy efficiency

INDUSTRIAL ENERGY EFFICIENCY

2020 country target for energy efficiency (%)
Indonesian National Energy Conservation Master Plan 2011 (RIKEN)

2030 country target for energy efficiency (%)
Indonesian National Energy Conservation Master Plan 2011 (RIKEN)

2020 and 2030 investment costs (\$ million/MW)
Tharakan, P., Summary of Indonesia's Energy Sector Assessment, ADP Papers on Indonesia, No. 9, Asian

Green buildings

NEW GREEN BUILD

2020 and 2030 green build (\$)
IFC EDGE staff

Transport

2020 and 2030 potential transportation investment (\$)
Master Plan for Acceleration and Expansion of Indonesia's Economic Development (2011–2025)

Waste

MUNICIPAL SOLID WASTE MANAGEMENT

2020 and 2030 potential solid waste management investment (\$)
IFC staff; *What a Waste: A Global Review of Solid Waste Management, World Bank 2012*

The Philippines

Renewable energy

Wind power

2020 potential wind capacity (MW)
Philippines NDC, MAKE Forecast, BNEF Projections 2016

2030 potential wind capacity (MW)
Philippines NDC, MAKE Forecast, BNEF Projections 2016

Investment costs (\$ million/MW)
IFC regional staff

Small hydropower

2020 potential small hydropower capacity (MW)
Philippines NDC, BNEF Projections 2016

2030 potential small hydropower capacity (MW)
Philippines NDC, BNEF Projections 2016

Investment costs (\$ million/MW)
IRENA Renewable Power Generation Costs in 2014, IRENA 2015

Biomass

SOLID BIOMASS COMBUSTION

2020 potential biomass capacity (MW)
Philippines NDC, BNEF Projections 2016

2030 potential biomass capacity (MW)
Philippines NDC, extrapolated using BNEF Projections 2016

Investment costs (\$ million/MW)
IRENA Renewable Power Generation Costs in 2014, IRENA 2015

Geothermal

2020 potential geothermal capacity (MW)
Philippines National Renewable Energy Plan

2030 potential geothermal capacity (MW)
Philippines National Renewable Energy Plan

Investment costs (\$ million/MW)
Scaling-Up Renewable Geothermal Energy in Indonesia, ESMAP/World Bank, May 2014

Energy efficiency

INDUSTRIAL ENERGY EFFICIENCY

2020 and 2030 country target for energy efficiency (%)
An Energy Efficiency Roadmap for the Philippines 2014–30, the Switch-Asia Programme 2013

2020 and 2030 investment costs (\$ million/MW)
Philippines Energy Efficiency and Conservation Action Plan 2016–2020, the Switch-Asia Programme 2015

Green buildings

NEW GREEN BUILD

2020 and 2030 green build (\$)
IFC EDGE staff

Transport

2020 and 2030 potential transportation investment (\$)
Extrapolated using the Philippines' National Dream Plan for Manila and Surrounding Areas

Waste

MUNICIPAL SOLID WASTE MANAGEMENT

2020 and 2030 potential solid waste management investment (\$)
IFC staff; *What a Waste: A Global Review of Solid Waste Management, World Bank 2012*

Vietnam

Renewable energy

Wind power

2020 potential wind capacity (MW)
Vietnam's Power Development Plan VII for the Period of 2016–2030, MAKE Forecast

2030 potential wind capacity (MW)
Vietnam's Power Development Plan VII for the Period of 2016–2030, MAKE Forecast

Investment costs (\$ million/MW)
Actual project data

Small hydropower

2020 potential small hydropower capacity (MW)
Vietnam's Power Development Plan VII for the Period of 2016–2030

2030 potential small hydropower capacity (MW)
Vietnam's Power Development Plan VII for the Period of 2016–2030

Investment costs (\$ million/MW)
IRENA Renewable Power Generation Costs in 2014, IRENA 2015

Solar power

SOLAR PV

2020 potential solar PV capacity (MW)
Vietnam's Power Development Plan VII for the Period of 2016–2030

2030 potential solar PV capacity (MW)
Vietnam's Power Development Plan VII for the Period of 2016–2030

Investment costs (\$ million/MW)
IRENA Renewable Power Generation Costs in 2014, IRENA 2015

Biomass

SOLID BIOMASS COMBUSTION

2020 potential biomass capacity (MW)
Vietnam's Power Development Plan VII for the Period of 2016–2030, ASEAN Renewable Energy Policies 2016

2030 potential biomass capacity (MW)
Vietnam's Power Development Plan VII for the Period of 2016–2030, ASEAN Renewable Energy Policies 2016

Investment costs (\$ million/MW)
IRENA Renewable Power Generation Costs in 2014, IRENA 2015

Energy efficiency

INDUSTRIAL ENERGY EFFICIENCY

2020 and 2030 country target for energy efficiency (%)
An Energy Efficiency Roadmap for the Philippines 2014–30, the Switch-Asia Programme 2013

2020 and 2030 investment costs (\$ million/MW)
Philippines Energy Efficiency and Conservation Action Plan 2016–2020, the Switch-Asia Programme 2015

Green buildings

NEW GREEN BUILD

2020 and 2030 green build (\$)
IFC EDGE staff

Transport

2020 and 2030 potential transportation investment (\$)
Vietnam NDC, IFC staff

Waste

MUNICIPAL SOLID WASTE MANAGEMENT

2020 and 2030 potential solid waste management investment (\$)
IFC staff; *What a Waste: A Global Review of Solid Waste Management, World Bank 2012*

Latin America and the Caribbean Region

Argentina

Renewable energy

Wind power

2020 potential wind capacity (MW)
MAKE Forecast

2030 potential wind capacity (MW)
Argentina Renewable Energy 2030 Country Roadmap, Reference Case, IRENA 2016

Investment costs (\$ million/MW)
IRENA Renewable Power Generation Costs in 2014, IRENA 2015

Solar power

SOLAR PV

2020 potential solar PV capacity (MW)
BNEF Projections 2016

2030 potential solar PV capacity (MW)
Argentina Renewable Energy 2030 Country Roadmap, Reference Case, IRENA 2016

Investment costs (\$ million/MW)
IRENA Renewable Power Generation Costs in 2014, IRENA 2015

Biomass

SOLID BIOMASS COMBUSTION

2020 potential biomass capacity (MW)
Argentina Renewable Energy 2030 Country Roadmap, Reference Case, IRENA 2016

2030 potential biomass capacity (MW)
Argentina Renewable Energy 2030 Country Roadmap, Reference Case, IRENA 2016

Investment costs (\$ million/MW)
Cost and Performance Characteristics of New Generating Technologies, EIA Annual Energy Outlook 2016

Green buildings

NEW GREEN BUILD

2020 and 2030 green build (\$)
IFC EDGE staff

Transport

2020 and 2030 potential transportation investment (\$)
IFC staff; The Trillion Dollar Question II: Tracking Investment Needs in Transport, WRI 2016

Waste

MUNICIPAL SOLID WASTE MANAGEMENT

2020 and 2030 potential solid waste management investment (\$)
IFC staff; What a Waste: A Global Review of Solid Waste Management, World Bank 2012

Brazil

Renewable energy

Wind power

2020 potential wind capacity (MW)
2025 government target

2030 potential wind capacity (MW)
2025 government target; Brazil Renewable Energy 2030 Country Roadmap, Reference Case, IRENA 2016

Investment costs (\$ million/MW)
IRENA Renewable Power Generation Costs in 2014, IRENA 2015

Solar power

SOLAR PV

2020 potential solar PV capacity (MW)
2025 government target

2030 potential solar PV capacity (MW)
2025 government target; Brazil Renewable Energy 2030 Country Roadmap, Reference Case, IRENA 2016

Investment costs (\$ million/MW)
IRENA Renewable Power Generation Costs in 2014, IRENA 2015

Small hydropower

2020 potential small hydropower capacity (MW)
2025 government target

2030 potential small hydropower capacity (MW)
Extrapolated using 2025 government target

Investment costs (\$ million/MW)
IRENA Renewable Power Generation Costs in 2014, IRENA 2015

Biomass

SOLID BIOMASS COMBUSTION

2020 and 2030 potential biomass capacity (MW)
Brazil Renewable Energy 2030 Country Roadmap, Reference Case, IRENA 2016

Investment costs (\$ million/MW)
Cost and Performance Characteristics of New Generating Technologies, EIA Annual Energy Outlook 2016

Energy efficiency

INDUSTRIAL ENERGY EFFICIENCY

2020 and 2030 country target for energy efficiency (%)
Brazil NDC and National Energy Efficiency Plan

2020 and 2030 investment costs (\$ million/MW)
Energy Efficiency Market Report 2015, IEA 2015

Green buildings

NEW GREEN BUILD

2020 and 2030 green build (\$)
IFC EDGE staff

Transport

2020 and 2030 potential transportation investment (\$)
IFC staff; The Trillion Dollar Question II: Tracking Investment Needs in Transport, WRI 2016

Waste

MUNICIPAL SOLID WASTE MANAGEMENT

2020 and 2030 potential solid waste management investment (\$)
IFC staff; What a Waste: A Global Review of Solid Waste Management, World Bank 2012

Colombia

Renewable energy

Wind power

2020 and 2030 potential wind capacity (MW)
MAKE Forecast

Investment costs (\$ million/MW)
IRENA Renewable Power Generation Costs in 2014, IRENA 2015

Biomass

SOLID BIOMASS COMBUSTION

2020 and 2030 potential biomass capacity (MW)
Colombia Renewable Energy 2030 Country Roadmap, Reference Case, IRENA 2016

Investment costs (\$ million/MW)
Cost and Performance Characteristics of New Generating Technologies, EIA Annual Energy Outlook 2016

Solar power

SOLAR PV

2020 and 2030 potential solar PV capacity (MW)
Colombia Renewable Energy 2030 Country Roadmap, Reference Case, IRENA 2016

Investment costs (\$ million/MW)
IRENA Renewable Power Generation Costs in 2014, IRENA 2015

Green buildings

NEW GREEN BUILD

2020 and 2030 green build (\$)
IFC EDGE staff

Transport

2020 and 2030 potential transportation investment (\$)
IFC staff; The Trillion Dollar Question II: Tracking Investment Needs in Transport, WRI 2016

Waste

MUNICIPAL SOLID WASTE MANAGEMENT

2020 and 2030 potential solid waste management investment (\$)
IFC staff; What a Waste: A Global Review of Solid Waste Management, World Bank 2012

Mexico

Renewable energy

Wind power

2020 and 2030 potential wind capacity (MW)
MAKE Forecast

Investment costs (\$ million/MW)
IRENA Renewable Power Generation Costs in 2014, IRENA 2015

Small hydropower

2020 and 2030 potential small hydropower capacity (MW)
Renewable Energy Prospects for Mexico, 2015, IRENA 2015

Investment costs (\$ million/MW)
IRENA Renewable Power Generation Costs in 2014, IRENA 2015

Solar power

SOLAR PV

2020 potential solar PV capacity (MW)
Government of Mexico

2030 potential solar PV capacity (MW)
Government of Mexico; Mexico Renewable Energy 2030 Country Roadmap, Reference Case, IRENA 2016

Investment costs (\$ million/MW)
IRENA Renewable Power Generation Costs in 2014, IRENA 2015

Biomass

SOLID BIOMASS COMBUSTION

2020 and 2030 potential biomass capacity (MW)
Mexico Renewable Energy 2030 Country Roadmap, Reference Case, IRENA 2016

Investment costs (\$ million/MW)
Cost and Performance Characteristics of New Generating Technologies, EIA Annual Energy Outlook 2016

Geothermal

2020 potential geothermal capacity (MW)
Renewable Energy World; Mexico Renewable Energy 2030 Country Roadmap, Reference Case, IRENA 2016

2030 potential geothermal capacity (MW)
Government of Mexico

Investment costs (\$ million/MW)
IFC Staff, Scaling-Up Renewable Geothermal Energy in Indonesia, ESMAP/World Bank, May 2014

Energy efficiency

INDUSTRIAL ENERGY EFFICIENCY

2020 and 2030 country target for energy efficiency (%)
Government of Mexico

2020 and 2030 investment costs (\$ million/MW)
Energy Efficiency Market Report 2015, IEA 2015

Green buildings

NEW GREEN BUILD

2020 and 2030 green build (\$)
IFC EDGE staff

Transport

2020 and 2030 potential transportation investment (\$)
IFC staff; The Trillion Dollar Question II: Tracking Investment Needs in Transport, WRI 2016
Waste

MUNICIPAL SOLID WASTE MANAGEMENT

2020 and 2030 potential solid waste management investment (\$)
IFC staff; What a Waste: A Global Review of Solid Waste Management, World Bank 2012

SOUTH ASIA REGION

Bangladesh

Renewable energy

Wind power

2020 potential wind capacity (MW)
Government of Bangladesh

2030 potential wind capacity (MW)
IFC staff, government of Bangladesh

Investment costs (\$ million/MW)
BNEF, Levelised Cost of Electricity, DFID Priority Countries, November 2015

Solar power

SOLAR PV

2020 potential solar PV capacity (MW)
Government of Bangladesh

2030 potential solar PV capacity (MW)
IFC staff, government of Bangladesh

Investment costs (\$ million/MW)
BNEF, Levelised Cost of Electricity, DFID Priority Countries, November 2015

Biomass

SOLID BIOMASS COMBUSTION

2020 potential biomass capacity (MW)
Government of Bangladesh

2030 potential biomass capacity (MW)
Government of Bangladesh

Investment costs (\$ million/MW)
BNEF, Levelised Cost of Electricity, DFID Priority Countries, November 2015

Energy efficiency

INDUSTRIAL ENERGY EFFICIENCY

2020 and 2030 investment potential for industrial energy efficiency (\$)
Industry Specific Study on Sustainable Energy Finance Market Potential for Financial Institutions in Bangladesh, IFC 2012

Green buildings

NEW GREEN BUILD

2020 and 2030 green build (\$)
IFC EDGE staff

Transport

2020 and 2030 potential transportation investment (\$)
IFC staff, Bangladesh Energy Efficiency and Conservation Master Plan up to 2030

Waste

MUNICIPAL SOLID WASTE MANAGEMENT

2020 and 2030 potential solid waste management investment (\$)
IFC staff; What a Waste: A Global Review of Solid Waste Management, World Bank 2012

India

Renewable energy

Wind power

2020 potential wind capacity (MW)
India NDC, government of India

2030 potential wind capacity (MW)
India NDC, government of India

Investment costs (\$ million/MW)
BNEF, Levelised Cost of Electricity, DFID Priority Countries, November 2015

Solar power

SOLAR PV

2020 and 2030 potential solar PV capacity (MW)
India NDC, government of India

Investment costs (\$ million/MW)
BNEF, Levelised Cost of Electricity, DFID Priority Countries, November 2015

Biomass

SOLID BIOMASS COMBUSTION

2020 and 2030 potential biomass capacity (MW)
India NDC, government of India

Investment costs (\$ million/MW)
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INDUSTRIAL ENERGY EFFICIENCY

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Green buildings

NEW GREEN BUILD

2020 and 2030 green build (\$)
IFC EDGE staff

Transport

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Waste

MUNICIPAL SOLID WASTE MANAGEMENT

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SUB-SAHARAN AFRICA REGION

Côte d'Ivoire

Renewable energy

Wind power

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Solar power

SOLAR PV

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NEW GREEN BUILD

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Waste

MUNICIPAL SOLID WASTE MANAGEMENT

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Renewable energy

Wind power

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Investment costs (\$ million/MW) BNEF, *Levelised Cost of Electricity*, DFID Priority Countries, November 2015

Green buildings

NEW GREEN BUILD

2020 and 2030 green build (\$) IFC EDGE staff

Transport

2020 and 2030 potential transportation investment (\$) IFC staff

Waste

MUNICIPAL SOLID WASTE MANAGEMENT

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Nigeria

Renewable energy

Solar power

SOLAR PV

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Green buildings

NEW GREEN BUILD

2020 and 2030 green build (\$) IFC EDGE staff

Transport

2020 and 2030 potential transportation investment (\$) IFC staff

Waste

MUNICIPAL SOLID WASTE MANAGEMENT

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Renewable energy

Wind power

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Solar power

SOLAR PV

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Biomass

SOLID BIOMASS COMBUSTION

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Investment costs (\$ million/MW)
BNEF, Levelised Cost of Electricity, DFID Priority Countries, November 2015

Green buildings

NEW GREEN BUILD

2020 and 2030 green build (\$)
IFC EDGE staff

Transport

2020 and 2030 potential transportation investment (\$)
IFC staff, South African Department of Transportation

Waste

MUNICIPAL SOLID WASTE MANAGEMENT

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IFC staff; What a Waste: A Global Review of Solid Waste Management, World Bank 2012

EASTERN EUROPE AND CENTRAL ASIA REGION

Russia

Renewable energy

Wind power

2020 and 2030 potential wind capacity (MW)
MAKE Forecast, Energy Strategy of Russia to 2035, IFC staff

Investment costs (\$ million/MW)
IRENA Renewable Power Generation Costs in 2014, IRENA 2015

Solar power

SOLAR PV

2020 and 2030 potential solar PV capacity (MW)
Energy Strategy of Russia to 2035, IFC staff

Investment costs (\$ million/MW)
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Biomass

SOLID BIOMASS COMBUSTION

2020 and 2030 potential biomass capacity (MW)
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Investment costs (\$ million/MW)
Cost and Performance Characteristics of New Generating Technologies, EIA Annual Energy Outlook 2016

Small hydropower

2020 and 2030 potential small hydropower capacity (MW)
Energy Strategy of Russia to 2035, IFC staff

Investment costs (\$ million/MW)
IRENA Renewable Power Generation Costs in 2014, IRENA 2015

Energy efficiency

INDUSTRIAL ENERGY EFFICIENCY

2020 and 2030 investment potential for energy efficiency (\$)
IFC staff

Green buildings

NEW GREEN BUILD

2020 and 2030 green build (\$)
IFC EDGE staff

Transport

2020 and 2030 potential transportation investment (\$)
IFC staff

Waste

MUNICIPAL SOLID WASTE MANAGEMENT

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Serbia

Renewable energy

Wind power

2030 potential wind capacity (MW)
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Small hydropower

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BNEF Country Commentary 2016, IFC staff

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Green buildings

NEW GREEN BUILD

2020 and 2030 green build (\$)
IFC EDGE staff

Waste

MUNICIPAL SOLID WASTE MANAGEMENT

2020 and 2030 potential solid waste management investment (\$)
IFC staff; What a Waste: A Global Review of Solid Waste Management, World Bank 2012

Turkey

Renewable energy

Wind power

2020 and 2030 potential wind capacity (MW)
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Investment costs (\$ million/MW)
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Solar power

SOLAR PV

2020 and 2030 potential solar PV capacity (MW)
Turkey NDC

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Renewables 2016, Global Status Report, REN21 2016 Geothermal

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Turkey's Energy Transition: Milestones and Challenges, ESMAP/World Bank 2014, Turkey Renewable Energy 2030 Country Roadmap, Reference Case, IRENA 2016

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IRENA Renewable Power Generation Costs in 2014, IRENA 2015

Energy efficiency

INDUSTRIAL ENERGY EFFICIENCY

2020 and 2030 investment potential for energy efficiency (\$)
IFC staff

Green buildings

NEW GREEN BUILD

2020 and 2030 green build (\$)
IFC EDGE staff

Transport

2020 and 2030 potential transportation investment (\$)
IFC staff

Waste

MUNICIPAL SOLID WASTE MANAGEMENT

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Ukraine

Renewable energy

Wind power

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Energy Strategy of Ukraine up to 2030, MAKE Forecast

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IRENA Renewable Power Generation Costs in 2014, IRENA 2015

Small hydropower

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Energy Strategy of Ukraine up to 2030

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IRENA Renewable Power Generation Costs in 2014, IRENA 2015

Solar power

SOLAR PV

2020 and 2030 potential solar PV capacity (MW)
Energy Strategy of Ukraine up to 2030; UNECE Renewable Energy Status Report, REN21 2015

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Cost and Performance Characteristics of New Generating Technologies, EIA Annual Energy Outlook 2016

Energy efficiency

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2020 and 2030 investment potential for energy efficiency (\$)
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2020 and 2030 green build (\$)
IFC EDGE staff

Transport

2020 and 2030 potential transportation investment (\$)
IFC staff

Waste

MUNICIPAL SOLID WASTE MANAGEMENT

2020 and 2030 potential solid waste management investment (\$)
IFC staff; *What a Waste: A Global Review of Solid Waste Management, World Bank 2012*

MIDDLE EAST AND NORTH AFRICA REGION

Egypt

Renewable energy

Wind power

2020 and 2030 potential wind capacity (MW)
Egypt NDC, MAKE Forecast

Investment costs (\$ million/MW)
IFC staff; IRENA Renewable Power Generation Costs in 2014, IRENA 2015

Solar power

SOLAR PV

2020 and 2030 potential solar PV capacity (MW)
Egypt NDC

Investment costs (\$ million/MW)
IFC staff

SOLAR THERMAL/CONCENTRATED SOLAR POWER

2020 and 2030 potential concentrated solar power capacity (MW)
Egypt NDC

Investment costs (\$ million/MW)
IFC project data

Energy efficiency

INDUSTRIAL ENERGY EFFICIENCY

2020 and 2030 investment potential for energy efficiency (\$)
IFC staff

Green buildings

NEW GREEN BUILD

2020 and 2030 green build (\$)
IFC EDGE staff

Transport

2020 and 2030 potential transportation investment (\$)
Egypt Transportation Ministry, IFC staff

Waste

MUNICIPAL SOLID WASTE MANAGEMENT

2020 and 2030 potential solid waste management investment (\$)
IFC staff; *What a Waste: A Global Review of Solid Waste Management, World Bank 2012*

Jordan

Renewable energy

Wind power

2020 potential wind capacity (MW)
2015 Middle East and North Africa Outlook, BNEF 2015; MAKE Forecast

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MAKE Forecast, IFC Staff

Investment costs (\$ million/MW)
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Solar power

SOLAR PV

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Jordan NDC; 2015 Middle East and North Africa Outlook, BNEF 2015

Investment costs (\$ million/MW)
IFC staff

SOLAR THERMAL/CONCENTRATED SOLAR POWER

2020 and 2030 potential concentrated solar power capacity (MW)
Jordan NDC; 2015 Middle East and North Africa Outlook, BNEF 2015

Investment costs (\$ million/MW)
IFC project data

Energy efficiency

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IFC EDGE staff

Transport

2020 and 2030 potential transportation investment (\$)
IFC staff

Waste

MUNICIPAL SOLID WASTE MANAGEMENT

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IFC staff; *What a Waste: A Global Review of Solid Waste Management, World Bank 2012*

Morocco

Renewable energy

Wind power

2020 and 2030 potential wind capacity (MW)
Morocco NDC; MAKE Forecast; Morocco Renewable Energy 2030 Country Roadmap, Reference Case, IRENA 2016

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IFC staff

Small hydropower

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Investment costs (\$ million/MW)

IFC staff

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2020 and 2030 potential concentrated solar power capacity (MW)

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Investment costs (\$ million/MW)

IFC project data

Energy efficiency

INDUSTRIAL ENERGY EFFICIENCY

2020 and 2030 investment potential for energy efficiency (\$)

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Green buildings

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2020 and 2030 green build (\$)

IFC EDGE staff

Transport

2020 and 2030 potential transportation investment (\$)

IFC staff

Waste

MUNICIPAL SOLID WASTE MANAGEMENT

2020 and 2030 potential solid waste management investment (\$)

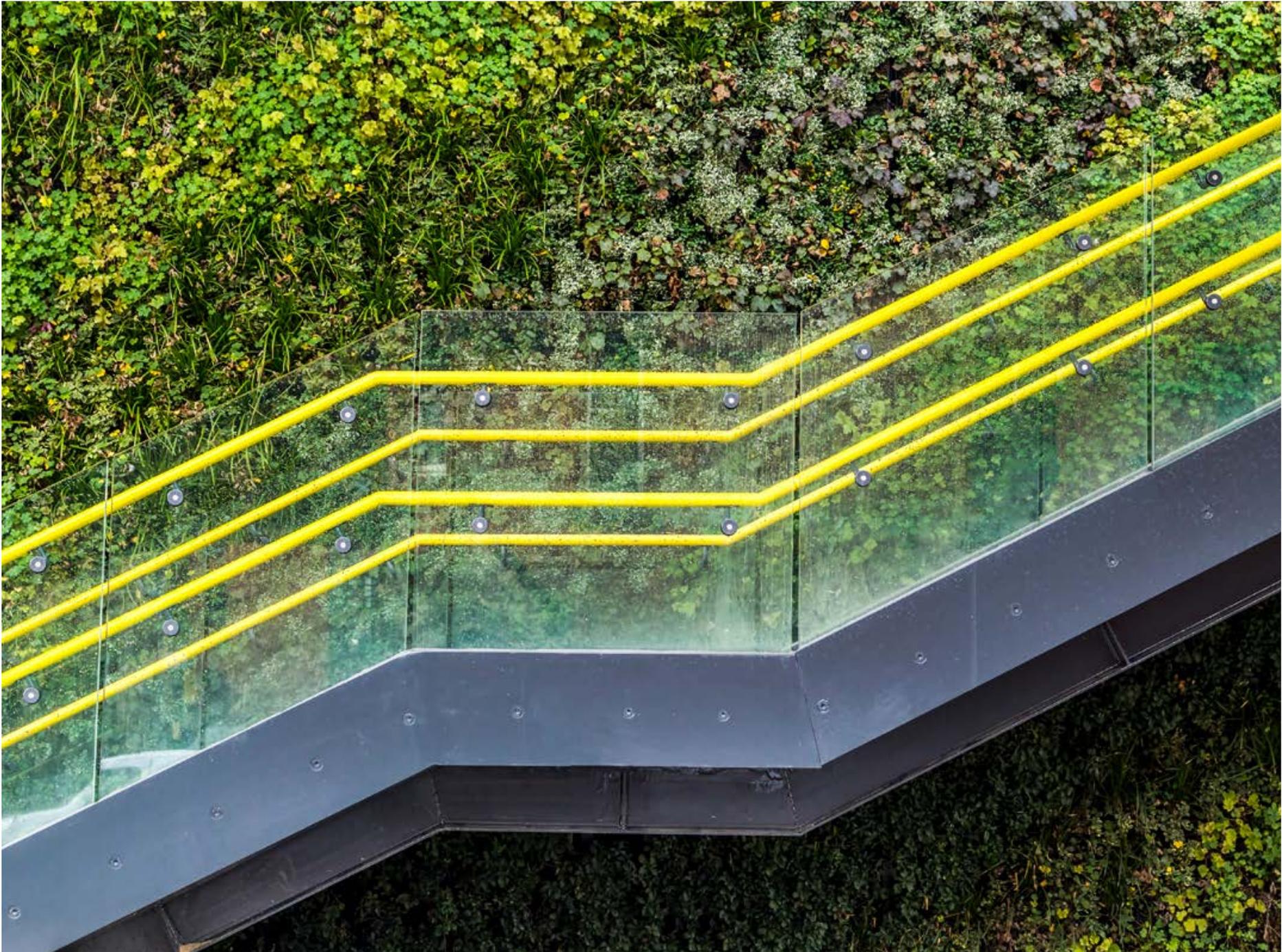
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