

Climate Investment Opportunities in South Asia

An IFC Analysis



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Creating Markets, Creating Opportunities



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The study reflects the views of IFC and does not necessarily reflect the views of the governments of the countries covered by the study. The findings of the study would, thus, not be in any way binding on the countries covered by the study.

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Foreword



Philippe le Houérou
Chief Executive Officer, IFC

South Asia as a region has among the highest economic growth rates in the world. The region has seen a surge in investment in clean energy and energy efficiency in recent years, contributing to significant development gains. This progress, however, is coming under threat by unchecked climate change. Globally, without urgent action, the changing climate could push an additional 100 million people into poverty by 2030. We feel its impact every day: 2016 was the hottest year since record-keeping began, and global temperatures have already risen 1.2 degrees Celsius above pre-industrial levels.

The governments of Bangladesh, Bhutan, India, the Maldives, Nepal, and Sri Lanka, along with the other signatories of the 2015 Paris Agreement, have recognized the risks and the opportunities to transition to a low-carbon growth path. They are driving change by moving the national climate

commitments submitted under the Paris Agreement from plans to implementation.

A low-carbon growth path for countries in the region goes beyond environmental benefits and opens enormous opportunities for climate investments, positioning companies for the markets of tomorrow. Just for infrastructure, the world will require about \$90 trillion over the next 15 years—most of it in developing and middle-income countries. Across South Asia alone, from now to 2030, over \$410 billion will need to be invested in renewable energy; another \$670 billion in greening the vehicle fleet; and more than \$1.5 trillion to ensure the future building stock is green and resilient.

Unlocking the potential trillions in climate investing requires appropriate reforms. Governments must put into place policies that will shift market incentives, open doors for climate business, and invest in projects that are resilient to the impacts of climate change and in line with low-carbon growth strategies. Businesses and investors around the world, including in South Asia, are acting on these signals to green their operations and portfolios. More than \$1 trillion in investment is already moving annually into climate-related projects globally; with the right policy frameworks in place, trillions more will flow. India has introduced auctions for solar power; Sri Lanka has a green buildings code and evaluation system; Bhutan has a target for electric vehicles; Bangladesh and Nepal are pursuing public-private partnerships for public transport infrastructure and hydropower respectively; and the Maldives is integrating resilience into its new urban development.

Last year, IFC studied the national commitments submitted by 21 emerging market countries as part of the Paris Agreement, and found \$23 trillion in investment opportunity if they achieve

their targets by 2030. By taking a similar approach, this report has identified \$3.4 trillion in climate-smart investment opportunities in South Asia, and seeks to help these six countries mobilize their private sector and unlock private investment for achieving their climate-related targets. IFC is committed and well positioned to work together with private sector clients and governments across South Asia, leveraging the strengths of the entire World Bank Group to create markets for climate business.

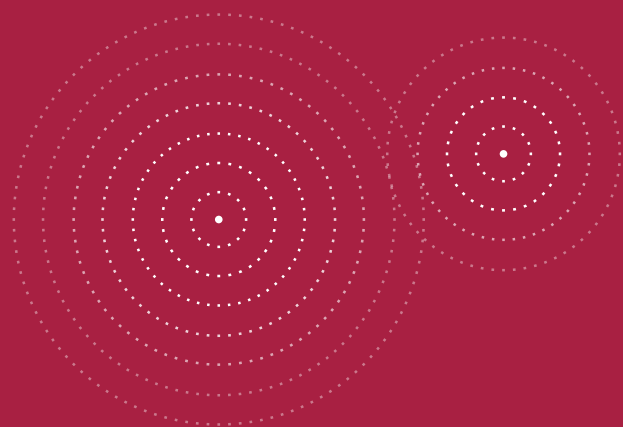
IFC is actively pursuing investments in the region such as solar, wind, energy storage, green buildings, energy-efficiency, waste, and climate-smart agriculture. By supporting the creation of the Sustainable Housing Leadership Consortium, we have helped bring industry and financiers together to embed sustainability into India's buildings market. In Bangladesh, IFC is helping the textile industry improve resource efficiency through the Partnership for Cleaner Textile. We are helping Sri Lanka's largest retail chain develop sustainable local supply chains and reduce its carbon footprint by installing solar panels on stores' roofs. In Nepal, we are working with agribusinesses to promote efficient resource utilization, enhance productivity, and improve climate resilience in the agricultural sector. IFC is also investing in projects that provide clean, affordable energy access across the region.

Building on this experience, this report offers recommendations to help unlock trillions of private sector financing for climate-smart investment opportunities in key sectors of interest to businesses in South Asia. The countries in the region are taking the lead in fulfilling their Paris commitments. Scaling and replicating such progress across the region will require catalyzing private finance and creating markets for climate business solutions through policies, financial innovations, and business models targeted at sector-specific local conditions.

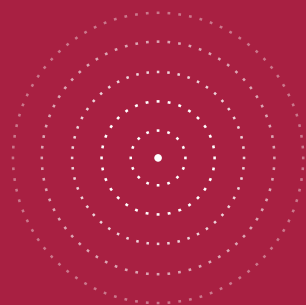


Acronyms

ASPIRE	Accelerating Sustainable Private Investment in Renewable Energy
CDP	Carbon Disclosure Project
EDGE	Excellence in Design for Greater Efficiencies
FY	Fiscal year
GDP	Gross domestic product
GW	Gigawatt
kWh	Kilowatt-hour
LEED	Leadership in Energy and Environmental Design
LPWA	Low-power, wide-area
MtCO ₂ e	Million tons of carbon dioxide equivalent
MW	Megawatt
MWh	Megawatt-hour
NDC	Nationally Determined Contribution
PaCT	Partnership for Clean Textile
PPP	Public-private partnership
SME	Small and medium enterprise



Executive Summary



Executive Summary



South Asia's Governments and Businesses: Partners in Mainstreaming Climate Action

South Asia is home to three of the top five countries in terms of vulnerability to climate change globally.[†] It thus urgently needs climate investment to enhance resilience and unlock opportunities for low-carbon growth. The region is one of the fastest growing regions in the world; however, estimates suggest that climate impacts could reduce its annual gross domestic product by an average of 1.8 percent by 2050, rising to 8.8 percent by 2100.[‡] The good news is that the region has governments that are actively pursuing ambitious policies to address climate change. Moreover, its private sector is already investing in climate-smart sectors, developing new business models and technologies, building more resilient supply chains, and growing their operations in a sustainable way.

Countries of focus for this report have been identified based on IFC's operational regional grouping for South Asia, which includes Bangladesh, Bhutan, India, the Maldives, Nepal, and Sri Lanka. All six of these countries have ratified the 2015 Paris Agreement and pledged to tackle climate change in support of it, as part of their ambitious long-term economic growth and sustainable development plans. Almost all the Nationally Determined Contributions (NDCs) across the region make

[†] Bangladesh, India, Madagascar, Nepal, and Mozambique in order of vulnerability.

[‡] See <https://www.adb.org/news/climate-change-may-slash-9-south-asias-economy-2100-report>

some reference to the private sector's role. Climate business activity in key sectors such as renewable energy, green buildings, and energy-efficiency has increased since the Paris Agreement, boosted by governments' commitments to address climate change. For example, between 2014 and 2016, when the agreement came into force, installed capacity of renewable energy increased by 18 percent to 100 gigawatts (GW) across Bangladesh, India, and Nepal collectively.

Turning Risk into Opportunity

Where climate change presents a risk it also presents an opportunity. The transition to low-carbon and resilient growth will require significant investment, which can only be delivered with the help of strong private sector engagement. The business case for addressing climate change and pursuing sustainable growth is already strong and continues to strengthen, reinforced by the positive returns on investments and enhanced resilience of operations. The impacts of climate change on business assets, supply chains, and business interruptions are already a major concern for South Asian companies. To gauge industry sentiment, IFC surveyed businesses in the region, and the results are clear: **over 85 percent** of participating businesses responded that they are either very concerned or concerned about the impacts. Businesses are already taking action to address climate risks and opportunities by incorporating environmental considerations into their decision-making processes. These progressive companies are optimizing planning and investing in new business models, resulting in better market positioning and increasing their competitive edge.

For example, supported by IFC's Excellence in Design for Greater Efficiencies (EDGE) Green Building Certification system, leading companies in the property sector in India have championed green construction and stimulated capital markets products through the creation of the Sustainable Housing Leadership Consortium. In 2015 alone, about 20,000 housing units and 10 million square feet of commercial space were EDGE-certified. Sri Lanka is planning a public-private partnership (PPP) to develop a light rail transit system to cover Colombo and its suburbs to cater for anticipated growing transport demand and encourage a shift from private to public transport. Such



investments have global benefits but are often motivated by national policy priorities such as addressing air pollution, congestion, energy security and access, and urban planning. Creating markets for climate-resilient infrastructure, climate-smart agriculture, expanding renewable energy capacity, sustainable transport, and green and resilient buildings, among others, can present serious investment opportunities for the private sector.

Investment potential by country and sector in South Asia, 2018–2030

	Bangladesh	Bhutan	India	Maldives	Nepal	Sri Lanka	Total
Renewable energy	\$3.2 billion	\$72 million	\$403.7 billion	\$55 million	\$2.1 billion	\$2.3 billion	\$411.4 billion
Large hydro	-	\$40.6 billion	\$44 billion	-	\$22.5 billion	\$190 million	\$107.3 billion
Green buildings	\$118.8 billion	\$390 million	\$1.4 trillion	\$200 million	\$3.4 billion	\$8.4 billion	\$1.53 trillion
Transport infrastructure	\$23.7 billion	\$615 million	\$250 billion	\$1.5 billion	\$10 billion	\$326 million	\$286.1 billion
Transport electric vehicles	-	\$322 million	\$667 billion	-	\$2.5 billion	-	\$669.8 billion
Municipal solid waste	\$4 billion	\$11.5 million	\$11 billion	\$46 million	\$83 million	\$3.5 billion	\$18.6 billion
Climate-smart urban water	\$13 billion	\$106 million	\$128 billion	\$86 million	\$686 million	\$2.7 billion	\$144.6 billion
Climate-smart agriculture	\$9.1 billion	\$140 million	\$194 billion	\$31 million	\$4.8 billion	\$964 million	\$209 billion
TOTAL	\$171.8 billion	\$42.3 billion	\$3.1 trillion	\$1.9 billion	\$46.1 billion	\$18.4 billion	\$3.4 trillion

INCREASING INVESTMENT OPPORTUNITY BY COUNTRY

South Asia's Climate-Smart Investment Opportunity

IFC estimates a \$3.4 trillion climate investment opportunity for South Asia in key sectors between 2018 and 2030, assuming that each country **will fully meet** its NDC and relevant sectoral targets and policy objectives as stated.

This number exceeds the \$2.2 trillion investment potential estimate for South Asia included in the 2016 global Climate Investment Opportunities report, as more countries and new sectors such as electric vehicles are included in the analysis. For example, the estimate for India now includes electric vehicles, urban water, and climate-smart agriculture, which were not covered in the 2016 analysis and represent a sizeable portion of this increase, along with increased renewable energy potential reflecting the scaled-up energy access targets.

While the majority of the estimated investment potential lies in India, due to the scale of its economy and population, there is substantial untapped opportunity for growth in the rest of South Asia.

Private sector investment needs to be unlocked to help achieve the region's ambitious targets. The opportunity estimated for the six countries, representing 7.38 percent of global carbon dioxide emissions, focuses on those sectors that have the greatest potential to attract private investment, namely renewable energy, transport, green buildings, urban water, climate-smart agriculture, and municipal solid waste management. While the NDCs are an essential building block to signaling a market for climate investments, they need to be supplemented by a comprehensive approach to creating markets for climate business across these sectors.

Key Sectors for Climate Business across the Region

Rapid rates of urbanization and economic growth present significant opportunity to green as yet unconstructed infrastructure across the region in the next 15 years. Between 2018 and 2030, the green buildings sector could see investments totaling more than \$1.5 trillion across the region, with India and Bangladesh leading the market. Similarly, investment in the transport sector can unlock growth and private investment, by providing access to markets, enabling trade, and ensuring mobility. Investment in the sector is a key priority and huge opportunity across the region, amounting to over \$950 billion by 2030 and catalyzing additional investment in other sectors through improved logistics and connectivity. Other key climate-smart investment opportunities in these countries include:

- **Climate-smart urban wastewater and agriculture in Bangladesh:** The government's prioritization of wastewater infrastructure projects creates a \$13 billion investment opportunity. With the second fastest rate of productivity growth after China, Bangladesh's climate-smart agriculture sector could see investments of more than \$9 billion.
- **Hydropower and electric transport in Bhutan:** Developing Bhutan's 25,000 megawatts (MW) of economically feasible hydropower potential to meet national energy needs and generate export revenues presents an investment opportunity of over \$40 billion. The government has also set an ambitious electric vehicle target and emphasizes the need for a low-carbon transport system, creating \$940 million worth of potential for investment in the sector.
- **Renewable energy and electric vehicles in India:** The impressive national target of generating 175 GW of renewable energy by 2022, growing to 40 percent of total energy by 2030, represents almost \$404 billion in investment potential. This will be integral given India's aim to electrify all new vehicle sales by 2030, creating a potential investment opportunity of almost \$670 billion if this goal is fully met.
- **Climate-smart infrastructure in the Maldives:** The country's goals to climate-proof its infrastructure against rising sea levels and extreme weather events translates to an investment opportunity of at least \$1.5 billion in transport-related infrastructure and \$200 million in green buildings by 2030.
- **Hydropower and climate-smart agriculture in Nepal:** Achieving Nepal's NDC ambition to install 12,000 MW of hydropower capacity creates an investment opportunity of \$22.5 billion. The government's policy push to make its agricultural sector more climate friendly and its NDC goals to increase the use of efficient technologies and production of local crop varieties represent an investment opportunity of \$4.8 billion.



Photo: Ramesh NG / Flickr

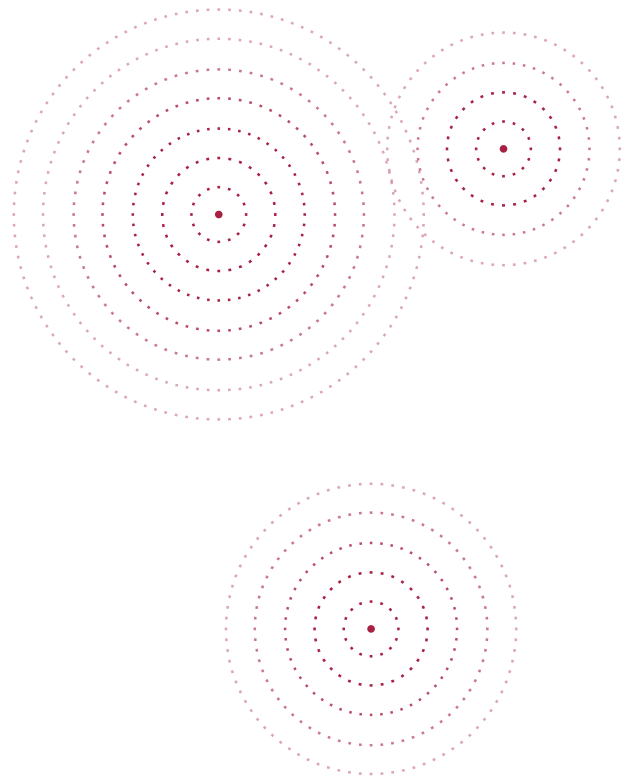


- **Municipal solid waste management and climate-smart urban wastewater in Sri Lanka:** Recognizing the need for solid waste management, Sri Lanka's national policies create a \$3.5 billion opportunity for investment in the sector. Sri Lanka also identifies water and sanitation as key areas for investment. Meeting its NDC goals for water and wastewater management will create an investment opportunity of more than \$2.7 billion.

Creating Markets and Unlocking Private Investment

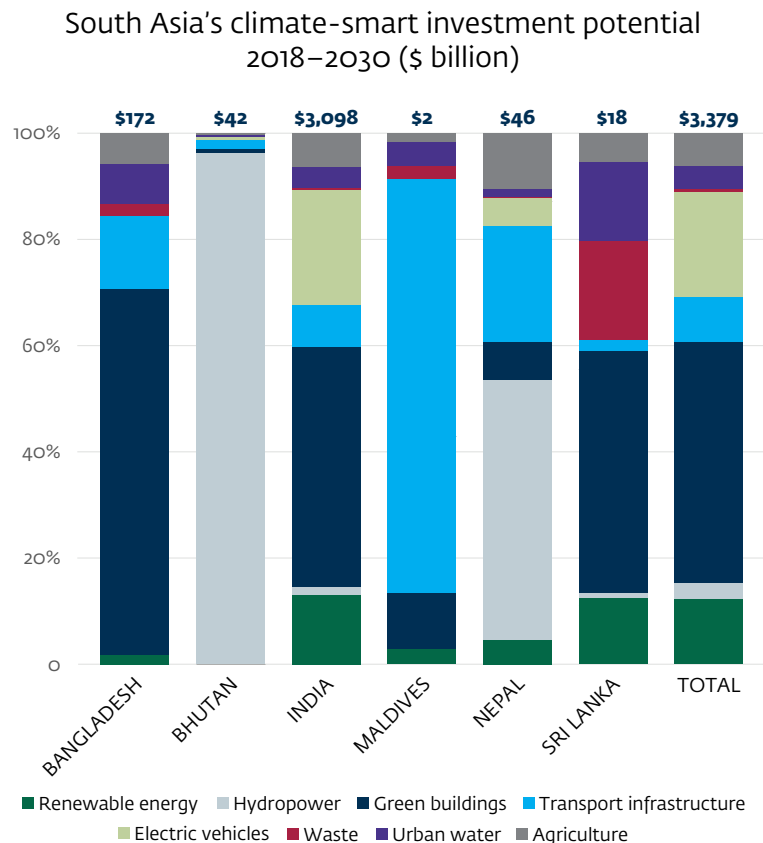
This sizeable opportunity associated with the countries' ambitious targets cannot be achieved by the public sector alone. A strong and engaged private sector is often better placed to implement and execute projects; what they need is a market opportunity and a risk-adjusted return. While the NDCs identify potential markets for climate investments, a comprehensive approach to creating markets for climate business is needed across these sectors. This involves establishing regulatory and policy frameworks; promoting competition and innovation; achieving demonstration effects that encourage replication; and building capacity and skills to open new markets. This broad framework must be tailored to sector and country-specific conditions.

Bankable projects and an attractive investment climate are needed to unlock private investments at the required scale. PPPs, the identification and appropriate allocation of risks to lower costs, and the enabling and mobilizing of finance will also be necessary. Creating these conditions will require strong political leadership and continued, consistent, and clear signals to provide certainty to companies and investors. IFC stands ready to work with partners across the region to build on the progress to date to further unlock investment and support South Asian countries as they work to achieve their objectives.



Turning Climate-Smart Investment Opportunities into Reality in South Asia

Turning Climate-Smart Investment Opportunities into Reality in South Asia



South Asia is home to three of the top five countries* in terms of vulnerability to climate change globally,¹ making it urgently in need of climate investment to enhance resilience and unlock low-carbon growth opportunities.

The region's governments are actively pursuing ambitious policies to address climate change and the private sector is already investing in climate-smart sectors, developing new business models and technologies, building more resilient supply chains, and growing operations in a sustainable way. Companies across the region are being recognized globally for their leadership.

Countries of focus for this report have been identified based on IFC's operational regional grouping for South Asia, which includes Bangladesh, Bhutan, India, the Maldives, Nepal, and Sri Lanka. All six of these countries have ratified the 2015 Paris Agreement and pledged to tackle climate change in support of it, as part of their ambitious long-term economic growth and sustainable development plans. While the investment potential in India dominates IFC's analysis of the regional

* Bangladesh, India, Madagascar, Nepal, and Mozambique in order of vulnerability.

opportunity forecast, there are several other attractive investment markets in South Asia. These countries in the region have among the highest economic growth rates in the world, averaging almost 7 percent in 2017,² and are beginning to attract increased foreign investment. India alone received foreign capital inflows of more than \$44 billion in 2016.³

There has been a surge in climate business activity in key sectors such as renewable energy, green buildings, and energy-efficiency since the Paris Agreement, boosted by clear policy signals provided by South Asian governments of their intention to address climate change. Between 2014 and 2016, when the agreement came into force, there was an 18 percent increase (from 85 gigawatts [GW] to 100 GW) in installed capacity of renewable energy, including hydropower, across Bangladesh, India, and Nepal collectively.⁴ This is in keeping with global growth in investments in and commitments to low-carbon alternatives. The RE100 campaign, led by The Climate Group in partnership with the Carbon Disclosure Project (CDP), has had 112 major companies from a range of sectors and operations around the world agree to source 100 percent renewable electricity, creating about 146 terawatt-hours in demand for renewable electricity annually—about as much as it takes to power Poland or New York State.⁵ South Asian companies such as Dalmia Cement, Infosys, and Tata Motors have made this commitment.

Championed by the We Mean Business Coalition, 620 companies from across the world (including 21 from India and Bangladesh)⁶ with a market capitalization of \$15.5 trillion have made almost 1,100 commitments to bold climate actions. These include adopting science-based emissions targets, doubling energy productivity, growing the market for sustainable fuels and electric vehicles, reducing short-lived climate pollutant emissions, putting a price on carbon, and improving water security. **These companies are acting because it makes business sense to drive investment towards low-carbon and resilient alternatives.** According to the Clean 200 report, the world's 200 largest publicly listed companies by total clean energy revenues, including seven companies from India, outperformed their industry benchmark index by 18 percent in 2017.⁷ Investors are also demanding it. A survey commissioned by HSBC showed that more than two-thirds of institutional investors are planning to increase investments in tackling



climate change, confirming that “green finance” is moving from the margins to the mainstream of global markets.⁸

The transition to low-carbon and resilient growth can only be achieved with the help of strong private sector engagement. The business case for addressing climate change and pursuing sustainable growth continues to strengthen, reinforced by positive returns on investment and improved operational resilience. Conducive policies, market conditions, and willing investment capital open up new opportunities for climate business and potential efficiency gains, driving innovation and enhancing corporate reputations. Sustainable companies around the world are thriving and delivering attractive returns to shareholders.⁹ Businesses across all six countries in South Asia, including some small and medium enterprises (SMEs), are pursuing sustainable business practices and 234 companies¹⁰ have signed up to the United Nations Global Compact’s 10 principles for corporate sustainability.¹¹

The Urgent Imperative to Act

South Asia is highly vulnerable to climate change, with rising temperatures, changing precipitation patterns, and intensifying extreme events such as storms and droughts. Climate change affects economic productivity and consumption in many ways, causing a decline in living standards. The region’s vulnerability is compounded by its large population in absolute terms, with many people living in coastal areas that are most likely to be affected by extreme weather conditions and rising sea levels. These populations are also highly dependent on sectors such as agriculture, fisheries, and tourism, which are directly affected by climate change. The region’s growing population and rapid urbanization will only increase the pressure and vulnerability to climate-related threats. Left unchecked, estimates by the Asian Development Bank predict that, by 2050, the collective economy of these six South Asian countries will lose an average of 1.8 percent of its annual gross domestic product (GDP) due to the effects of climate change, rising to 8.8 percent by 2100.¹²

Agriculture accounts for 15.5 percent of GDP on average for the region, but with significant variation across the countries.¹³ Given the significance of the sector to the regional economies and populations, a broad perspective of the food-water-energy nexus is important. Water sources such as the Brahmaputra, Ganga, and Meghna rivers connect Bangladesh, India, and Nepal, and each country relies on these shared resources. Rice and wheat, the staple foods in the region, require huge amounts of water and energy. Fresh water, once abundant, is under increasing stress as demand grows for competing uses, while climate change creates additional uncertainties. **The increase in water stress and demand raises questions about how to ensure there is enough water for growing food without losing hydropower for energy security.**

Companies are identifying solutions to address this challenge by investing in renewable energy, energy and water-efficiency measures, and climate-smart agriculture practices such as drip irrigation. In India, the growing application of innovations such as solar irrigation is providing the energy required to make water available for crop production in a low-carbon way.¹⁴

The World Bank’s forthcoming South Asia’s Hidden Hotspots report¹⁵ analyzes the long-term effects of climate change in the region. It identifies several climate “hotspots” where living standards will be adversely affected, particularly in areas already experiencing declining welfare, poor road connectivity, uneven access to markets, and other development challenges. Consumption in most countries has already been negatively affected due to rising temperatures and rainfall, and this trend is set to continue. In the worst-case scenario, the areas in which almost half of South Asia’s population lives will become moderate to severe hotspots by 2050. Identifying the location of climate hotspots is a valuable tool for devising strategies to cope with the impacts.

Landlocked, mountainous Bhutan and Nepal are vulnerable to extreme climate hazards, such as flash floods, glacial lake outburst floods, and landslides. Heavy monsoon rains in August 2017 led to flooding across the Himalayan foothills in Bangladesh, Nepal, and India, affecting 40 million people and killing more than 1,200 people, causing landslides, damaging roads and electric towers, and washing away tens of

thousands of homes and vast tracts of farmland.¹⁶ The Maldivian islands face the long-term existential threat of rising sea levels, as well as short-term challenges such as damaged ports as a result of harsh storms. Sri Lanka, which is also prone to cyclones, faces similar challenges.

Without investments in flood protection, damage costs in cities across these six South Asian countries—home to a fourth of the world’s people—could be as much as \$143 billion each year by 2030, with potential GDP losses four times that amount, according to the World Resources Institute’s global flood analyzer.¹⁷

Companies with operations on coasts, next to large rivers, on low-lying floodplains, or in urban areas with poor drainage and sanitation are at greatest risk. More rain and extreme weather will not only hit businesses in South Asia, but also global companies that source their products and raw materials from the region. **If the world continues on its current path, South Asia will need to spend at least \$73 billion, or an average of 0.86 percent of its GDP every year between now and 2100, to address climate change damage.¹⁸**

Countries in the region are working to strengthen resilience planning in public infrastructure projects, fuel supplies, and electricity distribution networks. This will help manage the scale of the threat posed by changing weather patterns. Most of these threats are infrastructural risks, including the need for electricity and technology backups; the cost of repairing dams, roads, and embankments; and the provision of flood relief, which requires planners to change the way cities are built. **With almost 250 million more people expected to live in South Asian cities by 2030,¹⁹ investment in climate-resilient urban infrastructure is gaining new urgency.**



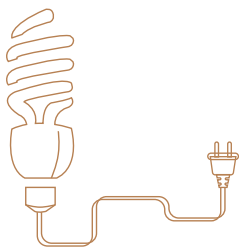
Turning Risk into Opportunity

Each risk posed by climate change also presents an **opportunity**. Adaptation and mitigation measures intended to address the impact of climate change require significant investment to make the South Asian economies more resilient. Creating markets for climate-resilient infrastructure, climate-smart agriculture, renewable energy, sustainable transport, industrial energy-efficiency, and green and resilient buildings, among others, can present significant investment opportunities for the private sector.



GRID-TIED RENEWABLE ENERGY

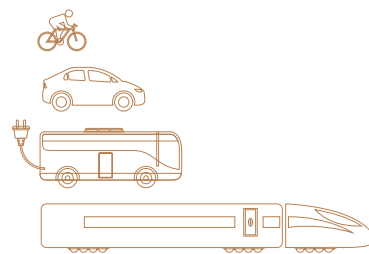
The Indian government is working to address the country's growing air pollution problem. This urgent priority, along with the recognition that there is a growing risk of stranded assets as the world transitions to a low-carbon future, has influenced the Indian government's decision to stop building coal plants after 2022.²⁰ The government predicts that renewables will generate 57 percent of its power by 2027—a pledge far outstripping its commitment under the Paris Agreement.²¹ In keeping with this push towards renewables, plans for nearly 14 GW of coal-fired power stations were scrapped in May 2017²² and Coal India announced the closure of economically unviable mines in 2018,²³ signaling a seismic shift in India's energy market. The country's solar sector has received strong investor interest, both domestic and foreign, with \$5.5 billion invested in 2016.²⁴ In addition, the plummeting price of solar electricity has increased pressure on fossil fuel companies in the country. The government has launched the International Solar Alliance—a common platform for cooperation to advance solar energy through innovative policies, projects, programs, capacity-building measures, and financial instruments.²⁵ The Energy and Resources Institute found that if the right policies are in place and the cost of renewable energy continued to fall at the same rate, India could phase out coal completely by 2050.²⁶ The growth in renewable energy is also creating jobs in India, with 621,000 people employed directly and indirectly in the sector in 2016.²⁷



ENERGY ACCESS

The IFC-led Lighting Asia program aims to increase access to clean, affordable energy by promoting modern off-grid lighting products, home systems, and mini-grid connections in India and Bangladesh.²⁸

Both countries' governments have pledged to expand access to electricity to cover the 300 million people across the two nations that are currently without. The Lighting Asia program is working with the private sector to address barriers to growth by providing market intelligence, fostering business-to-business connections, strengthening access, and raising consumer awareness of quality-assured lighting products. It has already benefited 6 million people in the Indian states of Uttar Pradesh, Bihar, and Rajasthan. By introducing verified quality standards, manufacturers are increasingly interested in supplying to this market segment. Solar energy products are rapidly transforming energy access in Bangladesh, where 50,000 solar home systems are being installed every month, making it the fastest growing solar home systems market in the world.²⁹ The expansion in off-grid solutions is being extended to appliances—the Infrastructure Development Company Limited issued a tender that led to the procurement of 12,000 quality-assured off-grid televisions by Bangladeshi companies, which are now being sold to customers.³⁰



TRANSPORT

Countries across the region are grappling with traffic congestion and the need to ensure efficient transportation for goods and services, and each is prioritizing different solutions. Bhutan, Nepal, and India have articulated targets for greening their vehicle fleets through electric vehicles. India alone aims to electrify 100 percent of new vehicle sales by 2030. Sri Lanka is focusing on a modal shift from private to public transport to cater for anticipated growing transport demand, including developing a light rail transit system to cover the capital of Colombo and its suburbs. The government plans to build this through a public-private partnership (PPP), with a request for proposals expected to be issued by the end of 2017.³¹ Bangladesh is prioritizing inland waterways to facilitate trade and reduce transport costs and emissions. Waterway transport uses about a fifth of the fuel road transport does. The government is negotiating with India to enable the free movement of cargo along the Ganga and Brahmaputra rivers, supplemented by road and coastal shipping, which would give isolated markets in northeast India access to the industrial centers of north India and Bangladesh. This will make it easier for Bangladeshi companies to sell their garments, pharmaceuticals, and leather to India, Bhutan, and possibly Nepal. Landlocked Nepal and Bhutan, in turn, would finally have an easy route to the sea through downstream Bangladesh, allowing for exports that could stimulate economic growth.³²



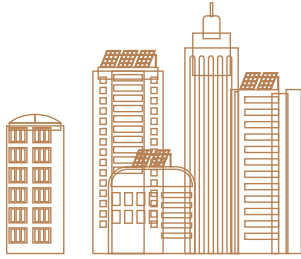
REGIONAL COOPERATION

This push for enhanced connectivity is part of the broader regional cooperation agenda being championed through the Bangladesh, Bhutan, India, and Nepal Initiative. Its vision is to increase trade and cooperation within eastern South Asia, ensuring faster movements of goods and people, building sustainable development through water resource management, and striving for climate protection. The Motor Vehicles Agreement, signed by all four countries in June 2015 to regulate passenger, personal, and cargo traffic, is making progress on this front. Investments in hard infrastructure such as roads, bridges, and border facilities will also be scaled up, particularly in Bangladesh. The agreement has identified 30 transport connectivity projects into which \$8 billion will be channeled.³³



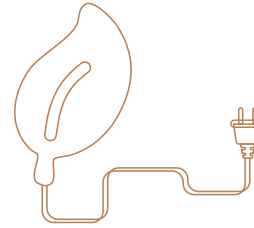
URBAN DEVELOPMENT AND RESILIENCE

The Maldives government is tackling the threat of rising sea levels by relocating people living on remote islands to be closer to the capital of Malé. To accommodate this shift, it is constructing the City of Hope on a nearby artificial island called Hulhumalé. To build it, a state-owned company is pumping sand from surrounding atolls and depositing it on shallow reefs that surround the original lagoon. It is being fortified with walls 3 meters above sea level—which is higher than the highest natural island at 2.5 meters above the sea. When construction is finished in 2023 it will be able to accommodate about 130,000 people.³⁴ Making the city inhabitable will require integrated planning systems for buildings, energy, transport, waste, and water, presenting significant scope for private sector investment.



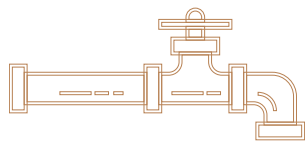
GREEN BUILDINGS

As cities across South Asia grow, the demand for residential and commercial properties does too. Estimates indicate that half of the urban centers that will exist in India in 2030 are as yet unbuilt.³⁵ Countries are seizing the opportunity to make this construction energy efficient and resilient. Bhutan, India, Nepal, and Sri Lanka have already implemented green building codes, policies, and rating systems for construction, while other countries are developing their policies. To encourage lenders, builders, and buyers to recognize the value of a property's green measures, IFC is working across these countries to roll out the Excellence in Design for Greater Efficiencies (EDGE) Green Building Certification system—an inexpensive, quick, and simple standard for quantifying a building's energy and water efficiency that is tailored to the local market. In India, 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). Supported by IFC's EDGE system and Eco-cities program, leading companies in the property sector in India have championed green construction and stimulated capital markets products through the creation of the Sustainable Housing Leadership Consortium, a first-of-its-kind, industry-led alliance of developers and financiers to drive sustainability in India's housing market, with a particular focus on the affordable housing sector.



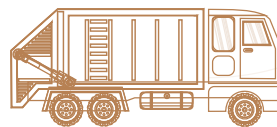
ENERGY-EFFICIENCY

IFC has helped the city of Jaipur, in Rajasthan, to develop a PPP to convert public street lighting to use energy-efficient LEDs with centralized automated control systems under an energy performance contract. This retrofitting of 70,000 street lamps has reduced energy usage by more than 70 percent, made the streets safer, and lowered municipal energy consumption and consequent greenhouse-gas emissions.



CLIMATE-SMART WATER INFRASTRUCTURE

Countries across South Asia have identified the need for greater investment in flood-mitigation and water infrastructure. These water projects will generate opportunities for investors and companies that have specialized technology and expertise in the sector.³⁶ India, Bangladesh, and Nepal, for example, are investing more than \$32 billion in building 78 water infrastructure projects, according to BMI research.³⁷ State governments in India have signed agreements with private sector companies to build the country's first two sewage treatment plants using a hybrid annuity payment model in Haridwar and Varanasi, in support of the national priority to clean the Ganga river. Under this model, the government pays 40 percent of the project cost linked to construction milestones. The remaining 60 percent is paid over 15 years as annuities to the private operators along with operation and maintenance expenses. IFC helped design the hybrid annuity structure, balancing public and market risks and creating a competitive bidding process, thereby increasing private sector participation. This bankable model can be used to roll out similar PPP projects in more than 100 cities in the Ganga basin, helping to improve the water quality for millions of people.³⁸



MUNICIPAL SOLID WASTE

Many South Asian cities are already planning for the confluence of climate change, worsening monsoon floods, and urbanization. In 2016, Kolkata, India, was recognized as one of the 10 best cities globally by the C40—a network of cities that addresses climate change—for its innovative and inspiring efforts to address solid waste management. Kolkata's approach involves going door to door to educate people and collecting, segregating, and recycling solid waste, which is then sold in the market. Depending on the site, the project has achieved between 60 percent and 80 percent segregation of waste at its source, with further segregation occurring at transfer stations. The project aims to eradicate open dumping and burning of waste and to limit the concentration of methane gas generated at landfill sites. Other Indian cities, including Bengaluru, Chennai, Jaipur, Mumbai, and New Delhi, along with Dhaka in Bangladesh, are also members of the C40 Mayors Group.³⁹

TABLE 1: Sectors relevant to the private sector in South Asian countries' NDCs and globally

	Renewable energy	Agriculture	Forestry	Energy-efficiency	Transport	Waste	Water	Industries	Buildings	Urban
Global	130	126	120	107	107	101	101	70	66	66
Bangladesh	🎯📄	🎯	📄	🎯📄	🎯📄	🎯		🎯	🎯	📄
Bhutan	🎯📄	📄	📄	📄	📄	📄		📄	📄	📄
India	🎯📄	📄	🎯	🎯	🎯📄	🎯📄	🎯	📄	🎯📄	📄
Maldives		📄			📄	📄	📄		📄	📄
Nepal	🎯📄	📄	🎯📄		🎯📄	📄			📄	
Sri Lanka	🎯📄	📄	🎯📄	📄	🎯📄	📄	📄	📄	📄	📄

🎯 Target

📄 Policy

National Climate Plans Accelerate Opportunities for Climate-Smart Investment

A total of 190 countries—nearly the entire international community, representing 95 percent of global emissions—had submitted Nationally Determined Contributions (NDCs) by April 2016,⁴⁰ including the countries of focus in this report. NDCs are country-proposed targets that were invited for submission by the United Nations Framework Convention on Climate Change as part of the Paris Agreement.⁴¹ The South Asian countries' NDCs vary significantly in form and content, but each outlines their ambitions and needs to pursue low-carbon

economic growth and build resilience to the effects of climate change. The NDCs in each of the six countries are underpinned by sector-specific policies and objectives that address local development needs such as energy access; food security; efficient public transit systems; comprehensive water, sanitation, and waste management services; and curbing air pollution. They each signal the actions that the countries will take unconditionally, supplemented by targets that they will undertake subject to external financial, technology, and capacity-building support.

Almost all the NDCs across the region make some reference to the role of business. The private sector is already active in government



initiatives related to climate change and resource efficiency in India, and is playing a key role in sustainable development efforts in the country. In Bangladesh, the NDC was developed in consultation with the private sector. In Nepal, the NDC highlights work already under way to build climate-resilient communities through private sector participation, and prioritizes the creation of an enabling environment to promote private and foreign direct investments in low-carbon technologies. Bhutan stresses the role of PPPs in supporting the implementation of its NDC. Sri Lanka aims to promote public and private investment in environmental conservation projects through corporate social responsibility programs.

Estimating Climate-Smart Investment Potential

There is no consistent bottom-up approach to estimating the climate-smart investment potential associated with policies and targets in key sectors. The estimates that do exist tend to emphasize what the market considers as a conservative achievable volume of investment given current and planned interventions, incentives, and the prevailing economic and financial conditions. These estimates have, thus far, only emerged for sectors where there is good publicly available data that is consistent over several years, such as renewable energy. Other sectors such as climate-smart agriculture and forestry, waste, and transport have substantial data gaps. Similarly, estimating the investment potential for adaptation and resilience is difficult. There is a lack of consistent data and standardized metrics due to geographic, economic, and institutional constraints.

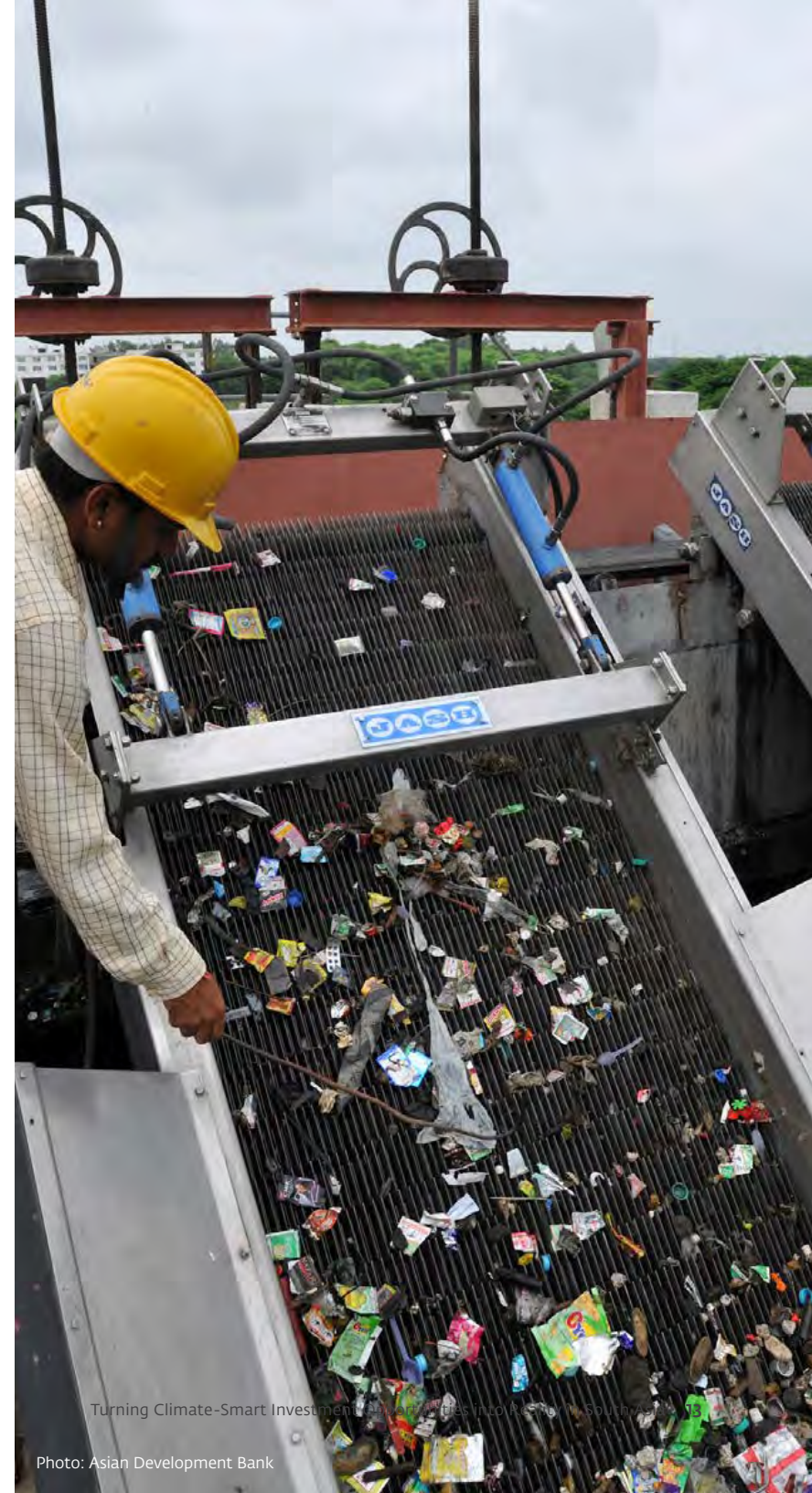
This report attempts to estimate the investment opportunity in key sectors in South Asia, based on the assumption that the countries will meet their stated targets/policy objectives. While in some cases this may not always be fully realized, **the estimates signal the full scale of the opportunity, for both public and private investment, that has been created by the governments' targets.** Our approach has been to identify the targets established by each of these six countries in their NDCs

and, where available, supplement this information with sector-specific policies as needed. This report builds on the methodology used in IFC's 2016 global Climate Investment Opportunities report.

The focus has been on sectors with the greatest potential for attracting private investment, where fairly consistent data was available, namely, power, green buildings, transport, waste, and water. The report attempts to provide investment opportunity estimates for climate-smart agriculture, but the authors were unable to generate figures for this sector due to a lack of data and variations in priorities across the countries. Although the region's NDCs include other sectors such as energy-efficiency and forestry, this report does not cover them due to the lack of data to support the calculation of investment potential.

The analysis assesses how the NDC targets and relevant national policies would affect the market size over the remaining period for NDC implementation (2018 to 2030). The investment opportunity estimates included here are for both public and private investment because there are no agreed-on metrics for dividing up the potential between the two sources of funding. To date, the private sector has largely focused its investment on mitigation-related opportunities, with the public sector leading the way on adaptation finance. Where possible, the report provides examples of the different ways the private sector is investing in these sectors already, and signals other avenues for engagement.

In the case of renewable energy, investment or capital costs (\$/megawatt [MW]) were used to derive the final investment potential figures, reflecting anticipated demand and, where possible, price trajectories for these technologies and services by 2030 (see Annex 1 for the detailed methodology for this and other sectors). Because this metric varies between technologies and countries, a variety of sources were used to improve the accuracy of the estimates (see Annex 2). As more governments in the region move towards implementing electronic procurement, processing, and filing, it should become easier to collect and aggregate consistent data for investments across key sectors, further enhancing the potential for improved estimates.



Turning Climate-Smart Investment Opportunities into Action in South Asia

Photo: Asian Development Bank

Investment potential by country and sector in South Asia, 2018–2030

	Bangladesh	Bhutan	India	Maldives	Nepal	Sri Lanka	Total	INCREASING INVESTMENT OPPORTUNITY BY COUNTRY
Renewable energy	\$3.2 billion	\$72 million	\$403.7 billion	\$55 million	\$2.1 billion	\$2.3 billion	\$411.4 billion	
Large hydro	-	\$40.6 billion	\$44 billion	-	\$22.5 billion	\$190 million	\$107.3 billion	
Green buildings	\$118.8 billion	\$390 million	\$1.4 trillion	\$200 million	\$3.4 billion	\$8.4 billion	\$1.53 trillion	
Transport infrastructure	\$23.7 billion	\$615 million	\$250 billion	\$1.5 billion	\$10 billion	\$326 million	\$286.1 billion	
Transport electric vehicles	-	\$322 million	\$667 billion	-	\$2.5 billion	-	\$669.8 billion	
Municipal solid waste	\$4 billion	\$11.5 million	\$11 billion	\$46 million	\$83 million	\$3.5 billion	\$18.6 billion	
Climate-smart urban water	\$13 billion	\$106 million	\$128 billion	\$86 million	\$686 million	\$2.7 billion	\$144.6 billion	
Climate-smart agriculture	\$9.1 billion	\$140 million	\$194 billion	\$31 million	\$4.8 billion	\$964 million	\$209 billion	
TOTAL	\$171.8 billion	\$42.3 billion	\$3.1 trillion	\$1.9 billion	\$46.1 billion	\$18.4 billion	\$3.4 trillion	

South Asia's Climate-Related Investment Opportunity

IFC estimates a \$3.4 trillion climate investment opportunity for South Asia between 2018 and 2030. Analysis of national climate change commitments and related sectoral policies for the six countries, representing almost 7.4 percent of global carbon dioxide emissions (7.1 percent of which is India), indicates sizeable investment opportunities in key sectors. This number exceeds the \$2.2 trillion investment potential estimate for South Asia included in the 2016 global Climate Investment Opportunities report,⁴² as more countries and new sectors such as electric vehicles are included in the analysis. For example, the estimate for India now includes electric vehicles, urban water, and climate-smart agriculture, which were not covered in the 2016 analysis. These sectors represent a sizeable portion of this increase, along with increased renewable energy potential reflecting the scaled-up energy access targets.

Green buildings account for a significant portion of this opportunity, along with renewable energy (including hydro). New technologies such as electric vehicles, complemented by ambitious policies, are also generating large investment potential. The absence of consistent data for climate-smart agriculture suggests that these overall figures are likely to be underestimated, given the significant role the sector plays in the region's economies. **While the majority of the estimated investment potential lies in India, due to the scale of its economy and population, there is substantial untapped opportunity for growth in the rest of South Asia.**

Creating Markets to Achieve this Potential

This sizeable opportunity cannot be tapped by the public sector alone, not just due to competing demands for an overstretched public purse,

but also because a strong and engaged private sector is often better placed to implement and execute projects.

While the NDCs are essential for signaling a market for climate investments, they can be supplemented by a comprehensive approach to creating markets for climate business across these sectors. This involves:

- Establishing regulatory and policy frameworks that improve public governance and enable markets to thrive.
- Promoting competition and innovation—demonstrating models that work and encourage replication.
- Building capacity and skills to open new markets.

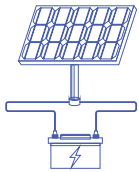
This approach has already been used to create markets. For example, in India, when the state of Gujarat announced its ambitious solar policy in 2009, it faced a challenge. Despite plentiful sunshine in the western Indian state, affordable land for solar panels was scarce. To meet its goal of becoming a true solar state, Gujarat had to innovate. An IFC-supported PPP to set up a 5 MW grid-connected solar rooftop project in Gujarat's capital city of Gandhinagar, initiated in 2010, had enormous potential for replication. IFC supported the government in structuring a framework of incentives, including a guarantee that 80 percent of public rooftops in Gandhinagar would be included, and assured potential investors that the government would help secure access to rooftops. With no specific regulatory framework in place for rooftop solar, consultations with regulators resulted in an approved project and bid structure, with agreed feed-in tariffs.

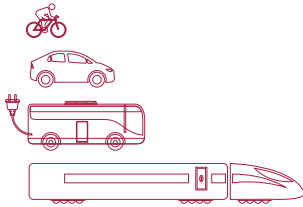
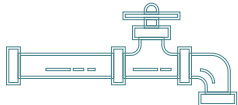
The project was financially and technically structured to address the risks and challenges constraining the market in India. Azure Power and SunEdison each won a 25-year concession for 2.5 MW of installed rooftop solar power in 2012. The project was fully commissioned by 2014 and is operational with 4.7 MW of installed capacity—and an expected reduction in greenhouse gases of 7,200 tons of carbon dioxide equivalent per year. Gandhinagar's PPP project is now being replicated in five other Gujarat cities, resulting in a reduction of another 30,000 tons of carbon dioxide equivalent per year. Other countries are examining the Gujarat model in order to replicate it, with promising



rooftop solar PPPs in Bangladesh, the Maldives, Sri Lanka, and Thailand.

There is no uniform approach to catalyzing private investment for all sectors, but there are core elements that need to be tailored to the technology, sector, and country context. IFC's *Creating Markets for Climate Business* report⁴³ identifies the key steps to develop markets and enable private investment in the sectors examined in this report. While these steps, outlined below, will still need to be customized to the local conditions for each sector in countries seeking to scale up investments, they provide a guiding framework for policymakers:

Sector	Market snapshot	Highest growth markets	Key actions to attract private investment
Grid-tied renewables 	• In 2016, over 160 GW of renewable energy capacity was built • This was \$280 billion in investment, 2X fossil fuel investment • China & India are the leading markets, with nearly 1/2 new capacity added • Over 100 countries targeted renewable energy in their NDCs	• There is \$6 trillion in new investment potential in wind and solar power up to 2040; half of which is in the Asia-Pacific region • Africa is attracting solar investment, with 170 MW in Algeria and 500 MW in South Africa • China led in wind power additions in 2016, with 23.4 GW new capacity • Battery storage markets are expected to reach 21 GW by 2025	Step 1: Set a target. Step 2: Put in place smart, market-responsive policies. Step 3: Ensure that other policies are not inhibiting market growth. Step 4: Adapt policies to meet the evolving needs of the electricity market.
Off-grid solar and storage 	• The global energy storage market was \$2.5 billion in 2016, with hot markets in Sub-Saharan Africa and South Asia • 89 million people in the developing world own at least one solar light • 31 NDCs target off-grid solar and storage	• Investment in emerging market energy storage will grow from \$2.5 billion to \$23 billion in 2025 • Sub-Saharan Africa has the greatest growth potential • Pay-as-You-Go companies raised \$223 million in capital in 2016	Step 1: Set a target. Step 2: Publicize a grid expansion plan to give confidence to developers and investors. Step 3: Provide targeted incentives to encourage deployment. Step 4: Allow different electricity tariffs for mini-grids and rooftop photovoltaic. Step 5: Provide microfinance, training, and education.
Climate-smart agriculture 	• Agriculture is a \$5 trillion global industry, supporting 500 million farmers and responsible for 10% of consumer spending and 30% of greenhouse-gas emissions • Over the last 40 years, global meat consumption has grown 2X and will continue to grow • Over a third of all food that is grown is wasted • 61 NDCs specifically target climate-smart agriculture	• By 2032, food demand will increase 20%, driven by growth in the developing world. • Food production will need to increase by 70%	Step 1: Mainstream climate-smart agriculture into national policies and sector development plans. Step 2: Address inefficient government price and subsidy regimes to reward climate-smart agriculture. Step 3: Invest in strategic infrastructure to facilitate climate-smart agriculture investment. Step 4: Promote outreach, training, and agribusiness centers of excellence.
Green buildings 	• Energy-efficient building investment was \$388 billion in 2015 and is growing • 86 countries target energy-efficient buildings in their NDCs	• Energy-efficient buildings need nearly \$300 billion annual investment to achieve climate stabilization • Energy service company have emerged as a key business model; global revenues were \$24 billion in 2015	Step 1: Develop regulatory tools, including building codes, government procurement, appliance standards, and performance labels. Step 2: Build capacity via public awareness, awards, audits, ratings and certification, workforce training, and technical assistance. Step 3: Provide targeted incentives, revolving loan funds, risk guarantees, and energy performance contracts. Step 4: Encourage utilities to act via advanced metering, demand response, time-based tariffs, subsidies, and energy service company support.

Sector	Market snapshot	Highest growth markets	Key actions to attract private investment
Transport and logistics 	- Over 750,000 electric vehicles have been sold—a \$163 billion market - Governments are creating markets for electric vehicles by phasing out combustion engines in the coming decades - Bus rapid transit is an attractive urban mobility option—over 150 global cities now have bus rapid transit systems - Over 80 countries target transport in their NDCs	- Investment in transport infrastructure will grow to \$900 billion per year by 2025 - Asia-Pacific will attract over \$8 trillion in investment through 2025 - Doubling vehicle efficiency and enabling fuel switching could save \$8 trillion cumulatively by 2050	Step 1: Avoid the need for urban commuting via better urban design, bike lanes, and consolidated freight centers. Step 2: Shift from personal vehicles to other modes of transport with bus rapid transit, metro systems, travel demand management, fiscal measures, and PPPs. Step 3: Improve technology for passenger vehicles and freight via fuel economy standards, tax rebates, electric vehicle infrastructure, and automation and optimized routing.
Climate-smart water infrastructure 	- More governments are looking to the private sector for climate-friendly water supply and treatment investment - In 2015, private sector water investment totaled \$5.3 billion - More than 100 countries mention the water sector in their NDCs	- Investment for water supply and sanitation could exceed \$13 trillion by 2030, with \$8 trillion needed in the Asia-Pacific region alone - The global market for water recycling technologies is \$23 billion, and rapid growth will continue	Step 1: Establish water access, cost recovery, and service quality goals; increase inter-government coordination; and foster water-smart public awareness. Step 2: Ensure financial sustainability by implementing water pricing and removing subsidies. Step 3: Make public-private cooperation deliver increased water efficiency via guarantees, PPPs, project preparation funds, and performance-based contracting. Step 4: Build capacity through training, regional cooperation, public awareness, home/equipment certification, auditing, and benchmarking.
Climate-smart urban waste management 	- The global waste market may reach \$2 trillion by 2020 - Over the past two years, waste processing projects have attracted \$300 billion in capital 800 waste-to-energy facilities were worth \$7.4 billion in 2013 - Waste recovery and recycling markets are around \$265 billion - Over 80 countries include waste in their NDCs	- Strong waste-to-energy investment is likely; the Asia-Pacific and Latin American regions will see the most growth - Between 2009 and 2013, waste generation increased by 15 percent each year in Brazil and China	Step 1: Achieve economies of scale by aggregating waste flows and developing regional plans/partnerships. Step 2: Use an integrated waste management approach to attract private investment. Step 3: Get the prices right via cost recovery through taxes, volume-based fees, and other means. Step 4: Put incentives in place through appropriate waste-to-energy pricing, mandates for compost, and other sector policies. Step 5: Raise consumer awareness to reduce non-recoverable waste streams.



Unlocking Private Investments at the Required Scale

The scale of the challenge and opportunity means governments need to ignite private sector solutions and investments where they can help achieve climate goals, and reserve scarce public finance for where it is most needed. There are four key considerations to promote increased private investment in addressing climate change: turning the NDCs into investment plans and bankable projects, creating an attractive enabling environment for investment, identifying and allocating risks appropriately across the public and private sector, and enabling and mobilizing finance to flow. These factors must be adapted according to each country's context, priorities, and constraints; specific recommendations on how to unlock investment are included in the individual country sections of this report. Creating these conditions will require strong political leadership and continued, consistent, and clear signals to provide certainty to companies and investors.

MOVING FROM PLANS TO BANKABILITY

Companies and investors in the region are ready to act on climate change. However, getting the trillions of dollars of financing available to the projects and potential opportunities that can quickly make a difference is challenging. This is largely because some of the plans countries have drawn up as part of the 2015 Paris Agreement are often a list of potential projects. **Turning the proposals into detailed investment plans that financiers can back—and that can begin changing perceptions among bankers about what a good investment looks like—is key to shifting funds into climate-smart investments.** This involves developing a sustainable business plan that considers several factors, including ownership structures, funding requirements, time horizons, capacity, technology, and environmental and market analysis.

Developing a pipeline of ready-to-fund climate projects is essential to **attracting available finance.** Initiatives such as the NDC Partnership, the Climate Finance Accelerator, NDC Invest, the Global NDC Implementation Partners (GNI Plus), and others are all working to support governments to translate their NDCs into bankable projects and implementation plans.

Bangladesh and the Maldives are working with the NDC Partnership to implement demonstration projects to signal feasibility and raise awareness in the market, which are essential for scaling and replication.

CREATING THE CONDITIONS TO ATTRACT INVESTMENT

An attractive investment climate enables private sector participation. Creating a sound policy, regulatory, and institutional environment that encourages foreign investment is fundamental to creating a broader investment-friendly climate. This affects both the perception and experience of risks associated with specific investments. The World Bank's annual Doing Business survey examines the overall enabling conditions for investment in countries, looking at factors such as the time taken to register a business and the ease of getting construction permits. India for the first time moved into the top 100 in the 2018 Doing Business global rankings on the back of sustained business reforms over the past several years.⁴⁴ **Countries across South Asia are putting in place policies and measures and streamlining processes to improve their investment climate and increase transparency.** For example, Sri Lanka has announced its plan to introduce e-procurement and permitting processes.⁴⁵ With upcoming elections, the Maldives and Nepal are working to limit any political economy risks and uncertainty in order to create an attractive environment for domestic and foreign investment.

In addition to proactive investment policies to encourage private financing, proposed regulations should aim to reduce excessive investment costs, whether due to taxation, perceived risks, or administrative hurdles. Governments need to ensure that investment regulations are harmonized to create a stable and predictable environment for domestic and foreign investors. Effective and transparent business taxation and legal enforcement of property rights can have a particularly significant effect on investor appetite for entering markets.

PPPs are an important vehicle to promote cost-effective infrastructure projects that can spur climate-smart innovation. Governments need the capital, innovation, smart technology, and cost-effectiveness that comes with such partnerships, and the private sector is looking for

risk-adjusted returns and a clear business model that is driven by predictable regulations, permits, and incentives. **Enabling regulations, transparent and streamlined tendering and procurement processes, and standardized documentation encourage the private sector to participate in PPPs, particularly in climate-related sectors.** All six countries in South Asia have implemented PPPs successfully and are looking to scale and replicate these projects in key sectors, including hydropower in Nepal, solid waste management in Sri Lanka, and transport in Bangladesh.

Often infrastructure projects and PPPs are developed at a subnational level. Creditworthiness is a key requirement for cities and states to unlock the long-term resources they need to finance their capital investments. This includes having credible accounting frameworks, sound financial management systems, independent auditing of local government finance, and performance evaluation for local government services. **By reaching investment-grade creditworthiness, local governments will be able to tap capital markets and other sources of subnational borrowing.** The Indian city of Pune issued a municipal bond in 2017 to raise money for investment in the city's water infrastructure. The Pune Municipal Corporation's AA+ local rating allowed the bond to raise about \$30 million.⁴⁶ Its creditworthiness has been earned through various policies, such as increasing property tax collections by 50 percent since 2015, allowing online tax payments, developing a debt policy with assistance from the U.S. Department of Treasury, and reducing risk for investors by offering state guarantees and escrow accounts for funds.⁴⁷

Targeted sector-specific policies and incentives aligned with national climate goals create opportunities for private sector engagement and promote investment. Investors and bankers are increasingly seeing green opportunities as a result of policy signals such as national targets for electric vehicles (Bhutan and India), green building codes (Bhutan, India, Nepal, and Sri Lanka), policies allowing for independent power producers and grid connections (Bangladesh, Bhutan, India, and Nepal), net metering (India and Maldives), water pricing (Bangladesh), carbon pricing, and feed-in-tariffs. These policies can be supplemented by campaigns that raise awareness among companies, financiers, and the public to increase demand for climate-friendly investments.

IDENTIFYING AND ALLOCATING RISK TO LOWER COSTS

Identifying and managing risk appropriately is central to enabling investment and lowering the lifetime operating, capital, and financing costs of low-carbon infrastructure projects. Given that the green investment sector is relatively new in many countries, the perception of associated policy, technology, operational, capacity, and currency risks tends to be higher. **When considering how to attract private finance for low-carbon investment opportunities, different investment risks need to be identified and allocated appropriately between private investors, public entities, and consumers to reduce financing costs.** This allocation of risks can be achieved through a blend of ownership models, policy, regulation, and specific finance instruments. Many risks, such as construction and operating costs, are generally better managed by private investors. Other risks are better managed by governments or development banks, or transferred to consumers.

The Climate Policy Initiative's analysis of a generic investment in solar power in India found that the ideal model is private finance, but with the transfer of many risks to public entities or consumers who are better positioned to manage them. The appropriate risk transfer mechanisms proposed in this stylized example included managing price risk through a long-term power purchase agreement, transferring development risk such as land acquisition to public entities, transferring curtailment risk to the state off-taker by including "take or pay" provisions in the power purchase agreement, and reducing currency risk via a government-provided hedging instrument. This reallocation generates large savings, reducing levelized costs and the cost of capital for private investors. The Indian government has already put in place measures to mitigate risks in the solar sector, including long-term power purchase agreements.

While the global surge in renewable energy investments is increasing familiarity with the market and opportunities, and helping to reduce perceptions of risk and therefore costs, this is not yet the case in all climate business sectors. **A strategic approach to identifying and allocating risks could help to significantly reduce the overall costs of financing clean infrastructure.**

ENABLING AND MOBILIZING FINANCE TO FLOW

To deliver on national priorities and targets across a range of sectors, projects need to be financed sustainably and on more attractive terms. **Project developers and companies seeking to invest in climate-related sectors face high and variable interest rates and short loan periods, increasing costs of debt across the region and adding to the overall cost of the planned project.** This is often supplemented by sector lending caps and other financing directives that constrain the banks' ability to finance such deals. Banks are often only willing to provide balance sheet-based debt financing, and are unwilling to lend to companies that are not capitalized with enough equity. Lack of familiarity with green sectors and inadequate capacity within financial institutions to assess risks can also hinder investment. Government restrictions on foreign ownership and joint ventures can further limit investment in these sectors.

To address these constraints, governments can remove regulatory, structural, and behavioral barriers that prevent the financial sector from being able to invest in climate-smart projects. Governments have successfully used policy to encourage financiers and investors to take a long-term view of climate financing by harnessing the public balance sheet, introducing market incentives and environmental legislation, ensuring market coherence, encouraging a cultural shift, and enhancing information sharing among stakeholders.⁴⁸ Key tools in this regard include introducing green finance policies, promoting green bonds, and using blended finance.

Green finance policies: Central banks, financial regulators, and banking associations in the region are already introducing green finance policies and guidance. The Bangladesh Central Bank is using monetary policy instruments to promote climate-resilient and sustainable investing, while the Sri Lankan government is preparing a sustainable finance roadmap. Many South Asian countries are benefiting from knowledge sharing with other emerging economies through the Sustainable Banking Network. Other actions being taken by countries that could be replicated in South Asia include standardizing what counts as "green," mandating environmental stress tests for financial institutions, asking for improved climate risk disclosure and reporting, implementing tax incentives, reducing capital requirements for green loans, and ensuring fiduciary

duties encompass sustainability (see box on innovative finance to scale up investments for more detail).

Green bonds: Green bonds provide long-term sources of debt capital for low-carbon and resilient investments, helping countries achieve their climate targets. Green bonds can directly finance or refinance investments, and can tap into a deep global pool of capital with a diverse base of investors. The Green Bond Principles,⁴⁹ the Climate Bond Standards,⁵⁰ assurance providers, and benchmark indices all play an important role in promoting transparency and integrity in the development of the green bond market. In the absence of a global standard or definition for “green,” the Securities and Exchange Board of India issued its own green bond framework and listing requirements in support of financing India’s NDC in 2016.⁵¹ India’s total issuance of green bonds was \$3.2 billion in April 2017, with 68 percent of the proceeds allocated to renewable energy projects, 21 percent to low-carbon transport, and 10 percent to green buildings and energy-efficiency.⁵²

Blended finance: Combining concessional funds and commercial financing—blended concessional finance—can help create markets in climate-smart industries and contribute to a country’s transition to a low-carbon economy. When used well, blended finance helps “crowd-in” private sector investors by helping them overcome real or perceived risks to “first-of-their-kind” investments, which in turn stimulates a series of follow-on investments, often on fully commercial terms. Most, if not all, NDCs will require new and additional investments in climate-friendly technologies and projects, particularly from the private sector. Several of the countries have identified conditional targets; unlocking these opportunities will require external support. Blended finance can play an important part in this as a highly effective catalyst for high-risk, nascent markets, and is already being used in South Asia to support projects in Bangladesh, Nepal, and Sri Lanka by IFC with support from the Climate Investment Fund’s Pilot Program for Climate Resilience and the IFC-Canada Climate Change Program (see country chapters for details).

Since 2010, IFC has blended \$442 million in concessional climate finance to support climate mitigation and adaptation investments. These concessional funds leverage about \$1.35 billion in IFC co-financing



and roughly \$4 billion in third-party financing. It should be noted though that poor use of concessional climate finance in private sector investments can lead to market distortions, such as over-subsidization, windfall gains, and inappropriate risk allocation, that undermine market creation and transformation. Proper use of blended finance, therefore, requires taking a rigorous and disciplined approach in using concessional funds to navigate these pitfalls. Development finance institutions including IFC have developed a common set of principles that can serve as a guide to others on the effective and efficient use of blended concessional finance in private sector projects to promote commercially sustainable solutions using minimum concessionality.⁵³

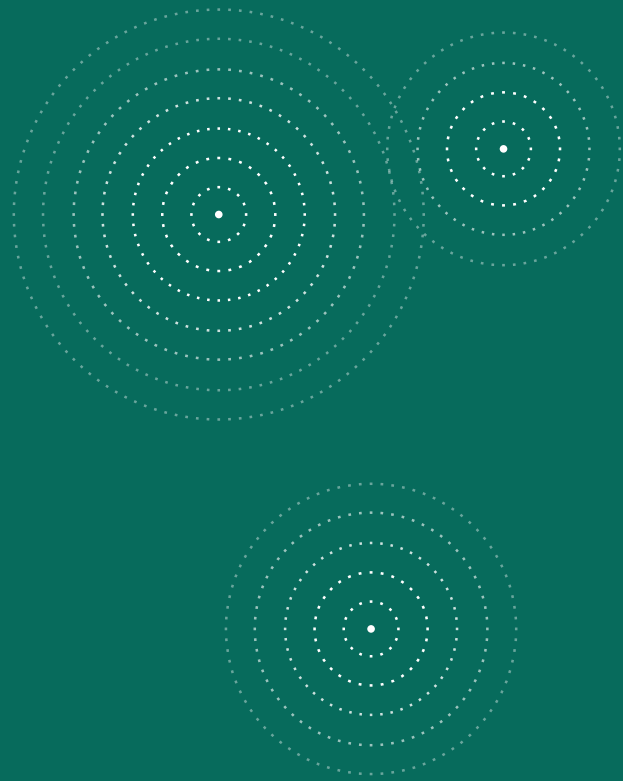
Multilateral and bilateral climate finance sources such as the Global Environment Facility, Climate Investment Funds, Green Climate Fund, IFC-Canada Program, and Finland-IFC Program are implemented in many cases through multilateral development banks and national development banks. These sources provide blended concessional finance through risk-sharing products, lower interest rates, longer loan periods, subordinated rank in loans, or lower returns for equity investments. For example, the \$8.3 billion Climate Investment Funds, implemented by IBRD, IFC, and regional multilateral development banks, are supporting projects in clean energy, sustainable transport, resilience, and sustainable forest management across 72 emerging economies, including most of the countries in South Asia. Countries across the region are also actively engaging with the Green Climate Fund. Projects in five of the six countries have received funding through this fund. The demonstration effect created through implementing such projects can build confidence among market participants and allow for replication and scaling.



The Report

The report starts with an analysis of business needs, opportunities, attitudes, and responses to the effects of climate change and resilience, drawing on the results of an IFC survey. The following chapters take a closer look at each of the six countries in South Asia, analyzing the current context and policy frameworks in each, delving into the investment potential in key sectors, and suggesting priority policy actions that can help unlock opportunities for private investment. These chapters are interspersed with themes of interest to the private sector in the region, linked by the common thread of innovation. The report showcases the activities already taking place in both the public and private sector, and provides recommendations to build on this progress.

Taking stock of progress, as this report does, is just the first step. Catalyzing investment and implementation will require targeted engagement between governments and the private sector. IFC stands ready to work with partners across the region to build on progress to date, unlock investment, and support South Asian countries as they continue to work towards their objectives.



Surveying Business Resilience to Climate Impacts

Surveying Business Resilience to Climate Impacts



August 2017 was one of the wettest summers in years in South Asia, bringing floods that caused enormous damage to livelihoods and the economy.⁵⁴ Hundreds of lives were lost, hundreds of thousands of houses were destroyed, and tens of millions of people were displaced.⁵⁵

While floods are not uncommon in the region, climate change is increasing their intensity. Rising sea surface and air temperatures increase the amount of moisture in the air, which contributes to stronger rainfall and greater floods.⁵⁶

The damages are staggering. According to global insurance firm Munich Re, Asia's losses from natural disaster events amounted to \$87 billion in 2016, of which \$77 billion was uninsured. These losses will increase as the climate changes—flood damages in the region could cost \$143 billion annually by 2030.⁵⁷ Reducing and preparing for this potential scale of climate impacts will require a sharp increase in adaptation investments above current levels.

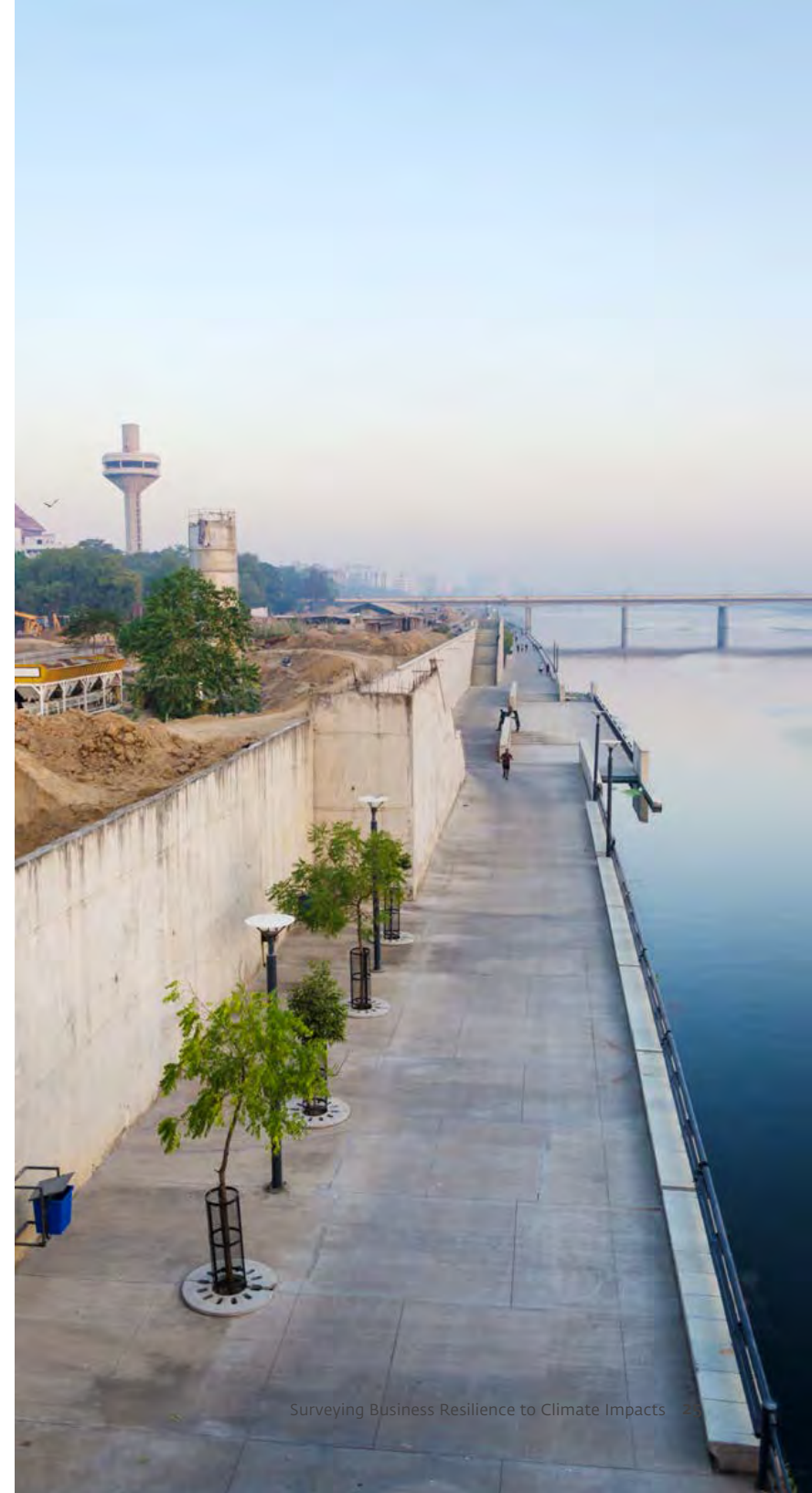
The effects of climate change on business assets, supply chains, and operations are a major concern for South Asian companies. To gauge

industry sentiment, IFC surveyed 52 businesses across the region, and though the sample size may not fully reflect the views of all sectors and countries equally, the results are clear. **More than 85 percent of businesses participating in the survey said that they are either very concerned (51 percent) or concerned (35 percent) about the impacts of climate change.** More than 36 percent of companies stated that climate change already had a material impact, while a further 21 percent expect negative impacts in the next five years. Less than 8 percent of the respondents are not expecting an impact in the foreseeable future. Almost 70 percent of companies said that they are concerned about “too much or too little water”—floods, rainstorms, monsoons and typhoons, and water scarcity. The concerns are not limited to extreme rainfall—over 32 percent of companies cite sea-level rise and almost 29 percent cite heat waves as important concerns.

The survey found that most companies are already taking steps to address climate risks and impacts, with almost half of the respondents either having or developing plans and strategies. Most businesses are already taking some action to manage climate risk and evaluating resilience investment needs. While the amounts depend on company size, sector, and physical location, 22 percent of companies estimated their needed investments to be more than \$10 million.

To become more resilient, 77 percent of the companies surveyed identified the need for better information about the effects of climate change on specific sectors. This is in line with other locations, such as South Africa, where a recent survey found that the need for sector- and location-specific climate impact information is needed to make business decisions. The IFC South Asia survey also found that 71 percent of companies want sector best practices and standards for climate-resilience information, along with help identifying solutions. **More than 40 percent of the companies see the need for incentives for private investments in climate-resilient assets and infrastructure, along with more PPPs and funding.**

The survey’s findings echo conclusions from a previous IFC study, *Enabling Environment for Private Sector Adaptation*,⁵⁸ which identified priority initiatives that are needed to incentivize and enable private sector engagement in adaptation and resilience initiatives and financing. Ensuring that local infrastructure—transport, water, and energy supply—are resilient and can provide uninterrupted service is critically important





for business. To address this need, the publication identified standards and codes for climate-resilient infrastructure and assets, and zoning laws that incorporate climate change impact and resilience considerations, such as projected areas of floodplains and associated building standards.

South Asian businesses are already taking action to address climate risks and opportunities by incorporating relevant information into their decision-making process: 67 percent reported initiatives and investments that focus on water and energy-efficiency, 63 percent include insurance products against identified risks, while 50 percent have risk management and business continuity plans. Nearly 10 percent of the respondents reported that they are relocating their facilities to reduce risk exposure.

Progressive companies that are optimizing planning and directing investments to new areas are seeing results: lower expenses and losses, higher efficiencies and returns, and positive effects on the availability or cost of financing, which gives these companies a better market position and competitive edge.

As part of its climate resilience work with clients and partners, IFC has produced climate risk analyses for a range of sectors and countries, and lists of sectoral adaptation investments and interventions that address impacts observed and expected in those sectors, which can help drive increased investments in climate resilience. Depending on the sector and climate risks specific to a location, investments range from hard measures such as upgrading essential infrastructure or building protective structures; to improving energy and water efficiency through better building materials, more efficient machinery, or water recycling; to developing and using monitoring and forecasting systems, investing in research and development, and using risk-mitigating products such as insurance. **IFC is developing sectoral climate information that can support businesses in their management of climate risks.** This initial set of climate risk management tools covers the following sectors: forestry, pulp and paper, ports, and insurance. Each tool provides information about changes in climate variables that are relevant for the performance of investments in the sector. **Considering their global coverage, the focus on indices material to investments, and shorter time horizons, these tools provide information that will help businesses around the world better understand climate risks and opportunities and strengthen their market competitiveness in the face of the changing climate.**



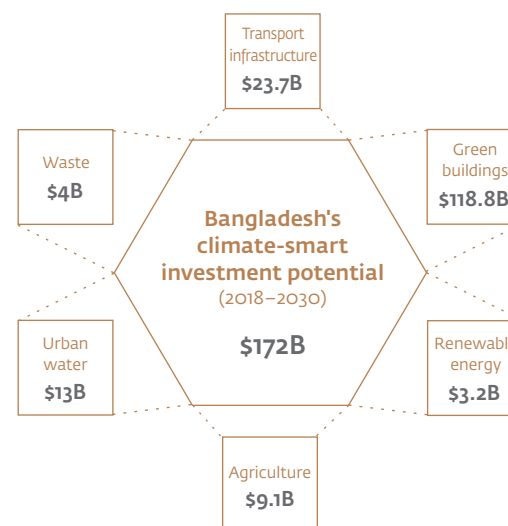
Bangladesh

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BANGLADESH

Bangladesh's estimated climate-smart investment potential in key sectors is \$172 billion between 2018 and 2030.

Bangladesh is a fast-growing economy with forecast growth rates of 6.9 percent in 2017 and 2018, driven by exports from its garments industry. This is particularly impressive in light of the slow growth in the markets upon which it depends.⁵⁹ The development of this industry has been critical to the transformation of Bangladesh's economy over the last 20 years, alleviating poverty and increasing employment, particularly for women.⁶⁰ Bangladesh has a young population—half of its 163 million people were under the age of 25 in 2016.⁶¹ The country is benefiting from this demographic dividend and is likely to achieve its goal of reaching middle-income country status by 2021.⁶²



The Climate Change Vulnerability Index ranks Bangladesh as the country most vulnerable to the impacts of climate change⁶³ and as the sixth worst affected by extreme weather events in the last 20 years.⁶⁴ Recognizing this extreme vulnerability, the government of Bangladesh has put in place more than 200 laws and bylaws to mitigate the effects of climate change, including a National Sustainable Development Strategy (2010–2020), a Climate Change Strategy and Action Plan (2009), and a Climate Change and Gender Action Plan (2013).⁶⁵ Bangladesh's NDC reflects the government's awareness of the potential impacts of climate change. It emphasizes resilience across all sectors, estimating a total investment of \$40 billion for adaptation from 2015 to 2030.⁶⁶ It has committed itself to 5 percent unconditional and 15 percent conditional reduction in emissions from the power, transport, and industry sectors. The conditional target depends on international support for capacity building, technology transfer, and financing,⁶⁷ which is where the private sector can step in.

Private sector engagement and investment is central to helping Bangladesh achieve its development objectives. In January 2017, Southern Solar Power Limited signed an agreement to set up a 200 MW solar park in Bangladesh with an estimated \$300 million investment.⁶⁸ The government is attempting to catalyze further private sector climate-smart investment through the Bangladesh Investment Development Authority. Launched in 2016, the organisation is tasked with improving the business climate of the country. It aims to establish a one-stop business service center by December 2017.⁶⁹ Other policies and government institutions also encourage sustainable, climate-smart private investment, such as an initiative by the Bangladesh Bank to incentivize private lending to SMEs and microfinance institutions that invest in green technologies. The state-owned Infrastructure Development Company Limited's initiative to finance decentralized climate-friendly energy programs, including setting up more than 3 million solar home systems in the country, has been emulated by several African countries.⁷⁰

BANGLADESH INDICATORS (2016)

Population	163 million
GDP	\$221.42 billion
GDP growth	7.10%
Inflation (consumer prices)	5.50%
Ease of Doing Business ranking	174
Foreign direct investment, net inflows (2015)	\$3.38 billion
S&P credit rating	BB-
Total greenhouse-gas emissions excluding land-use change and forestry (2014) (MtCO ₂ e)	167.71
Total greenhouse-gas emissions including land-use change and forestry (2014) (MtCO ₂ e)	196.93
Greenhouse-gas emissions rank (2012)	37
Total carbon dioxide emissions (kilotons)	48
Installed renewable energy capacity (MW)	425

NDC TARGETS

Main target	15 percent greenhouse-gas reduction by 2030
Green buildings	25 percent reduction of overall energy consumption of commercial buildings
Transportation	• 9 percent emissions reduction from transport: -9 percent unconditional and additional -15 percent conditional • Shift 20 percent of passenger traffic from road to rail by 2030
Agriculture	• Livestock: 50 percent reduction in draft animals • Fertilizers: 35 percent increase in organic fertilizer share

IFC CLIMATE BUSINESS (FY2010–2016)

Total own account	\$29 million
Green buildings	\$17.5 million



RENEWABLE ENERGY

\$3.2B

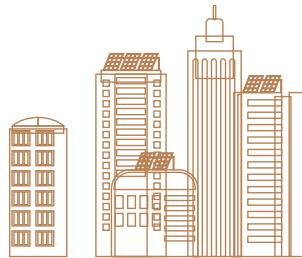
Bangladesh is the world's largest market for solar home systems, with more than 4 million units installed out of a worldwide total of about 6 million.⁷¹ These home systems have brought electricity to more than 18 million people in Bangladesh.⁷² The Infrastructure Development Company Limited provides a capital buy-down grant for the smaller solar home systems, thereby making them accessible to poorer consumers.⁷³ **There is still significant scope for growing this market** given the government's target of 100 percent electrification by 2021⁷⁴ and the 60 million people still lacking access to electricity in 2016.⁷⁵

Bangladesh's NDC commits to a 4 percent unconditional reduction in emissions from the power sector by 2030, and a 10 percent conditional reduction.⁷⁶ As of 2015, the country's power needs are met primarily by natural gas, which accounts for 63 percent of the country's electricity mix, with liquid fuels such as diesel accounting for another 29 percent, coal for 2 percent, and renewable energy for 1 percent out of the remaining 6 percent.⁷⁷ The country also pledged to obtain 10 percent of its energy from renewable sources by 2020, in line with the 2008 Renewable Energy Policy.⁷⁸ **In 2016, Bangladesh and the other members of the Climate Vulnerability Forum committed to meeting 100 percent of their energy needs from renewable sources by 2050.**⁷⁹

Bangladesh's Power System Master Plan 2016⁸⁰ pledges to overcome the challenge of limited land to maximize the country's renewable energy generation potential, committing to a target of more than 3,800 MW of domestic renewable energy generation by 2041 and proposing to take advantage of its neighbors' hydropower capacity through



energy imports. The master plan estimates that hydro, solar, wind, and other sources of renewable energy generation capacity will grow at an average rate of 6.5 percent per year to 2041.⁸¹ Private sector interest is growing, with an increase in annual investments of \$3 million in solar companies in 2012 to \$158 million in 2015 and \$223 million in 2016.⁸² Given these trends and Bangladesh's policy targets, IFC estimates an investment opportunity of \$3.2 billion in Bangladesh's renewable energy sector to 2030. The greatest potential, of **\$1.1 billion**, lies in utility-scale solar, with a further **\$850 million** in small-scale solar, **\$660 million** in biomass and converting waste to energy, **\$450 million** in wind, and **\$130 million** in small hydropower.



GREEN BUILDINGS

\$118.8B

The government of Bangladesh is prioritizing energy conservation and the greening of its buildings, reflected in its NDC and other policies. The Energy-efficiency and Conservation Master Plan aims to reduce energy consumption in new buildings, particularly in the commercial sector.⁸³ Bangladesh's Ministry of Housing and Public Works is working on releasing Green Buildings Guidelines and revising the National Building Code to promote energy-efficiency and conservation in its buildings.⁸⁴ The country's Paris Agreement targets include a reduction of 25 percent of overall energy consumed by commercial buildings by 2030.⁸⁵

Bangladesh is adding an estimated 500,000 houses in urban areas and 3.5 million in rural areas every year to bridge an annual shortfall of 5 million homes.⁸⁶ This presents a significant investment opportunity for the green buildings sector, estimated by IFC to be worth more than \$118 billion between 2018 and 2030, of which the residential sector accounts for \$100 billion and the commercial sector for \$18 billion.

INVESTMENT SPOTLIGHT

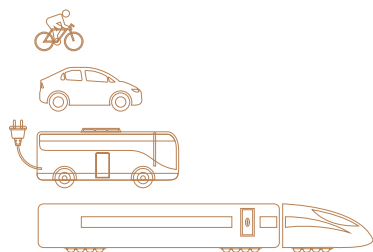


PARTNERSHIP FOR CLEANER TEXTILE (2013–2016)

IFC launched the Bangladesh Partnership for Clean Textile (PaCT) Program in January 2013, with financing of \$11 million. Supported by the Kingdom of the Netherlands, Solidaridad Network, and sponsoring international buyers, the program is helping 13 global brands and 200 textile factories implement innovations to improve resource efficiency (for more information, see box on energy-efficiency innovations in South Asia).

Since 2013, these measures have annually helped save 21.6 billion liters of water and 2.5 million megawatt-hours (MWh) of energy, reduce greenhouse-gas emissions by more than 460,400 tons of carbon dioxide equivalent, and realize cumulative cost savings of \$16.3 million. They have also helped catalyze \$39 million in additional investments in the program's member factories.

IFC partnered with Levi Strauss & Co in September 2016 to develop a global program for environmental sustainability through the PaCT Program. Pilot projects are planned in six facilities in Bangladesh, India, Sri Lanka, and Vietnam. This is the first time the program will be implemented outside Bangladesh.



TRANSPORT

\$23.7B

The transport and connectivity sector represented almost 27 percent of Bangladesh's total FY18 national budget, the highest of any sector. The sector also had the second highest number of projects, growing by 50 percent from the previous year.⁸⁷ The Outline Perspective Plan of Bangladesh's Vision 2021 seeks to upgrade the entire transport sector, especially the railway sector, and transition towards a multimodal system.⁸⁸ Other areas of focus for the government include improving rural transport and air transport,⁸⁹ establishing urban mass transport systems, and increasing the presence of high-efficiency vehicles in the country's fleet.⁹⁰

Bangladesh's NDC aims to reduce emissions from the transport sector by 9 percent unconditionally and by 24 percent with external support. This is expected to be achieved by shifting 20 percent of passenger traffic from road to rail by 2030, and increasing the climate resilience of transport infrastructure.⁹¹ The government intends to develop a mass rapid transit system and an elevated express highway in Dhaka to meet its urban transport needs.

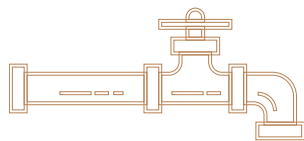
Bangladesh has also prioritized the development of its inland waterway system. The NDC Sectoral Action Plan for Transport⁹² highlights the role that the country's inland waterways can play in meeting its NDC targets, particularly through a planned regional waterway transport project.⁹³ The country is improving and developing 900 kilometers of inland waterways as part of a World Bank-supported Regional



Photo: Asian Development Bank

Connectivity and Integration Program for Bangladesh, Bhutan, India, and Nepal.⁹⁴

Accounting for Bangladesh's NDC and other transport policy priorities, as well as approved projects for the development of transport-related infrastructure, IFC estimates an investment potential of at least \$23.7 billion between 2018 and 2030.



CLIMATE-SMART URBAN WATER

\$13B

The Bangladesh government has announced its interest in seeking investment in innovative water-related infrastructure at the High-Level Panel on Water at the 2017 United Nations General Assembly.⁹⁵ Bangladesh's NDC also cites the need for such infrastructure, and emphasizes the importance of urban water management, particularly in drainage and flooding.⁹⁶

The government is working to improve water management in the country. It partnered with the Asian Development Bank to reduce water utility losses in Dhaka, covering more than 2,400 kilometers of water distribution pipes, and establishing or rehabilitating 45 district metering areas to reduce water losses in the city from 30 percent in 2012⁹⁷ to less than 10 percent in 2017.⁹⁸ The government also plans to add 11 sewage treatment plants by 2025. There is only one plant currently operational in Dhaka and its neighboring districts, which treats a tenth of the daily deposits.⁹⁹ The government of Bangladesh intends to enter into a PPP for the installation of an integrated urban water treatment system in Purbachal New Town, with an estimated total investment requirement of approximately \$70 million.¹⁰⁰

With the potential to increase the sewage treatment coverage from 20 percent¹⁰¹ in Bangladesh's urban centers to 64 percent nationally by 2030, IFC estimates an investment opportunity of more than \$13 billion in urban wastewater management between 2018 and 2030.

BRAC BANK AND THE INDUSTRIAL DEVELOPMENT LEASING COMPANY OF BANGLADESH LIMITED (2012–2014)

IFC is working with financial partners in Bangladesh to help increase access, improve affordability, and promote financing for sustainability initiatives for small enterprises. In June 2012, IFC supported Bangladesh's leading SME bank, BRAC Bank, to increase its business performance by using evaluation tools and sustainability reporting. IFC is a founding shareholder of BRAC Bank, which has provided finance of over \$1.8 billion to more than 320,000 SMEs. The bank is affiliated with BRAC, the world's largest nongovernmental development organization. With IFC's support the bank has since launched the Planet Solutions Loan—an affordable financing product to support water and energy-efficiency improvements for textiles manufacturers and technology service providers that are PaCT partners, and has undertaken water/energy audits.

Similarly, in April 2014, IFC committed to working with the Industrial Development Leasing Company of Bangladesh Limited to promote access to banking services for small businesses by improving credit approval processes, and enhancing the risk management and business development skills of the company's frontline employees. The company is now disbursing 10,000 loans worth \$370 million to SMEs. IFC is partnering with the Industrial Development Leasing Company to provide financial solutions to PaCT partners to promote investments in resource efficiency technologies. The partnership will expand the company's loan portfolio in energy-efficiency financing in the textile sector by providing technical advisory services and business development support to generate a sustainable pipeline of clients in the water and energy-efficiency sector.

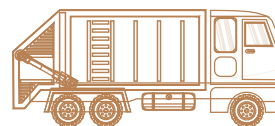


EXCELERATE ENERGY BANGLADESH LIMITED (2017)

In July 2017, IFC and Excelerate Energy Bangladesh secured debt financing to co-develop the Moheshkhali Floating Liquefied Natural Gas Project—Bangladesh’s first import terminal for liquefied natural gas. The project, which will cost \$179.5 million, will increase the country’s access to clean energy.

IFC helped arrange a debt financing package of \$125.7 million for the project, including a loan of \$32.8 million from IFC itself, and support from the CDC Group, the Entrepreneurial Development Bank (FMO), and the Japan International Cooperation Agency.

The import terminal will provide the critical infrastructure required for the country to access natural gas from global markets and enable Petrobangla, the state-owned energy company, to increase the supply of natural gas in the country by up to 20 percent. This increase will support up to 3,000 MW of power generation capacity. Construction will begin in 2017 and the terminal is expected to be operational by mid-2018.

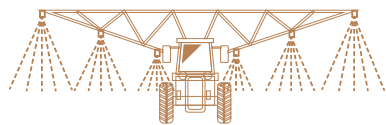


MUNICIPAL SOLID WASTE

\$4B

Bangladesh has adopted a reduce, reuse, and recycle approach to solid waste management.¹⁰² The management of urban waste is a mitigation objective set out in the Bangladesh Climate Change Strategy and Action Plan, and reinforced in the NDC.¹⁰³ The country intends to capture 70 percent of landfill gas to generate energy and increase the composting of organic waste by diverting 50 percent of managed waste from landfills to composting facilities by 2030.¹⁰⁴

With an annual urbanization rate of 3.2 percent¹⁰⁵ creating an increasing need for urban waste management, IFC estimates an investment opportunity of more than \$4 billion in municipal solid waste management between 2018 and 2030 to bring collection levels up from between 40 percent and 60 percent¹⁰⁶ currently to 80 percent in 2030.



CLIMATE-SMART AGRICULTURE

\$9.1B

Bangladesh's agricultural sector has the world's second fastest rate of productivity growth in the sector after China, at 2.7 percent per year.¹⁰⁷ It accounts for almost half of employment in the country, and contributes about 15 percent of Bangladesh's GDP.¹⁰⁸ In 2017, the agricultural sector grew by 3.4 percent,¹⁰⁹ benefiting from higher prices for crops and low international prices for fertilizers.¹¹⁰

The country's NDC pledges to lower emissions from agricultural land through a 50 percent reduction in draft animals and a 35 percent increase in the share of organic fertilizer by 2030.¹¹¹ It also intends to increase the use of climate-smart practices in rice cultivation by 20 percent, such as alternating between wetting and drying irrigation, by 2030.¹¹²

The Asian Development Bank is providing \$46 million in concessional loans to a \$58 million irrigation infrastructure project in Bangladesh, which focuses on climate-smart practices.¹¹³ In addition, the country has adopted a Master Plan for Agricultural Development in the Southern Region of Bangladesh, which estimates the need for \$7 billion worth of investments till 2021,¹¹⁴ of which \$500 million is allocated for irrigation.¹¹⁵ Policy incentives such as the agricultural loan disbursement target of \$2 billion for all banks,¹¹⁶ further boost the potential for climate-smart agricultural investment in Bangladesh to \$9.1 billion between 2018 and 2030.



GREEN DELTA INSURANCE LIMITED (2015)

IFC signed an agreement with Bangladesh's leading private insurer, Green Delta Insurance, in February 2015 to develop index-based insurance products that minimize the impact of crop losses caused by natural disasters such as drought, heavy rain, and cyclones. These products target individual farmers, agribusinesses, and financial institutions lending to farmers. The project partners are also working closely with the country's regulatory body to support the development of agricultural insurance.

The project is partly funded by IFC's Global Index Insurance Facility, a multi-donor trust supporting local markets for weather index and disaster insurance. By the end of the project, the facility expects to cover about 75,000 farmers in Bangladesh.

The project is also supported through the Pilot Program for Climate Resilience, which aims to increase the revenues of farmers and agribusinesses through sustainable and climate-smart technologies and practices.

Priorities for Bangladesh to Attract More Climate-Smart Investment

Bangladesh is the world's second largest exporter of ready-made garments after China. The sector accounts for almost 82 percent (\$28 billion) of the total exports of the country and 13 percent of the GDP, employing more than 4 million workers (of which 80 percent are women) in 4,400 garment factories.¹¹⁷ The country has a vision to expand the sector's exports to \$50 billion by 2021.

The private sector investments in Bangladesh's textiles and manufacturing sector have been the engine for impressive growth in GDP over the last decade, supported by the government's focus on creating jobs, improving living standards, and eliminating poverty. As the government works to maintain this growth performance, increased emphasis will be needed on raising the levels of investment and upgrading the policy-making practices and institutions.¹¹⁸

Energy shortages, lengthy and costly processes for obtaining an electricity connection, transport congestion, and the lack of readily available land with adequate access to infrastructure services could constrain continued growth in private sector investment. Fulfilling the energy and transport sector ambitions outlined in the country's NDC, Power System Master Plan, and Vision 2021 documents can go a long way to addressing these constraints.

An important step in facilitating climate-related investments is improving access to low-cost, long-term finance. Banks and financial services do not systematically consider climate risks in their investments. While many have environmental criteria in place for lending, this considers the impact of the investment activity on the environment, and does not consider how an investment will be affected by future climate change. Demonstration projects are essential to assuring banks of their commercial viability. The Bangladesh Central Bank has sought to address this through measures promoting the use of green finance (see box on innovative finance to scale up investments).

RENEWABLE ENERGY

Electricity generation capacity in Bangladesh has doubled since 2009, and more is needed to sustain its current pace of economic growth. In July 2015, Bangladesh generated more than 7,900 MW of electricity

BANGLADESH VENTURES FUND (2010–2017)

In June 2010, the Small Enterprise Assistance Funds and IFC launched the Bangladesh Ventures Fund as a commercial finance company to invest in SMEs in Bangladesh. IFC initially invested \$12 million to provide structured growth capital of up to \$500,000 per investment.

The Bangladesh Ventures Fund aims to invest in 300 SMEs in the country by 2020. It focuses on key high growth-potential sectors in Bangladesh that lack access to traditional financing sources. These sectors include renewable energy and energy-efficiency measures for rural households.

For example, the fund has invested \$1 million in SOLARIC Ltd., which supports energy access by providing patented micro-inverter-based solar home systems and power backup systems that optimize energy-efficiency and facilitate the use of smaller batteries, solar panels, and energy-saving appliances. This investment helped SOLARIC Ltd. to scale its operations and grow its sales to almost 58,000 solar home systems by December 2014—a revenue of \$6.7 million.¹²³

In May 2017, the fund received a follow-on commitment of \$10 million from IFC and the Climate Investment Funds’ Pilot Program for Climate Resilience. The pilot program is allocating \$110 million in grants and financing to Bangladesh, helping the country make strategic investments that contribute to climate resilience, poverty reduction, and sustainable development.

from an installed capacity of about 11,500 MW (excluding captive power).¹¹⁹ About 70 percent of the country’s power is generated from gas, but domestic gas production is expected to decline from 2017. **The government is keen to address the currently unreliable nature of grid-connected electricity, with frequent power outages resulting in industries using diesel and gas for captive generation, by expanding renewable energy capacity.**

The renewable energy sector has primarily focused on small-scale off-grid technologies, with 162,000 people directly and indirectly employed in the sector in 2016.¹²⁰ Bangladesh’s renewable energy targets will shift the emphasis to utility-scale investments, auctions for independent power producer investment on government land, and fixed tariffs for private investment. Solar power parks and solar zones as part of planned economic zones are options being considered to enable utility-scale investments.¹²¹ **The government can bolster private investment in this sector by improving access to land for solar and wind installations above 10 MW, enhancing profitability for companies facing high generation costs by raising feed-in-tariffs, and providing clarity on grid extension to encourage mini-grid investors.**

★ GREEN BUILDINGS

Bangladesh is among the most densely populated countries in the world. With 1,237 people per square kilometer, land is a scarce commodity. Its cities continue to grow, which means significant construction will be needed to meet commercial/industrial needs and address housing shortages. Multi-unit residential buildings are expected to be the primary area of growth in the residential sector, with an emphasis on affordable housing. **To encourage the private sector to get involved in the green buildings sector, the government has created policy incentives, including reducing the tax rate from 20 percent to 14 percent for garment companies whose factories have internationally recognized green buildings certifications.**¹²² The government is planning to launch a comprehensive building code, with an emphasis on green and resilient buildings. It is also important to raise awareness among developers of the long-term benefits of green buildings—2 percent upfront investment in green building design can result in lifecycle savings of 20 percent of the total construction costs.



**ENERGY PAC AGRO-G LIMITED,
SUPREME SEED, ACI LIMITED, AND LAL
TEER LIMITED (2013)**

IFC is providing advisory and financial support for a partnership between the country's largest private seed companies and nongovernmental organizations to produce and market eight new varieties of stress-tolerant rice seeds that can withstand extreme weather conditions, while developing contract farming and building farmers' overall capacity.

To date, more than 67,000 farmers and 600 dealers and retailers have gained a better understanding of stress-tolerant seeds through the initiative, expanding the market for high-yield seed varieties. These farmers have reported a 15 percent increase in revenue compared to farmers who did not receive the training.

★ **TRANSPORT**

The government is seeking a modal shift in transport to address congestion and facilitate trade. It has prioritized investments in the Padma Rail Link, the Chittagong-Dhaka highway—an essential trade route, and metro rail developments. This further supports its plans to establish economic zones in Bangladesh to boost industry, employment, production, and export. It is developing 66 zones, 11 of which are expected to be privately owned.¹²⁴ Robust transport links are essential to the success of such economic zones. Electric vehicles provide an as-yet untapped opportunity, but Bangladesh's private sector is exploring the possibility of applying its expertise in solar home systems and solar-powered battery technology to rickshaws. Given the scale of investment needed, the government has prioritized private sector involvement through its Public-Private Partnership Office, with bids being sought for the Dhaka Bypass and several others in the project development or procurement stage in 2017.¹²⁵ Expediting and streamlining the procurement process will help to encourage PPPs.

★ **CLIMATE-SMART URBAN WATER**

Economic growth driven by the garment sector and manufacturing has increased air, water, and land pollution in Bangladesh. The industry discharges 91 million cubic meters of wastewater every month, either untreated or partially treated. Because groundwater is underpriced, it has been overused, further affecting aquifer salinity and subsidence. Initial estimates suggest the textile industry may be consuming almost as much groundwater as the capital city's 12 million inhabitants.¹²⁶ As a result, in FY15 the government announced a 1 percent environmental protection surcharge ("green tax") on all products polluting the environment. Establishing PPPs can also play a significant role in addressing this challenge. Such partnerships can set up and run effluent treatment plants that can help reduce pollution entering the water system.

★ **CLIMATE-SMART AGRICULTURE**

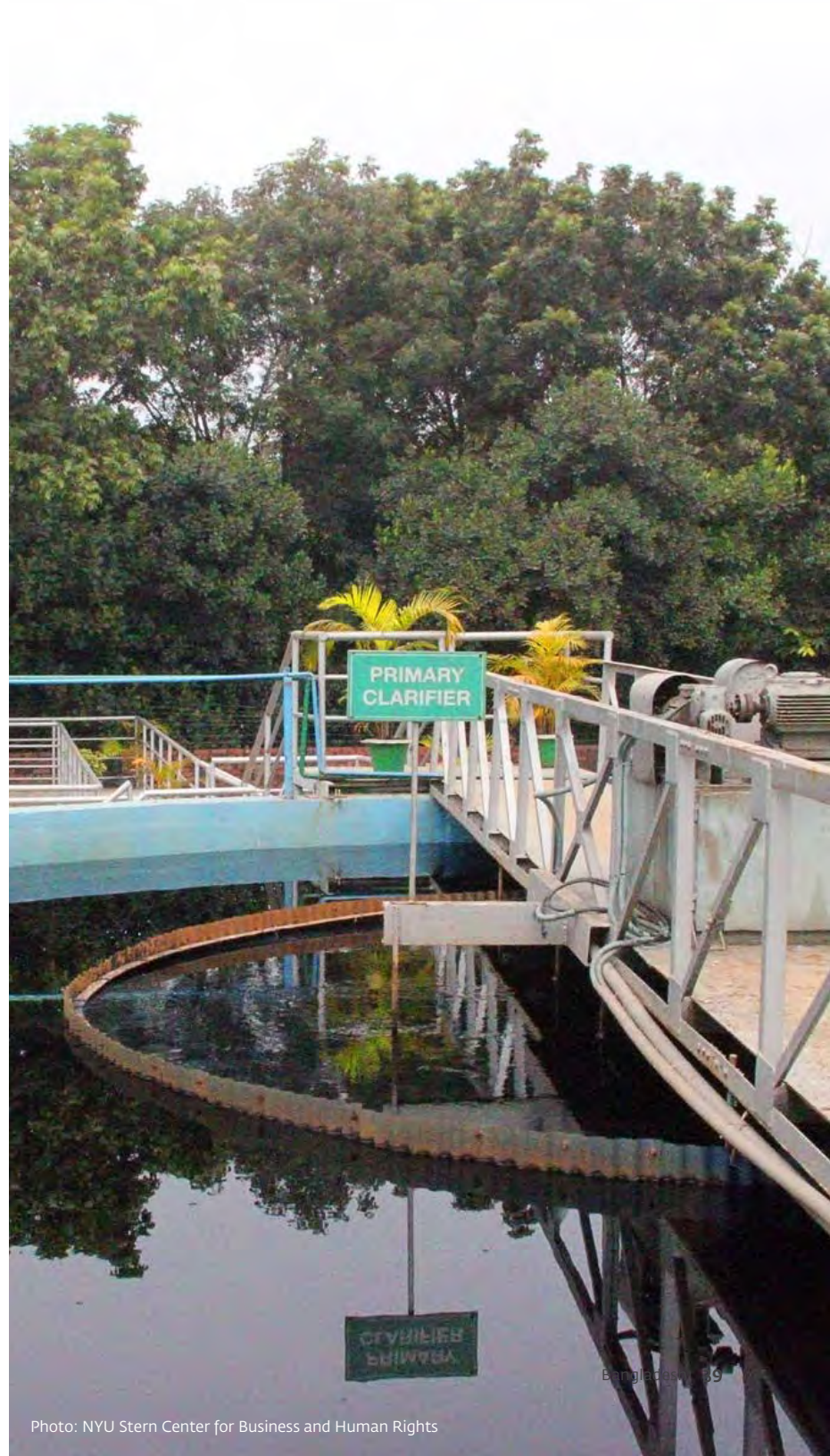
Bangladesh is losing 1.75 percent of its arable land each year as a result of increased flooding, saltwater intrusion, drought, and other natural disasters. As a result, lenders have been unwilling to extend finance to the sector without sufficient natural disaster risk-mitigating measures.

To encourage investment in the sector, the government has focused on agribusiness as a priority within the national Board of Investment.¹²⁷ Policy incentives include an agricultural loan disbursement target of \$2 billion for all state-owned and private banks, an interest rate ceiling for agricultural loans, and a requirement for private banks to disburse 2.5 percent of their total loans to the agricultural sector.¹²⁸

The private sector is starting to gain momentum in agriculture, with first movers exploring stress-resistant crop varieties, flood protection and insurance for farms and crops, and environmentally friendly fertilizers and pesticides.

Recommendations

- 1 Simplify and streamline land procurement processes, including by strengthening property rights.
- 2 Promote rooftop solar investments, particularly at manufacturing facilities, to address land availability constraints, through regulations on net metering and grid connection.
- 3 Launch and enforce comprehensive green building codes, complemented by a policy on voluntary certifications for all new constructions.
- 4 Strengthen groundwater pricing to encourage investment in water-efficient irrigation and water conservation.
- 5 Establish a PPP program to establish effluent treatment plants to reduce water pollution and promote wastewater recycling.



From Water ATMs to “Prosumers”: Innovative Climate Business Models in South Asia

The pace of innovation in climate business models is accelerating. The private sector increasingly views climate change adaptation and mitigation as a source of profit. Innovative business models enable companies to capture this profit while addressing the twin issues of global greenhouse-gas emissions and sustainable development. These new business models create markets, address various aspects of climate change, and even leapfrog over development challenges of the past by using technology to reach different customers faster.

From agriculture to renewable energy, climate business models in South Asia are responding to advances in technology, using public resources in new ways, and turning to customers as agents of change.

UBER FOR TRUCKS IN INDIA¹²⁹

Blackbuck is an Indian technology company focused on business-to-business logistics solutions for long-haul trucking. Its technology platform facilitates the booking of freight for inter-city transportation between shippers and truckers and is helping maximize efficiency while minimizing downtime for trucks. By reducing the number of trips taken by trucks with empty or partially full loads, Blackbuck is effectively reducing greenhouse-gas emissions in India. In March 2017, IFC provided \$10 million in equity investment for Blackbuck.

PRIVATIZING WASTE MANAGEMENT IN BHUTAN

From 2000 to 2010, Bhutan’s urbanization rate was the highest in South Asia at 5.7 percent. In 2015,

nearly 40 percent of the population was urban.¹³⁰ Consequently, challenges arose regarding waste management as the municipal services could not meet the demand. Systems for separating recyclables and compost were nonexistent. Then, in 2010, two local entrepreneurs established Greener Way, the first private waste management firm in Bhutan. As of 2013, the company processes 540 metric tons of paper, 240 metric tons of PET plastic bottles, and 360 metric tons of other plastics each year.¹³¹ In 2013, one of the cofounders was honored as the Environmental Entrepreneur of the Year by the Prince’s Youth Business International.

WATER ATMS IN INDIA

Piramal Sarvajal, the winner of the 2016 Financial Times/IFC Transformational Business Award, is



promoting water security by designing and deploying innovative technology to ensure safe water access for India's rural villages. The company installs local, remotely tracked water purification systems, and has built a strong network of "water ATMs"—solar-powered, cloud-connected vending machines that dispense water for villagers at the swipe of a smart card. The ATMs track every transaction that takes place, enabling sophisticated market forecasting and 24-hour access to water, as well as the possibility of providing targeted subsidies to certain villages through government-run programs.¹³² This model uses innovative technology to provide access to a basic resource in rural areas and holds a lot of promise for replication elsewhere in the region.

LEASE-TO-OWN SOLAR IN NEPAL¹³³

Gham Power designs hybrid grids that integrate photovoltaic (and, in some cases, storage) with the existing diesel grid. Targeting businesses that spend heavily on diesel generators, such as hospitals, factories, and banks, Gham Power acts as the holding company and legal owner of the installed photovoltaic systems. The end-user is usually offered a lease-to-own option for buying the solar panels at the end of the lease term of 10 years. The lease period coincides with a bank loan from Nepal's Clean Energy Development Bank, which finances up to 70 percent of the project cost. Gham Power pays the interest on the bank loan with the solar assets

as collateral. Part of the business model includes a direct tie-in between the solar electricity generation and local revenue generation for the business.

FARMING AS A SERVICE IN INDIA¹³⁴

EM3 Agri Services leases advanced technologies and equipment to Indian farmers on a pay-per-use basis, ensuring accessibility and affordability. Its laser-leveling machine has reportedly reduced water use by almost 30 percent, and its power harrows increased crop productivity by up to 20 percent. By introducing new technologies, EM3 Agri is making the Indian agricultural sector more efficient and environmentally friendly. Moreover, its business model is increasingly gaining traction with investors.

"PROSUMERS" IN BANGLADESH¹³⁵

An estimated 65 million people in Bangladesh cannot access a central power grid. ME SOLshare aims to address this problem by developing peer-to-peer trading networks for power produced from rooftop solar. Customers who produce electricity (i.e., "prosumers") can sell power into a micro-network where it is available for neighbors to buy, free of any contract with a utility. The company can verify online peer-to-peer transactions with the help of a black box called a SOLbox located in each household and mobile phones connected to the largest mobile banking network in the country, bKash.¹³⁶

ELECTRIC TWO-WHEELERS IN INDIA¹³⁷

Ather Energy is developing India's first local electric two-wheeler with a touchscreen. With built-in navigation and a digital speedometer, the Ather S340 is not a typical two-wheeler. Not only is Ather incorporating cutting-edge electric vehicle technology, but it is also taking a page out of Tesla's book in developing a business model for a climate-friendly product for wealthier consumers. Marketed to first adopters, the Ather S340 is available at a premium and designed to appeal to a desire for a high-performing vehicle, just like the standard Tesla models. Production is expected to begin in Bangalore in early 2018.

Many other innovative business models have already shown success or are under development. These include aggregating corporate demand for distributed rooftop solar in India¹³⁸ and using waste heat from diesel-electricity production to desalinate drinking water in the Maldives.¹³⁹ As they scale and replicate, innovative climate business models offer new investment opportunities in South Asia and elsewhere.



Bhutan

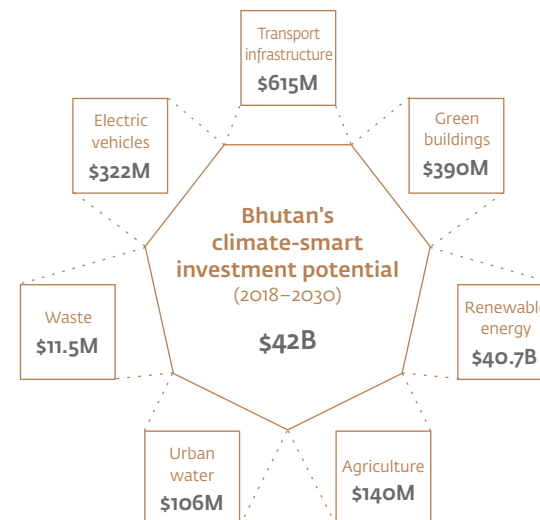
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BHUTAN



Bhutan's estimated climate-smart investment potential in key sectors is \$42 billion from 2018 to 2030.

Bhutan, a small landlocked, mountainous kingdom nestled between India and China, is Asia's fastest-growing economy, with GDP expected to increase by 8.2 percent in 2017.¹⁴⁰ This growth is driven primarily by investments in hydropower,¹⁴¹ which contributes about a fifth of GDP.¹⁴² Rather than focusing on GDP, however, Bhutan uses gross national happiness as a well-rounded metric to assess its people's welfare. Gross national happiness embeds sustainability within the constitution, the culture, and every economic activity of the country, emphasizing equitable and environmentally responsible development.¹⁴³ Every policy, target, and project proposed in Bhutan is systematically assessed for its



impact on gross national happiness before it can be implemented.¹⁴⁴ This approach has informed policies such as ensuring rural farmers get 100 units of free electricity¹⁴⁵ to reduce their dependence on fuelwood, which accounts for 94 percent of rural household energy consumption;¹⁴⁶ planting new trees through a program called Green Bhutan; and subsidizing the purchase of LED lights and electric vehicles.¹⁴⁷

Bhutan's NDC also reflects this emphasis on sustainability, building on the country's commitment to remain carbon neutral. It is now the only carbon-negative country in the world—72 percent of Bhutan's land is forested, absorbing three times the amount of carbon that the country emits.¹⁴⁸ The government is constitutionally committed to retaining the carbon sink function of its forest cover, prohibiting the country from reducing its forest cover below 60 percent at any time.¹⁴⁹ The NDC also outlines the development of a low-carbon transport system, diversification of its renewable energy sources, sustainable waste management and zero-waste practices, and climate-smart agriculture and livestock farming practices, all of which open up opportunities for private sector investment. Given its geographic location, Bhutan recognizes its vulnerability to the adverse impacts of climate change, and thus also places great emphasis on enhancing resilience across all sectors.

Bhutan is a significant exporter of hydropower, selling much of the surplus electricity it generates to India. The country has an estimated 25,000 MW of commercially viable potential hydropower resources, of which 6 percent has already been developed, and there is significant scope for further investment.¹⁵⁰ There are five major hydropower projects in operation in Bhutan, all of which are run-of-river schemes: Tala (1,020 MW), Chhukha (336 MW), Dagachhu (126 MW), Basochhu (64 MW), and Kurichhu (60 MW). The \$200 million Dagachhu project, which began operating in 2015, was the first PPP in infrastructure investment in Bhutan.¹⁵¹

BHUTAN INDICATORS (2016)

Population	797,765
GDP	\$2.24 billion
GDP growth	6.20%
Inflation (consumer prices)	3.30%
Ease of Doing Business ranking (2018)	71
Foreign direct investment, net inflows	\$10.8 million
S&P credit rating	n/a
Total greenhouse-gas emissions excluding land-use change and forestry (2014) (MtCO ₂ e)	1.53
Total greenhouse-gas emissions including land-use change and forestry (2014) (MtCO ₂ e)	-2.26
Greenhouse-gas emissions rank (2012)	169
Total carbon dioxide emissions (kilotons)	156
Installed renewable energy capacity (MW)	1,614

NDC TARGETS

Main target	6.3 MtCO ₂ e absolute target by 2025
Renewables	Hydro offset 22.4 MtCO ₂ e per year by 2025 through export of hydropower
Green buildings	Integration of low-emission strategies in urban and rural settlements through green buildings and climate-smart cities
Agriculture	- Develop and promote climate-smart agriculture - Integrate sustainable soil and land management technologies - Promote climate-smart livestock farming

IFC CLIMATE BUSINESS (FY2010–2016)

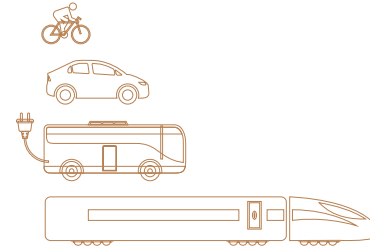
Total own account	\$3 million
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RENEWABLE ENERGY

\$40.7B

Bhutan's domestic and export energy needs are almost entirely serviced by cheap, abundant hydropower, the major driver of its economy. The country's 12th Five-Year Plan (2018–2023) prioritizes economic diversification, building on the solid base of hydropower exports,¹⁵² and its NDC commits Bhutan to promoting other sources of renewable energy.¹⁵³ The latter builds on a minimum target of 20 MW of non-hydro renewable energy generation by 2025, as outlined in the country's Alternative Renewable Energy Policy of 2013. Solar, wind, and biomass generation are each expected to account for 5 MW of generation, and solar, thermal, and biomass energy systems each have a target of 3 MW, signaling opportunity for private developers.¹⁵⁴ Small hydro will also be developed if needed.¹⁵⁵ This helps to address energy deficits in winter due to reduced power supply from the run-of-river schemes, when Bhutan imports some power from India. While the majority of Bhutan's energy needs will continue to be met by hydropower for the foreseeable future, IFC estimates an investment opportunity of \$40.6 billion in large hydro, to reach an installed capacity of 25,000 MW, and \$72 million in other sources of renewable energy generation between 2018 and 2030.



TRANSPORT

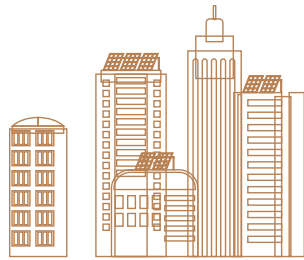
\$937M

Bhutan's NDC emphasizes the need for a low-carbon transport system, drawing from its 2040 Integrated Strategic Vision. The transport vision cites accessibility, economic efficiency, safety, and environmental sustainability as its goals.¹⁵⁶

Bhutan anticipates building an additional 2,500 kilometers of rural roads by 2040,¹⁵⁷ expanding and improving its highways, introducing inter- and intra-city public transport, and developing the civil aviation sector.¹⁵⁸ The government intends to develop three dry ports and seven additional domestic airports.¹⁵⁹

To further eliminate emissions, transform its capital—Thimphu—into a “clean electric” city,¹⁶⁰ and reduce its dependence on fossil fuel imports, Bhutan plans to replace the country's entire fleet of cars with electric vehicles, with a medium-term target of 6,000 electric vehicles by 2020.¹⁶¹ The government has encouraged Nissan Motor Co.¹⁶² and Mahindra & Mahindra to help with the first step in achieving this goal, by replacing the public sector fleet of vehicles and taxis in Thimphu with electric vehicles.¹⁶³ The government has provided tax exemptions for the import of electric vehicles to further promote their uptake.¹⁶⁴

IFC estimates a total investment opportunity of \$615 million in transport infrastructure and \$322 million to green Bhutan's fleet with electric vehicles between 2018 and 2030.



GREEN BUILDINGS

\$390M

The building sector accounts for 16 percent of Bhutan's total energy consumption. To reduce this, the government has developed the Building Energy-efficiency Code of Bhutan, modeled on India's Energy Conservation Building Code, detailing performance benchmarks.¹⁶⁵ In addition, Bhutan has introduced voluntary Green Buildings Guidelines. A study commissioned by the Department of Renewable Energy recommends making them legally binding to further open up opportunities for private investment.¹⁶⁶

The 11th Five-Year Plan set a goal to build 75 eco-efficient and disaster-resilient buildings between 2013 and 2018. This positive policy signal, in addition to the impetus enshrined within the Green Buildings Guidelines, underpins IFC's expectation of continued growth in green buildings to reach 15 percent of all residential buildings and 20 percent of all commercial buildings in Bhutan by 2030, particularly as the government seeks to meet the growing need for affordable housing. IFC estimates an investment opportunity of almost \$390 million in the green buildings sector between 2018 and 2030, of which \$50 million will be in commercial buildings and \$340 million in residential buildings, offering a business opportunity for construction companies and property developers.

INVESTMENT SPOTLIGHT



MOUNTAIN HAZELNUT VENTURE PRIVATE LIMITED (2015)

IFC, in partnership with the Asian Development Bank and Global Agriculture and Food Security Program, provided a \$12 million financing package in 2015 for Mountain Hazelnuts to expand its hazelnut production. This was IFC's first project in Bhutan's agribusiness sector.

Mountain Hazelnuts aims to plant 10 million new hazelnut trees across Bhutan that will help store up to 1.5 million metric tons of carbon dioxide and improve the local environment. The company provides farmers with shrubs, agricultural inputs, and training, and arranges for farmers without land to lease plots from the government. Staff monitors regularly visit the farms to record data that they send to headquarters via smartphones to ensure rapid response to issues with irrigation or pests. The trees are planted on degraded land and deforested foothills to reduce erosion. The project is expected to help enable Mountain Hazelnuts to integrate 15,000 farmer households, mostly located in Bhutan's poorer eastern regions, into the international supply chain. These farmers will sell their nuts at a guaranteed price that is expected to double their incomes. In addition, the project will help create 400 direct jobs while supporting 12,000 indirect jobs. Up to 15 percent of Bhutan's population is expected to directly benefit from the project.

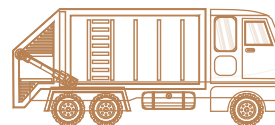


THIMPHU PARKING PPP (2014)

The government of Bhutan aims to create an efficient, safe, and equitable urban transport system to encourage use of public transportation. Thimphu City, the capital of Bhutan, is growing quickly and faces severe congestion. To address these challenges and prepare for future growth, the Thimphu City Municipality partnered with IFC to develop multi-level car parks, offering at least 550 parking spaces. The project opens up vital road space by augmenting the off-street parking supply and creating road space for deploying mass public transportation. The project is also expected to generate \$230,000 of revenue for the city each year.

IFC developed a larger, city-wide parking plan for Thimphu and managed the bidding of the PPP tender process. The project will mobilize about \$8 million of private sector investment.

Thimphu Parking is the first PPP to develop urban infrastructure in the country, and has cleared the way for more projects in this area, including mass public transportation vital to sustainably growing the city. More importantly, it has reduced congestion and made life easier for the 110,000 Bhutanese who live in Thimphu.

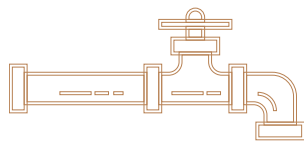


MUNICIPAL SOLID WASTE

\$11.5M

In 2013, 70 percent of Bhutan's population lived in rural areas; however, by 2040 an estimated 75 percent of the population will be living in urban areas.¹⁶⁷ Waste management is therefore increasingly becoming a priority. The National Environmental Commission recognizes the impact of changing consumption patterns on waste generation and has introduced the Waste Prevention and Management Act Regulation (2012), which was amended in 2016.¹⁶⁸ The regulation promotes three principles: reduce (waste reduction through policies to change consumption habits), reuse (waste segregation to promote reuse), and recycle (opportunity for compost plants to help recycle high organic content in municipal solid waste).¹⁶⁹

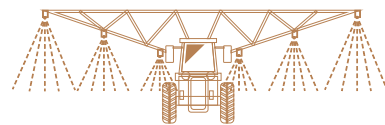
The government of Bhutan is supporting integrated waste management strategies. For example, the Bhutan Trust Fund for Environmental Conservation recently approved a high-profile zero-waste project in the Samdrup Jongkhar region, granting about \$26,000 for its implementation between 2017 and 2019.¹⁷⁰ In addition, waste as a sector is increasingly attracting private initiatives, especially in recycling and management,¹⁷¹ such as Thimphu-based private waste company Greener Way¹⁷² and The Green Road,¹⁷³ which reuses plastic waste for paving roads. IFC estimates an investment opportunity of \$11.5 million in solid waste management between 2018 and 2030 in Bhutan.



CLIMATE-SMART URBAN WATER

\$106M

The water sector is an integral part of Bhutan's NDC, which emphasizes the need to safeguard its water security and ensure water sources and uses are sustainable. The Water Act of Bhutan (2011) grants everyone the right to safe, affordable, and sufficient access to water, emphasizing integrated water resource management and the need for effluent discharge and water quality standards.¹⁷⁴ Bhutan's Water Vision 2025 targets universal coverage of safe water supply and sanitation in both rural and urban areas. The government has already made great strides towards this goal, with nearly 63 percent of the population having access to sanitation and 98 percent with access to water as of 2015.¹⁷⁵ However, given the growing urbanization challenge, coupled with the universal access policy, wastewater treatment provides a significant opportunity for urban water management. **Increasing the percentage of wastewater treated from zero¹⁷⁶ to 64 percent by 2030 represents an investment opportunity of almost \$106 million between 2018 and 2030.**



CLIMATE-SMART AGRICULTURE

\$140M

Bhutan emphasizes the role of agriculture in meeting its NDC as it is the sector with the highest emissions and employs 58 percent of the workforce as of 2015.¹⁷⁷ The government has prioritized resilience in the sector, because crop production and livestock are highly vulnerable to the impacts of climate change and can affect the country's food security. The NDC highlights the government's intention to pursue mitigation strategies by promoting sustainable land management, improved livestock management, and organic agriculture, thereby creating climate-smart investment opportunities.

Bhutan's National Irrigation Master Plan¹⁷⁸ seeks to enhance food security through efficient irrigation practices that reduce emissions and water use. Investments in such practices will support growing total agricultural production from 115,000 metric tons to 317,000 metric tons by 2032 and present an opportunity to increase the national self-sufficiency of paddy farming from 50 percent to 75 percent,¹⁷⁹ while efficiently irrigating an additional 140,000 acres of cultivable land over the period.¹⁸⁰ In addition, climate-smart irrigation is expected to create rural jobs and spur development of livestock and agribusiness ventures, including in food processing. **The Master Plan estimates an investment opportunity of \$140 million from 2016 to 2031 in irrigation-related infrastructure and services.**

Priorities for Bhutan to Attract More Climate-Smart Investment

Bhutan's innovative approach to development has been guided by its philosophy that economic growth must be balanced with social progress, cultural preservation, and environmental protection, all within the framework of good governance. Forward-looking policies guided by this approach, combined with political stability, an abundance of cheap power, and investments in social programs, have been instrumental in sustaining Bhutan's rapid climate-smart economic growth. Recognizing that this growth is too dependent on hydropower projects, the government is working to diversify the nation's economic base.

Although Bhutan enjoys free trade with India, the constraints and associated high costs of covering a small market size (21 listed companies and a market capitalization of \$382 million)¹⁸¹ are compounded by difficult topography and low population density, making it difficult to scale up private investment. Small businesses dominate the domestic private sector, but their growth is constrained by limited access to finance and markets due to deficiencies in transport, logistics, customs procedures, marketing, and policies to encourage competition.¹⁸² To address this, the government has prioritized improving transport infrastructure and engaging these enterprises in “clean manufacturing,” including food processing and the manufacture of hydropower-related parts and maintenance, in line with its NDC priorities and capitalizing on “Brand Bhutan.”

The public sector remains dominant in the economy, particularly in sectors such as energy, banking, transport, and infrastructure, accounting for almost half of all jobs outside agriculture. To increase private participation in the country's development, the government of Bhutan issued a PPP policy in 2016. This policy institutionalizes, regulates, and further incentivizes private participation in infrastructure development projects in transport, buildings, special economic zones, industrial parks, and other sectors.¹⁸³ While private sector participation has since increased in the development of hydropower, this has mostly been in subcontracting during the construction phase.¹⁸⁴



The government has also endorsed green public procurement principles and is using these to underpin its tenders, further enabling climate-friendly investments.¹⁸⁵ It received European Union-funded assistance for green public procurement through the Switch Asia program, which developed a strategic approach to help the government enhance public demand for sustainable goods, services, and infrastructure.¹⁸⁶ A recent tender for the supply of solar home lighting and solar street lighting systems with complete accessories demonstrates this and the government's commitment to meeting its non-hydro renewable energy target.¹⁸⁷

While many of the necessary enabling conditions exist to enable climate-friendly private investment, the pace of progress is constrained by investments being approved on a case-by-case basis. Even though the Doing Business 2018 report finds Bhutan to be the easiest country in South Asia to do business,¹⁸⁸ attracting investment at the scale identified will require strengthening insolvency rules, protecting minority investors, and streamlining processing of environmental clearances and construction permits, which are seen as among the most challenging aspects of business regulation that hamper private sector investment in Bhutan.¹⁸⁹ Moreover, the foreign direct investment policy places limits on ownership and investment in key sectors,¹⁹⁰ and as such, demonstration projects are needed to build confidence and attract investors. As the first financial institution in the country to adopt environmental and social policies in lending operations, Bhutan National Bank is both providing a demonstration to other lenders and enabling increased lending to climate-related sectors. However, regulation and/or incentives may be needed to level the playing field and increase uptake of such practices by other financial institutions.

Recommendations

- 1 Introduce e-permitting and procurement systems to help simplify and streamline processes, particularly for the construction sector.
- 2 Develop demonstration PPP projects in non-energy areas such as climate-resilient transport infrastructure and urban waste water treatment to help diversify the economic base, increase business confidence, and enable further replication and scale.
- 3 Involve private companies in establishing charging points for electric vehicles through tenders or PPPs and ensure standardization of charging points.
- 4 Strengthen the implementation of green buildings by making the Green Building Guidelines binding, either through legislation or regulation.
- 5 The Royal Monetary Authority of Bhutan could participate in the Sustainable Banking Network to help promote environmental and social risk management policies for use by the entire banking sector and to create a level playing field.



Bhutan

Innovative Finance to Scale Up Investments

To increase investment, the governments of developing countries are looking at ways to leverage their public sector spending to attract private investment. Private investors are already investing large sums of money in the low-carbon economy in South Asia, but much more investment is needed. Well-designed financial instruments and appropriate public support that reduce risk for private investors could play a central role in global efforts to address the adaptation and mitigation needs of developing countries.

GREEN BONDS

More than \$3 trillion is needed to meet India's climate change mitigation targets by 2030, and about half of the total investment is expected to come from the private sector. Green bonds are expected to play an important role in financing the Indian government's vision of transitioning to a low-carbon economy.

India's green bond market is rapidly expanding: at the beginning of 2017, it was ranked among the top 10 green bond markets worldwide,¹⁹¹ with \$3.6 billion in debt outstanding.

To catalyze the national green bond market, the Indian Green Bonds Council was formed in late 2016, and in June 2017, the Securities Exchange Board of India released guidelines for listing green bonds to help ensure greater transparency and certainty in the Indian green bond market.

In the past three years, IFC has committed about \$1.4 billion in climate-smart projects in India, of which \$260 million was used to help its clients in India issue green bonds, through "Masala" bonds. In 2015, IFC issued the first green Masala bond¹⁹² on the London Stock Exchange. The bond raised \$47.2 million for private sector investments that address climate change in India, and the proceeds were invested in a green bond issued by Yes Bank, one of India's largest commercial banks, for funding renewable energy and

energy-efficiency projects. The market's appetite for Masala bonds is increasing as more investors accept the risks associated with the rupee. As of September 2017, four green bonds had been issued by Indian issuers on the London Stock Exchange, including a five-year masala bond issued by the Indian Renewable Energy Development Agency Limited, raising nearly \$300 million to be used towards financing renewable energy projects across India.

Municipalities and other state-owned entities in South Asia such as Energy-efficiency Services Limited in India (see box on energy-efficiency innovations) could also tap into this market by issuing green bonds to help finance the low-carbon transition. India's Ministry of Urban Development has already granted a 2 percent interest subsidy to incentivize municipal issuance.¹⁹³

GREENING THE FINANCIAL SYSTEM

Launched in 2012, the Sustainable Banking Network is a community of financial sector regulators and

industry associations from 34 emerging markets⁹⁴ that drives financial policy regulation in many emerging markets. IFC supports this network and serves as its secretariat. The members aim to embed sustainability within the financial market. Regulator and industry-led initiatives and innovation are transforming the financial sectors of many emerging economies, changing private sector behavior, and unlocking new sources of funding to address climate change challenges and meet the Sustainable Development Goals.

The South Asian member countries are Bangladesh (Bank of Bangladesh, founding member, banking regulator, 2012), India (Indian Banks Association, banking association, 2016), Nepal (Nepal Rastra Bank, banking regulator, 2014), and Sri Lanka (Central Bank of Sri Lanka, banking regulator, 2016).

Bangladesh has made good progress on achieving the network's goal, having integrated sustainable finance into banking supervision and promulgated



reporting requirements. Bangladesh Bank has used monetary policy instruments to promote the extension of credit for climate resilience and sustainability objectives. It has also updated its environmental and social risk management guidelines for banks and financial institutions. The bank has been working with IFC on establishing green finance initiatives to meet Bangladesh's Paris Agreement targets.¹⁹⁵

In emerging markets, the success of the green bond market to raise capital for green projects is stimulating strong interest in a growing number of countries to develop national frameworks that link international good practice to local priorities. Financial sector regulators in these markets, including members of the Sustainable Banking Network, are therefore increasingly involved in the global dialogue and knowledge exchange to align definitions and increase cross-border collaboration.

INNOVATIVE FINANCIAL PRODUCTS

In 2014, the [Global Innovation Lab for Climate Finance](#)¹⁹⁶ was established to identify, design, and pilot new climate finance instruments to address financing challenges that projects face. These instruments can build new markets, attract new investors, and help unlock new climate-friendly investment in developing countries.

Today, the lab comprises four programs: the Global Innovation Lab for Climate Finance, the

India Innovation Lab for Green Finance, the Brazil Innovation Lab for Climate Finance, and the Fire Awards for Sustainable Finance. As of 2017, these programs have launched 11 instruments, which have mobilized \$822 million.

Recognizing the need for innovative financial products, the Indian, U.S., and UK governments launched the India Lab in 2015 as a sister initiative of the Global Lab. In its first cycle, three instruments were selected for analysis and further development. All three instruments addressed challenges in renewable energy, such as scale and currency risk.

- The Rooftop Solar Private Sector Financing Facility aims to lower the cost of financing for developers of rooftop solar projects, by providing long-term debt financing through aggregation, and ultimately securitization. This instrument has been approved but has yet to be developed further.
- Loans4SME is a lending platform to help small businesses that deliver renewable energy and energy-efficiency raise debt finance. Loans4SME has partnered with 50 lenders, including banks, non-banking financial companies, venture debt funds, and wealthy individuals. The platform closed about 20 transactions worth about \$6.2 million by mid-2017.
- The FX Hedging Facility expects to facilitate large-scale foreign investment into renewable energy in India by providing a cheaper currency hedging

solution. Currency risk—the risk of unexpected devaluation when investing in a foreign currency—is one of the main risks facing potential foreign investors in renewable energy as most evaluate returns in hard currency. The FX Hedging Facility may reduce the cost of currency hedging by 30 percent and has the potential to mobilize a minimum of \$9 of foreign debt per dollar of donor grant. Discussions are under way on rolling this out.

The Global Lab has also helped develop instruments focused on driving sustainable investment in South Asia, such as:

- The Oasis Platform, which aims to provide access to transparent and standardized analytics to enable and improve insurance markets in regions vulnerable to extreme climate-related events.
- Climate Investor One, which provides vital early-stage development services to help build a pipeline of renewable energy projects in Africa, Asia, and Latin America and mobilize private sector financing.
- Energy Savings Insurance, an insurance product for projected savings in energy-efficiency projects undertaken by small businesses in seven Latin American countries. In 2016 the India Lab endorsed applying this concept in the Indian context.



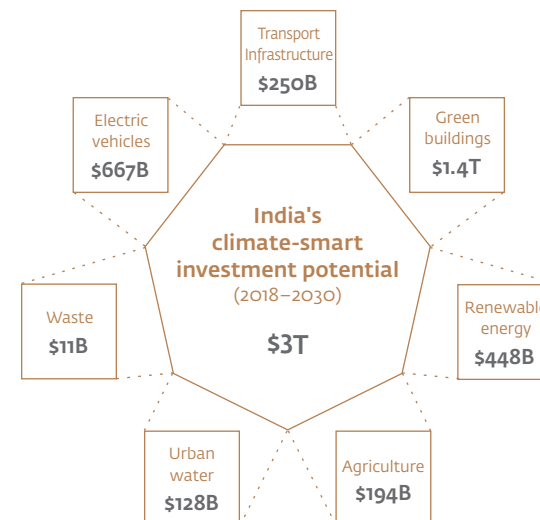
India

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INDIA

India's estimated climate-smart investment potential in key sectors is more than \$3 trillion from 2018 to 2030.

With a population of 1.3 billion,¹⁹⁷ the world's third largest economy according to purchasing power parity,¹⁹⁸ and a young, large, and growing labor force, India is a significant market for the private sector whose growth story has been avidly tracked across the world. However, this trajectory will require large investments in energy, transport, agriculture, and infrastructure to lift 400 million people out of poverty.¹⁹⁹ The Indian government has committed itself to developing sustainably, as reflected in its ambitious Paris Agreement targets.



The Indian government is pursuing an agenda of “development without destruction,”²⁰⁰ with a target to reduce the emissions intensity of its GDP by about 35 percent from 2005 levels by 2030. India’s NDC reflects the government’s ambitious domestic policy targets for renewable energy, urban infrastructure, and industry. It also recognizes the challenges that climate change will pose for a country with diverse geographies, including coastal areas and the Himalayan region, and a large agricultural sector. As India works to deliver electricity access to the 244 million citizens that are currently without²⁰¹ and address rapid urbanization, this creates business opportunities. With India’s urban population expected to grow to 590 million, or 40 percent of the total population, by 2030,²⁰² cities will be paramount to reducing the climate impact of Indian development, through low-carbon investment opportunities in urban waste, water, mobility, and electricity use.

The country’s private sector is responding quickly to the opportunities created by the NDC and domestic policy goals and is taking every chance to make climate-smart investments marketable. Following the government’s implementation of supportive policies, private firms are dominating in the development of solar projects in India, thanks to strong financial engineering capability, more efficient operations, and higher risk-taking ability.²⁰³ As part of the Indian government’s RE-Invest Summit in 2015, 293 companies pledged to build a total of 266 GW of renewable energy projects in India by 2022, leading to \$100 billion worth of commitments within eight months.²⁰⁴ Sales of electric vehicles grew by 37.5 percent between 2015 and 2016,²⁰⁵ while small businesses in the agricultural sector are securing financing to scale up their investments (see the box on innovative business models for details).

INDIA INDICATORS (2016)

Population	1.32 billion
GDP	\$2.26 trillion
GDP growth	7.10%
Inflation (consumer prices)	4.90%
Ease of Doing Business ranking (2018)	100
Foreign direct investment, net inflows	\$44.46 billion
S&P credit rating	BBB-
Total greenhouse-gas emissions excluding land-use change and forestry (2014) (MtCO ₂ e)	3,079.81
Total greenhouse-gas emissions including land-use change and forestry (2014) (MtCO ₂ e)	3,202.31
Greenhouse-gas emissions rank (2012)	3
Total carbon dioxide emissions (kilotons)	3
Installed renewable energy capacity (MW)	90,748

NDC TARGETS

Main target	• Target to reduce emissions intensity of GDP by 33 to 35 percent from 2005 level, by 2030 • Plan to promote energy-efficiency in the economy, notably in industry, transportation, buildings, and appliances
Renewables	175 GW by 2022
Green buildings	• Households: Save up to 100 billion kilowatt-hours (kWh) each year from efficient lighting • Implement energy conservation building code and energy rating system
Agriculture	• Implement national initiative on climate-resilient agriculture • Implement national agroforestry policy to encourage and expand tree plantation in an integrated way with crops and livestock

IFC CLIMATE BUSINESS (FY2010–2016)

Total own account	\$1.7 billion
Renewables	\$604 million
Green buildings	\$313 million
Agriculture	\$24 million



RENEWABLE ENERGY

\$448B

India has set an ambitious target of generating 175 GW of renewable energy by 2022 in its National Action Plan on Climate Change. Solar and wind installations in 2016 exceeded the government's yearly goal towards this target by 116 percent and 43 percent respectively.²⁰⁶ The government is using innovative policies, technologies, and financing to achieve this goal. It plans to install 40 GW of rooftop solar capacity by 2022,²⁰⁷ and will use the State Bank of India and World Bank financing program to support the installation of more than 600 MW of rooftop solar capacity.²⁰⁸ Equally ambitious is India's NDC target for the sector, which aims for 40 percent of the country's installed power capacity to come from renewable energy by 2030. Ernst & Young's 2017 Renewable Energy Country Attractiveness Index places India in second place, behind China and ahead of the United States, signaling both the policy push and private investments in the sector.²⁰⁹ This was reflected in the \$9.7 billion worth of new investments in renewable energy in 2016,²¹⁰ and bids as low as \$0.38 cents per kWh in auctions of utility-scale solar contracts sharply reducing solar tariffs in the country in 2017.²¹¹ This push comes from a **national priority to reduce India's dependence on imported oil and gas**, which make up an overwhelming share of its energy imports, and works in tandem with the government's goal to electrify all households by December 2018 under the Saubhagya Yojna scheme.

Using the 2017 National Energy Policy revised targets of between 50 percent and 57 percent²¹² renewable energy capacity by 2040, IFC estimates a total investment opportunity of almost \$404 billion in



renewable energy, excluding large hydro, by 2030, of which utility-scale solar accounts for \$79 billion, concentrated solar thermal for \$82 billion, and small-scale distributed solar for \$48 billion. Investments in onshore and offshore wind energy will amount to \$90 billion and \$20 billion respectively, with a further \$14 billion for small-scale hydropower and \$71 billion for biomass and waste-generated power. India's power sector also has the potential to attract \$44 billion in large hydropower investment to 2030.



GREEN BUILDINGS

\$1.4T

India is third in the world for green building growth, with more than 4,500 green building projects as of 2016,²¹³ including at least 12 EDGE²¹⁴ and 2,386 Leadership in Energy and Environmental Design (LEED)²¹⁵ projects, of which almost 650 projects earned LEED certification in 2016 alone.²¹⁶ In addition, the Ministry of New and Renewable Energy has adopted an indigenous green building rating system known as Green Rating for Integrated Habitat Assessment, with 975 registered projects to date.²¹⁷ India's NDC encourages energy-efficiency in the economy, with a particular focus on industry, transport, buildings, and appliances. As part of its NDC commitments, an updated Energy Conservation Building Code was launched in June 2017, which sets minimum energy standards for new commercial buildings and has provisions to encourage energy neutrality in new buildings.²¹⁸ The adoption of the new code in 2017 will likely halve the energy use of the sector by 2030.²¹⁹

Green buildings represent the largest investment opportunity for India, particularly as 70 percent of buildings needed by 2030 have not yet been constructed.²²⁰ This includes the 20 million urban homes²²¹ and 10 million rural homes²²² to be built as part of the government's Housing for All by 2022 program.²²³ Demand for green buildings is being driven by environmental regulation and rising consumer awareness.²²⁴ With a tremendous public and private push towards sustainability in the sector, IFC estimates a potential investment opportunity of \$1.4 trillion by 2030, of which **\$1.25 trillion will come from the residential sector and \$228 billion from commercial buildings.**

INVESTMENT SPOTLIGHT



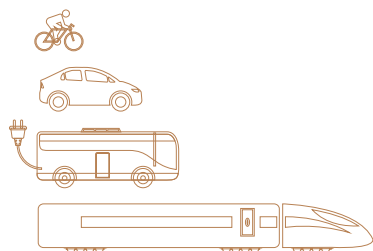
AZURE CLEAN ENERGY PRIVATE LIMITED (2009–2016)

As one of the first solar power companies in the country, Azure Power has played a catalytic role in building a market that is now thriving. Supported by a broad range of IFC's financial products and services, the company's capacity has grown exponentially, reaching 500 MW distributed in 25 plants and several commercial rooftop projects. Azure aims to install 5 GW of solar power in India by 2022.

HERO FUTURE ENERGIES PRIVATE LIMITED (2017)

Hero Future Energies is Hero Group's renewable energy arm with a presence in 12 states in India and a capacity of over 360 MW of utility solar, wind, and rooftop solar installations.

Partnering with the Global Infrastructure Fund—a private equity fund managed by IFC's Asset Management Company—IFC is investing \$125 million in equity, enabling the company to set up 1 GW of solar and wind plants in the next 12 months across India. These projects will contribute to the company's target to install 2.7 GW of renewable energy capacity by 2020 while creating jobs and promoting private sector development in renewable energy. This company also plans to use investment to further develop hybrid renewable energy projects and energy storage technologies.



TRANSPORT

\$917B

India's NDC prioritizes the development of a “safe, smart, and sustainable green transportation network,” increasing the share of rail in total land transport from 36 percent to 45 percent, improving fuel efficiency standards, and transforming the national fleet to electric vehicles, recognizing the importance of low-carbon transport linkages to maintain the country's growth trajectory.

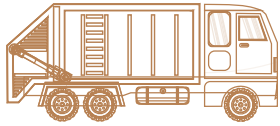
Existing national and state-level initiatives to encourage a shift from road to rail and promote coastal shipping and inland waterways are being supplemented with a concerted effort to streamline and decongest urban transport through mass rapid transit systems. A new metro rail policy, approved by the cabinet in August 2017, emphasizes the need for private sector involvement and creative revenue-earning methods to encourage a broad roll-out of mass rapid transit systems beyond the existing 350 kilometers in eight cities, with 550 kilometers under construction and another 600 kilometers planned. Investment in road and rail-related infrastructure alone amounted to almost \$24 billion²²⁵ in 2014.²²⁶ **Climate-smart investment in transport infrastructure amounting to \$250 billion between 2018 and 2030** will be instrumental in helping India achieve its target of lowering the emissions intensity of its economy.

With nearly 50,000 new motor vehicles registered daily for the last decade,²²⁷ **greening India's fleet is essential to meeting its NDC target, as well as reducing its dependence on importing oil**, and the government has set ambitious targets to do so. India is among the few countries in the world to specify fuel economy norms for heavy-duty vehicles. Bharat Stage IV Emission Standards for vehicle fuel efficiency are aligned with European



Union standards and regulations and came into force countrywide in 2017, reaffirming the government's mitigation goals.²²⁸ The standards are expected to keep 50 million tons of carbon dioxide out of the atmosphere.²²⁹

The **National Electric Mobility Mission Plan** aims to roll out about **7 million electric vehicles on Indian roads by 2020** through the Faster Adoption and Manufacturing of Hybrid and Electric Vehicles Program, and the government has recently set a target for all new car sales in 2030 to be electric. IFC estimates an investment opportunity of up to **\$667 billion at current capital costs between 2018 and 2030** if the government's stated target were to be fully achieved. This full achievement estimate is higher than those from other sources,²³⁰ which are based on an assessment of what the current trajectory of India's electric vehicle market can deliver. To achieve this potential, the government will have to put in place several policy interventions and significant fiscal and non-fiscal incentives. Energy-efficiency Services Limited has recently issued a tender to replace existing government vehicles with 10,000 electric vehicles and 4,000 chargers, to be serviced by Mahindra & Mahindra (currently the only local manufacturer in the Indian electric vehicle market) and Tata Motors,²³¹ in a deal worth an estimated \$168 million.²³²



MUNICIPAL SOLID WASTE

\$11B

In 2016, the Ministry of Environment, Forest, and Climate Change released a new solid waste management policy after a gap of 16 years.²³³ This new policy extends the enforcement of regulations to urban and industrial areas, and aims to establish waste treatment facilities in every area with a population of more than 1 million by 2018. It also earmarks at least 5 percent of the total area of special economic zones and industrial areas for recovery and recycling facilities. The government has invested significantly in solid waste management projects over the years and has provided \$397 million in grants to states and urban local bodies to drive this through PPPs.²³⁴

As of 2015, India generates 62 million tons²³⁵ of waste annually, and it is expected to grow at a rate of almost 8 percent per year. With only 27 percent²³⁶ of total waste generated being processed through 553 compost and vermin-compost plants, 56 biomethanation plants, 22 refuse-derived fuel plants, and 13 waste-to-energy plants as of 2014, a significant gap exists between the amount of waste produced and appropriate infrastructure for solid waste management. IFC estimates an investment opportunity of \$11.09 billion in the sector by 2030.

INVESTMENT SPOTLIGHT



JAIN IRRIGATION SYSTEMS LIMITED (2007–2012)

In 2010, IFC partnered with Jain Irrigation Systems Limited, one of the world's largest manufacturers of micro-drip irrigation systems and other agricultural products, to conduct a water footprint assessment. This assessment helps clients reduce water-related risks, improve water efficiency, and limit water-related social and environmental impacts. This was the first time that a business conducted this assessment in a developing country, paving the way for similar assessments for IFC clients in countries facing water scarcity.

Jain Irrigation has received \$133 million in IFC-led investments since 2007. Use of the company's micro-drip irrigation systems has resulted in annual yield increases between 60 percent and 130 percent, and income increases between \$500 and \$6,000 annually for client farmers. Growth in sales has more than tripled Jain Irrigation's consolidated revenues from \$315 million in 2007 to more than \$1 billion in 2012.

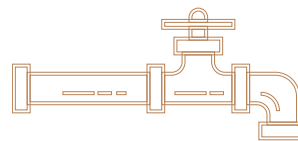


PUNJAB NATIONAL BANK HOUSING FINANCE LIMITED (2016)

India's housing finance market caters largely to middle-income and high-income individuals, and the country's "green" residential building segment is still in an early stage of development. With the residential sector accounting for 29 percent of electricity consumption, improvements in the design and building of residential housing can reduce emissions and sustainably fill the urban housing gap.

Recognizing this potential, IFC committed to investing \$75.8 million in April 2016 in green bonds issued by Punjab National Bank Housing Finance Limited, India's fifth largest housing finance company, to help construct green residential buildings, develop affordable housing, and create more jobs. The bond is the first issuance designated to green buildings in India.

The bank's funding of residential building projects is based on recognized green building standards, including the EDGE certification program. Projects financed through IFC's investment in this green bond are expected to reduce greenhouse-gas emissions by 1,500 metric tons of carbon dioxide each year and promote green building in India.

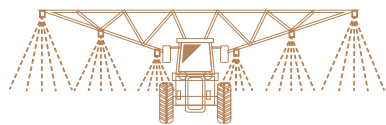


CLIMATE-SMART URBAN WATER

\$128B

Water security is a key challenge and priority for India. Although the agricultural sector accounts for more than 80 percent of water demand, rapid urbanization is increasingly causing acute water stress in urban centers across the country. India's NDC priorities for the water sector also include some opportunities for private sector investment, including efficiency in water use, losses in water utilities, and wastewater management. Recent private investments of \$18.5 million in 2015 have started to create new opportunities in the water and sanitation sector.²³⁷

The wastewater sector can play a significant role in relieving urban India's water stress, and a comprehensive national policy could help catalyze necessary private investment.²³⁸ Less than 10 percent of wastewater is treated in India;²³⁹ however, IFC estimates that there is an investment opportunity of \$128 billion in urban wastewater management alone, associated with the projected growth in treatment to 64 percent²⁴⁰ of generated wastewater by 2030. Opportunities for private investment in wastewater exist in sewage treatment equipment and construction.²⁴¹ Successful PPPs in wastewater management include one between the Mangalore City Council and the Mangalore Special Economic Zone Limited. This partnership led to a 350-kilometer expansion of pipes to feed wastewater into three treatment plants. As a result, the Union Urban Development Ministry ranked Mangalore third in a multi-city sanitation rating.²⁴²



CLIMATE-SMART AGRICULTURE

\$194B

Agriculture is an integral part of the Indian economy, accounting for nearly half of total employment in 2012. Although its share has been declining, agriculture still contributed 17.4 percent to India's GDP in 2016.²⁴³ India is a net exporter of food.²⁴⁴ Between 2000 and 2016, the sector attracted foreign direct investment of more than \$2.3 billion.²⁴⁵

India's NDC cites the need to produce an additional 100 million tons of grain by 2030 to feed its citizens. Farm productivity in India is, on average, one-third to one-half less productive than the rest of the world.²⁴⁶ The private sector is increasingly investing in climate-smart agricultural practices such as precision farming, efficient irrigation, production of resilient crop varieties, and smarter land-use practices.

The Indian government recognizes the need to boost agricultural productivity sustainably, and has in place several schemes and policies, including Pradhan Mantri Krishi Sinchayee Yojana (on efficient irrigation), the National Initiative on Climate-Resilient Agriculture, Paramparagat Krishi Vikas Yojana (to promote organic farming practices), and the National Mission on Sustainable Agriculture.²⁴⁷

In his 2016 General Budget speech, the finance minister promised the completion of 23 irrigation projects, signaling an opportunity for investment of \$2.5 billion²⁴⁸ to 2017, and a further \$12.9 billion²⁴⁹ to 2022. State governments, too, are increasingly promoting climate-smart agriculture. The government of Karnataka, for example, plans to invest \$15 billion to develop irrigation projects across the state.²⁵⁰ Bloomberg has estimated a \$60 billion investment opportunity in solar irrigation, if all diesel-operated irrigation pumps are replaced with solar pumps



Photo: CCAFS, CGIAR / Flickr

(going beyond the government's target of 1 million units by 2021).²⁵¹ In addition, the Indian government has set a target of doubling farmers' income by 2023, an endeavor that will require an estimated additional investment of about \$96 billion²⁵² in modernizing the agricultural sector.²⁵³ While it is difficult to estimate investment potential for the entire sector, these initiatives signal an investment opportunity of at least \$194 billion in climate-smart agriculture in India.

Priorities for India to Attract More Climate-Smart Investment

India's national sector-specific policies and NDC identify the country's investment needs and opportunities. The government has clarified where it sees the public sector taking the lead and where it expects the private sector to drive investment and implementation.

★ RENEWABLE ENERGY

Many leading international and Indian investors have entered the renewable energy market, attracted by the large scale and strong government commitment to install 175 GW of capacity by 2022. The solar and wind auctions, along with targeted financial incentives, including tax holidays, concessional allotment of public land, and reduced costs of borrowing have boosted private investment in recent years, with nine private developers having built up solar portfolios exceeding 500 MW.²⁵⁴ Solar capacity volumes are expected to grow 90 percent year-on-year, making India the third largest solar market worldwide in 2017 and solar the cheapest new source of power in the country.²⁵⁵

Nevertheless, sustaining this pace and achieving the intended targets will be challenging if bottlenecks are not addressed. Investors and developers are potentially constrained by tender cancellations, delayed signing of power purchase agreements, and lack of pipeline visibility. This lack of visibility likely results in increased competition for the few solar auctions taking place and aggressively low bids, which are also driven by falling photovoltaic costs.²⁵⁶ Some states are now experiencing a power surplus and facing the challenge of sustaining a high level of demand for renewable energy. In addition for implementing demand-side reforms, enhancing grid flexibility to integrate both large utility-scale and medium to small distributed generation and minimizing curtailment rates for renewable power will be essential to ensuring continued expansion of the sector and reducing the risks for developers. The National Energy Plan guidelines for solar procurement, forecasting and scheduling regulations, and investments in battery energy storage systems will be helpful in this regard. For example, a 20 MW solar auction, which included battery storage, was recently conducted for projects in the Andaman and Nicobar Islands.²⁵⁷

To meet its renewable energy targets, India needs more financing on more attractive terms. Developers are interested in raising capital to sustain business growth. The high cost of debt in India, including high and variable interest rates and short loan periods, can add more than 20 percent to the cost of renewable energy.²⁵⁸ Investors are interested in addressing key risks facing the sector such as a slowing pipeline and falling tariffs, poor distribution company credit, uncertainty about grid availability, and removal of incentives.²⁵⁹ Moreover, banks are interested in resolving stressed loans and overexposure to the power sector,²⁶⁰ as well as priority sector lending caps, which are constraining their ability to invest in new renewable energy ventures.

★ GREEN BUILDINGS

The government has taken many positive strides in creating a market for green buildings. It has instituted countrywide green building policies for several years and keeps them up to date to include the latest technologies. As a result, 5 percent of buildings are green. This creates opportunities for expansion and there is large market potential given the presence of several international and local rating tools. Key to this will be addressing the lack of public awareness and the high cost of borrowing to enable incremental funding in green technologies and materials, because this can result in higher loan costs for investors in the green sector. Since green certificates require additional costs, developers may be unwilling to pay for certification—despite the long-term savings in operational costs that green infrastructure provides.²⁶¹ To ensure builders have a level playing field, better labeling that allows customers to distinguish between developers/buildings based on, for example, carbon intensity or a green index could be introduced.

🔍 INVESTMENT SPOTLIGHT



REWA ULTRA MEGA SOLAR PARK (2017)

In April 2017, India's state government of Madhya Pradesh signed project agreements with solar power companies to begin building the 750 MW Rewa Ultra Mega Solar Park. IFC played a pivotal role advising the government of Madhya Pradesh, leading extensive negotiations with stakeholders and introducing internationally acceptable principles of project finance for renewable energy contracts in India. A unique three-tiered payment security mechanism was introduced for the first time in India to reduce the project's risk.

Due to unprecedented market interest and competitive bidding, for the first time, solar energy tariffs fell lower than thermal power rates, without viability gap funding (a record low tariff of \$0.44 cents per kWh was offered). The 750 MW capacity project was auctioned in three packages of 250 MW each, which were won by Mahindra Renewables, ACME Solar, and Solenergie Power. Once commissioned, the plant will nearly double installed solar capacity in Madhya Pradesh, add 7.5 percent of India's total installed solar capacity as of 2016, and mobilize private sector investment of about \$500 million. In addition, the project will avoid 1 million tons of greenhouse-gas emissions each year.



TATA CLEANTECH CAPITAL LIMITED (2011–2017)

Tata Cleantech Capital Limited was established as a joint venture between Tata Capital and IFC in 2011. Tata Cleantech has since worked with over 40 clients to identify, evaluate, and fund renewable energy, energy-efficiency, and water treatment investments. It has funded more than 80 renewable energy projects with a total capacity of 3,500 MW.

In July 2017, IFC signed an agreement to subscribe to \$40 million through a green bond issued by Tata Cleantech Capital Limited. Proceeds of the bond will be used to finance wind, solar, and other climate finance projects that meet green bond eligibility criteria. The green bond will be structured to be compliant with the 2016 Green Bond Principles, and Tata Cleantech Capital Limited is expected to become a signatory to the Green Bond Principles.

★ TRANSPORT

The government aims to ensure that all new cars beyond 2030 are electric. This is supported by India's policies such as the switch from carbon subsidization to effectively taxing petroleum products through deregulation.²⁶² Electric vehicles provide last-mile connectivity, and present an attractive option for shared mobility that is being explored by aggregators like Uber and Ola.²⁶³ In 2016, India had 0.4 million electric two-wheelers, 0.1 million e-rickshaws, and a few thousand electric cars,²⁶⁴ relative to a total of 21 million vehicles sold each year.²⁶⁵ While many automotive groups, including BMW, Mahindra, Maruti, Toyota, Suzuki, and Volvo, sell electric or hybrid models in India, they are reliant on imports for key components such as batteries. Moreover, the supporting infrastructure needs to be developed: there are only about 100 charging stations across India. This restricts the use of electric vehicles to mostly within city limits as long journeys are not feasible with the available infrastructure²⁶⁶ Meeting the National Electric Mobility Mission Plan's 2020 target²⁶⁷ alone will require an investment of \$1.8 billion in charging infrastructure and research and development. This level of investment will need to be scaled further in order for the country to meet the 2030 target.

★ CLIMATE-SMART URBAN WATER

The public sector has traditionally been responsible for providing and managing water supply. However, low electricity prices have led to the systemic overdraw and irrecoverable depletion of groundwater in the country.²⁶⁸ **Water stress has become an ongoing concern for most Indian cities.** During periods of supply scarcity, household demand takes precedence over industrial demand, potentially leading to supply restrictions for industrial users, leading to lost output. Moreover, the current low cost of exploiting groundwater makes reuse unviable. However, **the government is supporting the reuse of treated wastewater**, which forms an important part of its ambitious plan to clean up the River Ganga (Clean Ganga Mission). Reusing treated wastewater is also included in other urban policies and their related funding streams. The central government will provide initial financing for projects. The long-term strategy is to cover operating costs through user fees.²⁶⁹

Recommendations

- 1 Clarify the mechanism and time of withdrawal of incentives such as renewable purchase obligations, “must-run” status, and tax benefits provided to the sector to boost investor confidence and positively influence the sector’s growth.
- 2 Support the development of energy storage technologies through investments in research and development, incentives for manufacturing, and installation of large-scale storage facilities to improve grid management.
- 3 Involve private companies in establishing charging points for electric vehicles through bids and PPPs, and ensure charging points are standardized.
- 4 Introduce a voluntary disclosure approach, enabling companies to self-disclose or have a third party evaluate their compliance with green building codes; this would promote awareness and provide better information on the cost and benefits of green buildings. A government mandate for its own buildings to be green will create demand and set an example.
- 5 Clear signals are needed on the role of PPPs/private sector participation in urban wastewater and reuse at the basin scale, and/or at the state level, as most projects are executed by state governments.



Innovative Corporate Practices: Internal Carbon Pricing

Companies across the world recognize the important role they play in tackling climate change, and are making bold commitments.

They are setting science-based emissions targets, procuring 100 percent renewable energy, eliminating deforestation from their supply chains, and disclosing their carbon footprints and climate risk strategies. These initiatives demonstrate that companies are delivering climate action to drive innovation, competitiveness, and greener growth.

Internal carbon pricing is a key mechanism that businesses are using to achieve these climate goals, and to prepare for a carbon-constrained future. According to the CDP, the number of global companies disclosing that they use an internal carbon price today, or plan to do so within the next two years, has increased from 150 in 2014 to almost 1,400 in 2017. This includes more than 100 Fortune Global 500 companies with collective annual revenues of about \$7 trillion.²⁷⁰

About half of the government commitments submitted as part of the Paris Agreement indicate that they will use carbon pricing as part of their national strategy. Smart businesses are preparing for this regulation by internalizing a carbon price today. They are also increasingly advocating for carbon pricing action by governments through initiatives like the Carbon Pricing Leadership Coalition.²⁷¹ In this way, they aim to level the playing field by applying a price to high-emitting activities that can be used to support cleaner alternatives.

In South Asia, companies are also taking action. In 2016, almost 50 Indian companies intended to use internal carbon pricing, a 60 percent increase on the previous year.²⁷² In addition to action by emissions-intensive industries, other sectors—including automotive, textiles, financial services, and information technology—are taking steps to apply the following internal carbon pricing approaches:

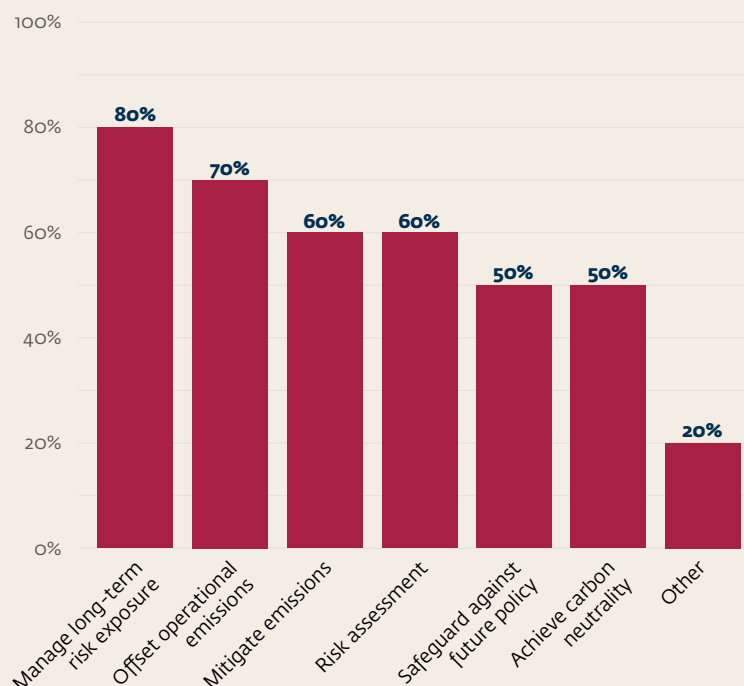
- **Shadow price:** Used to evaluate investments, stress test assumptions, manage risks, and guide business strategy against a carbon-constrained world.
- **Implicit price:** Assessed as the marginal abatement cost of emissions-reduction measures within an organization, including the cost of regulatory compliance. Used for decision making, capital allocation, and assessing economic implications for specific climate targets.
- **Explicit price or carbon fee:** Applied as financial incentives that redirect/generate cash flows to achieve a goal. For example, some facilities or emissions-intensive operations are taxed internally to create a central pool of funds that is used to boost investments in lower-carbon alternatives.

Comprehensive stakeholder consultations with more than 30 of India's largest businesses in 2016 identified

the following trends in internal carbon pricing for the region:

- **Risk management is the key driver.** Most Indian businesses are exploring internal carbon pricing to reduce climate-related risks. Other objectives include reducing emissions or becoming carbon neutral.
- **Carbon pricing is not new.** Many businesses have participated in offset trading programs like the Clean Development Mechanism, as well as independent voluntary initiatives like the Verified Carbon Standard. This experience is informing their approach to internal carbon pricing. Most companies expect internal carbon pricing to influence or change fuel procurement, their transportation outlook, and measures to upgrade processes in line with overall sustainability goals.
- **Indian leadership is growing.** A few large companies have pioneered internal carbon pricing initiatives, and are building and sharing a solid knowledge base on the process, approach, challenges, and opportunities.

For **Arvind Limited**, one of the largest textile companies in the region, internal carbon pricing has helped reduce overall emissions by improving electricity consumption—its largest emission source. With electricity tariffs varying widely across its installations and facilities, Arvind identified an opportunity to adopt a shadow carbon price based on the highest electricity tariff paid across all its facilities. This enabled a common evaluation framework for energy-efficiency projects, resulting



in savings of more than 12 percent in energy consumption between 2013 and 2016.

Dalmia Bharat, one of the region's largest cement companies, adopted an internal emissions reduction price of \$11 per metric ton of carbon dioxide emitted by its facilities. This enabled the company to reduce its exposure to the national clean energy tax (which is no longer in place in 2017), while creating an internal revenue stream to fund further efficiency and abatement measures. Dalmia based its carbon price on carbon abatement costs, including regulatory and other external factors. As a result, the company was able to reduce its carbon footprint by 7 percent between 2015 and 2016.

Essar Oil adopted an internal carbon price to manage the risk of stranded assets and drive



technological innovation. With a carbon price of \$15 per metric ton of carbon dioxide, Essar aims to build further internal support to put in place technologies, process upgrades, and product improvements that can cut emissions by 1.6 percent year-on-year. During FY16, Essar Oil reduced emissions by 2.75 percent—the equivalent of 0.16 million tons of carbon dioxide.

Infosys Limited, a leading information technology service provider, implemented internal carbon pricing to achieve its carbon neutrality goal. Its internal price of \$10.5 per metric ton of carbon dioxide was based on its electricity tariffs and the assumed capital costs for investing in renewable energy and other abatement options. The internal carbon price has enabled the company to increase the yearly capital outlay to implement projects that result in a 50 percent reduction in per capita energy demand. For the remaining demand, the company uses renewable energy through offsetting mechanisms and buys electricity from independent power providers.

Mahindra & Mahindra, one of the top five utility manufacturers in the world, was one of the first companies to adopt a comprehensive internal carbon pricing scheme. Based on an internal evaluation of emissions reductions and energy savings associated with green investments, Mahindra established an internal price of \$10 per metric ton of carbon dioxide. The company uses a hybrid approach of shadow and explicit prices to accelerate investments in low-carbon alternatives and prioritize the implementation of green projects. It is making good progress on achieving its goal of reducing its emissions by 25 percent by 2019, while doubling energy productivity by 2030.

	Arvind Limited	Dalmia Bharat	Essar Oil	Infosys	Mahindra
Company background	Top 5 denim producers in the world	Top 5 cement manufacturers in India	One of the largest non-state refiners in India	Top 3 IT companies in India, with a large market cap	Top 5 utility vehicle manufacturers globally
Price on carbon (in \$)	Mark-up of 5-25 percent on its electricity tariff across operations	11	15	10.5	10
Emission sources	Scope 1 and 2: Electricity consumption at facilities	Scope 1: Fuel consumption for operations	Scope 1 and 2: Fuel consumption for operations	Scope 2: Electricity consumption at offices and data centers	Scope 1 and 2: Fuel and electricity consumption for assembly
Corporate goal delivered by carbon pricing	Achieving sector-leading benchmarks on energy intensity globally by 2020	Building a 4-fold increase in the renewable energy component across the overall fuel mix by 2030	Reducing the risks of future regulations by driving business innovation	Being carbon neutral across key operations by 2018	Reducing emissions intensity by 25 percent by 2019
Approach used	Shadow price to better inform decision making	Explicit price involving cash flows to create a dedicated fund	Shadow price to better inform decision making and drive innovation	Inbuilt cost of initiatives to be undertaken for carbon abatement	Shadow-explicit price hybrid to help decision making and boost investments

Source: Forthcoming WRI Carbon Pricing Primer for India, expected to be published end-2017



Maldives

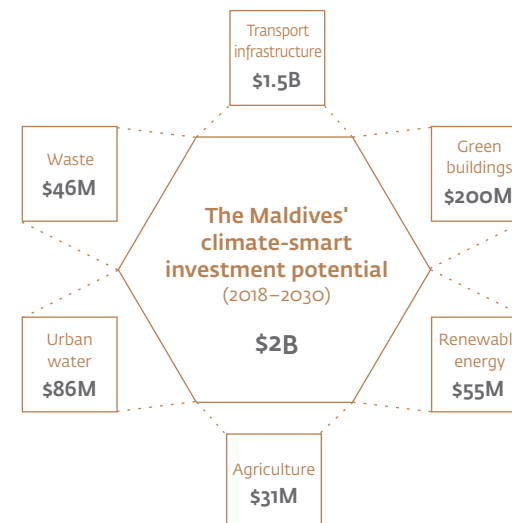
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MALDIVES



The Maldives' estimated climate-smart investment potential in key sectors is \$2 billion between 2018 and 2030.

The Maldives, a small island nation made up of about 1,190 islands, graduated from least developed country status in 2011²⁷³ and is now categorized as an upper-middle-income country by the World Bank Group.²⁷⁴ Its economy is expected to grow by 4.9 percent in 2018, driven primarily by the construction and tourism sectors.²⁷⁵ Tourism accounts directly for about a third of its GDP, and up to about two-thirds of GDP when accounting for related sectors.²⁷⁶ Tourist arrivals grew by 6.1 percent to mid-2017, more than three times the previous



year.²⁷⁷ Tourist resort islands are largely responsible for managing their own energy, waste, water, and transport needs, allowing the government to focus on development programs for locally populated islands.²⁷⁸

The low elevation of the Maldivian islands makes the nation highly vulnerable to rising sea levels. The NDC acknowledges the challenges it faces given its high population density, dispersed geography, and limited resources.²⁷⁹ Actions that the Maldivian government is taking to address these issues include relocating its population from the outer islands and consolidating its people within the greater Malé region to ensure its limited resources are used efficiently. The country's NDC commits to an unconditional 10 percent reduction of its emissions by 2030, which increases to 24 percent if it receives external financial resources, technological assistance, and capacity building.²⁸⁰ Prioritizing the energy, transport, and waste sectors, it emphasizes the need to reduce dependence on fossil fuel imports, which currently meet the entirety of the Maldives' energy demand, through energy-efficiency measures and the use of clean alternative sources where possible. Given the country's extreme vulnerability, the Maldives' NDC places a strong focus on crucial actions to strengthen the country's resilience to the impacts of climate change.

Although private investment in sectors other than tourism has been limited,²⁸¹ the Maldivian government is taking several steps to mobilize private resources for other areas. Invest Maldives, the government agency for promoting investment, has invited private investment in agribusiness, energy, financial services, and infrastructure projects, such as developing a port in Thilafushi, expanding the Maldives' airport, and building a new city.²⁸² In collaboration with various United Nations agencies, the government has entered into a three-year, \$9.2 million joint program for Low Emission and Climate Resilient Development, which aims to mobilize local public and private investment in evidence-based action plans for climate-smart development.²⁸³

MALDIVES INDICATORS (2016)

Population	417,492
GDP	\$3.59 billion
GDP growth	4.1%
Inflation (consumer prices)	0.5%
Ease of Doing Business ranking (2018)	136
Foreign direct investment, net inflows	\$448 million
S&P credit rating	n/a
Total greenhouse-gas emissions excluding land-use change and forestry (2014) (MtCO ₂ e)	1.42
Total greenhouse-gas emissions including land-use change and forestry (2014) (MtCO ₂ e)	1.43
Greenhouse-gas emissions rank (2012)	177
Total carbon dioxide emissions (kilotons)	165
Installed renewable energy capacity (MW)	4

NDC TARGETS

Main target	Mitigation target: -24 percent, 3.3 MtCO ₂ e by 2030
Green buildings	• Build climate-resilient infrastructure in airports, ports, government, social service buildings, and housing • Establish a national building code
Waste	Develop appropriate sewage treatment systems on the islands, and manage and safely disposal of solid waste
Agriculture	Strengthen existing climate risk insurance mechanisms to protect the farmers and reduce the income losses from extreme weather events

IFC CLIMATE BUSINESS (FY2010–2016)

Total own account	\$4 million
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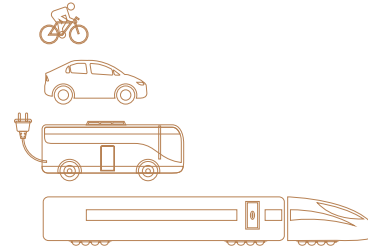


RENEWABLE ENERGY

\$55M

Because the islands are dispersed, Maldives cannot use a national grid. The islands' energy demand is met by its 330 MW installed capacity of diesel generators, which ensures universal access to electricity.²⁸⁴ With electricity demand expected to grow 8.5 percent each year, the government is striving to improve its energy security, reduce its dependence on fossil fuels, and provide affordable and reliable electricity to its people.²⁸⁵

The Maldives' NDC targets the country's energy sector for its mitigation contribution, prioritizing energy-efficiency in domestic consumption, processes, and product use, as well as clean electricity generation. The government intends to provide a minimum of 30 percent of the country's daily peak electricity from renewable sources by 2018,²⁸⁶ and add a total of 20 MW of solar capacity by 2020.²⁸⁷ The Maldives is a pilot country for the World Bank Group's Accelerating Sustainable Private Investment in Renewable Energy (ASPIRE) project (see below), which aims to expand renewable energy projects in the Maldives through private sector engagement and over \$40 million worth of investment.²⁸⁸ Despite the unfavorable geographic conditions that constrain the development of an indigenous renewable energy sector, in 2016 the Maldives pledged to obtain 100 percent of its electricity needs from renewable sources by 2050 alongside other members of the Climate Vulnerability Forum in Marrakech.²⁸⁹ Considering the pledges and efforts of the Maldivian government to develop its renewable energy sector, IFC estimates an investment potential of \$55 million in the sector between 2018 and 2030.



TRANSPORT

\$1.5B

The Maldives' transport sector accounts for a quarter of its total greenhouse-gas emissions.²⁹⁰ Its NDC identifies transport as an important sector for both mitigation and resilience actions. In its attempt to reduce the emissions footprint of its transport sector, the Maldives developed a Low Carbon Strategy²⁹¹ for the Transport Sector, outlining 18 mitigation strategies and eight adaptation strategies. Strategies include encouraging a shift to low-carbon modes of transport, establishing integrated transport networks, and promoting stronger fuel economy standards.

The Maldives' NDC emphasizes the need for resilient transport infrastructure. The government seeks to establish a sustainable financing mechanism to facilitate investment in climate-smart transport infrastructure.²⁹² To this end, the government has called for investments in the expansion of the Maldives' international airport and the building of a commercial port facility at Thilafushi, as discussed above.²⁹³ IFC estimates an investment opportunity of up to \$1.5 billion in physical transport infrastructure between 2018 and 2030.



GREEN BUILDINGS

\$200M

Energy-efficient buildings are a priority for the government of the Maldives. The country's NDC outlines the government's intention to establish a new National Building Code to integrate climate and efficiency considerations into building design, with a focus on resilience.²⁹⁴ Several public and local buildings have already been audited for their energy-efficiency.²⁹⁵ The Maldives' LEED-certified international airport²⁹⁶ is an example of successfully greening one of the country's buildings. **The government has identified the shortage of housing as the country's biggest social challenge as of 2017,²⁹⁷ and the private sector has an opportunity to meet this need through green buildings.**

The government's policy push to relocate its population more centrally around the greater Malé region, recent growth in the construction and real estate sectors (by almost 28 percent and 4.5 percent respectively in 2015),²⁹⁸ and the building of the planned city of Hulhumalé²⁹⁹ present significant opportunities to green the Maldives' building sector. IFC estimates the investment potential of green buildings to be \$200 million between 2018 and 2030, with an **expected green buildings penetration of up to 10 percent of the total housing market.**

INVESTMENT SPOTLIGHT



Photo: Universal Resorts Maldives

UNIVERSAL ENTERPRISES PRIVATE LIMITED (2010)

In 2010, IFC provided a \$2.5 million loan through its "Cleaner Production" Lending Pilot Facility to Universal Enterprises, an operator of eight island resorts in the Maldives, to support the application of Cleaner Production best practices—an integrated strategy to minimize waste and pollution by making energy and water processes more efficient. Universal Enterprises conducted an assessment of four of its resorts, which led to recommendations to optimize the use of electrical and diesel generator sets, steam and hot water systems, refrigeration and air conditioning, and lighting. Together, these measures qualified for funding through IFC's Cleaner Production Lending Pilot Facility. The company will cover the remaining \$2.76 million in project implementation costs itself.

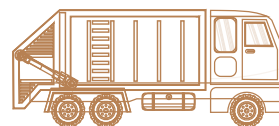
These measures are expected to reduce greenhouse-gas emissions by more than 5,000 tons per year, or 25 percent of the four resorts' total existing emissions. The measures will also save about 21,500 cubic meters of water and 4 million kWh of electricity each year.



ASPIRE PROJECT (2014–PRESENT)

The Accelerating Sustainable Private Investment in Renewable Energy project is enabling private sector investment in photovoltaic infrastructure development and diversifying the investment base in the country by developing a local market and expertise in renewable energy. The project received a \$16 million International Development Association guarantee from the World Bank, as well as a \$11.7 million grant from the Scaling Up Renewable Energy Program.

The Maldives is one of six pilot countries that participated in the Scaling Up Renewable Energy Program. The Maldivian government has developed an investment plan to expand renewable energy in the country. Led by the World Bank, the ASPIRE project is a five-year initiative designed to promote additional private sector investments of between \$40 million and \$70 million in these projects, resulting in up to 30 MW of new solar photovoltaic capacity. The ASPIRE project develops local capacity, helps structure and deliver a tariff buy-down for planned projects, and provides a security package to cover payment shortfalls.

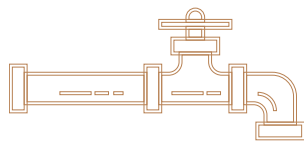


MUNICIPAL SOLID WASTE

\$46M

Waste is the third key sector of focus in the Maldives' NDC, and the government is prioritizing the management and safe disposal of solid waste.³⁰⁰ In 2015, the government released an updated solid waste management policy³⁰¹ encouraging island-specific waste management policies that comply with local requirements. It introduced a fee-based system for waste collection, and sought to establish mechanisms to transport waste from individual islands to a regional waste management facility. In collaboration with the Abu Dhabi Fund for Development, the government is also setting up a \$6 million waste-to-energy power plant in Addu, the second largest city in the Maldives, which is expected to generate about 4 MW of energy and meet 18 percent of the city's electricity needs.³⁰²

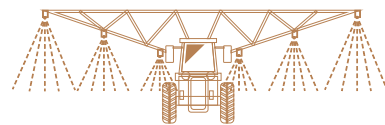
Waste generation is expected to increase at a rate of about 4 percent per year in the Maldives, and more than half of the country's waste is generated in the greater Malé region.³⁰³ There is a significant opportunity to turn this waste into compost, since it is mostly organic waste.³⁰⁴ IFC estimates an investment opportunity of \$46 million in solid waste management between 2018 and 2030 in the Maldives.



CLIMATE-SMART URBAN WATER

\$86M

The public sector provides water and sanitation services in the Maldives. The Malé Water and Sewerage Company operates and manages water and sewerage services in and around the city.³⁰⁵ The Maldives' 2016 State of the Environment document recognizes the adverse effects of untreated wastewater on the country's ecology.³⁰⁶ **Little to no wastewater management or treatment takes place in the locally populated islands of the Maldives, although some resort islands reuse wastewater for irrigating crops and landscaping³⁰⁷** There is thus significant opportunity to start treating wastewater, with a target of treating 69 percent of all wastewater by 2030.³⁰⁸ **IFC estimates an investment potential of \$86 million in wastewater management between 2018 and 2030.**



CLIMATE-SMART AGRICULTURE

\$31M

The agricultural sector accounts for 2 percent of total employment in the Maldives,³⁰⁹ and fisheries account for another 6 percent, employing about 12,000 people in 2014.³¹⁰ Together, these sectors accounted for almost 3 percent of GDP in 2015.³¹¹ **Despite their relatively small contribution to the economy, agriculture and fisheries are priorities for the government.**³¹² The NDC prioritizes the resilience of the agricultural sector by establishing strategic food storage and distribution facilities, promoting the use of alternative and efficient agriculture technologies, and strengthening climate risk insurance mechanisms to protect farmers' incomes from climate change-related events.³¹³

The government has identified agribusiness as a priority sector for private investment,³¹⁴ and companies are taking notice. In 2015, UK-based Hummingbird Farms signed a deal for the largest agricultural project in the history of the Maldives to date, pledging investments of more than \$10 million to develop protected cropping (for example, by growing berries in greenhouses).³¹⁵ The Maldivian government is also trying to leverage private funds for its Sustainable Fisheries Development Project worth almost \$21 million to support the country's marine fisheries and mariculture sector.³¹⁶ These initiatives signal an investment opportunity of at least \$31 million to 2030 in the Maldives.

Priorities for the Maldives to Attract More Climate-Smart Investment

The government of the Maldives has identified clear development goals for itself, including economic growth and diversification, reductions in regional inequalities, and increased private sector participation.³¹⁷ Although the government is allocating a portion of its revenues from a thriving tourism sector to achieve these goals,³¹⁸ leveraging private capital and continuing to consolidate a strained fiscal position will be critical.³¹⁹ Successful demonstration projects in infrastructure, particularly through PPPs, can help scale the market and generate private sector interest. In addition, the government can build the capacity of local entrepreneurs to participate by nurturing domestic expertise and removing barriers to financing, such as high minimum loan thresholds that make banks unwilling to process small loans.

The Maldives had its first multiparty presidential election in 2008 after transitioning to a constitutional democracy and gaining an independent judiciary and electoral body.³²⁰ The political climate has since been dynamic, but **policy continuity and predictability following the next election in 2019 will be vital for attracting private sector investment in the country.**

The country's Climate Change Policy Framework³²¹ outlines five strategic goals to facilitate a transition to a more efficient and clean economy: sustainable financing, low emissions development, adaptation opportunities, capacity building, and fostering sustainable development. The Maldives' NDC and other government plans prioritize the need for resilient development, recognizing the potentially devastating impact of climate change on the country. **The government is planning and encouraging an increasing number of resilience-oriented projects and investment in the country.** These include the Green Climate Fund's \$23.6 million contribution to an integrated water supply system that uses rainwater, groundwater, and desalinated water, and is expected to benefit almost 300,000 people.³²² Water management and desalinization are emerging as priorities for the government. In addition to using public funds to finance these priorities, the government can also leverage capital from private tourist resorts by supporting implementation to achieve its goals in these priority areas.



Photo: IWRM AIO SIDS / Flickr



The government's plan to relocate 70 percent of its population to the greater Malé region will allow it to allocate resources more efficiently, enhancing the country's capacity to weather the impacts of climate change. However, this move is likely to lead to congestion and other problems that accompany high population density. The urban migration can be planned and implemented in a way that reduces pressure on urban infrastructure and resources, using capital support and expertise from the private sector. This migration presents an opportunity to ensure transit-oriented development on the new islands, to reduce congestion, while enabling new buildings to be both green and resilient.

★ RENEWABLE ENERGY

The lack of a national grid, due to the dispersed nature of the Maldivian islands, has entrenched the use of diesel generators to meet the country's energy demand.³²³ Utilities such as STELCO are predominantly publicly owned,³²⁴ relatively efficient, and influential stakeholders that will need to be included in the transition to alternative energy sources. The government has asked the Energy Sector Management Assistance Program and the World Bank to help assess and map the Maldives' solar and wind resources.³²⁵ Given land and other geographic constraints, **encouraging rooftop solar in inhabited islands may provide an opportunity to reduce diesel imports and emissions, while creating jobs.** Net-metering regulation was introduced in 2015 to facilitate this. Removing electricity subsidies will further incentivize commercial users to consider installing solar photovoltaic on their roofs. The government can lend support by easing access to credit and introducing standardized power purchase agreements.

★ MUNICIPAL SOLID WASTE

Uncontrolled waste disposal is negatively affecting the country's coral reefs and fisheries industry. It will be important for the government to engage with the private resort islands to maintain its status as a hub for high-end tourism.³²⁶ **Measures could include introducing regulatory improvements and building capacity in the solid waste management sector to attract private funds.**

Recommendations

- 1 Develop a policy framework and guidelines for PPPs in infrastructure, alongside a one-stop-shop agency for PPPs.
- 2 Subsidize loans and guarantee roof-lease agreements for rooftop solar.
- 3 Engage in regulatory improvements and capacity building in the solid waste management sector to attract private funds.
- 4 Establish an integrated urban planning approach for the development of Hulhumalé that takes into consideration all sectors and entrenches resilience across urban areas. Create and enforce green and resilient building codes for construction on the new island.
- 5 Incentivize private tourist resorts to conduct energy audits, switch to renewable sources such as solar photovoltaic rather than diesel generators, and adopt green and resilient measures for new construction on resort property.



Energy-Efficiency Innovations in South Asia

The primary energy demand for South Asian countries is expected to increase significantly. In India, it is expected to increase from 770 million tons of oil equivalent in 2012 to about 1,250 million tons in 2030.³²⁷ This increase is driven by several factors, including increasing incomes and economic growth, which lead to greater demand for energy services such as lighting, cooking, space cooling, mobility, industrial production, and office automation. Air conditioning alone makes up about half the energy demand in major Indian cities. With less than 10 percent of homes currently having air-conditioning units, and an expected rapid increase in market penetration implying millions of families will have more than one air conditioner, energy-efficiency in air cooling is an essential market segment to target.³²⁸

Energy-efficiency presents substantial cost-saving opportunities across all sectors, but there are challenges to implementing such measures at a

meaningful scale. Access to finance, insufficient technical expertise, and lack of awareness are significant barriers.

Innovative approaches can unlock the untapped potential of energy-efficiency to save costs and energy. Four examples of promising breakthroughs are discussed below: improving energy-efficiency across the textile supply chain, implementing energy-efficiency in small businesses, making LEDs affordable through competitive procurement, and using a standard for continuous energy-efficiency improvement in industry and buildings.

PACT: SUPPLY CHAIN ENERGY-EFFICIENCY IN THE BANGLADESH TEXTILE INDUSTRY

The textile sector has historically struggled with energy-efficiency. For a country like Bangladesh where textiles are the dominant industry, innovative energy-efficiency initiatives can significantly reduce consumption and save money. As the costs of

energy and water rise, growth in the Bangladesh textile industry can only be sustained by improving efficiency in all stages of the value chain. PaCT tackles resource efficiency challenges in the sector by working with key stakeholders (major brands, their suppliers, financial institutions, and equipment vendors) and providing them with advisory services. The graphic below outlines the impact of the program since commencing in 2013.

SMALL INDUSTRIES DEVELOPMENT BANK OF INDIA: IMPROVING ENERGY-EFFICIENCY IN SMALL BUSINESSES

One of the biggest barriers for scaling energy-efficiency in the highly diverse and fragmented micro, small, and medium enterprises sector is access to finance. High transaction costs relative to the project size make energy-efficiency investments unattractive for investors. It is critical for a country like India to address this barrier, given that small businesses account for more than 80 percent of

PaCT HELPING FACTORIES DO MORE WITH LESS

Freshwater saved:	21.6 billion ltr/yr
Energy saved:	2.5 million MWh/yr
Greenhouse-gas emissions avoided:	460,428 tonnes CO ₂ equivalent/yr
Factory savings in resource efficiency:	\$16.3 million/yr
Wastewater avoided:	18.8 billion ltr/yr
Investments:	\$39 million

PaCT PARTNERS



total industrial enterprises and employ about 117 million people. In addition, these businesses consume almost half of the total energy used in the industrial sector.³²⁹ Without adequate access to financing, it is difficult for micro, small, and medium enterprises to become more energy efficient.

In 2008, the Small Industries Development Bank of India launched an innovative program of credit line facilities to target small businesses, leveraging financing from the Japan International Cooperation



Agency, KfW Group, the French Development Agency (AFD), the Industrial Credit and Investment Corporation of India, and the World Bank. Micro, small, and medium enterprises used these investments to buy or upgrade their energy-saving equipment. During the first phase of the initiative, the Small Industries Development Bank of India processed more than 3,000 loans and helped more than 3,400 enterprises. This resulted in annual electrical savings of 477.7 million kWh and annual thermal energy savings of 446.5 billion kilocalories—translating to a reduction of more than 463,000 tons of carbon dioxide per year.

ENERGY-EFFICIENCY SERVICES LIMITED: MAKING LED LIGHTING AFFORDABLE THROUGH COMPETITIVE PROCUREMENT

Energy Efficiency Services Limited in India has developed an innovative business model that brings down energy costs for customers through competitive procurement. The UJALA program's success lies in its ability to aggregate demand and use bulk orders to reduce costs.

Using this approach, the program reduced the cost of LED light bulbs from 310 Indian rupees (\$5) to 40 rupees (\$0.65) by procuring 300 million units

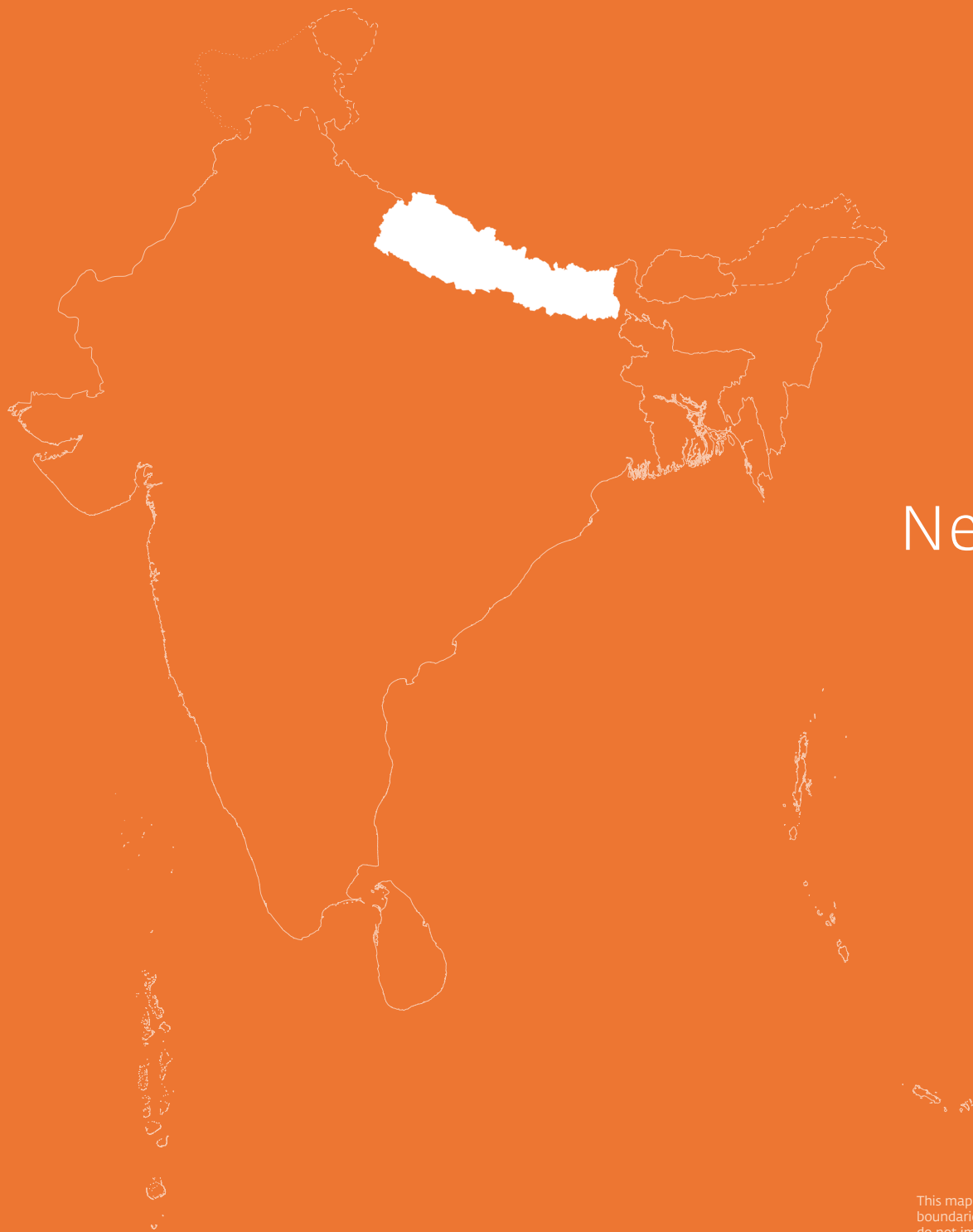
over a two-year period—without any government subsidy. The cost of LED street lamps and services decreased 65 percent over the same period. In addition, the repayment period dropped from 10 years to less than three months between 2014 and 2017. The program has been extended to include 800,000 energy efficient fans and 3.7 million LED tube lights, which collectively not only helps companies and governments save money, but has also reduced annual energy consumption by 35 billion kWh and carbon dioxide emissions by 28 MtCO₂e.

Following its success with LED light bulbs, UJALA is broadening its application to other equipment such as solar irrigation pumps, fans, air conditioners, and electric vehicles. This innovative business model is garnering much attention from other countries, including developed economies such as the United Kingdom.

CERTIFICATION FOR ENERGY MANAGEMENT SYSTEM: CONTINUOUS IMPROVEMENT IN INDUSTRY AND BUILDINGS

An energy management system is one of the most effective tools in promoting energy-efficiency across industrial enterprises. It equips companies with certifiable practices and procedures that help them continually improve their energy-efficiency. ISO 50001 is an internationally recognized standard for energy management systems, established in 2008, which has helped expand energy-efficiency. While most certifications have been in Europe, ISO 50001 is playing an instrumental role in India. As of 2015, there are at least 405 certifications across India. JK Lakshmi Cement Limited, Cummins Inc., Shree Cement Limited, and Raymond Limited have adopted the standard and are leading innovation in India.

Examples of ISO 50001 certification	Payback/savings
Cummins Inc.	\$3.5 million annual savings across nine sites with a one-year payback period
JK Lakshmi Cement Limited	\$13.5 million ³³⁰ savings with a three-year and two-month payback period
Raymond Limited	\$39,000 ³³¹ annual savings
Shree Cement Limited	\$6.1 million ³³² savings with a three-year payback period



Nepal

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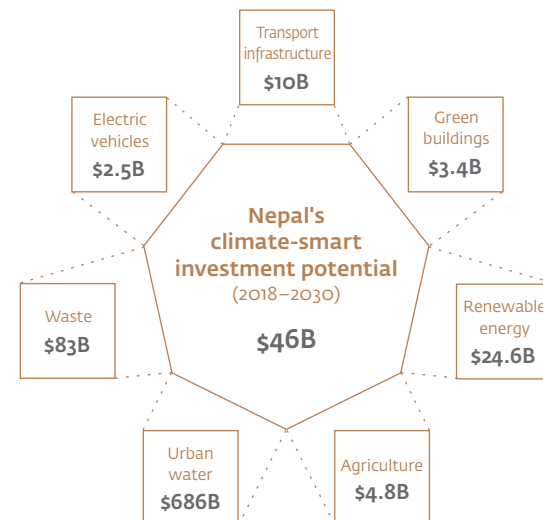
NEPAL



IFC estimates a climate-smart investment opportunity of more than \$46 billion in Nepal between 2018 and 2030.

Nepal, a mountainous, landlocked country, is recovering from two severe natural disasters—a 2015 earthquake that killed almost 9,000 people, injured more than 22,000 people, and damaged or destroyed 800,000 homes,³³³ as well as devastating floods in mid-2017 that have affected more than 1.7 million people.³³⁴ But Nepal has shown the resilience of its people and economy, and is expected to have real GDP growth of 7.5 percent in 2017,³³⁵ fueled by investment in rebuilding and a revitalized agricultural sector.³³⁶

Nepal's government has prioritized reconstruction and resilience to future disasters in its budget, policies, and NDC. It allocated more than 26 percent of its FY18 budget to capital expenditure,³³⁷ prioritizing post-earthquake reconstruction.³³⁸ Other focus areas include



hydroelectricity production and transport, urban, and agricultural infrastructure.³³⁹ Nepal's NDC emphasizes its development agenda and seeks to manage its vulnerability to climate change as part of its efforts to improve the socioeconomic conditions of the quarter of its population living below the poverty line.³⁴⁰

The government seeks to mitigate the potential loss of between 1.5 percent and 2 percent of its GDP per year in key climate-vulnerable sectors such as hydropower and agriculture.³⁴¹ To achieve this, Nepal's NDC commits the country to actions that encourage green energy, sustainable transport, climate-friendly agricultural practices, waste management, and institutional changes to implement its low-carbon economic development strategy. Its 2017 Urban Development Strategy also highlights the urban infrastructure required to match an increase in designated urban areas from 58 to 217 municipalities. About 40 percent of Nepal's population lives in these areas.³⁴² The strategy estimates an investment of \$3.6 billion³⁴³ to bridge the infrastructure gap in the 58 old municipalities, and almost \$9 billion³⁴⁴ for the 159 new municipalities.

Nepal's NDC also highlights the role of the private sector in helping the country achieve sustainable development, especially in the energy sector and in building resilient communities. The Nepal Business Forum liaises with the private sector, encourages its engagement in Nepal's economic development,³⁴⁵ and prioritizes reforms.³⁴⁶ Similarly, the government of Nepal issued a PPP policy in 2015 and announced its plans to establish a PPP center to facilitate investment in infrastructure and services.³⁴⁷ Private sector engagement through PPPs has been concentrated in key urban areas, such as water and sanitation, hydropower generation, and solid waste management, with scope to increase involvement in road and urban transport management.³⁴⁸ Providing services through community-driven approaches has also been successful, especially in the case of renewable energy³⁴⁹ and water and sanitation.³⁵⁰

NEPAL INDICATORS (2016)

Population	28.9 million
GDP	\$21.14 billion
GDP growth	0.60%
Inflation (consumer prices)	8.80%
Ease of Doing Business ranking	105
Foreign direct investment, net inflows (2015)	\$106 billion
S&P credit rating	n/a
Total greenhouse-gas emissions excluding land-use change and forestry (2014) (MtCO ₂ e)	37.52
Total greenhouse-gas emissions including land-use change and forestry (2014) (MtCO ₂ e)	44.06
Greenhouse-gas emissions rank (2012)	85
Total carbon dioxide emissions (kilotons)	113
Installed renewable energy capacity (MW)	934

NDC TARGETS

Main target	20 percent renewables in energy mix by 2020
Renewables	- Hydro: 4 GW by 2020 and 12 GW by 2030 - Solar: 2.1 GW by 2030 with arrangements to distribute it through the grid
Green buildings	Implement housing building code
Transportation	- Increase share of electric vehicles to 20 percent by 2020 - Develop electric (hydro-powered) rail network by 2040 to support mass transportation of goods and public commuting by 50 percent through effective mass public transport

IFC CLIMATE BUSINESS (FY2010–2016)

Total own account	\$41 million
Renewables	\$38 million
Green buildings	\$3 million



RENEWABLE ENERGY

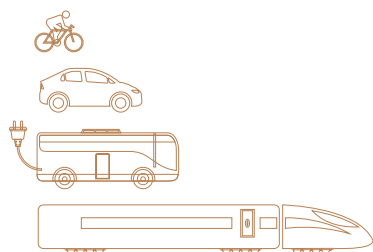
\$24.6B

Nepal's energy supply meets about 60 percent of its demand, which the government plans to augment using clean energy.³⁵¹ **The country's NDC commits to expanding the share of renewable energy to 20 percent of the total energy mix by 2020, achieving 80 percent electrification through renewable sources and decreasing its dependence on fossil fuels by 50 percent by 2050.**³⁵² Like its fellow Climate Vulnerability Forum members, Nepal has pledged to generate 100 percent of its electricity from renewable sources by 2050.³⁵³

Nepal's vast hydropower resources are central to its development.³⁵⁴

The country has an estimated 83,000 MW of hydropower potential, of which 42,000 MW is commercially exploitable and 802 MW—in mostly run-of-river capacity—has already been installed.³⁵⁵ The private sector is investing in 150 hydro projects under construction, amounting to a combined capacity of almost 3,000 MW.³⁵⁶ By 2030, Nepal plans to have increased its installed energy capacity to 12,000 MW of hydropower, 2,100 MW of grid-tied solar, 220 MW of bioenergy, and an additional 50 MW of small and micro hydroelectricity.³⁵⁷ There is great potential to increase the share of renewable energy, which currently stands at 1 percent of total energy use.³⁵⁸ IFC estimates an investment opportunity of **\$22.5 billion in hydropower** in Nepal between 2018 and 2030, reflecting an installed capacity of 12,000 MW, with an additional **\$2.1 billion investment opportunity** in other forms of renewable energy (**\$707 million from biomass and converting waste to energy, \$1.3 billion from solar, and \$100 million from small hydro**).





TRANSPORT

\$12.5B

With a road density of 0.9 kilometers per 1,000 people, Nepal is working to expand its strategic road network and improve its transport infrastructure.³⁵⁹ The government also aims to establish an electric railway system,³⁶⁰ with a goal to complete the nationwide network by 2040.³⁶¹ Nepal's Environment Friendly Vehicles and Transport Policy outlines its intent to transition its fleet to hybrid, electric, and efficient cars, and includes several supporting policy measures such as establishing a polluter-pays system, discouraging the import of high-polluting vehicles, and reclassifying vehicles based on their speed and weight to manage traffic capacity on roads.³⁶²

There are about 615 electric three-wheelers, 300 private electric vehicles, and 2,000 electric bikes registered and on the roads of Nepal.³⁶³ The NDC aims to increase the share of electric vehicles to 20 percent by 2020.³⁶⁴ IFC estimates an investment opportunity of \$2.5 billion in electric vehicles in Nepal between 2018 and 2030.

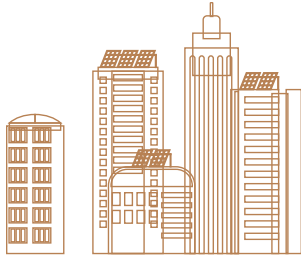
IFC estimates an investment opportunity of more than \$10 billion³⁶⁵ in transport infrastructure over the same period. This reflects the government's focus on enhancing road and rail connectivity,³⁶⁶ as well as its intention to upgrade urban transport infrastructure.³⁶⁷ Nepal's Strategic Plan for 2016–2021 outlines the government's intention to modernize the country's transport infrastructure, including developing 941 kilometers of four-lane roads, constructing 1,100 bridges and 398 kilometers of new railway track and bridges, and establishing 25 bus mass transit system routes.³⁶⁸

BUTWAL POWER COMPANY LIMITED (2010–2014)

Butwal Power Company is a leading hydropower company in Nepal, supplying power to the national grid and directly to almost 48,500 domestic and industrial customers. Across two projects from 2010 to 2014, IFC has committed \$25.8 million in loans, mobilizing an additional \$65.3 million to support the construction and development of new and existing hydropower generation capacity.

In 2010, IFC provided the company with a \$6.5 million long-term loan to expand its 5.1 MW Andhikhola Hydropower Project to 9.4 MW. This financing was critical for the company given the limited financing capacity of local commercial banks at the time. IFC also provided the company with advanced training in environmental and social management to attract investors.

Following the Andhikhola project, IFC committed \$19.3 million, alongside \$19 million from the IFC-Canada Climate Change Program, to finance Nepal's first project-financed hydropower plant, the 38 MW Kabeli plant. Blended finance helped the project reach financial close by improving its debt service coverage ratio, which had deteriorated due to significant delays in implementation. The government of Nepal and Kabeli Energy Limited (a project company owned by Butwal) have signed a project development agreement, which includes a concession period of 35 years, during which Kabeli Energy will build, own, and operate the project. After the concession period, ownership will be transferred to the government. The project is a first step towards addressing Nepal's energy deficit.



GREEN BUILDINGS

\$3.4B

Since the 2015 earthquake, Nepal's government and private sector have recognized the need and opportunity for resilient, green buildings in their reconstruction efforts. Nepal's NDC emphasizes the need for green homes, with standards and guidelines for construction led by the National Reconstruction Authority.³⁶⁹ In addition, the Department of Urban Development and Construction has formulated Guidelines for Green Building Technology.³⁷⁰

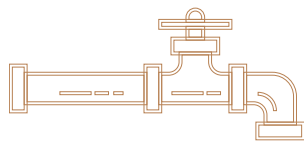
The government has identified the use of green building materials for post-earthquake reconstruction in its Post Disaster Needs Assessment, Rapid Environmental Assessment, and Post Disasters Recovery Framework.³⁷¹ The Post Disaster Needs Assessment identifies housing and human settlement construction as the biggest priority for Nepal's reconstruction plans.³⁷² This objective is being supported through various initiatives, including the United Nations Human Settlements Programme's SWITCH-Asia project for Green Homes, which has enabled local SMEs to start manufacturing green materials for construction.³⁷³

This push for green buildings is being pursued across sectors, with the tourism and hospitality sector leading the way with a \$6 million investment by IFC and FMO, the Netherlands-based development bank, in a sustainable, green business hotel in Kathmandu. This model will be replicated across the country.³⁷⁴ The construction industry is also pushing for the use of green building materials in reconstruction.³⁷⁵



Photo: Gennady Grechishkin / Shutterstock.com

With the planned reconstruction of about 600,000 buildings and the repair and retrofitting of more than 250,000,³⁷⁶ as well as the need for additional building stock to meet the needs of Nepal's growing urban population, IFC estimates an investment opportunity of \$3.4 billion in the green buildings industry between 2018 and 2030, of which **\$2.7 billion will be in the residential sector and almost \$650 million in the commercial sector.**



CLIMATE-SMART URBAN WATER

\$686M

Nepal's NDC focuses primarily on managing the risk of water-related disasters, emphasizing the importance of robust water and sanitation security.³⁷⁷ The country's Urban Development Strategy prioritizes the need to improve water supply and sanitation in the country,³⁷⁸ estimating a required investment of almost \$727 million annually for the period covered by the document.³⁷⁹ **Nepal's growing population and rapid urbanization, which is increasing by more than 3 percent per year,³⁸⁰ underscores the need to prioritize urban wastewater management.**

Small community-driven projects have seen success in Nepal, including in the urban water and sanitation sector.³⁸¹ A long-term project by the Asian Development Bank has introduced a model of shared ownership for water and sanitation provision and wastewater management in Nepal's small urban centers, with communities contributing to capital costs and operational and maintenance expenses, and making financial decisions about tariff rates and levels of investment.³⁸² The project is expected to benefit more than 1.2 million people in 69 urban centers by 2021.³⁸³ This model creates a precedent for the effective involvement of stakeholders other than the government in the urban wastewater sector—an opening that the private sector can capitalize on.

IFC estimates an investment opportunity of more than \$686 million in urban wastewater management alone between 2018 and 2030, as the country increases the volume of wastewater treated from negligible levels in 2015 to 54 percent by 2030.³⁸⁴

INVESTMENT SPOTLIGHT



THE NEPAL PILOT PROGRAM FOR CLIMATE RESILIENCE (2013)

IFC is working with agribusiness firms in Nepal to promote improved agricultural and water management practices, helping small farmers producing rice, maize, and sugarcane to improve their resilience against climate change. The Nepal Pilot Program for Climate Resilience, funded in part through the Climate Investment Funds, 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 has laid the foundation for future investments that promote resilience without sacrificing productivity.

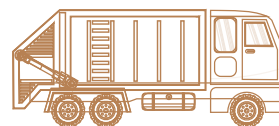
Recognizing that 91 percent of Nepal's employed women work in agriculture (64 percent of men), the project has tailored its training and other services to the needs of women farmers, such as recruiting women farm extension workers and arranging training schedules that suit their availability.



UPPER TRISHULI 1 HYDRO (2012)

In 2012, IFC invested \$3 million in equity in the Nepal Water and Energy Development Company to finance the development, construction, and operation of a 216 MW run-of-river hydropower plant on the Trishuli River in Nepal. IFC has been co-developing the \$550 million project as a shareholder with a 15 percent stake in the company alongside its lead sponsor, the Korea South East Power Company.

The project will be the first large domestic independent power producer in Nepal and, once constructed, one of the largest operating hydropower plants in the country—estimated to be capable of meeting up to 50 percent of domestic electricity demand.



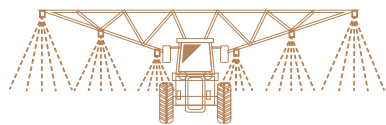
MUNICIPAL SOLID WASTE

\$83M

With the addition of 159 municipalities in FY15,³⁸⁵ the need for solid waste management in Nepal's urban areas is urgent. Its NDC acknowledges the importance of waste management and signals the prioritization of waste-to-energy plants in the country.

In 2015, about 50 percent of Nepal's 700,000 tons of waste was collected,³⁸⁶ six out of 58 official municipalities had sanitary landfills, and five practiced controlled waste dumping.³⁸⁷ **Nepal's Urban Development Strategy targets 100 percent waste collection from households in urban areas by 2031.**³⁸⁸ The composition of Nepal's municipal solid waste is primarily organic, presenting a significant opportunity for composting.³⁸⁹ Recognizing the potential for the private sector to contribute to waste management and improve operational efficiency and cost-effectiveness, the government enacted the Solid Waste Management Act in 2011, which has provisions for competitive bidding.³⁹⁰ The Kathmandu Municipal Corporation and other large municipalities already outsource some waste management services to private firms on contract.

IFC estimates an investment potential of \$83 million in solid waste management in Nepal between 2018 and 2030, with collection rates in municipalities rising to 100 percent during this period as per the 2017 Nepal Urban Development Strategy.



CLIMATE-SMART AGRICULTURE

\$4.8B

The agricultural sector employs almost 66 percent of the total working population of Nepal, and contributes about a third of the country's GDP.³⁹¹ Nepal's NDC emphasizes the need to make this sector more climate friendly, pledging to promote efficient technologies and local crops.³⁹² The country's Agriculture Development Strategy 2015–2035 indicates its intent to encourage climate-smart practices in commercial agriculture, highlighting the need for stress-tolerant crops and breeds of livestock, early warning systems to manage climate-related risks, improved standards, and efficient climate-smart technologies.³⁹³

Nepal's government encourages private sector participation in the agricultural sector. It allows 100 percent foreign investor ownership³⁹⁴ and established the Nepal Agribusiness Innovation Center in 2017—the country's first business incubator and innovation center solely for agriculture-focused companies.³⁹⁵ Supported by the World Bank Group's InfoDev program and the government of Nepal, it seeks to commercialize the country's agricultural sector sustainably.³⁹⁶ In addition, the Asian Development Bank allotted \$89 billion for investment in Nepal's agricultural sector in its country partnership strategy for 2013 to 2017, including in irrigation, other agricultural infrastructure, and environmental sustainability in the sector.³⁹⁷ At the Nepal Investment Summit 2017, companies from Bangladesh pledged to invest \$1 billion in Nepal's agricultural sector.³⁹⁸ The investment opportunity for climate-smart agriculture is estimated to be near \$4.8 billion to 2030. The agribusiness opportunity alone in Nepal is estimated to be \$1.5 billion in key areas, including spices, fruit processing, seeds, tea, and dairy over a period of just four years, signaling significant potential for continued growth.³⁹⁹



Priorities for Nepal to Attract More Climate-Smart Investment

Devastating earthquakes in 2015, trade disruptions leading to a fuel crisis from late 2015 to early 2016, and floods in 2017 underlined the need for Nepal to diversify energy sources, enhance connectivity, increase the versatility of agricultural production, and enhance disaster response capacity and preparedness.⁴⁰⁰ The government has prioritized reconstruction and reinvigorating economic growth to support its long-term development objectives. This presents an opportunity to address current growth bottlenecks, including insufficient infrastructure and power provision. Ensuring political stability and policy certainty as the government transitions to a federal democratic system will further cement its progress in boosting growth and attracting investment.

As the country strives to realize its potential in hydropower generation, tourism, high-value agriculture, manufacturing, and services, **addressing financing, policy, and institutional barriers will be essential to unlocking investment.** Lengthy processes, delayed and incomplete projects, and cost and time overruns can impede both public and private investment from keeping pace with demand and opportunity. The government is working to address constraints in the investment environment and bolstering institutional reforms and governance capacity. For example, it has commissioned cloud and digital signature infrastructure, which is critical to ensuring the security of transactions in the banking sector. It is also close to launching an online registration and approval system for foreign direct investment. Such initiatives, along with reviewing foreign ownership limits, sector caps, and restrictions on non-equity investments, will help increase foreign investment beyond 1 percent of GDP.⁴⁰¹ Strengthening alignment between planning, policy, and budgeting, and using consistent technical screening and appraisal criteria in financing decisions will also help address some of these challenges and facilitate PPPs.

The perceived costliness of adopting green technologies is a significant challenge. Small companies, which make up the bulk of the local private sector, are wary of investing in new expensive climate-friendly technologies. **The lack of access to financing is also a barrier for participation by local companies and entrepreneurs.** Successful demonstration projects and building the capacity to assess and implement them

can help encourage banks to lend to companies investing in such technologies. **Creating awareness about the financial benefits of resilient, climate-smart investment can further disrupt this pattern.**

★ RENEWABLE ENERGY

Large investments in Nepal's hydropower would improve productivity, increase wages significantly, and improve competitiveness in downstream industries.⁴⁰² There are many local hydro developers, but the Nepal Electricity Authority, a government body, is the only off-taker.⁴⁰³ The lack of stringent criteria for signing power purchase agreements with the Nepal Electricity Authority is a disincentive for local hydro developers to try to attract foreign investment. **Developing the sector would reduce load-shedding and provide major revenue through exporting electricity to India and Bangladesh.** In addition, the government has also indicated its intention to develop the solar sector. High solar subsidies to individuals that act as barriers for companies to invest need to be reformed to enhance profitability and make the sector more attractive to businesses.

★ TRANSPORT

The post-earthquake reconstruction process has seen the government adopt an integrated approach to urban development, which in turn supports transit-oriented development. Plans to increase the use of electric vehicles offer significant potential for private investment. **Clarifying the numbers associated with the target, alongside plans to build charging infrastructure, will indicate the scale of the opportunity for companies and investors and inform potential buyers.** Developing consistent standards for the necessary charging infrastructure will also promote growth in the sector. The use of PPPs to increase Nepal's road density, one of the lowest in the region,⁴⁰⁴ can be facilitated by easing procurement and land acquisition processes, encouraging best practices for terrain-specific road condition and safety, and inviting private sector expertise in monitoring and maintenance.





★ GREEN BUILDINGS

The county's building construction needs also provide a significant opportunity to implement and enforce the government's Guidelines for Green Building Technology. The guidelines' uptake can be increased by streamlining the process for obtaining construction permits, reducing the costs of permits for green construction, building domestic technological capacity, and providing financial assistance for implementing greening measures.

Recommendations

- 1 Generate awareness about the business case for green and resilient investment. Develop successful PPPs and climate-smart projects to demonstrate the financial benefits of investing in green projects.
- 2 Streamline and simplify permitting processes and procedures for projects.
- 3 Update policy on foreign ownership limits, sector caps, and restrictions on non-equity investments.
- 4 Standardize power purchase agreements to enable increased participation by independent power producers and initiate auctions for building hydropower generation capacity.
- 5 Implement and enforce green and resilient building codes for new structures and post-earthquake reconstruction.



Innovative Technology Solutions to Effect Change

Innovative technologies are needed to address climate change. While current technologies can help solve the problem,⁴⁰⁵ further research is needed to improve performance and reduce costs. Technologies should also be tailored to local conditions, deployed cost-effectively, and supported by governments. Several emerging technologies are being applied in new and innovative ways in South Asia. Power storage, improved connectivity to the Internet of Things (a network of devices and appliances connected to the Internet), sensors, and smart metering are just a few examples with broad applications.

STATIONARY ENERGY STORAGE IN SOUTH ASIA

Energy storage is crucial for integrating renewable energy and distributed/local generation effectively. However, despite rapidly falling costs, energy storage systems remain expensive and the significant upfront investment needed is difficult to overcome without

government support and/or low-cost financing. It requires expertise to be developed and the systems to be operated cost-effectively, and the services provided by energy storage systems are often not properly valued within existing energy market regulations. For example, if frequency support or intermittent renewable integration could receive long-term utility contracts, it would allow better access to financing. Despite these barriers, global installations of stationary energy storage systems are increasing as system costs drop and energy markets are reformed to allow more distributed resources; however, most advanced energy storage systems have been concentrated in a few developed countries.

The potential market for energy storage in South Asia is largest in India. In 2014, Indian Prime Minister Narendra Modi announced an ambitious target to install 100 GW of solar photovoltaic capacity by 2022. As of the end of September 2016, the total installed

solar capacity was more than 8.6 GW, including the world's largest power plant (648 MW), putting the country on track to become the world's third biggest solar market in 2017.⁴⁰⁶ India's first utility-scale battery-backed solar power project has just been awarded to Mahindra Susten in the Andaman and Nicobar Islands, replacing costly diesel power and cutting costs by half.⁴⁰⁷ Battery backup, previously used only for island grids, is necessary to ensure grid stability because the energy storage systems will be used to ensure the smooth and consistent output of solar photovoltaic power. While it may be preferable to keep storage systems and solar photovoltaic plants in different locations, a separately regulated investment program solely for energy storage systems may move at a different pace and impede the deployment of planned solar power. In addition, the requirement for "combined solar photovoltaic plus storage" may be crucial for establishing local technical expertise and developing investor trust in the technology and project development process.

In other parts of South Asia, use of energy storage is limited—but the opportunities are significant. Storage is particularly attractive in Bangladesh due to the nightly peak, when generation (from liquid fuels) costs between \$0.26 and \$0.38 per kWh. Money saved could help provide power to those without access to it,⁴⁰⁸ and energy storage solutions could help companies reduce productivity losses resulting from frequent outages. Bhutan's government plans to provide electricity to all households in the next 20 years, but the practical problems of extending the grid over long distances and mountainous terrain will make that target difficult and expensive to achieve. Off-grid solutions with energy storage could meet this need at a reasonable cost.⁴⁰⁹

In the Maldives, energy storage is used on five islands, with 2.7 MW of solar photovoltaic and 700 kW/333 kWh of energy storage systems, via a photovoltaic-diesel hybrid energy storage micro-grid. The islands previously relied on diesel for power that was expensive and of poor quality. The project is estimated to save \$1.4 million in fuel costs and meet more than 30 percent of local residential and commercial energy demands.⁴¹⁰ In the short term, much of the new energy storage capacity in the region is expected to come from the remote power system used for village electrification and physical island systems to expand energy services to new customers and improve reliability. In addition, a large market for secure backup power of more than four hours per day in the commercial and industrial sector, currently served by expensive diesel engines, will start to see competition from solar photovoltaic plus storage projects, if finance is accessible.

Pumped hydro storage in the Himalayan region is one of the few areas being developed to store energy in South Asia. In October 2016, the governments of Nepal and Bangladesh signed an agreement to develop 1,600 MW of pumped hydro storage capacity in Nepal for dispatch to Bangladesh through two different projects. While this plan could improve the region's ability to integrate new renewable energy generation, the projects may take up to 10 years to become fully operational.

LOW-POWER, WIDE-AREA NETWORKS

New technologies include the Internet of Things; low-power, wide-area (LPWA) networks; sensors; and smart meters. LPWA technology is an effective wireless network that builds coverage for low-data Internet of Things applications.

These innovative networks broadly fall into two categories: dedicated LPWA networks (such as Sigfox, LoRa, and Ingenu) and additions to cellular networks (for example, NarrowBand Internet of Things and Long-Term Evolution (4G), category M1). The two types are used for different purposes, and may continue to co-exist in the future. The dedicated networks aim to significantly reduce cost and energy use, while the cellular overlays aim to achieve rapid roll-out by working with existing cellular networks. LPWA is more than a lower-cost network—it allows a wide range of devices and assets to connect to the Internet. It is so low cost and power efficient that it makes sense to connect all assets as a standard approach, and then decide on specific applications at a later stage. Applications that are relevant for implementation in the region include logistics/asset tracking, sensors, and smart metering.



LOGISTICS/ASSET TRACKING

Logistics is the backbone of industrial development in emerging markets. As industry develops, so does the need for the movement of goods. The transport of logistics and goods is a significant opportunity in emerging markets, but the sector is fragmented and inefficient, resulting in unnecessary waste, spoilage, and delays. These inefficiencies could be addressed in the following ways:

- **Pallet tracking:** Every year, more than 3 billion pallets are produced to transport a variety of goods, but many are lost. Tracking assets is critical to efficient supply chain management, but traditional networks are expensive: cellular network tracking devices can cost \$100 a year, and the batteries last less than three months. LPWA technology, on the other hand, is available at a fraction of the cost, and the battery can last five years, saving resources and avoiding longstanding outages.
- **Unbroken cold chain:** Temperature-controlled supply chains (via uninterrupted refrigerated production, storage, and distribution activities) can be monitored using low-cost sensors installed on existing containers and trucks, which could save up to 30 percent of fresh produce otherwise lost to spoilage.
- **Truckload monitoring:** LPWA sensors added to trucks, vans, and containers can also help monitor cargo for tracking and asset allocation. This is particularly relevant in emerging markets that lack infrastructure, where asset monitoring is crucial, but connectivity is low and GPS receivers are costly.

LPWA has been rolled out in Western Europe and the United States, and is being introduced in emerging markets, including Latin America, Russia, and South Africa. Investors are interested in rolling out a network in South Asia. Both LPWA technologies will mobilize local partners to roll out their networks, creating opportunities for regional entrepreneurs and businesses with experience in building and maintaining distributed technical infrastructure.

SENSORS FOR AGRICULTURE

Investments in agricultural technology reached \$4.6 billion globally in 2015—95 percent higher than in 2014.⁴¹¹ Internet of Things applications made available via LPWA have the potential to improve decision making; reduce costs; and increase crop quality, quantity, and sustainability. For example, sensors can measure soil moisture and reduce water use by an additional 15 percent beyond the introduction of drip irrigation. They can also measure nitrate and phosphate levels to ensure even fertilizer application, measure soil sensitivity to runoff, and monitor the effectiveness of flood-management techniques.⁴¹² Start-ups in South Asia are building Internet of Things-enabled smart agriculture solutions, including an end-to-end supply chain monitoring solution in India by Stellapps. Sensors can also be used in asset tracking, including vulnerable/endangered species (piloted with rhinos in Zimbabwe).⁴¹³

SMART METERING

Smart meters (electricity, water, and gas) read resource use in near real-time (frequencies of about every 15 minutes), empowering customers to make more informed decisions about resources, as

opposed to analog meter readings, which happen once a year in many markets. The specific savings in resource consumption vary by market (for example, markets with residential air-conditioning use have a higher potential for electricity savings), with savings of up to 4 percent for electricity, 3 percent for gas, and as high as 6.4 percent for water. Electricity savings of between 3 percent and 4 percent in a typical household translate to between 90 kWh and 120 kWh annually. This can add up, recovering the cost of the smart meter within two years. Smart meters also allow smart pricing, where resource use is priced based on time of day or grid load—this additional information can further inform consumer actions. Moreover, they make customer billing more transparent and can lead to more financial transparency at the power, water, or gas distribution company. In India, about 280,000 basic smart meters were installed in 2015, and this number is forecast to increase to 1.2 million by 2020.⁴¹⁴



Sri Lanka

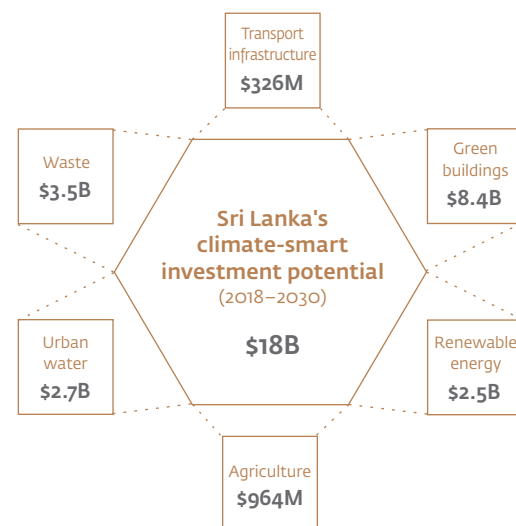
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SRI LANKA



Sri Lanka's estimated climate-smart investment potential in key sectors is more than \$18 billion between 2018 and 2030.

Sri Lanka has come out of a 30-year civil war with a strong policy focus on reconstruction and growth.⁴¹⁵ With an average annual GDP growth rate of 6.4 percent between 2010 and 2015,⁴¹⁶ Sri Lanka is transitioning its economy towards urban-based manufacturing and service sectors.⁴¹⁷ Economic development has been driven by the public sector, but the Sri Lankan government is implementing several reforms to encourage transparency and competitiveness for private sector-driven growth.⁴¹⁸ Sri Lanka's success in developing basic infrastructure such as a road network density of 98 percent (highest in South Asia)⁴¹⁹ and its ranking as 73rd out of 138 countries in FY17 for infrastructure development in



the Global Competitiveness Index⁴²⁰ make it an attractive destination for private investment. Rigorous policies and government incentives have ensured that 98 percent of its 21.2 million people⁴²¹ have access to electricity, 96 percent have access to safe water, and 95 percent have access to sanitation.⁴²²

The government has emphasized the need for sustainable, resilient development, launching a Vision for a Sustainability Era initiative as part of its Sri Lanka 2030 goals, which seeks to tailor the United Nations Sustainable Development Goals to local needs and constraints.⁴²³ Sri Lanka's NDC comprises four areas—mitigation; adaptation; loss and damage from extreme weather events; and implementation through finance, technology, and capacity building. As part of these measures, Sri Lanka aims to reduce its greenhouse-gas emissions by 20 percent in the energy sector and by 10 percent in the transport, waste, industry, and forestry sectors. In addition, the government introduced a “blue-green era” development strategy in 2016 to curb unsustainable production and consumption patterns through the sustainable development of its marine resources (blue development) and green development across all sectors, including the creation of green jobs for its workforce.⁴²⁴

Sri Lanka's Vision 2025, which outlines the government's plans for the economy to achieve upper-middle-income status, signals its intention to **empower the private sector and attract domestic and foreign investment by reforming investment incentives, improving policy predictability, encouraging PPPs, and integrating SMEs into the formal sector.**⁴²⁵ It also aims to establish economic corridors, meet the demand for urban housing, and improve the public transport system. Megapolis, the massive \$40 billion urban infrastructure project envisioned by the Sri Lankan government,⁴²⁶ is one example of how the private sector can involve itself in the opportunities presented by sustainable waste, transport, green buildings, and other sectors.⁴²⁷

SRI LANKA INDICATORS (2016)

Population	21.2 million
GDP	\$81.32 billion
GDP growth	4.4%
Inflation (consumer prices)	4%
Ease of Doing Business ranking	111
Foreign direct investment, net inflows (2015)	\$890 million
S&P credit rating	B+
Total greenhouse-gas emissions excluding land-use change and forestry (2014) (MtCO ₂ e)	40.75
Total greenhouse-gas emissions including land-use change and forestry (2014) (MtCO ₂ e)	45.25
Greenhouse-gas emissions rank (2012)	94
Total carbon dioxide emissions (kilotons)	89
Installed renewable energy capacity (MW)	1,859

NDC TARGETS

Main target	Greenhouse-gas reduction target: 23 percent by 2030
Renewables	• Solar: 115 MW installed • Wind: 514 MW large-scale wind farm • Absorb at least 50 percent non-conventional renewable energy into the system by 2030
Transportation	• Establish energy-efficient and environmentally sustainable transport systems by 2030 • 25 percent to 40 percent of public transport green fueled • Introduce electric rail system • Launch pilot project on electric buses
Agriculture	• Improve land and soil management • Irrigation: Introduce efficient water management practices and establish water flow and sediment loads monitoring system • Promote climate-smart agriculture

IFC CLIMATE BUSINESS (FY2010–2016)

Total own account	\$26 million
Renewables	\$4 million
Green buildings	\$8 million



RENEWABLE ENERGY

\$2.5B

The Sri Lankan government is working to shift the current electricity supply mix away from imported fossil fuels, which has both budgetary and carbon footprint implications,⁴²⁸ toward cleaner alternatives. In recent decades, Sri Lanka's electricity supply had shifted from 95 percent hydropower in 1995 to thermal power plants accounting for up to 60 percent of generation in 2016.⁴²⁹ Recent policies have included measures to rebalance this by emphasizing the need to shift to indigenous natural gas and renewable energy sources.⁴³⁰

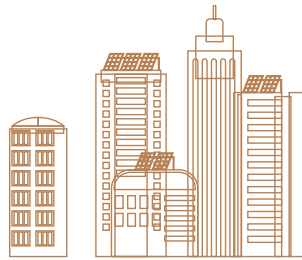
The Sri Lanka Energy Sector Development Plan 2015–2025 aims to reduce regional disparities in the delivery of energy services, adopt innovative financing for renewable energy infrastructure, and become energy self-sufficient by 2030.⁴³¹ Priority areas include developing clean energy, improving the effectiveness of energy-related institutions through e-procurement, strengthening transmission networks and utility-related infrastructure, and encouraging innovative financing to diversify the energy sector. These priorities open up significant opportunities for the private sector.⁴³² The country's NDC aims to establish large-scale renewable energy installations, including 514 MW of wind power, 115 MW of solar, 105 MW of biomass, and 176 MW of mini-hydro.⁴³³

Sri Lanka's Paris Agreement target aimed to increase the share of renewables in the energy mix from 50 percent to 60 percent by 2020 and keep the share constant at that level, but the country has since deepened its commitment. In 2016, Sri Lanka, along with the other members of the Climate Vulnerability Forum, pledged to generate 100 percent of its electricity from renewable sources by 2050.⁴³⁴



With private entities accounting for 31 percent of the country's total electricity generation in 2014,⁴³⁵ this target is an opportunity for the private sector to invest in renewable energy.

Accounting for these longer-term targets, IFC estimates a potential investment opportunity of \$2.5 billion in Sri Lanka between 2018 and 2030. Of this, \$981 million will come from wind power, \$679 million from small-scale hydro, \$464 million from biomass, \$190 million from large hydro, and \$104 million from utility solar.



GREEN BUILDINGS

\$8.4B

Smart cities and green buildings are key pillars in Sri Lanka's Energy Sector Development Plan to achieve the government's goal of reducing total energy demand by 10 percent by 2020, through conservation and efficient use of energy.⁴³⁶ In 2014, the construction industry grew by 20 percent on the previous year, with significant contribution from the buildings sector.⁴³⁷ With two-thirds of the annual demand for 50,000–100,000 housing units being met every year, there is an opportunity to scale building construction to clear the backlog demand with green buildings.⁴³⁸ As 30 percent of the population is expected to be living in cities by 2050⁴³⁹ and the current vacancy rate is less than 5 percent in commercial buildings in the capital of Colombo, **the buildings sector will continue to grow in tandem with Sri Lanka's development, representing a significant opportunity to green the country's buildings.**⁴⁴⁰

The government has already put in place many of the necessary policies and measures to achieve this objective and enable private investment in this sector, including a green ratings system for buildings and a green labeling system for building materials,⁴⁴¹ as well as 3.4 million square feet of LEED-certified activities.⁴⁴²

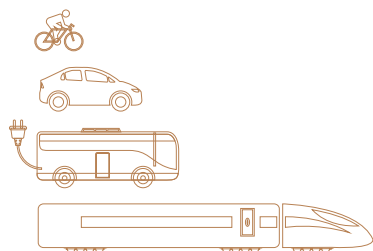
IFC estimates an investment opportunity of almost \$8.4 billion in Sri Lanka's green buildings sector, of which **\$6.8 billion will come from the residential sector and \$1.6 billion from the commercial sector.**

INVESTMENT SPOTLIGHT



COMMERCIAL BANK OF CEYLON PLC (2017)

In August 2017 IFC extended its long-term partnership with Sri Lanka's Commercial Bank of Ceylon, committing to a \$100 million own-account senior loan to help the bank increase its lending for renewable energy and energy-efficiency projects in the country. This is IFC's largest financing from its own account in the country. Issued over seven years, this financing will help reduce greenhouse-gas emissions, promote energy-efficiency, and support the expansion of conventional and non-conventional renewable energy projects. The loan will also contribute between 7,500 and 23,250 new direct jobs, while its projects will save an estimated 165,040 tons of greenhouse-gas emissions annually. Earlier in the year, IFC extended its partnership with the bank through an advisory project to help develop its green finance business.



TRANSPORT

\$326M

Sri Lanka's road transport infrastructure is concentrated in a dense network around Colombo.⁴⁴³ Of the 5 million vehicles on the road, only 11 percent are cars—with motorcycles making up the majority.⁴⁴⁴ Due to a 2010 policy⁴⁴⁵ to substantially reduce taxes on hybrid vehicles, **Sri Lanka is a global leader in the use of hybrid electric vehicles, which comprised 56 percent of all cars in the country in 2014.**⁴⁴⁶ The government is pushing to improve fuel efficiency even further, aiming to upgrade its emissions standards to Euro III for diesel vehicles and Euro IV for petrol vehicles by 2018.⁴⁴⁷

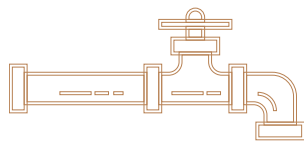
The Sri Lankan government is prioritizing a modal shift towards mass public transport. Traffic congestion can result in annual economic losses of \$2.5 billion—an amount greater than the annual investment in improving the country's road infrastructure.⁴⁴⁸ The Clean Air Action Plan includes a clear strategy to manage emissions from the transport sector to 2025 through urban mass public transport systems; a green freight transport system; and cleaner fuels, technologies, and practices.⁴⁴⁹ In addition, as part of its Nationally Appropriate Mitigation Actions, the government intends to develop an electric bus rapid transit system in Galle through public and private investment, consisting of 100 electric buses introduced in two phases over 10 years.⁴⁵⁰ Given the success of PPPs in the implementation of the government's vehicle emissions testing program, the plan signals further opportunities for private participation and PPPs in developing environmentally friendly public and freight



transport systems and introducing cleaner fuels and transport technologies.

Reducing journeys through urban design, encouraging a shift to less carbon-intensive modes of transport, improving the energy-efficiency of vehicles, and improving fuel quality will help achieve Sri Lanka's NDC target for the transport sector.⁴⁵¹ These strategies create private investment opportunities, including the establishment of a sustainable urban transport system by 2030 in conjunction with the Megapolis plan, the electrification of Sri Lanka's railway systems, and the introduction of inland water transport systems.

Taking projects in the pipeline into consideration, IFC estimates an investment opportunity of at least \$326 million in Sri Lanka's transport sector between 2018 and 2030.



CLIMATE-SMART URBAN WATER

\$2.7B

The water sector in Sri Lanka is almost exclusively the domain of the public sector.⁴⁵² The government aims to provide access to clean and safe water and sanitation to the entire population by 2020. The National Water Supply and Drainage Board doubled the number of new water connections in the country between 2004 and 2013.⁴⁵³

Sri Lanka's NDC goals for the water sector prioritize water supply, water management, and resilience, and its goals for the tourism sector emphasize the need for wastewater management,⁴⁵⁴ particularly as the urban population is growing by 1.4 percent per year.⁴⁵⁵ Sri Lanka's Board of Investments priority sector list published in March 2017 identifies water supply and sanitation as a key investment area.⁴⁵⁶ IFC estimates an investment opportunity of more than \$2.7 billion between 2018 and 2030 in urban wastewater management alone. This scale of investment would result in 64 percent of wastewater being treated by 2030, building on the 2.5 percent of piped sewage in 2010.⁴⁵⁷

INVESTMENT SPOTLIGHT



MAS CAPITAL PRIVATE LIMITED (2014)

In June 2014, IFC committed to providing a \$28 million own-account investment in MAS Capital Private Limited, Sri Lanka's largest export apparel manufacturer, to support the group's expansion and innovation plans. MAS Capital is Sri Lanka's largest private sector employer, with 42 facilities spread over 10 countries and a workforce exceeding 64,000. The group's operations span the entire value chain of the manufacturing process to the final product.

The project supports new investment for capacity expansions, sustainability projects, and product development, helping to improve the apparel sector's compliance with environmental standards and energy-efficiency. The project will also create more job opportunities for women in Sri Lanka.

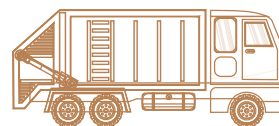


ARPICO (2016)

In March 2016, IFC, with support from the government of Canada, committed to investing \$15 million in the Sri Lankan retail chain Richard Pieris Distributors Limited. The company's flagship brand, "Arpico", has been one of the most powerful local brands in Sri Lanka for more than 50 years, serving the community with a diverse range of products across many sectors such as manufacturing, plantations, financial services, exports, consumer goods, construction, logistics, educational services, and retail.

IFC's investment consists of a \$7.5 million loan from IFC's own account and a further \$7.5 million from the IFC-Canada Climate Change Program. The project will help the company expand its modern retail network, support job creation, and develop local supply chains. The financing will also be used to install solar panels on company store rooftops.

This investment will help create more than 800 direct new jobs and an even larger number of indirect jobs by 2020. It will also help the company adopt green building measures and promote climate-smart technologies. Rooftop solar photovoltaic installations funded through the project will help reduce greenhouse-gas emissions by 2,200 tons of carbon dioxide equivalent annually.



MUNICIPAL SOLID WASTE

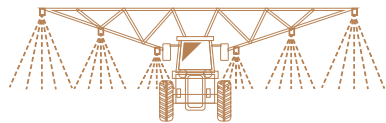
\$3.5 B

Increased waste generation due to economic development, rapid urbanization, and a growing population has caused waste management to ascend the list of priorities for the government of Sri Lanka.⁴⁵⁸

Accordingly, the National Solid Waste Management Support Center, in line with the National Solid Waste Management Strategy, is focused on waste minimization, resource recovery, and landfill sanitization.⁴⁵⁹

The emphasis on solid waste management in Sri Lanka's NDC presents a significant opportunity for private firms in the waste sector to improve on the 40 percent of waste currently collected.⁴⁶⁰ Policy approaches include adopting the reduce, reuse, and recycle model, as well as setting up secondary liquid fuel facilities, composting plants, and waste-to-energy projects.⁴⁶¹ Sri Lanka has one landfill with a functional secondary liquid fuel facility and one composting plant, with plans to set up eight more of the latter.⁴⁶² In keeping with the NDC priority, construction began on two 10 MW waste-to-energy projects in August 2017, with a combined value of about \$195 million.⁴⁶³ These projects were awarded to private firms through a competitive bidding process.⁴⁶⁴

IFC estimates a solid waste management investment opportunity amounting to \$3.5 billion in Sri Lanka between 2018 and 2030, with collection rates rising to 80 percent.

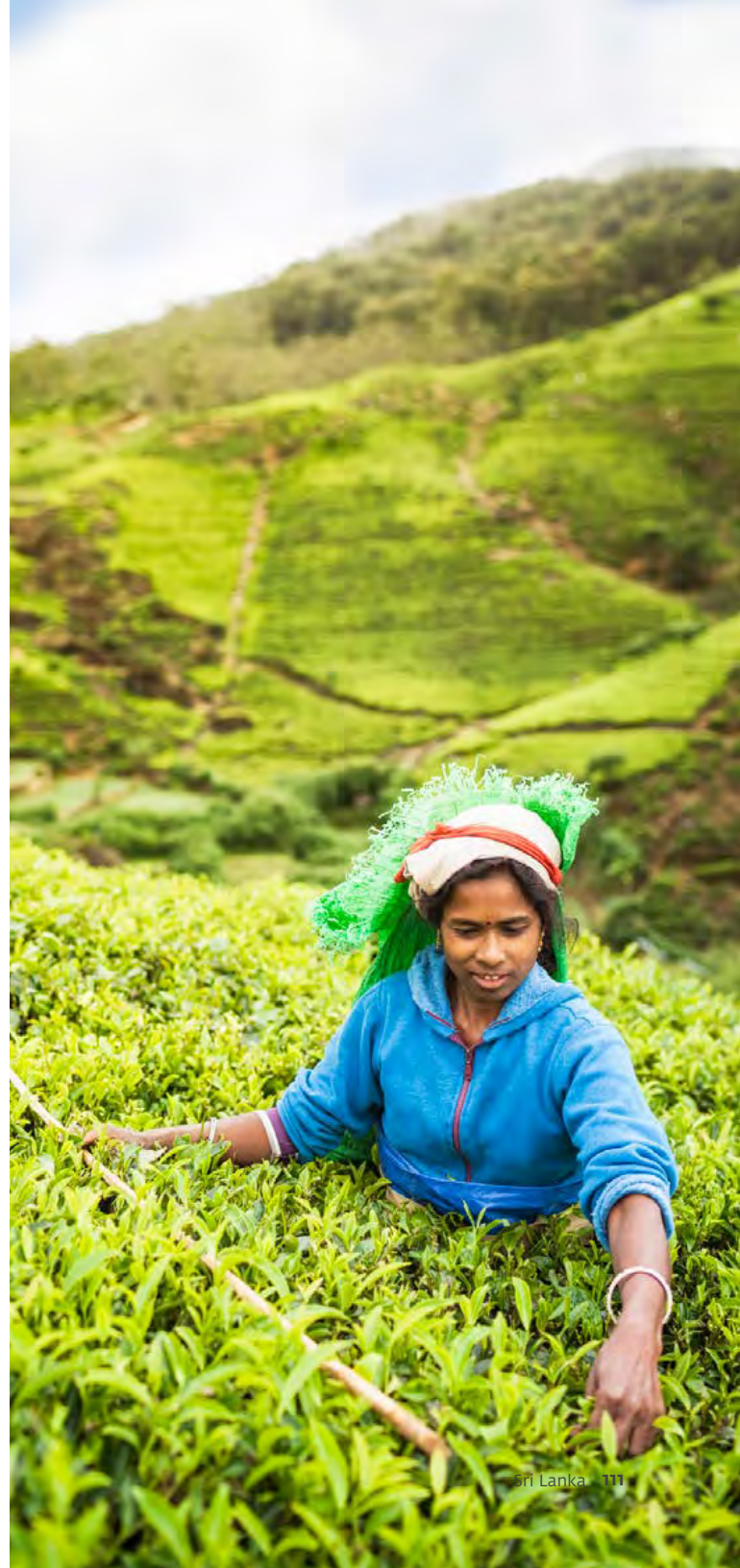


CLIMATE-SMART AGRICULTURE

\$964 M

In 2015, the agricultural sector accounted for 8.1 percent of Sri Lanka's GDP and employed 2.4 million people, with an additional 0.6 percent of GDP contribution from animal production.⁴⁶⁵ Sri Lanka's NDC emphasizes food security and resilience in its agricultural sector, with a particular focus on environmentally friendly technology packages; crops tolerant to heat, drought, salt, and floods; and measures such as green energy and integrated waste systems for agriculture and livestock production.⁴⁶⁶

The government has prioritized investments in improving productivity, innovative technology, access to international markets, and resilient seed varieties.⁴⁶⁷ In 2015, the Asian Development Bank invested \$453 million in a \$621 million project to enhance agricultural productivity by securing access to water, a major proportion of which will go towards building irrigation efficiency.⁴⁶⁸ The Asian Infrastructure Investment Bank is poised to invest \$115 million for the second tranche of the project in 2017, with an additional \$195 million from the Asian Development Bank. The project is expected to be completed in 2024.⁴⁶⁹ The private sector has an opportunity to invest in modernizing the sector, as demonstrated by the \$33 million investment in smallholder agribusiness in Sri Lanka by the International Fund for Agricultural Development and its private sector allies.⁴⁷⁰ Sri Lanka's Vision 2025 invites private participation and PPPs to modernize the agricultural sector and introduce efficient and sustainable value chains.⁴⁷¹ It outlines a plan to establish an agriculture logistics network using a PPP approach, make credit available for investment in livestock and fisheries, and promote a smallholder agribusiness partnership to enhance competitiveness.⁴⁷² These policies present a significant opportunity for the private sector to invest in climate-smart agriculture in Sri Lanka.





Priorities for Sri Lanka to Attract More Climate-Smart Investment

Sri Lanka is a strategically located country with a population of 21 million and an \$83 billion economy. Its real GDP grew by 43 percent from 2009 to 2014, but the top four sectors—accounting for half of total growth—were all non-tradable (construction, transport, domestic trade and banking, and insurance and real estate), which may make this growth difficult to sustain in the long term.⁴⁷³ The growth has contributed to reducing extreme poverty from 13 percent to 3 percent. Most Sri Lankans have access to financial services, education, electricity, connectivity, and health care. However, critical development gaps still exist: 32 percent of the population lives on less than \$2.50 per day.⁴⁷⁴ In addition, Sri Lanka is particularly vulnerable to the consequences of climate change and rising sea levels. **Without significant investment in climate resilience, the country could lose about 1.2 percent of annual GDP growth per year by 2050 due to climate change.**

The country is in the midst of a major political and institutional transition as it seeks to formulate and adopt a new constitution. Low and declining tax revenues have affected its fiscal position—it currently has one of the lowest tax revenue-to-GDP ratios in the world—and the country is working to restore fiscal sustainability.⁴⁷⁵ While Sri Lanka's infrastructure base is strong for South Asia, prioritizing this sector has squeezed spending on other public goods. **Given the country's fiscal challenges and ambitious energy, transport, and waste management infrastructure plans, there are many opportunities for the private sector to fill this investment gap.**

The private sector has an important role to play, particularly in urban development, industrial parks, and PPPs for large-scale project implementation.⁴⁷⁶ Sustaining economic growth and job creation will require new ways of incentivizing domestic private and foreign direct investment. Fiscal incentives to date have not fully overcome perceived political risks and institutional legal and regulatory constraints, which have limited investment. As Sri Lanka pursues deeper integration with the global economy through export-oriented production, opportunities for scaling up private investment and attracting greater foreign investment will open up. The government has also introduced several policies and regulations that build confidence among private actors. These include several measures to improve transparency and bolster the

investment climate, such as the 2017 Inland Revenue Act to provide clarity on the taxes being levied and the 2015 Right to Information Act. Expediting the resolution of litigated matters and strengthening regulations such as property rights registration systems and land-use regimes that introduce limitations will also help.

★ RENEWABLE ENERGY

Sri Lanka has pledged to provide affordable, reliable, high-quality energy to all of its citizens. Although the country enjoys a high level of electrification, the government aims to rectify regional disparities in access and attain a 100 percent electrification rate in all provinces.⁴⁷⁷ The government has introduced a community-based rooftop solar power generation program, Soorya Bala Sangramaya (Battle for Solar Energy), that is expected to add 1,000 MW of capacity by 2025. Participants can sell their excess energy production back to the grid or bank it for later use through three programs: net metering, net accounting, or micro solar power producers.⁴⁷⁸ There is also interest in developing solar and wind parks. Such energy investments are all expected to be PPPs, and will be managed by the PPP unit in the Ministry of Finance. Efforts are under way to develop a national PPP framework. A recent joint assessment by the Asian Development Bank and the United Nations Development Programme has determined that Sri Lanka is on track to achieving its renewable energy target, projecting an estimated 15 GW of wind energy and 16 GW of solar energy towards its projected 34 GW requirements in 2050, with the balance coming from hydro and biomass power plants.⁴⁷⁹

★ GREEN BUILDINGS

The government has put in place a variety of measures that have incentivized investments in green buildings. It is also developing a Green Building Code and Evaluation System, which will be supplemented by a new green building policy in the near future.⁴⁸⁰ As the first step in this program, all government buildings will be subject to green buildings standards from 2017.





★ CLIMATE-SMART URBAN WATER

The government's preference to not privatize public utilities has precluded private sector participation in the provision of water and sanitation services. Policy reform will be required to attract different forms of capital to help the sector rehabilitate and extend service coverage. The Board of Investment is encouraging domestic and foreign private companies to invest in this sector through financial incentives for developers. As such, there remains an opportunity for the private sector to help water and wastewater utilities increase operational efficiency and cost recovery in the sector.⁴⁸¹ However, the lack of independent regulatory oversight of the sector is likely to be a continuing disincentive.

★ MUNICIPAL SOLID WASTE

The collapse of a waste dump in Colombo in 2017 has led to a surge in efforts to address solid waste management issues in Sri Lanka. A call for proposals has been issued for the Metro Colombo Solid Waste Management Project to develop a sanitary waste landfill disposal facility, with the objective of eventually turning Colombo into a waste-free city. A \$60 million PPP is being created in the Western Province as a sustainable model for solid waste management processing in Karadiyana.⁴⁸² The project includes a 22-year concession agreement, signaling long-term alignment between developers, investors, and the government, paving the way for a major reduction in the diversion of waste to landfills. In addition, two PPP solid-waste-to-energy power plants, totaling \$193 million in investment, are expected to start construction in Muthurajawela, adding 20 MW of capacity to the grid. They will collectively process 1.3 billion tons of unsorted waste generated from Colombo and Gampaha.⁴⁸³

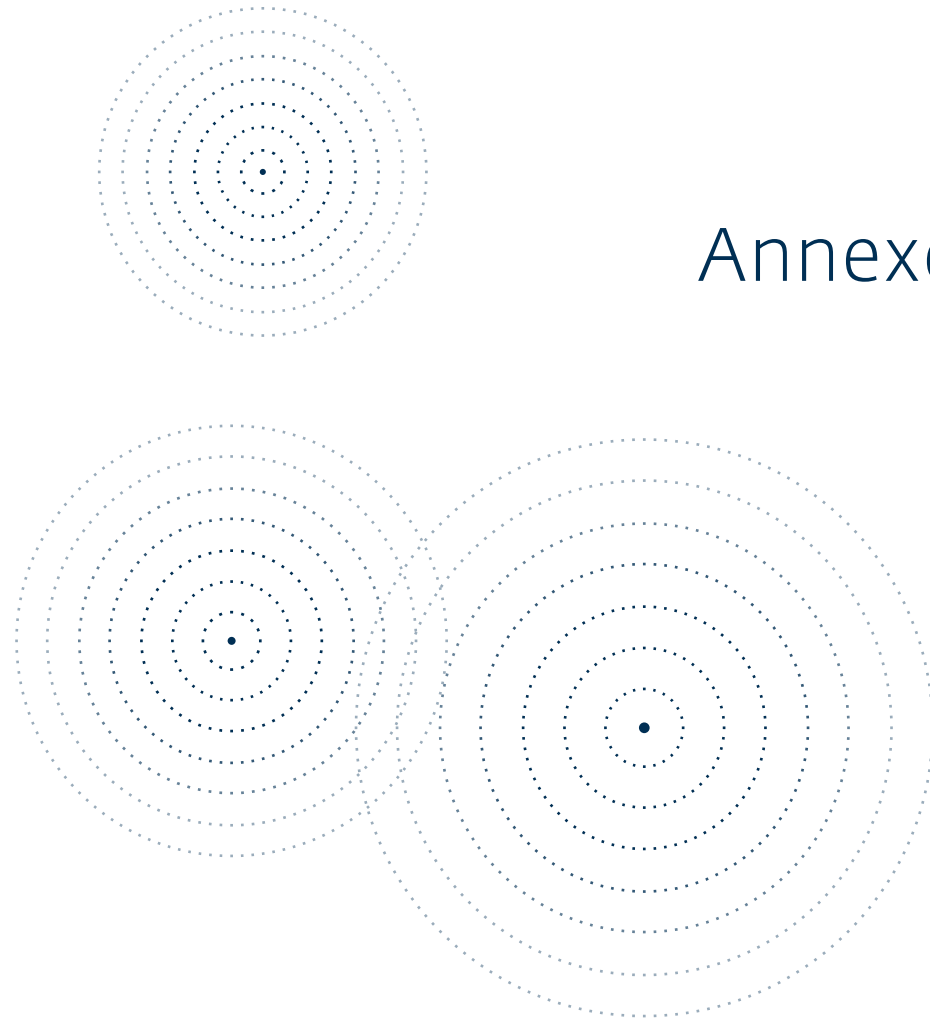
Recommendations

- 1 Finalize and implement a national PPP framework, with standardized procurement processes to build investor confidence.
- 2 Launch and enforce implementation of the proposed Green Building Code and Evaluation System, supplemented by policy targets.
- 3 Clarify the incentives to be provided for private participation in wastewater treatment projects for the sector as a whole, rather than on an individual project basis, so as to attract developers.
- 4 Establish an independent regulator to oversee the water and sanitation sector.
- 5 Provide policies and incentives to better sort waste and enhance waste-to-energy processing.





Annexes



Methodology for Estimating Climate Investment Opportunities

Goal: To calculate the investment opportunity in key sectors for each of the selected countries based on targets set out in country NDCs and policy frameworks.

Renewable Energy

- Determined energy goals set in country NDCs and energy plans.
- Sourced MW capacity goals for years indicated and adjusted to 2030 where needed. Where applicable, the team used energy roadmap assessments to guide adjustments. Once projected MW capacity installed for each technology was determined, the installation schedule was projected based on constant growth rate, unless otherwise indicated in country plans or other sources. This assumes that there are fewer installations in the beginning as the industry scales up, and more installations towards the end of the period as costs decrease and the local industry hits maturity. This also matches the electricity demand growth in the countries.
- Used \$/MW figures for the countries/technologies, where available, as initial costs. If these were unavailable, the team used regional numbers

from either Bloomberg New Energy Finance or the International Renewable Energy Agency. The future costs were projected based on the cost curve estimates provided in the National Renewable Energy Laboratory's global technology review (only the change in costs has been used from the laboratory's data, not the actual cost figures).

- Multiplied the installation schedule by the cost curve to determine the dollar investment per year for each technology, then summed to find the total investment opportunity for each country/technology.

Green Buildings

- Identified government policies and targets, mainly from information in the World Bank NDC Database. Additional information was found using various searches and government websites.
- Sourced building stock from the Global Building Stock Database, and confirmed with country experts where possible. The main source of information was the Green Building Information Gateway, confirmed by local green building council reports, if these existed. The research team focused on properties certified as green.
- Applied an assumption of obsolescence, with 1.43 percent of the stock being decommissioned annually.
- Projected green penetration for each subsector based on total market growth, a snapshot of the current green market, and the enabling environment of government policies. A weighted average of combined sector data produced the final penetration number. The analysis focused only on new construction and certified properties. Market sizing was used for new construction and did not focus on retrofits. As tools for retrofits take off in the market (including IFC's EDGE product), analysis may be amended to include the retrofit market.
- Used total capital expenditure costs for the buildings constructed, not just the incremental cost. For simplicity, the team assumed that green buildings would not be significantly more expensive than traditional buildings, and used the same local prices for capital construction

expenses, or applied global proxies. The global proxy was \$1,000 per square meter of space, on average.

Country-specific assumptions:

BANGLADESH

- The green building market already exists, with more than 400 buildings certified and registered.
- The commercial buildings opportunity is 50 percent green penetration in 2030, because the NDC specifies a 25 percent emissions reduction in the commercial space.
- The residential sector is forecast at 20 percent penetration in 2030, as the green benefits are understood.

BHUTAN

- The country has building guidelines that focus on resource efficiency.
- Penetration into commercial space is projected at 20 percent in 2030, starting at zero now and growing steadily each year.
- Hotels are projected at 50 percent green penetration, as demand for green hotels from international travelers is likely to remain high and the business case is understood.
- The residential sector is forecast at 15 percent penetration in 2030, starting from zero now and growing steadily.

INDIA

- Complicated, large market with many players.
- Large presence of international and local labels, but the size of the market dwarfs green penetration.
- Penetration into commercial space is projected at between 10 percent and 15 percent in 2030—8 percent for offices, 15 percent in retail, and 8 percent for warehouses. Variation among sectors is based on current green projects.

- In the residential market, green penetration is forecast at 15 percent for the multi-unit residential sector, due in part to IFC's market creation program. In the single-family homes market, penetration is at 8 percent because the houses are likely to be constructed informally and green certification would not reach that segment.

MALDIVES

- The nascent green building market with only two buildings registered for certification.
- The NDC focused mostly on resilience and less on mitigation.
- Penetration into commercial space is projected at 15 percent in 2030, starting at zero now and growing by 1 percent each year.
- In the hotel sector, penetration is forecast at 50 percent in 2030, as demand for green hotels from international travelers is likely to remain high and the business case is understood.
- The residential sector is forecast at 10 percent—lower penetration overall, but with the ability to reach a large portion of the population because 38 percent of the population lives in the capital.

NEPAL

- The country has indicated it will introduce a building code, but the 2015 update did not have a focus on efficiency.
- It has 12 LEED activities—more than most other countries in the region, but not significant penetration.
- Penetration into commercial space is projected at 15 percent in 2030, starting at zero now and growing by 1 percent each year.
- In the hotel sector, penetration is forecast at 50 percent in 2030, as demand for green hotels from international travelers is likely to remain high and the business case is understood.
- The residential sector is forecast at 10 percent penetration due to the introduction of tools such as EDGE.

SRI LANKA

- The country has an internal labeling system for buildings, in addition to 78 buildings registered or certified through international channels.
- As a result, both commercial and residential green penetration is forecast to be higher than other countries in the region.
- Penetration into commercial space is projected at 40 percent in 2030.
- In the hotel sector, penetration is forecast at 50 percent in 2030, as demand for green hotels from international travelers is likely to remain high and the business case is understood.
- The residential sector is forecast at 30 percent penetration due to the presence of international and local rating tools and the introduction of a mass market tool such as EDGE.

Transport

INFRASTRUCTURE

- Took government estimates, projections, and targets of investment where available. Where unavailable, the team looked at the list of projects planned or in the pipeline.
- Categorized projects as climate-smart transport infrastructure if they encouraged a modal shift towards efficient and greener types of transport.
- Took dollar investment estimates for climate-smart transport infrastructure from government policies or project lists where available. Where estimates were in local currencies, the team used a 2015 yearly average exchange rate to convert to dollars. Where estimates were in kilometer form for road and railway projects, the team used per-unit infrastructure costs from the Meeting Asia's Infrastructure Needs report by the Asian Development Bank to estimate the dollar investment required.

ELECTRIC VEHICLES

- Determined total number of electric vehicles per country by 2030 as per NDC and policy targets. For Bhutan and Nepal, the team projected the total vehicle fleet till 2030 using a compound annual growth rate from existing data. It kept 2030 proportions of electric vehicles in total fleet constant from country-wise targets, i.e. 6,000 electric vehicles in Bhutan by 2020 and 20 percent of 2010 levels by 2020 in Nepal. For India, the team used an International Energy Agency estimate of 50 million electric vehicles by 2030 to meet government targets, and determined the proportion of each type of vehicle from the country's National Electric Mobility Mission Plan targets.
- Used capital cost estimates by type of vehicle from World Bank transport specialists and a report by the Rocky Mountain Institute and NITI Aayog (India Leaps Ahead: Transformative Mobility Solutions for All). The team multiplied the number of each type of electric vehicle by its capital costs, and then summed this to find the total required investment.
- Measured the capital cost of manufacturing vehicles to estimate investment, which does not include the cost of charging and other infrastructure. It assumes constant capital costs at current levels, and a constant proportion of electric vehicles in the total vehicle fleet according to current targets.

Country-specific assumptions for electric vehicles:

BHUTAN

- Divided buses equally between light and heavy vehicles.
- Assumed all light vehicles to be sedan-type cars.
- Assumed constant growth rate of total vehicles.

NEPAL

- Assumed constant growth rate of total vehicles.
- Assumed no obsolescence or retiring of vehicles.

Municipal Solid Waste

- Took country total generation numbers from the World Bank team working on an update of the 2012 report What a Waste: A Global Review of Solid Waste Management.
- Found per capita waste generation figures using the generation numbers and population statistics from the source years of the data above. Projected per capita waste generation numbers to 2030 in accordance with growth in population and GDP.
- Found yearly total generation numbers by multiplying per capita generation per year with the population estimate for that year. Yearly generation from 2018 to 2030 was summed to find total waste generation till 2030 per country.
- Using What a Waste 2012 numbers for the percentage of waste collected, the cost of collection (\$), and the cost of disposal (\$) by country income level, the team calculated the required investment till 2030.
- The 2030 cost and waste collection percentages were assumed to be the same as projections in the 2012 What a Waste report for 2025, due to lack of available data for 2030.

Climate-Smart Urban Wastewater

- Used latest available country-specific wastewater generation numbers for Bangladesh, Bhutan, India, Nepal, and the Maldives from the 2013 Global, Regional, and Country Level Need for Data on Wastewater Generation, Treatment, and Use report by Sato et al. Used latest available wastewater generation data for Sri Lanka from the 2006 Urban Growth and Wastewater Agriculture: A Study from Sri Lanka report by Jayakody et al.
- Found per capita wastewater generation numbers using World Bank population estimates from the source year provided. Projected per capita wastewater generation by country till 2030 in tandem with growth in GDP and growth in population.
- Found yearly total generation numbers by multiplying per capita generation per year with the population estimate for that year for each country. Yearly generation from 2018 to 2030 was summed to find total wastewater generation till 2030 per country.
- Calculated the volume of wastewater to be treated using aspirations from the United Nations World Water Development Report 2017 by country income level as defined by the World Bank.
- Estimated investment potential using wastewater treatment capital cost numbers from IFC's 2016 Water and Wastewater Investment: A Non-Technical Guide. Used \$0.5 per cubic meter as an average total cost for South Asia, as per IFC industry specialist.
- Found total investment opportunity by multiplying the capital cost with total wastewater volume to be treated.

Data Sources Informing Estimates of Climate-Smart Investment Potential

1. Nationally Determined Contribution (NDC)

- a. Bangladesh: Intended Nationally Determined Contribution, Government of Bangladesh 2015 http://www4.unfccc.int/ndcregistry/PublishedDocuments/Bangladesh%20First/INDC_2015_of_Bangladesh.pdf
- b. Bhutan: Intended Nationally Determined Contribution, Royal Government of Bhutan 2015 <http://www4.unfccc.int/submissions/INDC/Published%20Documents/Bhutan/1/Bhutan-INDC-20150930.pdf>
- c. India: Intended Nationally Determined Contribution, Government of India 2015 <http://www4.unfccc.int/submissions/INDC/Published%20Documents/India/1/INDIA%20INDC%20TO%20UNFCCC.pdf>
- d. Maldives: Intended Nationally Determined Contribution, Government of Maldives 2015 <http://www4.unfccc.int/ndcregistry/PublishedDocuments/Maldives%20First/Maldives%20INDC.pdf>

- e. Nepal: Intended Nationally Determined Contribution, Government of Nepal 2016 <http://www4.unfccc.int/ndcregistry/PublishedDocuments/Nepal%20First/Nepal%20First%20NDC.pdf>
- f. Sri Lanka: Intended Nationally Determined Contributions, Government of Sri Lanka 2016 <http://www4.unfccc.int/ndcregistry/PublishedDocuments/Sri%20Lanka%20First/NDCs%20of%20Sri%20Lanka.pdf>

2. Bangladesh

- a. Renewable Energy
 - i. Key Cost Input in LCOE Scenarios, Bloomberg New Energy Finance 2017
 - ii. Power System Master Plan, Ministry of Power, Energy and Mineral Resources 2016 http://powerdivision.portal.gov.bd/sites/default/files/files/powerdivision.portal.gov.bd/page/4f81bf4d_1180_4c53_b27c_8fa0eb11e2c1/percent28Epercent29_FR_PSMP2016_Summary_revised.pdf
 - iii. IFC Climate Business staff
- b. Green Buildings
 - i. Global Building Stock Database, Navigant Research 2015 <https://www.navigantresearch.com/research/global-building-stock-database>
 - ii. IFC Climate Business staff
- c. Transport
 - i. Bangladesh NDC
 - ii. List of On-going Projects, Bangladesh Inland Water Transport Authority 2016 <http://www.biwta.gov.bd/site/page/b4289c6e-b85f-4368-a5fd-bca90e679363/On-going-Projects>

- iii. Seventh Five Year Plan, Planning Commission 2015 [http://www.lged.gov.bd/UploadedDocument/UnitPublication/1/322/11.%207th%20Five%20Year%20Plan\(Final%20Draft\).pdf](http://www.lged.gov.bd/UploadedDocument/UnitPublication/1/322/11.%207th%20Five%20Year%20Plan(Final%20Draft).pdf)
 - d. Municipal Solid Waste
 - i. World Bank staff
 - ii. What a Waste: A Global Review of Solid Waste Management, World Bank 2012 https://siteresources.worldbank.org/INTURBANDEVELOPMENT/Resources/336387-1334852610766/What_a_Waste2012_Final.pdf
 - e. Climate-Smart Urban Water
 - i. Global, Regional, and Country Level Need for Data on Wastewater Generation, Treatment, and Use, Sato et al. 2013 <http://www.sciencedirect.com/science/article/pii/S0378377413002163#bbib0490>
 - ii. World Water Development Report, United Nations World Water Assessment Programme 2017 <http://unesdoc.unesco.org/images/0024/002475/247553e.pdf>
 - iii. Water and Wastewater Investment: A Non-Technical Guide, IFC 2016
- 3. Bhutan
 - a. Renewable Energy
 - i. Key Cost Input in LCOE Scenarios, Bloomberg New Energy Finance 2017
 - ii. 12th Five Year Plan Guidelines, Gross National Happiness Commission Secretariat 2016
 - iii. Bhutan Country Profile, International Hydropower Association 2016 <https://www.hydropower.org/country-profiles/bhutan>
 - iv. National Transmission Grid Master Plan for Bhutan, Central Electricity Authority of India 2012 http://www.cea.nic.in/reports/others/ps/pspa1/ntgmp_voll.pdf
 - v. IFC Climate Business staff
 - b. Green Buildings
 - i. Global Building Stock Database, Navigant Research 2015 <https://www.navigantresearch.com/research/global-building-stock-database>
 - ii. IFC Climate Business staff
 - c. Transport
 - i. National Transport Policy of Bhutan, Ministry of Information and Communication 2017 <http://www.moic.gov.bt/wp-content/uploads/2017/08/Draft-Final-PPR.pdf>
 - ii. Annual Report 2015-16, Road Safety and Transport Authority 2016 http://www.rsta.gov.bt/rstaweb/load.html?id=96&field_cons=MENU
 - iii. The Bhutan Electric Vehicle Initiative, World Bank 2016 <http://www.indiaenvironmentportal.org.in/files/file/The%20Bhutan%20Electric%20Vehicle%20Initiative.pdf>
 - d. Municipal Solid Waste
 - i. World Bank staff
 - ii. What a Waste: A Global Review of Solid Waste Management, World Bank 2012 https://siteresources.worldbank.org/INTURBANDEVELOPMENT/Resources/336387-1334852610766/What_a_Waste2012_Final.pdf

- e. Climate-Smart Urban Water
 - iii. Global, Regional, and Country Level Need for Data on Wastewater Generation, Treatment, and Use, Sato et al. 2013 <http://www.sciencedirect.com/science/article/pii/S0378377413002163#bbib0490>
 - iv. World Water Development Report, United Nations World Water Assessment Programme 2017 <http://unesdoc.unesco.org/images/0024/002475/247553e.pdf>
 - v. Water and Wastewater Investment: A Non-Technical Guide, IFC 2016
- 4. India
 - a. Renewable Energy
 - i. Key Cost Input in LCOE Scenarios, Bloomberg New Energy Finance 2017
 - ii. Draft National Energy Policy, NITI Aayog 2017 http://niti.gov.in/writereaddata/files/new_initiatives/NEP-ID_27.06.2017.pdf
 - iii. Draft National Electricity Plan—Generation, Ministry of Power 2016
 - iv. IFC Climate Business staff
 - b. Green Buildings
 - i. Global Building Stock Database, Navigant Research 2015 <https://www.navigantresearch.com/research/global-building-stock-database>
 - ii. IFC Climate Business staff
 - c. Transport
 - i. India Transport Report: Moving India to 2032, Planning Commission 2014 http://planningcommission.nic.in/reports/genrep/NTDPC_Vol_01.pdf
 - d. Municipal Solid Waste
 - i. World Bank staff
 - ii. What a Waste: A Global Review of Solid Waste Management, World Bank 2012 https://siteresources.worldbank.org/INTURBANDEVELOPMENT/Resources/336387-1334852610766/What_a_Waste2012_Final.pdf
 - e. Climate-Smart Urban Water
 - ii. Global EV Outlook, International Energy Agency 2017 <https://www.iea.org/publications/freepublications/publication/GlobalEVOutlook2017.pdf>
 - iii. India Leaps Ahead: Transformative Mobility Solutions for All, Rocky Mountain Institute & NITI Aayog 2017 http://niti.gov.in/writereaddata/files/document_publication/RMI_India_Report_web.pdf
- 5. Maldives
 - a. Renewable Energy
 - i. Key Cost Input in LCOE Scenarios, Bloomberg New Energy Finance 2017
 - ii. Maldives Energy Policy and Strategy, Ministry of Environment and Energy 2016 <http://www.environment.gov.mv/v2/en/download/4295>
 - b. Green Buildings
 - i. Global Building Stock Database, Navigant Research 2015 <https://www.navigantresearch.com/research/global-building-stock-database>
 - ii. IFC Climate Business staff
 - c. Transport
 - i. India Transport Report: Moving India to 2032, Planning Commission 2014 http://planningcommission.nic.in/reports/genrep/NTDPC_Vol_01.pdf
 - d. Municipal Solid Waste
 - i. World Bank staff
 - ii. What a Waste: A Global Review of Solid Waste Management, World Bank 2012 https://siteresources.worldbank.org/INTURBANDEVELOPMENT/Resources/336387-1334852610766/What_a_Waste2012_Final.pdf
 - e. Climate-Smart Urban Water
 - i. Global, Regional, and Country Level Need for Data on Wastewater Generation, Treatment, and Use, Sato et al. 2013 <http://www.sciencedirect.com/science/article/pii/S0378377413002163#bbib0490>
 - ii. World Water Development Report, United Nations World Water Assessment Programme 2017 <http://unesdoc.unesco.org/images/0024/002475/247553e.pdf>
 - iii. Water and Wastewater Investment: A Non-Technical Guide, IFC 2016

- iii. Renewable Energy Roadmap: The Republic of Maldives, International Renewable Energy Agency 2015 <http://www.irena.org/EventDocs/Maldives/Maldivesroadmapbackgroundreport.pdf>
 - iv. IFC Climate Business staff
 - b. Green Buildings
 - i. Global Building Stock Database, Navigant Research 2015 <https://www.navigantresearch.com/research/global-building-stock-database>
 - ii. IFC Climate Business staff
 - c. Transport
 - i. Invest Maldives, Ministry of Economic Development 2015 http://investmaldives.gov.mv/downloads/INVEST_MALDIVES.pdf
 - ii. Airport Development Works in Need of Revving up, Maldives Times 2017 <https://maldivestimes.com/airport-development-works-in-need-of-revving-up/>
 - d. Municipal Solid Waste
 - i. World Bank staff
 - ii. What a Waste: A Global Review of Solid Waste Management, World Bank 2012 https://siteresources.worldbank.org/INTURBANDEVELOPMENT/Resources/336387-1334852610766/What_a_Waste2012_Final.pdf
 - e. Climate-Smart Urban Water
 - i. Global, Regional, and Country Level Need for Data on Wastewater Generation, Treatment, and Use, Sato et al. 2013 <http://www.sciencedirect.com/science/article/pii/S0378377413002163#bbib0490>
 - ii. World Water Development Report, United Nations World Water Assessment Programme 2017 <http://unesdoc.unesco.org/images/0024/002475/247553e.pdf>
 - iii. Water and Wastewater Investment: A Non-Technical Guide, IFC 2016
6. Nepal
- a. Renewable Energy
 - i. Key Cost Input in LCOE Scenarios, Bloomberg New Energy Finance 2017
 - ii. Nepal Country Profile, International Hydropower Association 2016 <https://www.hydropower.org/country-profiles/nepal>
 - iii. Nepal Energy Sector Assessment, Strategy and Road Map, ADB 2017 <https://www.adb.org/publications/nepal-energy-strategy-roadmap>
 - iv. IFC Climate Business staff
 - b. Green Buildings
 - i. Global Building Stock Database, Navigant Research 2015 <https://www.navigantresearch.com/research/global-building-stock-database>
 - ii. IFC Climate Business staff
 - c. Transport
 - i. Vehicle Registration Details up to Fiscal Year 2073-74 (2016-2017) (Vehicle Typewise), Department of Transport Management 2017 <https://www.dotm.gov.np/uploads/files/type%20wise207374.pdf>
 - ii. Strategic Plan for 2073-78 (2016-2021), Ministry of Physical Infrastructure & Transport 2015
 - iii. National Urban Development Strategy, Ministry of Urban Development 2017 http://moud.gov.np/wp-content/uploads/2017/02/NUDS_cabinet-document_approved-on-2073-10-9.pdf

- d. Municipal Solid Waste
 - i. World Bank staff
 - ii. What a Waste: A Global Review of Solid Waste Management, World Bank 2012 https://siteresources.worldbank.org/INTURBANDEVELOPMENT/Resources/336387-1334852610766/What_a_Waste2012_Final.pdf
 - e. Climate-Smart Urban Water
 - i. Global, Regional, and Country Level Need for Data on Wastewater Generation, Treatment, and Use, Sato et al. 2013 <http://www.sciencedirect.com/science/article/pii/S0378377413002163#bbib0490>
 - ii. World Water Development Report, United Nations World Water Assessment Programme 2017 <http://unesdoc.unesco.org/images/0024/002475/247553e.pdf>
 - iii. Water and Wastewater Investment: A Non-Technical Guide, IFC 2016
7. Sri Lanka
- a. Renewable Energy
 - i. Key Cost Input in LCOE Scenarios, Bloomberg New Energy Finance 2017
 - ii. Long-term Generation Expansion Plan 2015-2035, Ceylon Electricity Board 2015 <http://pucsl.gov.lk/english/wp-content/uploads/2015/09/Long-Term-Generation-Plan-2015-2034-PUCSL.pdf>
 - iii. Initial Assessment of Sri Lanka's Power Sector—Electricity Generation through 100 percent Renewable Energy, Asian Development Bank and United Nations Development Programme 2017 http://www.undp.org/content/undp/en/home/librarypage/environment-energy/sustainable_energy/assessment-of-sri-lanka-s-power-sector.html
 - iv. IFC Climate Business staff
 - b. Green Buildings
 - i. Global Building Stock Database, Navigant Research 2015 <https://www.navigantresearch.com/research/global-building-stock-database>
 - ii. IFC Climate Business staff
 - c. Transport
 - i. Investment Proposals, Ministry of Transport and Civil Aviation 2015
 - ii. Nationally Appropriate Mitigation Action: Sustainable Transport in Sri Lanka Through an Electric Bus Rapid Transit System, United Nations Development Programme 2015 <http://www.undp.org/content/undp/en/home/librarypage/environment-energy/mdg-carbon/sustainable-transport-in-sri-lanka-through-an-electric-bus-rapid.html>
 - d. Municipal Solid Waste
 - i. World Bank staff
 - ii. What a Waste: A Global Review of Solid Waste Management, World Bank 2012 https://siteresources.worldbank.org/INTURBANDEVELOPMENT/Resources/336387-1334852610766/What_a_Waste2012_Final.pdf
 - e. Climate-Smart Urban Water
 - i. Urban Growth and Wastewater Agriculture: A Study from Sri Lanka, Jayakody et al. 2006 http://www.academia.edu/2685010/Urban_growth_and_wastewater_agriculture_A_study_from_Sri_Lanka
 - ii. World Water Development Report, United Nations World Water Assessment Programme 2017 <http://unesdoc.unesco.org/images/0024/002475/247553e.pdf>
 - iii. Water and Wastewater Investment: A Non-Technical Guide, IFC 2016

Data Sources for Country Indicators

1. Population: Total Population, World Bank Open Data Bank 2016 <https://data.worldbank.org/indicator/SP.POP.TOTL>
2. GDP: GDP (Current US\$), World Bank Open Data Bank 2016 <https://data.worldbank.org/indicator/NY.GDP.MKTP.CD>
3. GDP growth: GDP growth (annual %), World Bank Open Data Bank 2016 <https://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG>
4. Inflation: Inflation, consumer price (annual %), World Bank Open Data Bank 2016 <https://data.worldbank.org/indicator/FP.CPI.TOTL.ZG>
5. Ease of Doing Business Ranking: Doing Business 2018, World Bank Group 2017 <http://www.doingbusiness.org/~media/WBG/DoingBusiness/Documents/Annual-Reports/English/DB2018-Full-Report.pdf>
6. FDI: Foreign direct investment, net inflows (balance of payments, current \$), World Bank Open Data Bank <https://data.worldbank.org/indicator/BX.KLT.DINV.CD.WD>
7. S&P credit rating: Standard and Poor's Global Ratings 2017 <https://www.standardandpoors.com>
8. Total greenhouse-gas emissions excluding land-use change and forestry (2014) (MtCO₂e): CAIT Climate Data Explorer, World Resources Institute 2017 <http://www.wri.org/resources/data-sets/cait-country-greenhouse-gas-emissions-data>
9. Total greenhouse-gas emissions including land-use change and forestry (2014) (MtCO₂e): CAIT Climate Data Explorer, World Resources Institute 2017 <http://www.wri.org/resources/data-sets/cait-country-greenhouse-gas-emissions-data>
10. Greenhouse-gas emissions rank (2012): EDGAR—Emissions Database for Global Atmospheric Research, European Commission 2017 <http://edgar.jrc.ec.europa.eu/overview>
11. Total carbon dioxide emissions (kilotons): EDGAR—Emissions Database for Global Atmospheric Research, European Commission 2017 <http://edgar.jrc.ec.europa.eu/overview>
12. Installed renewable energy capacity (MW): International Renewable Energy Agency Renewable Capacity Statistics 2017 https://www.irena.org/DocumentDownloads/Publications/IRENA_RE_Capacity_Statistics_2017.pdf

Climate Resilience Business Survey Questions

1. What is your email address?

2. Which of the following best describes your company?

- ☐ Public company
- ☐ Privately held
- ☐ State-owned enterprise

3. What is your role within the company?

- ☐ Sustainability
- ☐ Administration
- ☐ Finance – investment
- ☐ Finance – accounting
- ☐ Finance – other
- ☐ Strategy
- ☐ Human resources
- ☐ Communications
- ☐ Marketing
- ☐ Business development
- ☐ Product design
- ☐ Corporate social responsibility
- ☐ Other (please specify):

4. Which of the following best describes your company's sector?

- ☐ Basic materials
- ☐ Consumer goods
- ☐ Consumer services
- ☐ Financials
- ☐ Health care
- ☐ Industrials
- ☐ Oil & gas
- ☐ Technology
- ☐ Telecommunications
- ☐ Utilities
- ☐ Professional services
- ☐ Metals, metallurgy & mining
- ☐ Renewable energy
- ☐ Agriculture
- ☐ Transport
- ☐ Construction
- ☐ Tourism
- ☐ Other (please specify):

5. In which country is your company headquartered?

6. What is the size of your company?

- ☐ 1-9 employees
- ☐ 10-49 employees
- ☐ 50-249 employees
- ☐ More than 250 employees

7. What is your company's annual revenue?

- ☐ \$0-1 million
- ☐ \$1-5 million
- ☐ \$5-10 million
- ☐ Over \$10 million

8. How much would you say that you personally know about climate change and the impacts?

- ☐ Nothing
- ☐ Not very much
- ☐ A fair amount
- ☐ A great deal

9. How concerned are you that climate change will have a material impact on your company's operations?

- ☐ Not concerned at all
- ☐ Not very concerned
- ☐ Somewhat concerned
- ☐ Concerned
- ☐ Very concerned
- ☐ I do not know

10. Which of the following climate change impacts present a risk to your company? Please check all that apply.

- ☐ Rainstorms and monsoons/typhoons
 - ☐ Water scarcity
 - ☐ Floods
 - ☐ Heat waves
 - ☐ Winter storms
 - ☐ Sea-level rise
 - ☐ Wildfires
 - ☐ Other (please specify):
-

11. In your view, when will the impacts of climate change have a material impact on your company?

- ☐ It has already had an impact
- ☐ In the next 1-5 years
- ☐ In the next 5-20 years
- ☐ In more than 20 years
- ☐ Not in the foreseeable future
- ☐ I do not know

12. How does your company assess risks related to the physical impacts of climate change?

- ☐ We do not monitor or quantify climate change risks
 - ☐ We have done a risk assessment on a specific risk driver or concern (e.g., water or extreme weather events)
 - ☐ We monitor some climate risks as part of our current enterprise risk management
 - ☐ Climate change is integrated into our enterprise risk management
 - ☐ I do not know
 - ☐ Other (please specify):
-

13. Does your company have a climate adaptation/resilience plan or strategies in place?

- ☐ Yes, we have a plan/strategies in place
- ☐ We are developing a plan/strategy
- ☐ We intend to develop a plan/strategy in the future
- ☐ No, we have not developed a plan/strategies to adapt our business to climate impacts
- ☐ I do not know

14. Which of the following climate resilience or adaptation measures has your company implemented?

	I do not know	Not being considered	Under consideration	Planned/Under implementation	Already implemented	N/A
Research to better understand and quantify climate risks	☐	☐	☐	☐	☐	☐
Design of new buildings and infrastructure to incorporate predictive information	☐	☐	☐	☐	☐	☐
Retrofitting of company assets to reduce impact of risk (e.g., raise facility to mitigate flood damage)	☐	☐	☐	☐	☐	☐
Temporary measures to reduce impact of risk (e.g., placing sandbags to minimize water inflow)	☐	☐	☐	☐	☐	☐
Relocation of a facility or asset to reduce risk exposure	☐	☐	☐	☐	☐	☐
Water and energy-efficiency to improve operations	☐	☐	☐	☐	☐	☐

	I do not know	Not being considered	Under consideration	Planned/Under implementation	Already implemented	N/A
Staff training on risk management and business continuity (e.g., course of action in the event of power loss)	☐	☐	☐	☐	☐	☐
Business continuity plan development	☐	☐	☐	☐	☐	☐
Insurance coverage purchased to cover asset or activity at risk	☐	☐	☐	☐	☐	☐
Business partner (e.g., supplier, distributor) engage to promote better risk management	☐	☐	☐	☐	☐	☐
Business partnership discontinuation to reduce risk exposure (e.g., change in the selection of a supplier)	☐	☐	☐	☐	☐	☐

15. In your opinion, do you feel that your organization has enough information to know whether you should change any of your plans because of a changing climate?

- ☐ Yes, definitely
- ☐ Yes, probably
- ☐ No, probably not
- ☐ I do not know

16. What do you see as the most relevant needs for your company to implement adaptation in its operations? Please check all that apply.

- ☐ More information about climate change impacts affecting my sector
- ☐ More information about adaptation investments and solutions to address the impacts (e.g. technologies, products, services)
- ☐ Assistance in identifying climate risks to the company's supply chain, operations, and/or assets
- ☐ Assistance in identifying the change in supply and/or demand that results from the changing climate
- ☐ Access to finance for adaptation investments
- ☐ Availability of best industry practices and standards for climate resilience in my company's sector
- ☐ Other (please specify):

17. If you have identified necessary investments to address existing or expected climate impacts, what is the amount of finance that your company would need to implement them?

- ☐ \$0-1 million
- ☐ \$1-5 million
- ☐ \$5-10 million
- ☐ Over \$10 million

18. What do you think is the most important thing that government or international institutions can do to support more corporate investment in climate adaptation/resilience?

- ☐ Public-private partnerships
- ☐ Increased funding for climate resilient assets/infrastructure
- ☐ Incentives for private investment in climate resilient assets/infrastructure
- ☐ Provision of training/information on climate change impacts
- ☐ Other (please specify):

Endnotes

Turning Climate-Smart Investment Opportunities into Reality in South Asia

- 1 See <https://maplecroft.com/about/news/ccvi.html>
- 2 International Monetary Fund (2017), South Asia Regional Update, South Asia: Continued Robust Growth
- 3 See <https://data.worldbank.org/indicator/BX.KLT.DINV.CD.WD?locations=IN>
- 4 See <https://www.bnef.com/core/market-size?tab=Capacity>
- 5 See <http://there100.org/>
- 6 See <https://www.wemeanbusinesscoalition.org/companies/#region=Asia%20Pacific>
- 7 See <https://www.clean200.org/>
- 8 See <https://www.ft.com/content/0c485f68-96eb-11e7-a652-cde3f882dd7b>
- 9 See http://s3.amazonaws.com/aws-bsd/BetterBusinessBetterWorld_India_web.pdf
- 10 See <https://www.unglobalcompact.org/what-is-gc/participants>
- 11 See <https://www.unglobalcompact.org/what-is-gc/mission/principles>
- 12 See <https://www.adb.org/news/climate-change-may-slash-9-south-asias-economy-2100-report>
- 13 See <https://data.worldbank.org/indicator/NV.AGR.TOTL.ZS?locations=8S>
- 14 Bloomberg New Energy Finance (April 2017), India's \$60 Billion Solar Irrigation Opportunity: Frontier Power Research Note
- 15 World Bank Group (forthcoming, Spring 2018), South Asia's Hotspots: Impacts of Temperature and Precipitation Changes on Living Standards (Muthukumara Mani, Sushenjit Bandyopadhyay, Shun Chonabayashi, Anil Markandya, and Thomas Mosier)
- 16 See <https://www.theguardian.com/world/2017/aug/30/mumbai-paralysed-by-floods-as-india-and-region-hit-by-worst-monsoon-rains-in-years>
- 17 See <http://www.wri.org/resources/maps/aqueduct-global-flood-analyzer>
- 18 See <https://www.adb.org/news/climate-change-may-slash-9-south-asias-economy-2100-report>
- 19 See <https://openknowledge.worldbank.org/handle/10986/22549>
- 20 See <https://www.theguardian.com/world/2016/dec/21/india-renewable-energy-paris-climate-summit-target>
- 21 See http://niti.gov.in/writereaddata/files/new_initiatives/NEP-ID_27.06.2017.pdf
- 22 See <http://www.climateactionprogramme.org/news/plans-for-13.7-gw-of-coal-power-in-india-axed>
- 23 See <http://in.reuters.com/article/coal-india-mines-closure/coal-india-to-shut-37-mines-this-fiscal-year-sources-idINKBN18Z1XD>
- 24 See http://www.ren21.net/gsr-2017/chapters/chapter_04/chapter_04/
- 25 See <https://www.isolaralliance.org>
- 26 See http://www.climateactionprogramme.org/news/india_could_eliminate_the_use_of_coal_by_2050
- 27 See https://www.irena.org/DocumentDownloads/Publications/IRENA_RE_Jobs_Annual_Review_2017.pdf
- 28 See <https://www.lightingglobal.org/where-we-work/lighting-asia/>
- 29 See <https://www.lightingglobal.org/where-we-work/lighting-asia/bangladesh/>
- 30 See https://endev.info/content/Accelerate_the_uptake_of_off-grid_solar_technologies_with_Results-Based_Financing
- 31 See http://www.economynext.com/Sri_Lanka_Megapolis_light_rail_feasibility_starts_EOIs_by_year_end-3-7444.html
- 32 See <https://asiafoundation.org/2017/05/10/promising-future-inland-waterway-trade-south-asia/>
- 33 See <http://www.eastasiaforum.org/2017/06/24/bbin-countries-are-building-connections/>
- 34 See <https://www.newscientist.com/article/2125198-on-front-line-of-climate-change-as-maldives-fights-rising-seas/>
- 35 See <http://www.constructionworld.in/Search/News/Half-of-the-urban-centres-in-India-to-exist-in-2030-yet-to-be-built--102580>
- 36 See <https://www.bmiresearch.com/articles/south-asia-flooding-underscores-regional-water-infrastructure-need>
- 37 Ibid
- 38 See <https://ifcextapps.ifc.org/ifcext/pressroom/IFCPressRoom.nsf/o/021645361DA9DC57852581B7002859CF>
- 39 See <https://mediaindia.eu/social-vibes/kolkata-gets-global-recognition-for-tackling-climate-change/>
- 40 See <http://unfccc.int/focus/items/10240txt.php>
- 41 See <http://www4.unfccc.int/ndcregistry/Pages/All.aspx>

- 42 See https://www.ifc.org/wps/wcm/connect/51183b2d-c82e-443e-bb9b-68d9572dd48d/3503-IFC-Climate_Investment_Opportunity-Report-Dec-FINAL.pdf?MOD=AJPERES
- 43 Ibid
- 44 See <http://www.worldbank.org/en/news/press-release/2017/10/31/india-jumps-doing-business-rankings-with-sustained-reform-focus>
- 45 See <http://srilankamirror.com/news/1985-sri-lanka-to-introduce-e-government-procurement-system-soon>
- 46 200 Indian crore rupees at an exchange rate of \$1 to 66.8 Indian rupees
- 47 See <https://timesofindia.indiatimes.com/business/india-business/pune-raises-rs-200-cr-in-first-municipal-bond-issue-in-14-yrs/articleshow/59221950.cms>
- 48 See <http://www.thehindubusinessline.com/opinion/issues-in-financing-climate-resilience/article9490758.ece>
- 49 See <https://www.icmagroup.org/Regulatory-Policy-and-Market-Practice/green-social-and-sustainability-bonds/green-bond-principles-gbp/>
- 50 See <https://www.climatebonds.net/standards>
- 51 See <https://www.climatebonds.net/2016/01/india%E2%80%99s-security%E2%80%99s-regulator-finalises-official-green-bond-listing-requirements-says-green>
- 52 See <https://www.climatebonds.net/files/files/CB-HSBC-2017-India.pdf>
- 53 See http://www.ifc.org/wps/wcm/connect/30635fde-1c38-42af-97b9-2304e962fc85/DFI+Blended+Concessional+Finance+for+Private+Sector+Operations_Summary+R....pdf?MOD=AJPERES

Surveying Business Resilience to Climate Impacts

- 54 See <https://thediplomat.com/2017/09/amid-climate-disasters-south-asias-cities-need-to-focus-on-resilience/>
- 55 See <https://www.theguardian.com/world/2017/aug/30/mumbai-paralysed-by-floods-as-india-and-region-hit-by-worst-monsoon-rains-in-years>
- 56 See <https://psmag.com/environment/how-climate-change-contributed-to-massive-floods-in-south-asia>
- 57 See <http://www.wri.org/resources/maps/aqueduct-global-flood-analyzer>
- 58 See <https://openknowledge.worldbank.org/handle/10986/26121>

Bangladesh

- 59 See <https://www.adb.org/news/features/booming-south-asia-driving-economic-growth-asia>
- 60 See <https://www.imf.org/en/News/Articles/2017/02/28/spo2272017-Building-Economic-Progress-in-Bangladesh>
- 61 See <https://data.worldbank.org/indicator/SP.POP.TOTL?locations=BD>
- 62 See http://www.fao.org/fileadmin/user_upload/FAO-countries/Bangladesh/News/CIP_Draft_27_May_2016.pdf
- 63 Maplecroft (2011), Climate Change Vulnerability Index, available at <https://maplecroft.com/about/news/ccvi.html>
- 64 See <https://germanwatch.org/en/download/16411.pdf>
- 65 See http://www.fao.org/fileadmin/user_upload/FAO-countries/Bangladesh/News/CIP_Draft_27_May_2016.pdf
- 66 Bangladesh NDC, available at http://www4.unfccc.int/ndcregistry/PublishedDocuments/Bangladesh_percent20First/INDC_2015_of_Bangladesh.pdf
- 67 Ibid
- 68 See <http://www.thedailystar.net/business/deal-signed-set-200mw-solar-power-plant-1342867>
- 69 See <https://www.adb.org/sites/default/files/publication/365701/ado2017-update.pdf>
- 70 See <http://www.iccad.net/the-green-climate-fund-and-the-private-sector-in-bangladesh/>
- 71 See http://www.ren21.net/wp-content/uploads/2017/06/17-8399_GSR_2017_Full_Report_0621_Opt.pdf
- 72 See http://www.worldbank.org/en/news/immersive-story/2017/06/29/solar-powers-india-s-clean-energy-revolution?CID=CCG_TT_climatechange_EN_EXT
- 73 See http://bids.org.bd/uploads/events/TS_2_Monzur%20Hossain.pdf
- 74 Ren21 (2017), Global Status Report
- 75 See <http://www.worldenergyoutlook.org/resources/energydevelopment/energyaccessdatabase/>
- 76 Bangladesh NDC
- 77 See <https://unstats.un.org/unsd/energy/meetings/2016iwc/32bangladesh.pdf>
- 78 Renewable Energy Policy of Bangladesh (2008). See https://www.iea.org/media/pams/bangladesh/Bangladesh_RenewableEnergyPolicy_2008.pdf

79 See <http://www.independent.co.uk/news/world/renewable-energy-target-climate-united-nations-climate-change-vulnerable-nations-ethiopia-a7425411.html>

80 See http://powerdivision.portal.gov.bd/sites/default/files/files/powerdivision.portal.gov.bd/page/4f81bf4d_n8o_4c53_b27c_8fa0eb12c1/percent28E_percent29_FR_PSPM2016_Summary_revised.pdf

81 Ibid

82 See <http://www.thedailystar.net/frontpage/bangladesh-leads-clean-energy-use-1418806>

83 See http://open_jicareport.jica.go.jp/pdf/12231247.pdf

84 Ibid

85 Bangladesh NDC

86 See <http://www.iosrjournals.org/iosr-jef/papers/Vol8-Issue3/Version-3/Ao8o3o3o1o9.pdf>

87 See <http://cpd.org.bd/wp-content/uploads/2017/06/Presentation-on-An-Analysis-of-theNational-Budget-for-FY2017-18.pdf>

88 See http://planipolis.iiep.unesco.org/upload/Bangladesh/Bangladesh_Final_Draft_OPP_June_2010.pdf

89 Ibid

90 Government of Bangladesh Ministry of Power, Energy and Mineral Resources (2015), Energy-efficiency and Conservation Master Plan up to 2030, available at http://sreda.gov.bd/files/EEC_Master_Plan_SREDA.pdf

91 Bangladesh NDC

92 See http://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=4&ved=0aUKUkEwiHwNuDtjFWAhWCSCYKHvZaDcsQFgg3MAM&url=http:percent3A_percent2F_percent2Fmoef.portal.gov.bd_percent2Fsites_percent2Fdefault_percent2Ffiles_percent2Ffiles_percent2Fmoef.portal.gov.bd_percent2Fnotices_percent2Fes82oe3c_2cd7_4e4d_baf3_5e613b37348a_percent2Fsectoral_percent252oaction_percent252oplan_percent252o-percent252odraft_percent252ooutline_percent252ostructure_transport_vio_clean.docx&usg=AOvVaw25_AjgbSpVXyUmHRKvniJO

93 NDC Partnership Support Facility (2016), Low-Carbon and Resilient Waterway Transport in Bangladesh

94 See <http://www.worldbank.org/en/news/press-release/2016/06/16/provides-bangladesh-360-million-improving-inland-waterways>

95 See <https://bdnews24.com/bangladesh/2017/09/21/bangladesh-pm-hasina-seeks-heavy-investments-in-water-infrastructure>

96 Bangladesh NDC

97 See <https://www.adb.org/sites/default/files/project-document/78872/42173-013-ban-rrp.pdf>

98 See <https://blogs.adb.org/blog/bangladesh-thinking-small-helped-dhaka-save-water>

99 See <http://www.thefinancialexpress-bd.com/2017/04/05/66108/Waste-water-treatment-by-WASA>

100 See <https://www.pppo.gov.bd/projects-Water-Supply-Sewerage-Drainage-System-Solid-Waste-Management-System-in-Purbachal-New-Town.php>

101 See <http://www.thedailystar.net/backpage/five-more-sewer-treatment-plants-planned-city-1383043>

102 See <http://www.theindependentbd.com/arcprint/details/12202/2015-08-19>

103 Bangladesh NDC

104 Ibid

105 See <https://data.worldbank.org/indicator/SP.URB.GROW?locations=BD>

106 See <http://article.sciencepublishinggroup.com/pdf/10.11648/j.ijep.20170502.11.pdf>

107 See <http://www.worldbank.org/en/results/2016/10/07/bangladesh-growing-economy-through-advances-in-agriculture>

108 See <https://www.cia.gov/library/publications/the-world-factbook/geos/bg.html>

109 See <https://www.adb.org/sites/default/files/publication/365701/ado2017-update.pdf>

110 See <http://www.thedailystar.net/Bangladesh-Budget-2017-18/frontpage/subsidy-expense-90-173pc-1414411>

111 Bangladesh NDC

112 Ibid

113 See <http://www.futuredirections.org.au/publication/electronic-prepaid-irrigation-in-bangladesh-prospects-for-improving-food-and-water-security/>

114 See <http://www.fao.org/3/a-au752e.pdf>

115 See <http://csisa.org/bringing-fallows-into-cultivation-in-southern-bangladesh/>

116 See http://bida.portal.gov.bd/sites/default/files/files/bida.portal.gov.bd/page/f40752f4_ccac_45d4_9bc4_3367eb475e8a/Doing_percent20Agribusiness_percent2oin_percent20Bangladesh.pdf

117 See <http://thefinancialexpress.com.bd/print/etp-in-textile-garment-sector-scope-for-private-public-partnership>

118 See <file:///C:/Users/Amaheshwari/Downloads/051517-south-asia-continued-robust-growth.pdf>

119 World Bank Group (2015), Bangladesh Systematic Country Diagnostic, available at <http://documents.worldbank.org/curated/en/158801468180258840/pdf/100486-CAS-P152442-SecM2015-0312-IDA-SecM2015-0216-IFC-SecM2015-0155-MIGA-SecM2015-0103-Box393233B-PUBLIC-disclosed-11-2-15.pdf>

120 See https://www.irena.org/DocumentDownloads/Publications/IRENA_RE_Jobs_Annual_Review_2017.pdf

121 See <https://cleantechnica.com/2017/07/10/bangladesh-plans-1-6-gigawatts-solar-projects/>

122 See <https://home.kpmg.com/xx/en/home/insights/2017/06/bangladesh-tax-holidays-corporate-tax-rate-changes.html>

123 See <http://seafbv.com/featuredcompanies/9>

124 See <http://www.beza.gov.bd/all-zones/>

125 See <https://www.pppo.gov.bd/projects.php>

126 See http://bida.portal.gov.bd/sites/default/files/files/bida.portal.gov.bd/page/f40752f4_ccac_45d4_9bc4_3367eb475e8a/Doing_percent20Agribusiness_percent2oin_percent20Bangladesh.pdf

127 See http://bida.portal.gov.bd/sites/default/files/files/bida.portal.gov.bd/page/f40752f4_ccac_45d4_9bc4_3367eb475e8a/Doing_percent20Agribusiness_percent2oin_percent20Bangladesh.pdf

128 See http://www.fao.org/fileadmin/user_upload/FAO-countries/Bangladesh/News/CIP_Draft_27_May_2016.pdf

From Water ATMs to “Prosumers”: Innovative Climate Business Models in South Asia

129 See http://www.ifc.org/wps/wcm/connect/corp_ext_content/ifc_external_corporate_site/annual-report/2017-online-report/private-sector-impact/technology-connecting+communities+to+modern+solutions?CID=IFC_TT_IFC_EN_EXT

130 See <http://www.sierraclub.org/sierra/2016-2-march-april/green-life/leading-greener-way>

131 See <https://www.youthbusiness.org/wp-content/uploads/2013/08/Karma-Yonten.pdf>

132 See http://www.ifc.org/wps/wcm/connect/news_ext_content/ifc_external_corporate_site/news+and+events/news/ifc+transformational+business+awards+and+conference+2016

133 See http://www.iea-pvps.org/fileadmin/dam/intranet/ExCo/IEA-PVPS_Task_9_-_Innovative_PV_Business_Models_for_Emerging_Regions.pdf

134 See <https://economictimes.indiatimes.com/small-biz/startups/how-startup-em3-agri-services-is-tackling-farmers-distress-the-uber-way/articleshow/53133968.cms>

135 See https://www.nytimes.com/2017/03/13/business/energy-environment/brooklyn-solar-grid-energy-trading.html?smprod=nytcore-ipad&smid=nytcore-ipad-share&_r=1&mtref=www.me-solshare.com

136 See <https://www.linkedin.com/pulse/effective-disruption-how-blockchain-technology-can-energy-bronder/>

137 See <https://qz.com/1051634/ather-energys-s340-after-an-epic-delay-two-iit-grads-are-racing-to-roll-out-indias-first-smart-electric-scooter/>

138 See <http://www.wri.org/blog/2017/03/how-companies-are-buying-clean-energy-4-lessons-india>

139 See <https://www.wwdmag.com/desalination/success-maldives>

Bhutan

140 Asian Development Bank, News & Events (2017), Prosperous (and Happy) Bhutan is Asia’s Fastest Growing Economy, available at <https://www.adb.org/news/features/prosperous-and-happy-bhutan-asia-s-fastest-growing-economy>

141 Asian Development Bank, Asian Development Outlook (2017), Transcending the Middle-Income Challenge, available at <https://www.adb.org/sites/default/files/publication/237761/ado-2017.pdf>

142 Asian Development Bank (2016), Member Fact Sheet—Bhutan, available at <https://www.adb.org/sites/default/files/publication/27755/bhu-2016.pdf>

143 United Nations Environment Program (2016), Multiple Pathways to Sustainable Development: Further Evidence of Sustainability in Practice, available at https://www.unep.org/greeneconomy/sites/unep.org/greeneconomy/files/publications/further_evidence_sustainabilitypractice_2016_web0.pdf

144 Ibid

145 See <http://www.bbs.bt/news/?p=32694>

146 See <http://www.nec.gov.bt/neci/wp-content/uploads/2016/07/Bhutan-State-of-Environment-Report-2016.pdf>

147 See <https://www.fastcompany.com/3057722/how-the-tiny-poor-country-of-bhutan-became-one-of-the-most-sustainable-countries-on-earth>

148 Huffpost (2017), How One of the Smallest Countries Became a Eco Leader, available at http://www.huffingtonpost.co.uk/entry/how-one-of-the-smallest-countries-became-a-eco-leader_uk_58aef288e4b05ca474a13efe

149 See <http://www.nationalcouncil.bt/assets/uploads/files/Constitution%20%20of%20Bhutan%20English.pdf>

150 See <https://www.hidropower.org/country-profiles/bhutan>

151 International Hydropower Association, Bhutan Statistics, available at <https://www.hidropower.org/country-profiles/bhutan>

152 Gross National Happiness Commission Secretariat, Bhutan, available at http://www.gnhc.gov.bt/en/wp-content/uploads/2017/05/6th-Draft-Inception-Note_23May2016.pdf

153 Bhutan NDC, available at <http://www4.unfccc.int/submissions/INDC/Published%20Documents/Bhutan/1/Bhutan-INDC-20150930.pdf>

154 Royal Government of Bhutan (2013), Alternative Renewable Energy Policy, available at <https://policy.asiapacificenergy.org/sites/default/files/Alternative%20Renewable%20Energy%20Policy%202013.pdf>

155 Ibid

156 Asian Development Bank (2013), Bhutan Transport 2040 Integrated Strategic Vision

157 Ibid
 158 See <http://www.moic.gov.bt/wp-content/uploads/2017/08/Second-Draft-National-Transport-Policy-Bhutan.pdf>
 159 Asian Development Bank, Country Partnership Strategy: Bhutan, 2014–2018, Sector assessment (Summary): Transport, available at <https://www.adb.org/sites/default/files/linked-documents/cps-bhu-2014-2018-ssa-o3.pdf>
 160 GreenBiz (2014), Nissan to Help Bhutan Go Zero Emissions with EVs, available at <https://www.greenbiz.com/blog/2014/02/25/nissan-help-bhutan-go-zero-emissions-evs>
 161 World Bank Group (2016), Directions in Development, The Bhutan Electric Vehicle Initiative, available at <http://www.indiaenvironmentportal.org.in/files/file/The%20Bhutan%20Electric%20Vehicle%20Initiative.pdf>
 162 See <https://newsroom.nissan-global.com/releases/release-c8cb6d5b73899a7424d8f675bf8c2-140221-02-e?query=bhutan>
 163 Ibid
 164 Reuters (2015), On the Road to Zero Emissions, Bhutan Hits a Few Electric Car Bumps, available at <https://www.reuters.com/article/us-bhutan-climate-change-autosales/on-the-road-to-zero-emissions-bhutan-hits-a-few-electric-car-bumps-idUSKBN0OPoW720150609>
 165 PwC (January 2014), Development of Energy Codes and Standards for Buildings
 166 Ibid
 167 Asian Development Bank (2013), Bhutan Transport 2040 Integrated Strategic Vision
 168 National Economic Commission, Bhutan, Waste, available at <http://www.nec.gov.bt/nec1/index.php/waste/>
 169 United Nations Centre for Regional Development, Ministry of Works & Human Settlement, Presentation on Solid Waste Management in Bhutan, available at http://www.uncrd.or.jp/content/documents/4124Country%20Presentation_Bhutan.pdf
 170 Kuensel (2017), Bhutan Trust Fund Supports Four Environment Conservation Projects, available at <http://www.kuenselonline.com/bhutan-trust-fund-supports-four-environment-conservation-projects/>
 171 Asian Development Bank, Country Environment Assessment Summary, available at <https://www.adb.org/sites/default/files/linked-documents/cps-bhu-2014-2018-ena.pdf>
 172 Sierra (2016), Leading to a Greener Way, available at <http://www.sierraclub.org/sierra/2016-2-march-april/green-life/leading-greener-way> (Samal, P)
 173 Reuters (2015), In Bhutan, the Road to Green Development is Paved with Plastic, available at <http://www.reuters.com/article/bhutan-green-paving/in-bhutan-the-road-to-green-development-is-paved-with-plastic-idUSL8N12X21M20151102>
 174 The Water Act of Bhutan (2011), available at <http://oag.gov.bt/wp-content/uploads/2010/05/Water-Act-of-Bhutan-2011-English-and-Dzongkha.pdf>
 175 UNICEF Data, Water and Sanitation, Drinking Water, available at <https://data.unicef.org/topic/water-and-sanitation/drinking-water>
 176 World Economic Forum (2015), The Travel & Tourism Competitiveness Report, available at http://www3.weforum.org/docs/TT15/WEF_Global_Travel&Tourism_Report_2015.pdf
 177 World Bank Data, Employment in Agriculture, available at <https://data.worldbank.org/indicator/SL.AGR.EMPL.ZS?locations=BT>
 178 Asian Development Bank (2016), National Irrigation Master Plan, available at https://www.adb.org/sites/default/files/project-documents/46463/46463-002-dpta-en_o.pdf
 179 Asian Development Bank (2017), Completion Report, Bhutan: Adapting to Climate Change through Integrated Water Resources Management, available at <https://www.adb.org/sites/default/files/project-documents/46463/46463-002-tcr-en.pdf>
 180 Kuensel (2016), 27,000 Acres Under Paddy Cultivation by 2032, available at <http://www.kuenselonline.com/27000-acres-under-paddy-cultivation-by-2032/>
 181 Based on 25,531,303,705 Bhutanese ngultrum market capitalization as quoted on the Royal Securities Exchange of Bhutan <http://www.rsebl.org.bt/> (accessed October 13, 2017) and converted using IRS yearly average currency exchange rates. Using an exchange rate of 66.8 Indian rupees to \$1 (2015 average taken from: <https://www.irs.gov/individuals/international-taxpayers/yearly-average-currency-exchange-rates>) because the Bhutanese ngultrum is pegged to the Indian rupee
 182 World Bank Group (2017), Investment Climate Assessment of Bhutan, available at <http://documents.worldbank.org/curated/en/673381506689928071/pdf/120144-ICA-PUBLIC-P153221-Bhutan-Competitiveness-Policy-Note-Web.pdf>
 183 Ministry of Finance, Bhutan (March 2016), Public Private Partnership Policy, available at http://www.mof.gov.bt/wp-content/uploads/2014/07/PPP_Policy_2016.pdf
 184 World Bank Data, Performance and Learning Review of the Country Partnership Strategy for the Kingdom of Bhutan (FY2015–2019), available at <http://documents.worldbank.org/curated/en/55103149688725781/pdf/Bhutan-PLR-Final-5-8-17-05122017.pdf>
 185 International Institute for Sustainable Development (2017), How Green Public Procurement Became a Crucial Pillar for Bhutan's Sustainable Development Strategy, available at <https://www.iisd.org/sites/default/files/publications/gpp-bhutan-sustainable-development-strategy.pdf>
 186 See <http://www.switch-asia.eu/projects/gpp-bhutan/>
 187 Ministry of Economic Affairs, Supply of Solar Home Lighting and Solar Street Lighting Systems with Complete Accessories, available at <http://www.moea.gov.bt/?p=2327>

188 World Bank Group (2017), Doing Business 2018 Fact Sheet: South Asia, available at <http://www.doingbusiness.org/~media/WBG/DoingBusiness/Documents/Annual-Reports/English/DB2018-Full-Report.pdf>
 189 World Bank Group, Doing Business Data, available at <http://www.doingbusiness.org/data/exploreeconomies/bhutan#dealing-with-construction-permits>
 190 Royal Government of Bhutan (2010), Foreign Direct Investment Policy, available at [http://admin.theiguides.org/Media/Documents/FDI%20Policy%202010%20\(amended\).pdf](http://admin.theiguides.org/Media/Documents/FDI%20Policy%202010%20(amended).pdf)

Innovative Finance to Scale Up Investments

191 Climate Bond Initiative and HSBC (2017), Bonds and Climate Change: State of the Market 2017
 192 Bonds issued offshore but denominated in Indian currency
 193 Climate Bond Initiative and HSBC (2017), Bonds and Climate Change: State of the Market 2017
 194 Argentina, Bangladesh, Brazil, Cambodia, Chile, China, Colombia, Dominican Republic, Ecuador, Egypt, Fiji, Georgia, Ghana, Honduras, India, Indonesia, Jordan, Kenya, Lao PDR, Mexico, Mongolia, Morocco, Nepal, Nigeria, Pakistan, Panama, Paraguay, Peru, Philippines, South Africa, Sri Lanka, Thailand, Turkey, and Vietnam. The network represents \$42.54 trillion in banking assets, accounting for over 85 percent of the total banking assets in emerging markets
 195 See <https://ifcextapps.ifc.org/ifcext/pressroom/ifcpressroom.nsf/o/DF3667AFC9F5F31852581B500296591>
 196 See www.climatefinancelab.org

India

197 World Bank Group, Population Data, available at <https://data.worldbank.org/indicator/SP.POP.TOTL?locations=IN>
 198 World Bank Group, The World Bank in India: Overview, available at <http://www.worldbank.org/en/country/india/overview>
 199 Ibid
 200 INDC Published Documents, India's Intended Nationally Determined Contribution: Working Towards Climate Justice, available at <http://www4.unfccc.int/submissions/INDC/Published%20Documents/India/1/>
 201 International Energy Agency (2016), World Energy Outlook
 202 World Resources Institute, WRI India, available at <http://www.wri.org/our-work/topics/india>
 203 Bridge to India (2016), Public Sector Struggling to Compete with Private Sector in Solar Power Generation, available at <http://www.bridgetoindia.com/public-sector-struggling-compete-private-sector-solar-power-generation/>
 204 Institute for Energy Economics and Financial Analysis (2015), India's Electricity-Sector Transformation: Global Capacity Building, available at http://ieefa.org/wp-content/uploads/2015/11/IEEFA-India-Electricity-Sector-Transformation_Global-Capacity-Building_11m2015.pdf
 205 Livemint (2016), India's Electric Vehicle Sales Grow 37.5% to 22,000 Units, available at <http://www.livemint.com/Industry/IBkrw7B4nyVb5YAlrak9CK/Indias-electric-vehicle-sales-grow-375-to-22000-units.html>
 206 Government of India (2017), Ministry of New and Renewable Energy, India: Annual Report 2016–17, New Delhi. Available at <http://mnre.gov.in/file-manager/annual-report/2016-2017/EN/content.html>
 207 PV Magazine (2016), Rooftop and Off-Grid Solar to Soar in India in 2017, Says BNEF, available at https://www.pv-magazine.com/2016/11/01/rooftop-and-off-grid-solar-to-soar-in-india-in-2017-says-bnef_100026722/
 208 World Bank (2017), State Bank of India Approves 100MW of Grid-Connected Rooftop Solar Projects under Word Bank Program, available at <http://www.worldbank.org/en/news/press-release/2017/06/02/state-bank-of-india-approves-100mw-grid-connected-rooftop-solar-projects-under-word-bank-program>
 209 EY (May 2017), Renewable Energy Country Attractiveness Index, Issue 49
 210 Finance, BNE (2017), Global Trends in Renewable Energy Investment. Frankfurt: Frankfurt School, United Nations Environment Programme Collaborating Centre for Climate and Sustainable Energy Finance
 211 Bloomberg (2017), SoftBank and Foxconn Bring India Some of World's Cheapest Solar, available at <https://www.bloomberg.com/news/articles/2017-05-12/softbank-and-foxconn-bring-india-some-of-world-s-cheapest-solar>
 212 NITI Aayog, Government of India (2017), Draft National Energy Policy, available at http://niti.gov.in/writereaddata/files/new_initiatives/NEP-ID_27.06.2017.pdf
 213 Asia Green Buildings (2016), India Green Building Market Opportunity Outlook 2020, available at <http://www.asiagreenbuildings.com/14766/india-green-building-market-opportunity-outlook-2020/>
 214 GBIG, India, available at <http://www.gbig.org/search/site?search%5Btext%5D=india&search%5Blatitude%5D=&search%5Blongitude%5D=&search%5Bbox%5D=&type=buildings>
 215 ET Realty (2016), India Ranks Third Globally in LEED Certified Green Buildings with 2,386 Projects, available at <http://realty.economictimes.indiatimes.com/news/industry/india-ranks-third-globally-in-leed-certified-green-buildings-with-2386-projects/56084087>
 216 U.S. Green Building Council (2017), Green Building Trends in India, available at <https://www.usgbc.org/articles/green-building-trends-india-2017>
 217 Green Rating for Integrated Habitat Assessment, India, available at <http://grihaindia.org/>
 218 Bureau of Energy-efficiency, Ministry of Power, India, available at https://beeindia.gov.in/sites/default/files/tender_document/BEE_ECBC%202017.pdf

- 219 Press Information Bureau, Ministry of Power, India, Adoption of ECBC Could Lead to 30%-50% Energy Savings by Commercial Buildings, available at <http://pib.nic.in/newsite/PrintRelease.aspx?relid=165748>
- 220 IFC Press Release, A New CEO-led Consortium to Drive Sustainability in India's Housing Sector, available at <https://ifcext.ifc.org/ifcext/Pressroom/IFCPressRoom.nsf/o/6A6615E7383B854385257F4E0029DoB2?OpenDocument>
- 221 See <http://www.pmawasyojana.co.in/pradhan-mantri-awas-yojana-urban/>
- 222 See <http://www.pmawasyojana.co.in/gramin/>
- 223 See <http://pib.nic.in/newsite/PrintRelease.aspx?relid=122576>
- 224 The Hindu Business Line (2017), Demand for Green Buildings Grows as Health, Environmental Concerns Rise, available at <http://www.thehindubusinessline.com/news/real-estate/demand-for-green-buildings-grows-as-health-environmental-concerns-rise/article9750728.ece>
- 225 IRS yearly average currency exchange rates. Total of €18,551,323,164, using a 0.784 euro to dollar exchange rate (2014 average taken from <https://www.irs.gov/individuals/international-taxpayers/yearly-average-currency-exchange-rates>)
- 226 See <https://data.oecd.org/transport/infrastructure-investment.htm>
- 227 Rocky Mountain Institute & NITI Aayog (2017), India Leaps Ahead: Transformative Mobility Solutions for All
- 228 The Indian Express (2017), Bharat Stage-VI in 3 Years: Race over Speedbumps, available at <http://indianexpress.com/article/explained/death-by-breath-bharat-stage-iv-bs-iv-bs-vi-in-3-yrs-race-over-speedbumps-4545456/>
- 229 INDC Published Documents, India's Intended Nationally Determined Contribution: Working Towards Climate Justice, available at <http://www4.unfccc.int/submissions/INDC/Published%20Documents/India/1/>
- 230 These sources include Goldman Sach's estimates in India EV: Leapfrogging from 2-Wheelers to E-Wheelers, September 2017
- 231 Overdrive (2017), Mahindra Matches Tata Motors Bid for Electric Vehicles Tender, Will Provide 150 E-Verito Cars to EESL, available at <http://overdrive.in/news-cars-auto/mahindra-matches-tatas-bid-for-electric-vehicles-tender-bags-30-of-phase-1-order/>
- 232 See <http://www.hindustantimes.com/autos/tata-motors-wins-india-s-11-200-crore-electric-car-tender/story-bIHbxh4ErEoS5v5Aqcv6M.html>
- 233 Press Information Bureau, Ministry of Environment and Forests, Solid Waste Management Rules Revised After 16 Years; Rules Now Extend to Urban and Industrial Areas, available at <http://pib.nic.in/newsite/PrintRelease.aspx?relid=138591>
- 234 INDC Published Documents, India's Intended Nationally Determined Contribution: Working Towards Climate Justice, available at <http://www4.unfccc.int/submissions/INDC/Published%20Documents/India/1/>
- 235 Press Information Bureau, Ministry of Environment and Forests, Solid Waste Management Rules Revised After 16 Years; Rules Now Extend to Urban and Industrial Areas, available at <http://pib.nic.in/newsite/PrintRelease.aspx?relid=138591>
- 236 Central Pollution Control Board, CPCB Bulletin (July 2016), available at http://www.cpcb.nic.in/upload/Latest/Latest_123_SUMMARY_BOOK_FS.pdf
- 237 World Bank Group Data, Investment in Water and Sanitation with Private Participation (current \$), available at <https://data.worldbank.org/indicator/IE.PPI.WATR.CD?end=2015&locations=IN&start=2001&view=chart>
- 238 PwC (2016), Closing the Water Loop: Reuse of Treated Wastewater in Urban India, available at <https://www.pwc.in/assets/pdfs/publications/2016/pwc-closing-the-water-loop-reuse-of-treated-wastewater-in-urban-india.pdf>
- 239 Asian Development Bank (2012), Wastewater Management and Sanitation in Asia
- 240 UNESCO (2017), The United Nations World Water Development Report 2017, available at <http://unesdoc.unesco.org/images/0024/002475/247553e.pdf>
- 241 See http://ebtc.eu/pdf/mio31_SNA_Snapshot_Water-and-waste-water-in-India.pdf
- 242 Asian Development Blog, Mangalore Shows the Way on Wastewater Management in India, available at <https://blogs.adb.org/blog/mangalore-shows-way-wastewater-management-india>
- 243 KPMG Flash News, India Economic Survey 2015-16 Key Highlights, available at <https://home.kpmg.com/content/dam/kpmg/in/pdf/2017/01/KPMG-Flash-News-India-Economic-Survey-2015-16%E2%80%93Key-Highlights-3.pdf>
- 244 World Bank Group, The World Bank in India, Overview, available at <http://www.worldbank.org/en/country/india/overview>
- 245 See <https://www.ibef.org/industry/agriculture-india.aspx>
- 246 AgFunder News (2017), Five Trends in Agritech Innovation in India to Watch Out for in 2017, available at <https://agfundernews.com/five-trends-in-agritech-innovation-in-india-to-watch-out-for-in-2017.html>
- 247 See India Brand Equity Foundation (2017), Agriculture in India: Information About Indian Agriculture & Its Importance, available at <https://www.ibef.org/industry/agriculture-india.aspx>
- 248 IRS yearly average currency exchange rates. Total of 17,000 Indian crore rupees, using a 66.8 Indian rupee to dollar exchange rate (2015 average taken from <https://www.irs.gov/individuals/international-taxpayers/yearly-average-currency-exchange-rates>)
- 249 86,500 Indian crore rupees at 2015 dollar exchange rate used above
- 250 See <http://www.livemint.com/Politics/UMYGdCKHozRQEsBylKvQvH/Karnataka-govt-plans-to-invest-Rs1-trillion-in-irrigation-pr.html>
- 251 Bloomberg New Energy Finance (2017), India's \$60 billion Solar Irrigation Opportunity
- 252 6,39,900 Indian crore rupees at 2015 dollar exchange rate used above
- 253 The Economic Times Agriculture (2017), Additional Rs 6,39,900 Crore Investment Needed to Double Farmers' Income, available at http://economictimes.indiatimes.com/articleshow/60057405.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst
- 254 Bridge to India (2017), Renewable Developers Line Up for Public Offerings, available at <http://www.bridgetoindia.com/renewable-developers-line-public-offerings/>
- 255 Bridge to India (2017), India to Add 9.4 GW of Solar Capacity in 2017, available at <http://www.bridgetoindia.com/india-add-9-4-gw-solar-capacity-2017/>
- 256 See <http://www.bridgetoindia.com/states-will-drive-indias-next-round-solar-demand/>
- 257 Mercom India, Mahindra Susten Emerges as Lowest (L1) Bidder in NLC India's 20 MW BESS Auction, available at <https://mercomindia.com/mahindra-susten-lowest-l1-bidder-nlc-india-bess-auction/>
- 258 Climate Policy Initiative (2012), Meeting India's Renewable Energy Targets: The Financing Challenge, available at <https://climatepolicyinitiative.org/publication/meeting-indias-renewable-energy-targets-the-financing-challenge/> This paper discusses the 24 percent to 32 percent increase in the cost of renewable energy due to the cost of finance, and internal communication with the Climate Policy Initiative confirms that the numbers are now closer to the lower part of the range
- 259 Ibid
- 260 The Indian Express (2017), Non-Performing Assets: Loan Stress in Infrastructure May Wipe Out Banks' Entire Profits, says RBI, available at <http://indianexpress.com/article/business/non-performing-assets-loan-stress-in-infrastructure-may-wipe-out-banks-entire-profits-says-rbi-4746446/>
- 261 See http://www.business-standard.com/article/companies/eel-plans-to-lease-electric-vehicles-to-ola-uber-other-aggregators-117081600791_1.html
- 262 See <https://www.mckinseyenergyinsights.com/insights/impact-of-gasoline-and-diesel-subsidy-reforms-india-case-study/>
- 263 EY (2016), Electric Vehicles Adoption: Potential Impact in India, available at [http://www.ey.com/Publication/vwLUAssets/EY-ev-adoption-potential-impact-in-India-july-2016/\\$FILE/EY-ev-adoption-potential-impact-in-India-july-2016.pdf](http://www.ey.com/Publication/vwLUAssets/EY-ev-adoption-potential-impact-in-India-july-2016/$FILE/EY-ev-adoption-potential-impact-in-India-july-2016.pdf)
- 264 Society of Indian Automobile Manufacturers, Domestic Sales Trends, available at <http://www.siamindia.com/statistics.aspx?mpgid=8&pgidtrail=14>
- 265 Quartz India (2017), India is About to Embark on the Most Ambitious Electric-Car Transformation in the World, available at <https://qz.com/1072643/electric-vehicles-india-is-about-to-embark-on-the-most-ambitious-electric-car-transformation-in-the-world/>
- 266 See <https://cleantechnica.com/2017/04/21/india-considers-100-electric-vehicles-2030/>
- 267 Asia Green Buildings (2016), Government Incentives and Regulation as the Main Challenges for Green Building Development in Asia, available at <http://www.asiagreenbuildings.com/featured/2016/08/16/government-incentives-and-regulation-as-the-main-challenges-for-green-building-development-in-asia/>
- 268 Dubash, N. (2007), The Electricity-Groundwater Conundrum: Case for a Political Solution to a Political Problem, available at https://www.researchgate.net/publication/261889970_The_Electricity-Groundwater_Conundrum_Case_for_a_PoliticalSolution_to_a_Political_Problem
- 269 PwC (2016), Closing the Water Loop: Reuse of Treated Wastewater in Urban India, available at <https://www.pwc.in/assets/pdfs/publications/2016/pwc-closing-the-water-loop-reuse-of-treated-wastewater-in-urban-india.pdf>

Innovative Corporate Practices: Internal Carbon Pricing

- 270 Carbon Disclosure Project (October 2017), Putting a Price on Carbon: Integrating Climate Risk Into Business Planning, available at <https://b8f65cb3731bb7b15feb-c70d8ead6ced550b4d987d7c03fcdidd.ssl.cf3.rackcdn.com/cms/reports/documents/000/002/738/original/Putting-a-price-on-carbon-CDP-Report-2017.pdf?1507739326>
- 271 See <https://www.carbonpricingleadership.org/>
- 272 Based on Carbon Disclosure Project and World Resources Institute India analysis

Maldives

- 273 See <https://www.adb.org/sites/default/files/publication/372936/swp-53.pdf>
- 274 See <https://datahelpdesk.worldbank.org/knowledgebase/articles/906519>
- 275 World Bank Group (October 2017), South Asia Economic Focus, Maldives chapter, available at <http://www.worldbank.org/en/news/press-release/2017/10/08/right-policies-south-asia-potential-growth-lead-saef>
- 276 Maldives National Bureau of Statistics, Staff Estimates, available at <http://statisticsmaldives.gov.mv/>
- 277 See <https://www.adb.org/countries/maldives/economy>
- 278 World Bank Group expert
- 279 Maldives NDC, available at <http://www4.unfccc.int/ndcregistry/PublishedDocuments/Maldives%20First/Maldives%20INDC.pdf>
- 280 Ibid
- 281 See <http://documents.worldbank.org/curated/en/125521468195563512/pdf/103724-CPF-P157051-IDA-R2016-0053-IFC-R2016-0077-MIGA-R2016-0016-Box394878B-OUO-9.pdf>
- 282 See <http://investmaldives.gov.mv/opportunities.php>

283 See http://www.mv.undp.org/content/maldives/en/home/operations/projects/environment_and_energy/joint-programmeDoc.html.

284 See <http://www.environment.gov.mv/v2/wp-content/files/publications/20161220-pub-mv-energy-policy-strategy-2016-20dec2016.pdf>

285 Ibid

286 Ibid

287 See <http://www.presidencymaldives.gov.mv/Index.aspx?lid=13&dcid=18285>

288 See <http://www.worldbank.org/en/news/press-release/2014/07/17/maldives-private-investments-scale-up-renewable-energy-program>

289 See <http://www.independent.co.uk/news/world/renewable-energy-target-climate-united-nations-climate-change-vulnerable-nations-ethiopia-a7425411.html>

290 See http://www.environment.gov.mv/v1/wp-content/blogs.dir/1/files/downloads/Low_Carbon_Strategy_for_Transport_Sector_-_30.09.2014.pdf

291 Ibid

292 Ibid

293 See <http://investmaldives.gov.mv/opportunities.php>

294 Maldives NDC

295 See <http://www.iaa.org/policiesandmeasures/pams/maldives/name-45898-en.php?s=dHlwZTlZSzZdGFodXMgT2s,&return=PGshdiBpZD0iYnJlYWRJcnVtYiI-PGEgaHJlZjoilYl-SG9tZTWvYT4gJnJhcXVvOyA8YSBocmVmPSlvcG9saWNpZmRtZWZdXJlcY9lbmVzZ3lZmZpY2llbmN5Lyl-RW5lcmd5lEVmZmljaWVuY3k8LzE-PC9uYXY->

296 See <http://www.gbigo.org/places/26625>

297 See <http://www.presidencymaldives.gov.mv/Index.aspx?lid=12&dcid=17637>

298 See <https://www.gtai.de/GTAI/Content/DE/Trade/Fachdaten/PRO/2016/09/Anlagen/PRO201609155012.pdf?v=1>

299 See <http://investmaldives.gov.mv/projects.php>

300 Maldives NDC

301 English summary provided by Gaurav Joshi

302 See <http://www.africanreview.com/energy-a-power/power-generation/abu-dhabi-to-fund-waste-to-energy-project-in-maldives>

303 See http://www.environment.gov.mv/v1/wp-content/blogs.dir/1/files/downloads/20170202-Pub-State_of_the_Environment_2016.pdf

304 Ibid

305 See http://www.who.int/water_sanitation_health/monitoring/investments/maldives-10-nov.pdf?ua=1

306 See <http://www.environment.gov.mv/v2/wp-content/files/publications/20170202-pub-soe-2016.pdf>

307 See http://www.fao.org/nr/water/aquastat/countries_regions/MDV/MDV-CP_eng.pdf

308 See <http://unesdoc.unesco.org/images/0024/002475/247553e.pdf>

309 Maldives National Bureau of Statistics, Census 2014, available at https://www.cia.gov/library/publications/the-world-factbook/geos/print_mv.html

310 Ibid

311 Maldives National Bureau of Statistics, Staff Estimates, available at <http://statisticsmaldives.gov.mv/nbs/wp-content/uploads/2017/01/Statistical-Pocketbook-2016.pdf>

312 Maldives NDC

313 Ibid

314 See <http://investmaldives.gov.mv/opportunities.php>

315 See <http://maldivesindependent.com/business/british-company-to-invest-us10m-in-historic-agricultural-project-118356>

316 See <http://www.fishagri.gov.mv/images/download/MSFDP/msfd-esmf-january-17-2017.pdf>

317 See <https://www.adb.org/sites/default/files/evaluation-document/173308/files/pvr-399.pdf>

318 See <http://www.worldbank.org/en/news/feature/2016/05/10/maldives-a-systematic-country-diagnostic>

319 International Monetary Fund (May 2017), South Asia Regional Update

320 See <http://uk.reuters.com/article/idINIndia-35851720081008>

321 See http://www.environment.gov.mv/v1/wp-content/blogs.dir/1/files/downloads/Maldives_Climate_Change_Policy_Framework_draft_3.pdf

322 See <http://www.greenclimate.fund/-/support-of-vulnerable-communities-in-maldives-to-manage-climate-change-induced-water-shortages>

323 See <http://www.worldbank.org/en/news/feature/2016/05/10/maldives-a-systematic-country-diagnostic>

324 See <https://www.climateinvestmentfunds.org/country/maldives>

325 Ibid

326 See http://esmap.org/re_mapping_maldives

Energy-Efficiency Innovations in South Asia

327 See <http://www.powermin.nic.in/en/content/energy-efficiency>

328 See <https://www.nytimes.com/interactive/2017/07/13/climate/climate-change-make-a-difference-quiz.html>

329 See http://sameeksha.org/pdf/presentation/SIDBI_Energy-Efficiency-Initiatives-for-MSMEs.pdf

330 903 million Indian rupees at an exchange rate of \$1 to 66.8 Indian rupees

331 2.6 million Indian rupees at an exchange rate of \$1 to 66.8 Indian rupees

332 40.8 Indian crore rupees at an exchange rate of \$1 to 66.8 Indian rupees

Nepal

333 See <https://www.adb.org/news/features/booming-south-asia-driving-economic-growth-asia>

334 See <http://www.worldbank.org/en/country/nepal/publication/nepaldevelopmentupdate>

335 See <http://documents.worldbank.org/curated/en/76461505401428300/pdf/119723-WP-PUBLIC-SEPT-17-38p-Nepal-Development-Update-Sept-2017.pdf>

336 See <https://www.adb.org/news/features/booming-south-asia-driving-economic-growth-asia>

337 See [http://www.nbsm.com.np/assets/kcfinder/upload/files/Nepal%20Budget%202074:75\(1\).pdf](http://www.nbsm.com.np/assets/kcfinder/upload/files/Nepal%20Budget%202074:75(1).pdf)

338 See http://www.mof.gov.np/uploads/document/file/Budget_Speech_207475_20170530011441.pdf

339 Ibid

340 Nepal NDC, available at <http://www4.unfccc.int/ndcregistry/PublishedDocuments/Nepal%20First/Nepal%20First%20NDC.pdf>

341 Ibid

342 See http://moud.gov.np/wp-content/uploads/2017/02/NUDS_cabinet-document_approved-on-2073-10-9.pdf

343 Converted 372.94 billion Nepalese rupees to dollars using a yearly average currency exchange rate for 2015 (\$1 = 103.18 Nepalese rupees), found by averaging the monthly rates for the year from http://www.bundesbank.de/Navigation/EN/Statistics/Time_series_databases/Macro_economic_time_series/its_details_value_node.html?nsc=true&tsid=BBEX3.M.NPR.USD.CA.AB.A011

344 Converted 918 billion Nepalese rupees to dollars, using exchange rate as explained above

345 See <http://www.nepalbusinessforum.org/page/detail/about-us-17>

346 See <https://www.devex.com/news/how-to-engage-the-private-sector-in-development-86618>

347 See <https://pppknowledgelab.org/countries/nepal>

348 Ibid

349 See <https://www.adb.org/sites/default/files/institutional-document/363716/improving-lives-rural-communities-renewable-energy.pdf>

350 See <https://www.adb.org/sites/default/files/institutional-document/363611/tapping-unreached-nepal.pdf>

351 Nepal NDC

352 Ibid

353 See <http://www.independent.co.uk/news/world/renewable-energy-target-climate-united-nations-climate-change-vulnerable-nations-ethiopia-a7425411.html>

354 See <http://documents.worldbank.org/curated/en/311991468190177406/pdf/PAD1276-PAD-P150066-IDA-R2015-0241-1-Box393200B-OUO-9.pdf>

355 See <https://www.adb.org/sites/default/files/publication/356466/nepal-energy-assessment-road-map.pdf>

356 See <https://thehimalayantimes.com/perspectives/new-regulation-may-stunt-growth-hydropower-sector/>

357 Nepal NDC

358 Ibid

359 See <https://www.adb.org/sites/default/files/publication/159827/nep-sasec-road-connectivity-project-brief.pdf>

360 See [http://www.uncrd.or.jp/content/documents/3377Background%20Paper%20-EST%20Plenary%20Session%202%20\(No.%201\).pdf](http://www.uncrd.or.jp/content/documents/3377Background%20Paper%20-EST%20Plenary%20Session%202%20(No.%201).pdf)

361 Nepal NDC

362 Government of Nepal (2014), Nepal Environment Friendly Vehicle and Transport Policy

363 See <https://thehimalayantimes.com/opinion/editorial-promoting-evs/>

364 Nepal NDC

365 Converted 1.03 trillion Nepalese rupees to dollars, using exchange rate as explained above

366 See www.mopit.gov.np

367 See http://moud.gov.np/wp-content/uploads/2017/02/NUDS_cabinet-document_approved-on-2073-10-9.pdf

368 See www.mopit.gov.np

369 Nepal NDC

370 See <http://nra.gov.np/uploads/docs/ASTGGdnejZi6o823113341.pdf>

371 See http://envirodm.org/cms/wp-content/uploads/2017/05/building_material_selection_and_use___an_environmental_guide.pdf

372 See <https://www.nepalhousingreconstruction.org/sites/nuh/files/2016-09/nhrp%20overview%20%28003%29.pdf>

373 See <http://www.switch-asia.eu/news/after-the-earthquake-nepal-reconstructs-with-green-building-materials/>

374 See http://www.ifc.org/wps/wcm/connect/news_ext_content/ifc_external_corporate_site/news+and+events/news/trp_feature+1_hotelnepal

375 See <http://www.asiagreenbuildings.com/9858/nepal-eco-friendly-material-for-rebuilding-the-damaged-sector/>

376 See http://www.ilo.org/wcmsp5/groups/public/-/-ed_emp/documents/publication/wcms_397970.pdf

377 Nepal NDC

378 See http://moud.gov.np/wp-content/uploads/2017/02/NUDS_cabinet-document_approved-on-2073-10-9.pdf

379 Converted 75 billion Nepalese rupees to dollars, using exchange rate as explained above

380 See <https://data.worldbank.org/indicator/SP.URB.GROW?locations=NP>

381 See <https://www.adb.org/sites/default/files/institutional-document/363611/tapping-unreached-nepal.pdf>

382 Ibid

383 Ibid

384 See http://www3.weforum.org/docs/TT15/WEF_Global_Travel&Tourism_Report_2015.pdf

385 http://moud.gov.np/wp-content/uploads/2017/02/NUDS_cabinet-document_approved-on-2073-10-9.pdf

386 See <http://documents.worldbank.org/curated/en/753041468188954132/pdf/99686-BRI-P130461-and-P132268-PUBLIC-ADD-SERIES-OBApproaches-Box393207B-No46-Nepal-and-West-Bank-SWM-web.pdf>

387 See http://moud.gov.np/wp-content/uploads/2017/02/NUDS_cabinet-document_approved-on-2073-10-9.pdf

388 Ibid

389 See <https://www.adb.org/sites/default/files/publication/30366/solid-waste-management-nepal.pdf>

390 Ibid

391 See <http://www.moad.gov.np/en/post/welcome>

392 Nepal NDC

393 See <http://www.dls.gov.np/uploads/files/ADS%20Final.pdf>

394 See http://www.dolmimpact.com/pdf/DIF%201-%20Agriculture%20Market%20Report_Final_1-10-2014.pdf

395 See <http://www.nabic.agribiznepal.com/index.php/about-us>

396 See <https://thehimalayantimes.com/business/nepal-agribusiness-innovation-centre-inaugurated/>

397 See <https://www.adb.org/sites/default/files/institutional-document/34001/files/cps-nep-2013-2017.pdf>

398 See http://investmentsummitnepal.com/wp-content/uploads/2017/03/buletin_day-2.pdf

399 See http://www.dolmimpact.com/pdf/DIF%201-%20Agriculture%20Market%20Report_Final_1-10-2014.pdf

400 See <http://documents.worldbank.org/curated/en/893961489975249563/pdf/02-21-17-Nepal-PLR-final-02242017.pdf>

401 See <http://documents.worldbank.org/curated/en/358501495199225866/pdf/115156-CEM-PUBLIC-SAREC-70p-Country-Economic-Memorandum-19-May-2017.pdf>

402 Ibid

403 See <https://www.adb.org/sites/default/files/linked-documents/47036-001-nep-ssa.pdf>

404 See http://www.ibn.gov.np/uploads/files/Working%20Classification/IBN/Sector%20Profiles/Transportation_Sector%20Profile.pdf

Innovative Technology Solutions to Effect Change

405 See <http://science.sciencemag.org/content/305/5686/968.full>

406 See <https://www.forbes.com/sites/morganstanley/2017/10/10/using-technology-to-fight-climate-change/#66059fb57a10> and <http://www.aljazeera.com/news/2016/11/india-unveils-world-largest-solar-power-plant-161129101022044.html>

407 See https://economics.times.indiatimes.com/articleshow/61137358.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst

408 See http://www.rechsteiner-basel.ch/uploads/media/bd_roadmap_bangladesh_1505-2.pdf

409 See <http://www.sciencedirect.com/science/article/pii/S0360319906002825>

410 See <https://www.pv-magazine.com/2017/06/20/sungrow-supplies-inverters-storage-to-the-maldives/> and <https://www.prnewswire.com/news-releases/sungrow-pv-and-energy-storage-equipment-powers-five-maldivian-islands-300472805.html> and <https://www.pv-tech.org/news/sungrow-hybrid-solar-storage-microgrid-powers-five-islands-in-the-maldives>

411 See <https://agfundnews.com/agriculture-technology-investment-storms-to-4-6bn-in-2015-as-global-investors-take-note5380.html>

412 See <https://www.linkedin.com/pulse/changing-view-seeing-business-challenges-iot-solutions-michael-orr/>

413 See <https://www.sigfox.com/en/news/sigfox-foundation-partners-three-international-conservation-organisations-give-voice> and <http://lowveldrhinotruster.org/>

414 See <https://www2.frost.com/frost-perspectives/ami-infrastructure-developments-across-asia-progressing-digital-utility/> and <https://www.engerati.com/sites/default/files/Andy%20Bae.pdf> and <https://www.prnewswire.com/news-releases/southeast-asia-smart-metering-market-to-reach-69-billion-by-2022-170942281.html>

Sri Lanka

415 See <http://www.worldbank.org/en/country/srilanka/overview>

416 See <http://www.undp.org/content/dam/LECB/docs/pubs-reports/UNDP-LECB-Assessment-Sri-Lanka-Power-Sector.pdf>

417 See <http://www.worldbank.org/en/country/srilanka/overview>

418 See <http://www.worldbank.org/en/news/press-release/2016/07/30/supporting-sri-lankas-economic-reforms-sustain-growth-create-jobs>

419 See <https://data.worldbank.org/indicator/SP.POP.TOTL?locations=LK>

420 See <https://www.adb.org/sites/default/files/institutional-document/342216/cps-sri-2018-2022.pdf>

421 See <https://data.worldbank.org/indicator/SP.POP.TOTL?locations=LK>

422 See <https://www.adb.org/sites/default/files/institutional-document/342216/cps-sri-2018-2022.pdf>

423 See <http://dailynews.lk/2017/01/03/local/103630>

424 See <http://www.srilankanext.lk/sri-lanka-next.php>

425 Sri Lanka Vision 2025

426 See http://www.economynext.com/Private_funding_for_Sri_Lanka_Megapolis_govt_equity_minimal-3-8767-4.html

427 See <https://megapolis.gov.lk/masterplan/>

428 See http://www.info.energy.gov.lk/content/pdf3/2015_percent20Energy_percent20Balance.pdf

429 Ministry of Mahaweli Development and Environment (May 2016), Clean Air 2025 Action Plan

430 Ibid

431 See http://powermin.gov.lk/sinhala/wp-content/uploads/2015/03/ENERGY_EMPOWERED_NATION_2015_2025.pdf

432 Ibid

433 Sri Lanka NDC, available at <http://www4.unfccc.int/ndcregistry/PublishedDocuments/Sri%20Lanka%20First/NDCs%20of%20Sri%20Lanka.pdf>

434 See <http://www.independent.co.uk/news/world/renewable-energy-target-climate-united-nations-climate-change-vulnerable-nations-ethiopia-a7425411.html>

435 See <https://www.oxfordbusinessgroup.com/overview/power-surge-new-government-has-set-out-rejuvenate-nation-percentE2-percent80-percent99s-energy-and-utilities-industries>

436 See <http://www.sundaytimes.lk/101017/BusinessTimes/bt29.html>

437 See <https://www.oxfordbusinessgroup.com/overview/growth-spurt-sector-seeing-flurry-activity-country-rushes-make-years-underinvestment>

438 See <http://www.sundaytimes.lk/101017/BusinessTimes/bt29.html>

439 See <https://esa.un.org/unpd/wup/publications/files/wup2014-highlights.Pdf>

440 See <https://www.oxfordbusinessgroup.com/overview/high-rise-demand-driven-growth-across-sector-set-support-local-developers>

441 See <http://srilankagbc.org/Overview.html>

442 See <http://www.gbigo.org/places/694>

443 See <https://www.export.gov/article?id=Sri-Lanka-Transportation-Industry>

444 Sri Lanka NDC

445 See <https://www.globalfueleconomy.org/blog/2016/january/fuel-economy-policy-development-in-sri-lanka>

446 See http://wedocs.unep.org/bitstream/item/21675/Overview_percent20of_percent20the_percent20Global_percent20Fuel_percent20Economy_percent20Initiative_percent2C_percent20Jane_percent20Akumu_percent2C_percent20UN_percent20Environment.pdf?sequence=2

447 See http://powermin.gov.lk/sinhala/wp-content/uploads/2015/03/ENERGY_EMPOWERED_NATION_2015_2025.pdf

448 See <http://www.sundayobserver.lk/2017/03/12/brt-system-revolutionize-public-transport-priority-lane-buses>

449 Clean Air 2025 Action Plan (2016)

450 See <http://www.undp.org/content/undp/en/home/librarypage/environment-energy/mdg-carbon/sustainable-transport-in-sri-lanka-through-an-electric-bus-rapid.html>

451 Sri Lanka NDC

452 See <https://www.adb.org/sites/default/files/publication/161289/south-asia-wp-035.pdf>

453 Ibid

454 Sri Lanka NDC

455 See <https://data.worldbank.org/indicator/SP.URB.GROW?locations=LK>

456 See http://www.investsrilanka.com/images/publications/pdf/Investment_Guide_2017_March.PDF

457 See <https://www.adb.org/sites/default/files/project-document/74314/45148-004-sri-rrp.pdf>

458 See http://www.lgpc.gov.lk/eng/?page_id=1118

459 Ibid

460 Sri Lanka NDC

461 See <http://www.sundayobserver.lk/2017/07/09/features/waste-energy-plants-pipeline>

462 Ibid

463 27 billion Sri Lankan rupees converted using an exchange rate of \$1 = 138.2 Sri Lankan rupees (2015 yearly average) from http://www.bundesbank.de/Navigation/EN/Statistics/Time_series_databases/Macro_economic_time_series/its_details_value_node.html?tsId=BBEX3.A.LKR.USD.CA.AB.Ao4

464 See http://www.economynext.com/Sri_Lanka_starts_work_on_two_10MW_waste_to_energy_plants-3-8486-8.html

465 See http://www.investsrilanka.com/images/publications/pdf/Investment_Guide_2017_March.PDF

466 Sri Lanka NDC

467 See http://www.investsrilanka.com/images/publications/pdf/Investment_Guide_2017_March.PDF

468 See <https://www.adb.org/sites/default/files/project-document/161157/47381-001-rfp.pdf>

469 See https://www.aiib.org/en/projects/proposed/2017/_download/mahaweli-water-security-investment-program/mahaweli-water-security-investment-program.pdf

470 See <https://reliefweb.int/report/sri-lanka/ifad-invest-33-million-smallholder-agribusiness-partnerships-sri-lanka>

471 Sri Lanka Vision 2025

472 Ibid

473 See <http://documents.worldbank.org/curated/en/714211468189526474/pdf/100226-CAS-P152526-SecM2015-0298-IDA-SecM2015-0204-IFC-SecM2015-0149-MIGA-SecM2015-0100-Box393220B-PUBLIC-disclosed-10-13-15.pdf>

474 Ibid

475 See <http://documents.worldbank.org/curated/en/906781467305543915/pdf/104606-CPS-P156996-OUO-9-R2016-0105-Box396268B.pdf>

476 Ibid

477 See <https://www.adb.org/sites/default/files/institutional-document/173762/sri-power-sector-reforms.pdf>

478 See http://www.energy.gov.lk/surya_bala_sangramaya/index.php

479 See <http://www.undp.org/content/undp/en/home/presscenter/articles/2017/08/16/sri-lanka-on-path-to-100-renewable-energy-says-new-report-by-undp-and-adb.html>

480 See <http://www.president.gov.lk/president-emphasized-need-of-a-national-policy-on-building-construction-industry/>

481 See <http://www.sundaytimes.lk/170625/business-times/fairway-group-initiates-solid-waste-project-246180.html>

482 See <http://www.lankabusinessonline.com/sri-lanka-to-kick-off-solid-waste-plants-with-usd193-mln-investment/>

483 See <https://www.adb.org/sites/default/files/publication/161289/south-asia-wp-035.pdf>







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