

CLIMATE CHANGE BACKGROUND PAPER

A. Introduction

1. This paper assesses the Asian Development Bank's (ADB's) support for climate change-related activities in India between 2007 and 2015 and is an input to the country assistance performance evaluation (CAPE), 2007–2015. Given the strong focus on climate change in the new Sustainable Development Goals (SDGs), the Paris Agreement on Climate Change in December 2015, and India's prior submission of its Intended National Determined Contributions (INDCs), ADB's support to India as it addresses its challenges in this regard takes on particular relevance.

2. The paper begins with an overview of the principal mitigation and adaptation concerns India currently faces and the Government's response to date. It then examines how climate change has been considered in ADB assistance strategies and analytical work, as well as in its portfolio of sovereign and nonsovereign lending and technical assistance operations during this period. It draws on sectoral assessments by other members of the CAPE team as they apply to climate-change-related ADB assistance in India and concludes with suggestions as to how this support could be strengthened in future.

1. India's Contribution to Climate Change and Intrinsic Vulnerability

3. India was the source of 5.7% of the global total of greenhouse gases (GHGs) in 2014, making it the third largest emitter after the People's Republic of China (PRC) at 22.7%, and the United States at 15.6%. It is the fourth largest if the 28 countries that comprise the European Union (EU) are considered as a whole (10.9%).¹ Because of its robust economic growth and heavily coal-based energy matrix, India's share of global emissions has risen in both absolute and relative terms since then. With a population of over 1.25 billion in 2015, many of whom remain poor, large and rapidly growing cities, extensive coast line, growing groundwater scarcity, record high temperatures, and susceptibility to extreme weather events, including tropical storms, floods, and droughts, India is also one of the most vulnerable countries to the increasingly negative impacts of global climate change. One source has identified India as the third country most adversely affected by climate change in 2013, following only the Philippines and Cambodia).²

4. The Indian government is fully aware of this vulnerability and published a National Action Plan for Climate Change (NAPCC) in June 2008. It also issued its Second National Communication to the United Nations Framework Convention on Climate Change (UNFCCC) in 2012. This document observed, for example, that India has reasons to be concerned about climate change. Its large population depends upon climate-sensitive sectors such as agriculture and forestry for its livelihood. Any adverse impact on water availability due to recession of glaciers, decrease in rainfall and increased flooding in certain pockets would threaten food security, cause a dieback of natural ecosystems, including species that sustain the livelihood of rural households, and adversely impact the coastal system due to sea-level rise and the greater number of extreme events. The achievement of vital national development goals related to other systems such as habitats, health, energy demand, and infrastructure investments would be adversely affected.³

¹ Data from the World Resources Institute (WRI). The largest single emitter in the EU in 2010 was Germany, with 2.1% of the global total, and other large emitters were Russia (5.4%), Japan (2.9%), Brazil (2.6%), and Indonesia (1.9%).

² S. Kreft et al. 2015. *Global Climate Risk Index 2015*. Berlin: Germanwatch.

³ Ministry of Environment and Forests. 2012. *India Second National Communication to the United Nations Framework Convention on Climate Change*. New Delhi.

2. The Mitigation Challenge

5. The Second National Communication also clearly acknowledges that “energy and climate change-related concerns of the Indian economy include the growing gap between the demand and supply of energy and environmental externalities associated with energy use.” It observed further that “the Indian economy has been growing rapidly since the 1990s, with an even higher growth in the energy sector...because the economic growth was driven by energy intensive sectors, where the energy efficiency was low by international standards.” Rapid growth of these sectors resulted in high elasticity of energy consumption and increasing environmental emissions with respect to GDP (footnote 3). More specifically:

In 2000, India emitted 1,523,777.44 Gg CO₂ [Carbon Dioxide] equivalent (1,523.8 million tons of CO₂ eq.) from the energy, industrial processes, agriculture, and waste management sectors. The energy sector emitted 1,027,015.54 Gg of CO₂ eq., contributing 67% of the total GHG emissions in 2000 excluding LULUCF [Land Use, Land Use Change, and Forestry]. The agriculture sector emitted 355,600.19 Gg CO₂ eq., which was 23.3% of the total GHG emissions. The industrial processes and product use sector emitted 88,608.07 Gg CO₂ eq., or 6.0% of the total. The waste sector emitted 52,552.29 Gg CO₂ eq. in 2000, which was 3.4% of the total GHG emissions. The relative emissions of CO₂ from the energy sector to the total GHG emissions excluding LULUCF was by far the largest in 2000. CO₂ was 92.9% of the total emissions from the energy sector. Emissions of CH₄ [methane] and N₂O [Nitrous Oxide] originated mainly from the agriculture sector—73.0% of total CH₄ and 75.0% of total N₂O emitted in 2000 were from the agriculture sector (footnote 3).

6. Both India’s economy and its GHG emissions have grown rapidly since 2000, with total emissions, excluding land use, land use change, and forestry (LULUCF), estimated at 1,946,684.02 GG CO₂ eq. in 2007 and energy increasing its share to nearly 71% of the total, while that of agriculture fell substantially (footnote 3, Table 2.27).⁴ The Second National Communication acknowledges that these trends are likely to continue, especially as both industrialization and urbanization, together with the expansion of the national vehicle fleet, proceed apace. In terms of mitigation, the Second National Communication focuses primarily on measures taken over recent decades to reduce the energy intensity of the economy. It affirms, for example, that the emissions intensity of India’s GDP declined by more than 30% between 1994 and 2007 due to “improvements in energy efficiency, autonomous technological changes, and economical use of energy” (footnote 3).⁵ It also observes that, while the demand for energy will continue to grow in the years ahead, India faces energy shortages and, as a result, the Government’s focus “has been to expand energy resources through exploration, energy efficiency, using renewables, and R&D [research and development].” It adds, however, that the environmental impact of various energy options is also a growing concern owing to the widespread use of energy. The focus, therefore, has been on ensuring that the available fossil energy resources are optimally exploited, using enhanced recovery techniques. Additional sources of energy, such as coalbed methane, are also being explored, and fossil fuel reserves are being advanced through more intensive exploration. Although renewable energy sources such as wind energy, biomass, and biofuels account for a small percentage of total energy, their contribution was planned to increase by 2%–3% in the Eleventh Five Year Plan, 2007–2011. Accordingly, a road map with detailed policy initiatives is necessary in all the subsectors of the energy sector for achieving the desired growth (footnote 3).

⁴ Agriculture was responsible for just over 19%, industrial processes for over 7%, and waste for the remaining 3%. LULUCF is primarily a carbon sink in India and was estimated to result in a net removal of 275,358 GG CO₂ in 2007, reducing the estimated total to 1,771,662.02 GG CO₂ equivalent in that year.

⁵ It also affirmed that “on the energy efficiency front, India has been aggressively reducing the energy intensity of its GDP — from 0.3 kgoe per dollar GDP in PPP terms in 1980 to 0.16 kgoe per dollar GDP in PPP terms in 2007. India’s energy efficiency is comparable to Germany’s, and only Japan, United Kingdom, Brazil, and Denmark have lower energy intensities.”

7. Table 1 shows the shares of the principal sources of GHG emissions in India. Emissions from the agricultural (including livestock) sector declined between 2000 and 2007, as noted above, while those from the energy sector increased. These trends are likely to have continued to the present. India's vehicle fleet has also grown sharply, from less than 21.4 million in 1991 to close to 55 million in 2001 and an estimated 89.6 million in 2006. This includes a nearly three-and-a-half-fold increase in cars, buses, and trucks, while the national consumption of petroleum products and associated CO₂ emissions almost doubled between 1995 and 2008 (footnote 3, Tables 1.8 and 1.9).

Table 1: Key Sources of Greenhouse Gas Emissions in India, 2000

IPCC Source Category	Sector	Gas	% of total emissions	% of cumulative Emissions
Electricity production	Energy	CO ₂	34.3	34.3
Enteric fermentation	Agriculture	CH ₄	13.9	48.2
Road transport	Energy	CO ₂	5.6	53.8
Rice cultivation	Agriculture	CH ₄	4.9	58.7
Non-specific industries	Energy	CO ₂	3.9	62.5
Agricultural soils	Agriculture	N ₂ O	3.8	66.3
Residential	Energy	CO ₂	3.6	69.9
Iron and steel	Energy	CO ₂	3.4	73.4
Cement production	Industrial processes	CO ₂	2.9	76.3
Cement	Energy	CO ₂	2.6	78.9
Chemicals	Energy	CO ₂	2.3	81.1
Residential	Energy	CH ₄	2.2	83.4
Agriculture and fisheries	Energy	CO ₂	1.9	85.2
Food and beverages	Energy	CO ₂	1.6	86.8
Industrial waste water	Waste	CH ₄	1.5	88.3
Refinery	Energy	CO ₂	1.2	89.6
Domestic and commercial wastewater	Waste	CH ₄	1.0	90.6
Natural gas	Energy	CH ₄	1.0	91.5
Ammonia production	Industrial processes	CO ₂	0.7	92.2
Solid waste disposal on land	Waste	CH ₄	0.7	92.9
Textiles and leather	Energy	CO ₂	0.5	93.4
Open cast mining	Energy	CH ₄	0.5	93.9
Limestone and dolomite use	Industrial processes	CO ₂	0.4	94.3
Metal production	Industrial processes	CF ₄	0.4	94.7
Railways	Energy	CO ₂	0.4	95.1

CF₄ = Tetrafluoromethane, CH₄ = methane, CO₂ = carbon dioxide, IPCC = Intergovernmental Panel on Climate Change, N₂O = Nitrous oxide.

Source: Ministry of Environment and Forests. 2012. *India Second National Communication to the United Nations Framework Convention on Climate Change*. New Delhi.

8. In short, energy consumption and associated GHG emissions have increased substantially over recent decades and this trend is expected to continue as the national population further expands and urbanizes and incomes rise with greater economic growth. On the supply side, most of the increase in energy has come from domestic coal, although hydropower has also expanded since 1990–1991, as have natural gas, nuclear power, and wind power (Table 2). Most of the petroleum consumed in India is imported, with total daily consumption in 2008 of nearly 3 million barrels, having increased from less than 1.6 million in 1995, while domestic production increased only slightly over this period, from 770,000 barrels to 890,000 barrels a day. Except for wind power, which started at a very low base, coal production grew most rapidly between 2000–2001 and 2009–2010, more than doubling between 1990–1991 and 2009–2010, while crude oil production grew only slightly over this period.

Table 2: Trends in Commercial Energy Production in India, 1990–1991 to 2009–2010

Source	Units	1990–1991	2000–2001	2009–2010	Change 2009–2010 Over 2000–2001 (%)
Coal	Mt	211.73	325.65	532.06	63.4
Lignite	Mt	14.07	24.30	34.07	40.2
Crude Oil	Mt	33.02	32.03	33.70	5.2
Natural Gas	BCM	17.90	29.69	32.90	10.8
Hydro Power	BkWh	71.66	82.80	106.70	28.9
Nuclear Power	BkWh	6.14	16.92	18.60	9.9
Wind Power	BKWh	0.03	1.70	4.00	135.3

Source: India Second National Communication to United Nations Framework Convention on Climate Change (2012).

9. Clearly, the main focus of GHG emission reduction efforts in India, therefore, has to be on the energy and transport sectors, especially as agriculture's share has declined substantially in recent years. As noted in the Second National Communication to the UNFCCC, this means that increasing the share of renewables (hydro, wind, and solar) and other non-fossil sources (nuclear) in the national energy mix, continuing to increase energy efficiency and reduce the energy intensity of the economy, using clean coal and carbon capture and storage technologies to the maximum extent possible, and seeking to reduce petroleum consumption in the transport, together with the expansion of carbon sinks by controlling land use conversion and continuing afforestation.

10. A recent ADB report co-financed by Australian Agency for International Development notes that, without any climate policy interventions (under the base case), South Asia would become increasingly carbon-intensive during 2005–2030. The consumption of fossil fuels would grow more than fivefold in India and more than threefold in the other five countries as a group, with similar increases in the use of imported natural gas. The transport sector is the fastest growing in terms of energy consumption in South Asia over the study period, mainly due to its very high growth in India.⁶

11. However, the persisting strong dependence on coal and other fossil fuels in the energy and transport sectors will probably mean that India's share of global GHG emissions—as well as local urban air pollution, which is already a very serious and growing problem, according to the World Health Organization (WHO)⁷—will continue to increase for the foreseeable future, or as the Second Communication described the situation:

- (i) The consumption of commercial fuel (coal, oil, natural gas) for production of power and other uses has been steadily rising over the years, with domestically abundant coal continuing to be the dominant source. Coal meets 63% of India's total commercial energy requirement, followed by petroleum products (30%) and natural gas. Nearly 70% of the power requirement in India presently is met by thermal power plants. The total coal reserves in India are 211 billion tons, and by current estimates the reserves are

⁶ ADB. 2013. *Economics of Reducing Greenhouse Gas Emissions in South Asia: Options and Costs*. Manila.

⁷ One recent report (*Mongabay*, 12 May 2014) observes, for example, that "India, not People's Republic of China, has the world's worst urban air pollution," stating that "of the world's top twenty cities with the worst air, 13 of them are found in India," according to WHO. According to this source, "surveying 1,600 cities in 91 countries, the WHO found that New Delhi's air was the worst in the world with an average of 153 Particulate Matter (PM) 2.5 micrograms per cubic meter. Three other Indian cities – Patna, Gwalior, and Raipur – round out the top four." It added that "air pollution is caused by burning fossil fuels for energy, motor vehicles, industry and in some parts of the world cook stoves that use biomass or coal. India is heavily dependent on coal-fired energy: currently the country uses coal for over 60% of its energy and plans on building over 400 new coal plant. A report last year by Conservation Action Trust and Greenpeace-India found that burning coal in India likely led to 80,000–115,000 deaths annually, including 10,000 children under five. In addition to being heavily polluting, coal is also the most carbon-intensive fuel source causing climate change." According to WHO's *Urban Ambient Air Pollution Database Update-2016*, moreover, PM 2.5 pollution in Southeast Asia as a whole had grown by more than 5% between 2008 and 2013 while Kolkata and Mumbai were the fourth and fifth most polluted world megacities with populations exceeding 14 million after New Delhi, Cairo, and Dhaka between 2011 and 2015.

enough to meet India's power needs for at least another 100 years. However, due to expanding coal demand, coal imports have been rising rapidly since the last decade. The commercial energy/power consumption in India is distributed among agriculture, industry, transport, domestic, and other sectors.

- (ii) As can be easily inferred, all the energy demands of India cannot be met by coal alone, as the agriculture sector alternatively uses coal-powered electricity as well as oil, the transport sector is totally dependent on availability of petrol and diesel, and also fuel switching in some of the power plants from coal to oil/natural gas has taken place. In order to meet the growing demand for oil, India imports about 70% of its total crude oil requirements. Other than consumption of fossil fuel energy, about 90% of the rural and 30% of urban households in India consume a large quantity of traditional fuels or non-commercial energy such as firewood, dung cake, chips. The total renewable energy consumption in India, including biomass energy, amounts to about 30% of the total energy consumption, the rest being fossil fuel consumption. As a large part of the energy is still derived from fossil fuel, energy security is a matter of concern for India, although in the future it is expected that alternate sources of energy like biofuels would also be available. However, as mentioned earlier, coal being abundant, cheap, and locally available, it will be the mainstay of energy in the country for many years to come.⁸

3. The Adaptation Challenge

12. The Second National Communication to the UNFCCC also emphasized India's increasing vulnerability to the adverse effects of climate change in both rural and urban areas. Potential impacts on agricultural activity and food security, as well as on water resources, were described, as were some of the potential consequences of a warming climate for towns and cities, which will house an ever increasing share of the national population over coming decades. As concerns the latter, for instance, it affirms that "beyond the physical risks posed by the climatic changes, some cities will face difficulties in providing basic services to their inhabitants. These changes will affect water supply, physical infrastructure, transport, ecosystem goods and services, energy provision, and industrial production. Local economies will be disrupted and populations will be stripped of their assets and livelihoods. The impacts of climate change will be particularly severe in low-elevation coastal zones, where many of India's largest cities are located." It likewise argues that climate change adds to the existing stress on the sustainability of human settlements and society. The concentration of urban development in a few large cities has led to tremendous pressure on civic infrastructure systems such as water supply, sewerage and drainage, solid waste management, parks and open spaces, and transport. It has also led to a deterioration in the quality of the city environment. In several cities, traffic congestion, pollution, poverty, slums, crime, and social unrest are assuming alarming proportions. Climate change is likely to exacerbate the existing stresses that these settlements already face. It may also affect the measures that are being undertaken for sustainable development of these areas. Climate change impacts are felt locally—in cities, towns, and other human settlements. Due to rapid urbanization, cities are more at risk, given the existing environmental, economic and social problems. The cities with large concentrations of population, property, and crucial economic assets and infrastructure are highly vulnerable (footnote 3).

13. Similarly, it draws attention to the negative potential effects of climate change on both public health and coastal areas. It observes, for example, that "global warming poses a serious challenge to the health sector and hence warrants emergency health preparedness and response. Heat stresses, vector borne diseases, and water contamination are some of the main health impacts projected due to climate change. Warmer temperature, shifting rainfall patterns, and increasing humidity affect the transmission of diseases by vectors like mosquitoes [which] are quite sensitive to changes in temperature and rainfall and are among the first organisms to extend their range when environmental conditions become favorable." It also indicates that "health is very closely linked to access to sufficient nutrition, health care,

⁸ Footnote 3. pp. 21–22.

safe water, and sanitation, and is determined by a number of socio-economic factors characterizing the community (footnote 3)" all of which may also be adversely affected by climate change. And, as indicated above, the very close association between coal and fossil fuel-based GHG emissions and local urban air pollution in India also involves very significant negative impacts on public health.

14. With regard to coastal areas, it affirms that "impacts of climate change at the coast are caused mainly by mean sea level rise and occurrence of extreme sea level events...An important concern of the consequences of global warming is the possible changes in the frequency and intensity of tropical cyclones. As far as the coastline of India is concerned, the east coast is particularly vulnerable to the occurrence of storm surges generated by tropical cyclones in the Bay of Bengal" (footnote 3). In all of these areas, in short, there is an urgent need both to better adapt and increase local resilience to the increasing impacts of climate change, including through better natural disaster risk management.

15. Growing water scarcity, exacerbated by record high temperatures⁹ and recurrent droughts, is a major concern. One recent study, found that some of the highest groundwater depletion rates in the world are in northwestern India. It linked this situation to government subsidization of electricity costs for "pumping to encourage greater agricultural productivity at the expense of falling aquifer levels."¹⁰ Parts of India are now also experiencing a record-breaking drought, which, while associated in part with the current strong El Niño, is also the result of what a recent *New York Times* editorial has described as "years of mismanagement of water resources," among other poor governance-related causes. As a consequence, according to this source, "some 330 million people—about a quarter of India's population—are reeling from a drought that has turned vast areas of the subcontinent into a dust bowl, withering crops, and forcing farmers from their lands."¹¹ This condition is only likely to be further exacerbated in the years and decades ahead as periodic droughts are expected to become even more frequent and severe due to the effects of global climate change and will require strong proactive measures to decrease the rising vulnerability of the affected areas and populations.

16. A recent ADB study cofinanced by the United Kingdom's Department for International Development (DFID) examined the economic costs associated with the impacts of climate change and the cost and benefits of adaptation in Bangladesh, Bhutan, India, the Maldives, Nepal, and Sri Lanka.¹² Based on regional climate projections, it assesses potential impacts on vulnerable sectors, including agriculture, coastal and marine areas, energy, forest and other ecosystems, health, and water. The findings, most of which are particularly relevant for India due to its large and high density rural and urban populations, rapid urbanization rate, and extensive coastal areas, are summarized in Table 3.

⁹ India experienced its highest temperature ever recorded, 51° Centigrade (123° Fahrenheit), in parts of Rajasthan on 19 May 2016. The country as a whole has registered higher than normal temperatures to date throughout 2016.

¹⁰ See J. S. Famiglietti. The Global Groundwater Crisis. *Nature Climate Change*. Vol 4. November 2014. p. 946. More specifically, of the nine major aquifers of earth's arid and semi-arid mid-latitudes considered in this paper, the annual water depletion rate found by NASA in 2004–2008 (Table 1) was nearly twice as high in northwestern India (and parts of neighboring Pakistan) at 40 mm/year as in the northern plain of the People's Republic of China (22.0 mm per year) and the central valley of California in the United States (20.4mm/year) and much higher than that elsewhere. It also observed that "because the natural human response to drought is to pump more groundwater, continued groundwater depletion will very likely accelerate mid-latitude drying, a problem that will be exacerbated by significant population growth in the same regions." In addition, "vanishing groundwater will translate into major declines in agricultural productivity and energy production, with the potential for skyrocketing food prices and profound economic and political ramifications."

¹¹ Editorial: India's Water Crisis. *New York Times*. 2016. 3 May 2016.

¹² ADB. 2014. *Assessing the Costs of Climate Change and Adaptation in South Asia*. Manila.

Table 3: Project Impacts of Climate Change on Key Sectors in South Asia

Sector	Projected Impacts from Climate Change
Agriculture	South Asian agriculture is extremely vulnerable to climate change. Higher temperatures eventually reduce yields of desirable crops while encouraging weed and pest proliferation. Changes in precipitation patterns (timing and amount) increase the likelihood of short-run crop failures and long-run production declines, posing a serious threat to food security. Although there will be gains in some crops in some regions, the overall impacts of climate change on agriculture are expected to be negative and need to be much better understood.
Coastal and Marine Areas	The changes in climate events that have been observed to have significant impacts on coastal and marine resources in South Asia include the rise in air and ocean temperatures, sea level rise, and an increase in precipitation, as well as intensified extreme weather events (e.g., heat waves, intense rainfalls, droughts, and tropical cyclones). The impacts on marine and coastal areas have been observed in the alteration of ocean circulation, coral reef ecosystems, ocean and estuary salinity, fisheries, and recreation and tourism activities. The effects also include dryland and wetland losses, which impose both physical and economic risks on coastal communities.
Energy	Climate change alters the dynamics of energy security in the region in terms of both power supply and demand, while increasing the vulnerability of the poor by depriving them of the benefits of both energy and economic development. A rise in average warming will increase energy requirements for space cooling (but reduce energy needed for warming), while increasing energy demand for irrigation. On the supply side, there is a direct influence on hydropower and thermal power generation through availability of water and the temperature of cooling water, respectively. Increases in intensity and frequency of extreme events like storms and sea level rise may cause more electrical system failures.
Forest and Other Ecosystems	Climate change will affect forest carbon pools in some countries in the region. Under most greenhouse gas emission scenarios, there would be gains for Bhutan and India (the latter to a small extent) due to warmer temperatures.
Health	The cities of South Asian countries are vulnerable to water- and vector-borne infectious diseases that are climate-sensitive...Effects of global warming can develop suddenly, producing "climate shocks" that likely will have grave consequences for human health. The modeling results suggest that the mortality rate for the region caused by dengue, malaria, and diarrhea would increase over time as a consequence of climate change.
Water	Although the monsoon-dominated annual precipitation cycle is expected to remain unchanged over South Asia, future decades are predicted to have drier and warmer winter months with reduced snow cover, while the summer/monsoon months are predicted to become wetter and warmer. Reduced water availability will have serious impacts on agriculture and hydropower generation. Initially, it is projected that the river flows derived from glaciers will increase during the dry season as ice melting accelerates; this can give the wrong signals to policy makers and delay climate change adaptation measures. In time, as the remaining glaciers disappear, dry season flow will be dramatically reduced.

Source: Asian Development Bank. 2014. *Assessing the Costs of Climate Change and Adaptation in South Asia*. Manila.

17. Specific observations with respect to India from the same study included the following:
- (i) India ranks second worldwide in terms of agricultural output. A sensitivity analysis showed that in southern, central, and eastern India, any increase in temperature by more than 1 ° C from the current level would lower rice yields.
 - (ii) With an 8,000-kilometer coastline, 13 of 28 Indian states are prone to risks from sea level rise.
 - (iii) Approximately 412 million people are without access to electricity in India, whose current electrical system runs mainly on domestic coal. Pressures to reduce greenhouse gas emissions could limit options for coal use in India unless CO₂ capture and storage technologies can be implemented.
 - (iv) Studies on the impacts of climate change indicate that the quantity of surface runoff would vary across India's basins and sub-basins by the 2050s. This may be due to higher transpiration with projected higher temperatures and variations in rainfall distribution.

- (v) In India, irrigation accounts for 85% of present water demand but is projected to decline slightly to 83% by 2025 and 74% by 2050. The country's irrigation water demand is projected to grow by 68% in 2025 and almost double by 2050 from the 2000 baseline.

18. The study also concluded that “economic findings using integrated assessment models suggest that the total climate change cost in South Asia will increase over time and will be prohibitively high in the long-term. The model suggests that the Maldives would be hardest hit in GDP loss, while India...[is] projected to face [a] 1.8% loss of annual GDP by 2050.” Other important conclusions were that building resilience to climate change requires identifying the risks and vulnerabilities in each project and sector; identifying the options for adaptation (and mitigation) that are possible and economically sound, particularly in priority sectors; and mainstreaming this process in future development to ensure implementation of the necessary measures.” It also observes that “in South Asia, adaptation to current climate change and climate variability is weak and many communities are highly vulnerable [and that] development of a national policy framework to facilitate implementation of appropriate and effective mitigation measures and adaptation strategies is important.”

4. Government Response

19. Building on its National Environmental Policy issued in 2006, India launched the National Action Plan on Climate Change (NAPCC) in June 2008. According to the Second National Communication, this plan was based on the following principles:

- (i) protecting the poor and vulnerable sections of society through sustainable development strategies that are sensitive to climate change;
- (ii) achieving national growth targets by means that enhance ecological sustainability;
- (iii) devising an efficient and cost-effective strategy for demand-side management;
- (iv) deploying appropriate mitigation and adaptation technologies extensively and at an accelerated pace;
- (v) promoting sustainable development through innovative and new forms of market, regulatory and voluntary mechanisms;
- (vi) effecting implementation of various policies through unique links with civil society, local governments and public-private partnerships; and,
- (vii) welcoming international cooperation for research, development, sharing and transfer of technologies driven by external funding and facilitating a global Intellectual Property Rights regime for such a technology transfer under the UNFCCC (footnote 3).

20. Eight national “missions” form the core of the NAPCC, which are briefly described in the Second Communication. The key aims of these missions are presented in Table 4.

Table 4: Eight National Missions of the National Action Plan on Climate Change

Mission	Mission Aims
National Solar Mission	Under the brand name "Solar India," the mission was launched to significantly increase the share of solar energy in the total energy mix. The immediate aim is to set up a conducive environment for solar technology penetration in India, at centralized and decentralized levels.
National Mission for Enhanced Energy Efficiency	The mission focuses on four new initiatives: a market-based mechanism to enhance cost-effectiveness of energy efficiency improvements in energy-intensive large industries through the certification of energy savings that could be traded, accelerating the shift towards energy-efficient appliances in identified sectors, creating a financing mechanism for facilitating demand side management programs, and developing fiscal instruments that promote energy efficiency.
National Mission on Sustainable Habitat	The main objective of the mission is to exploit the potential for mitigation by reducing residential and commercial energy demand.
National Water Mission	The mission's objectives are conserving water, minimizing wastage, and ensuring more equitable distribution of water across and within states through integrated water resources development and management.
National Mission for a Green India	The mission aims to address climate change by enhancing carbon sinks in sustainably managed forests and ecosystems, enhancing the resilience and ability of vulnerable species and ecosystems to adapt to the changing climate, and enabling adaptation of forest-dependent local communities in the face of climatic variability.
National Mission for Sustaining the Himalayan Ecosystem	The mission identifies the importance of continuity and enhancement in the monitoring of the Himalayan ecosystem; in particular, the state of glaciers and the impact of changes in the glacial mass and its subsequent impact on river flows.
National Mission for Sustainable Agriculture	The mission seeks to transform Indian agriculture into a climate resilient production system through suitable adaptation and mitigation measures in the domain of crops and animal husbandry.
National Mission on Strategic Knowledge for Climate Change	The mission envisions a broad-based approach, to include the following: conducting research in the key domains of climate science, improving the global and regional climate models for the specificity and quality of climate change projections over the Indian sub-continent, strengthening observational networks and data gathering and assimilation, and creating an essential research infrastructure.

Source: Government of India. 2009. *National Action Plan on Climate Change*. New Delhi: Prime Minister's Council on Climate Change.

21. Each of India's states was expected to prepare climate change action plans, which would represent an extension of the NAPCC and be aligned with the eight national missions. In addition, the National Action Plan "envisaged an effective disaster management strategy that includes mainstreaming disaster risk reduction into infrastructure project design, strengthening communication networks and disaster management facilities at all levels, protecting coastal areas, providing enhanced public health care services, and assessing increased burden of disease due to climate change" (footnote 3).

22. At the 15th Conference of the Parties (COP) for the UNFCCC in Copenhagen in December 2009, India "pledged to continue a constructive role in international climate diplomacy while emphasizing the need for implementing a comprehensive domestic response to reduce the emissions intensity of gross domestic product (GDP) by 20%–25% by 2020 [in relation to] 2005 levels (emissions from the agriculture sector not included)" (footnote 3). It also highlighted the measures that had already been taken in this regard, including:

- (i) India's Twelfth Five Year Plan, 2012–2017, to be launched on 1 April 2012, would have a low-carbon growth strategy as one of its key pillars.
- (ii) A "carbon tax" (or "cess") on coal to fund clean energy (at the rate of \$1 per ton on both domestically produced and imported coal). The money collected would go into a National Clean Energy Fund, to be used to finance research and innovative projects on clean

- energy technologies and environmentally remedial programs. The expected earnings from the levy would be about \$500 million for 2010–2011.
- (iii) Aggressive strategies on forestry and coastal management, recognizing their ecological and livelihood significance. A major coastal zone management program has also been launched to address the adaptation challenges facing over 300 million vulnerable inhabitants in these regions.
 - (iv) In May 2010, India released its GHG emissions inventory for 2007 with the aim of informing decision making and ensuring transparency. Before this, the only official estimates were available for 1994.
 - (v) Promoting regional and international cooperation. The South Asian Association for Regional Cooperation (SAARC) adopted the Thimpu Statement on Climate Change in April 2010. This statement called for an Inter-Governmental Expert Group on Climate Change to develop a clear policy direction for regional cooperation on climate change. Sharing of knowledge among the SAARC countries would help to better assess all areas related to climate change (footnote 3).

B. India’s Intended Nationally Determined Contributions

23. For the Paris UNFCCC COP in December 2015, India’s current administration led by Narendra Modi, which assumed office in May 2015, submitted its Intended Nationally Determined Contributions (INDCs) with the subtitle “Working Towards Climate Justice” in October 2015.¹³ According to this document, “India’s contribution takes into account its commitment to conservation of nature as well as the imperatives of meeting the competing demand on resources for addressing the challenges of poverty eradication, food security and nutrition, universal access to education and health, gender equality and women empowerment, water and sanitation, energy, employment, sustainable urbanization and new human settlements, and the means of implementation for enhanced action for achieving, among others, the sustainable development goals for its 1.2 billion people.” It also affirmed that “climate change is a major challenge for developing countries like India that face large-scale climate variability and are exposed to enhanced risks from climate change. Few countries in the world are as vulnerable to the effects of climate change as India is with its vast population that is dependent on the growth of its agrarian economy, its expansive coastal areas, and the Himalayan region and islands. It also entails tradeoffs with economic growth and social development in the short run that need to be factored in the policy matrix, where eradication of poverty is one of the foremost priorities.”¹⁴ These tradeoffs are important, and need to be carefully considered by the country’s development partners, including ADB. The challenge for all is to maximize low-carbon development opportunities and interventions that, at the same time, support economic growth and poverty reduction.

24. This INDC document also reported that, in addition to the NAPCC, all 32 states and union territories had now put in place State Action Plans on Climate Change (SAPCCs), through which they were attempting to “mainstream climate change in their planning process,” many other national strategies and policies were supplementing these efforts, including the Energy Conservation Act, to encourage efficient use of energy and its conservation, the National Policy for Farmers that focuses on sustainable development of agriculture, and the National Electricity Policy, which underscores the focus on universalizing access to electricity and promoting renewable sources of energy, as did the Integrated Energy Policy. They also entail “fiscal instruments like the coal ‘cess,’ cuts in subsidies, increase in taxes

¹³The Modi administration has also converted the former Planning Commission, established in 1950, into the National Institute for Transforming India, or NITI Aayog, which, among other challenges the country presently faces, has highlighted that “responsible development implies environmentally sound development. India is one of the mega-diverse countries. Our environmental and ecological assets are eternal, and must be preserved and safeguarded. The country’s legacy of respect for environment is reflected in our reverence for trees and animals. Our legacy to future generations must be sustainable progress. Each element of our environment (*pariyavaran*) and resources, namely water, land and forest (*Jal, Jameen evam Jungle*) must be protected; and this must be done in a manner that takes into account their inter-linkages with climate (*jal vayu*) and people (*jan*). Our development agenda has to ensure that development does not sully the quality of life of the present and future generations.”

¹⁴ Government of India. 2015. *India’s Nationally Determined Contribution*. New Delhi. pp. 4–5.

on petrol and diesel, market mechanisms, including Perform Achieve and Trade, Renewable Energy Certificates and a regulatory regime of Renewable Purchase Obligation, [while] the institutional arrangements for offtake of renewable power will be further strengthened" (footnote 3).

25. The INDC document affirmed that "India is running one of the largest renewable [energy] capacity expansion programs in the world. Between 2002 and 2015, the share of renewable grid capacity has increased over 6 times, from 2% (3.9 GW) to around 13% (36 GW). This momentum of a tenfold increase in the previous decade is to be significantly scaled up with the aim to achieve 175 GW renewable energy capacity in the next few years." Similarly, it observed that with the goal of reducing energy intensity of the Indian economy, the Ministry of Power through the Bureau of Energy Efficiency has initiated a number of energy efficiency initiatives. The National Mission for Enhanced Energy Efficiency seeks to upscale the efforts to unlock the market for energy efficiency and help achieve total avoided capacity addition of 19,598 MW and fuel savings of around 23 million tons per year at its full implementation stage. The programs under this mission resulted in an avoided generation capacity addition of about 10,000 MW between 2005 and 2012 with the government targeting saving 10% of current energy consumption by 2018–2019. Demand side management programs have been launched to replace existing low-efficiency appliances (footnote 3).

26. As for increasing the climate resilience of cities, the document announced that the new government had "launched a number of schemes for transformation and rejuvenation of urban areas including the Smart Cities Mission, Atal Mission for Rejuvenation and Urban Transformation (AMRUT), and National Heritage City Development and Augmentation Yojana (HRIDAY)." The first of these programs would seek to intervene in 100 large urban areas "to develop new generation cities, which will provide core infrastructure and a decent quality of life to its citizens by building a clean and sustainable environment. Smart solutions like recycling and reuse of waste, use of renewables, protection of sensitive natural environment will be incorporated to make these cities climate resilient." The second program would apply to another "500 cities with a focus on ensuring basic infrastructure services such as water supply, sewerage, storm water drains, transport and development of green spaces and parks by adopting climate resilient and energy efficient policies and regulations" (footnote 3). As will be described further below, even though this will fall outside the present evaluation period, ADB is planning to support these new initiatives through a proposed multitranches financing facility (MFF).

27. The INDC document identified other relevant measures with respect to pollution reduction, water resource management, improving the sustainability of agricultural activities, strengthening public health and disaster risk management, and reducing the vulnerability of coastal areas, among others. It would carry these out "keeping in view its development agenda, particularly the eradication of poverty coupled with its commitment to following the low carbon path to progress and being sanguine about the unencumbered availability of clean technologies and financial resources from around the world."

28. India's declared INDCs for 2011–2030 consist of eight elements (Table 5).

Table 5: India's Intended Nationally Determined Contributions, 2011–2030

No.	Intended Nationally Determined Contributions
1	To put forward and further propagate a healthy and sustainable way of living based on traditions and values of conservation and moderation.
2	To adopt a climate friendly and a cleaner path than the one followed hitherto by others at corresponding levels of economic development.
3	To reduce the emissions intensity of its gross domestic product by 33% to 35% by 2030 from the 2005 level.
4	To achieve about 40% cumulative electric power installed capacity from non-fossil fuel based energy resources by 2030 with the help of transfer of technology and low cost international finance including from the Green Climate Fund).
5	To create an additional carbon sink of 2.5 to 3 billion tons of carbon dioxide equivalent through additional forest and tree cover by 2030.
6	To better adapt to climate change by enhancing investments in development programs in sectors vulnerable to climate change, particularly agriculture, water resources, Himalayan region, coastal regions, health, and disaster management.
7	To mobilize domestic and new and additional funds from developed countries to implement the above mitigation and adaptation actions in view of the resource required and the resource gap.
8	To build capacities, create domestic framework and international architecture for quick diffusion of cutting edge climate technology in India and for joint collaborative R&D for such future technologies.

Source: Government of India. 2015. *India's Nationally Determined Contribution*. New Delhi.

29. The INDC document observed further that, in order to achieve these proposed contributions, "India is determined to continue with its on-going interventions, enhance the existing policies, and launch new initiatives in the following priority areas: (i) introducing new, more efficient and cleaner technologies in thermal power generation; (ii) promoting renewable energy generation and increasing the share of alternative fuels in the overall fuel mix; (iii) reducing emissions from the transportation sector; (iv) promoting energy efficiency in the economy, notably in industry, transportation, buildings and appliances; (v) reducing emissions from waste; (vi) developing climate resilient infrastructure; (vii) full implementation of the Green India Mission and other programs of afforestation; and (viii) planning and implementation of actions to enhance climate resilience and reduce vulnerability to climate change." It also stated that the government had revisited the national missions under the NAPCC on the basis of "new scientific information and technological advances and identified new missions or programs on wind energy, health, waste to energy, and coastal areas [and] is redesigning the National Water Mission and National Mission on Sustainable Agriculture" (footnote 3). However, it did not provide details.

30. Finally, the document clarified that India's INDCs did "not bind it to any sector-specific mitigation obligation or action, including in the agriculture sector. India's goal is to reduce overall emission intensity and improve energy efficiency of its economy over time and at the same time protecting the vulnerable sectors of economy and segments of our society." Referring to the anticipated Paris Climate Change Agreement, it also affirmed that successful implementation of its INDCs would be "contingent upon an ambitious global agreement including additional means of implementation to be provided by developed country parties, technology transfer and capacity building" (footnote 3). This includes increased financial¹⁵ and technical support from multilateral sources, such as the Asian Development Bank, among others.

31. The Minister of State for Environment, Forests, and Climate Change signed the Paris Agreement on behalf of the government at the United Nations in New York on 22 April 2016. However, this is just the first step in the country's actual ratification of this commitment. While signing indicates the country's

¹⁵ In this regard, for example, the document (p. 31) indicates that the recently established NITI Aayog had estimated that "mitigation activities for moderate low carbon development would cost around US\$ 834 billion until 2030 at 2011 prices" while "at least US\$ 2.5 trillion (at 2014–2015 prices) will be required for meeting India's climate change actions between now and 2030." It also stated that "a detailed and full scale assessment of international climate finance needs will be finalized at a later stage and would depend on the gap between the actual cost of implementation and what can be made available from domestic sources."

intention to ratify the agreement in due course, this is likely to be a more complicated and time-consuming legislative process, whose timing and outcome is not yet known.

C. Links to the Sustainable Development Goals

32. In addition to the Paris Agreement on Climate Change, ADB's assistance to India and its other developing member countries (DMCs) will also now take place in the context of the Sustainable Development Goals (SDGs), which were approved by the United Nations in September 2015. The 17 interrelated SDGs include ending poverty and hunger, improving health and education, making cities more sustainable, combating climate change, and protecting oceans and forests. Regarding Goal 13, "take urgent action to combat climate change and its impacts," and acknowledging that the United Nations Framework Convention on Climate Change (UNFCCC) is the primary international, intergovernmental forum for negotiating the global response to climate change, the targets are to:

- (i) strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries;
- (ii) integrate climate change measures into national policies, strategies, and planning; and
- (iii) improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction, and early warning.

33. Two other "topics" associated with Goal 13 are to (i) implement the commitment undertaken by developed country parties to the UNFCCC to a goal of mobilizing \$100 billion annually from all sources to address the needs of developing countries in the context of meaningful mitigation actions and transparency on implementation and full operationalization of the Green Climate Fund through its capitalization as soon as possible; and (ii) promote mechanisms for raising capacity on effective climate-related planning and management in least developed countries and small island developing states, including focusing on women, youth, and local and marginalized communities.¹⁶

D. ADB Country Strategies for India, 2006–2008, 2009–2012, and 2013–2017

34. The most recent country partnership strategy (CPS) for India, which covers the period 2013–2017, was approved in October 2013. In discussing the country background, it states that "to sustain high and inclusive growth, India needs to expand and consolidate structural reforms, remove its infrastructure deficit, and improve the quality and coverage of basic social services. Environmental sustainability is also a priority "because population growth, rapid urbanization, and economic expansion have placed unprecedented pressures on the country's natural resources."¹⁷ The previous CPS, for 2009–2012, likewise identified "inclusive and environmentally sustainable growth" as one of its four pillars, the others being improved infrastructure and services, better portfolio management and knowledge, and greater regional cooperation and integration. There was also a country strategy and update for 2004–2006, which, however, did not mention climate change.¹⁸ The last full CPS was for 2004–2006 and thus before to the present evaluation period.

35. The CPS, 2009–2012, in contrast to its interim predecessor, clearly identified climate change as a major development challenge for India, observing initially that "a global consensus has emerged that climate change is a reality, and that it is happening because of human activities. The [2008] report of the Intergovernmental Panel on Climate Change shows that countries such as India, which are in the tropical and low temperate zones, would suffer the most from the adverse consequences of global warming, decrease in crop yields, spread of disease, rise in frequency and intensity of extreme weather events (including droughts and floods), rise in sea levels, and loss of biodiversity." It noted that policy makers

¹⁶ United Nations. 2015. *Sustainable Development Goals*. New York.

¹⁷ ADB. 2013. *Country Partnership Strategy: India, 2013–2017*. Manila. p. 1, para. 4.

¹⁸ ADB. 2005. *Country Strategy and Program Update: India, 2006–2008*. Manila.

were realizing that India's growth needed to follow an environmentally sustainable path over the long term. The National Environmental Policy, adopted in 2006, emphasized mainstreaming environmental considerations in socioeconomic development. The Council on Climate Change, headed by the prime minister, has been set up to plan and implement appropriate mitigation and adaptation strategies. The National Action Plan on Climate Change (NAPCC) was unveiled on 30 June 2008. Nearly a third of the projects registered under the Clean Development Mechanism (CDM) are from India, and these could facilitate an investment of about \$16 billion. Rapid urbanization is generating air and water pollution, as well as a solid waste management crisis. Numerous efforts are underway to help India's urban development move onto an environmentally sustainable path. The government has approved the "Green India" program to increase the forest cover on nearly 6 million hectares of degraded forest land. The National Rainfed Area Authority has been established to foster harvesting, conservation, and sustainable use of rainwater in arid zones. Water conservation is also being taken up on a large scale under the National Rural Employment Guarantee Program (NREGP) and the National Project for Repair, Renovation, and Restoration of Water Bodies.

36. Elsewhere, this CPS observed that the NAPCC had called for measures to adapt the agriculture and water sectors to make them more resilient to the adverse effects of climate change and that the government sought to "balance environment and growth," indicating more specifically that the 11th Five Year Plan, 2007–2011 recognized that "rapid growth needs to be achieved in an environmentally sustainable manner. It proposes several measures for improving water, land, and forest management; expanding use of renewable energy resources; enhancing energy efficiency; and encouraging recycling of resources and/or waste. It proposes the use of economic instruments based on the 'polluter pays principle,' and the promotion of PPPs [public-private partnerships] to improve environmental infrastructure. The eight missions of the National Action Plan on Climate Change will also be implemented over the 11th and the 12th five-year plan periods." The CPS noted, however, that "as the country environment analysis carried out for the CPS shows, while India's environmental legislation is fairly comprehensive and the country has been committed to its international obligations, the implementation of these environmental laws and regulations remains weak."¹⁹

37. As concerned the ADB's assistance strategy to India for 2009–2012, one key element is "maintaining environmental sustainability" which is described in the following terms:

The CPS strives for stronger integration of environmental dimensions into ADB's India assistance program. Each sector road map includes a strong environmental perspective. India's efforts to promote sustainable economic growth will be strengthened through ADB support for clean and efficient energy production and use, including an expansion of the railway network and urban public transport. ADB and the World Bank will work with the Government to determine how the Climate Change Investment Fund could help increase low-carbon investments and adaptation measures for the benefit of India. TA support will be provided to help in the implementation of National Action Plan on Climate Change. Interventions in agriculture and water resources will address resource efficiency and conservation, and food security and climate change resilience will be enhanced through more environmentally sound land and water management. Urban sector interventions will address integrated water and solid waste management. ADB will also tap concessional sources of funding and the carbon markets, to support the Government's efforts to move the economy onto a low-carbon, low-pollution, climate-resilient, and resource-conserving path (footnote 3).

38. The CPS, 2013–2017 in turn, adopted ADB's three Strategy 2020 agendas, including environmentally sustainable growth (ESG), as its own three strategic pillars in order to support the "government's vision of faster, more inclusive, and sustainable growth by emphasizing, *inter alia*, environmental sustainability, especially "investments in water resources management and introduction

¹⁹ ADB. 2009. *India Country Partnership Strategy 2009–2012 Abridged Version*. Manila. pp. 9–12. The country environment analysis referred to above, however, was not linked electronically to this CPS.

of new technologies and low-carbon solutions.”²⁰ The key sectors for ADB support in carrying out the strategy are energy, transport, and urban services (i.e., water supply and other municipal infrastructure and services). Activities in the energy sector were expected to include the promotion of clean energy and increased energy efficiency, together with renewables (particularly solar energy), among other activities, while those in the transport sector would seek to “embed low-carbon solutions in investments” as well as improving both urban and rural mobility, promoting better regional connectivity, especially “around lagging states” and supporting “mass transit systems in key urban centers” together with more traditional road investments. As concerns urban services, the focus would be on “expanding the coverage, quality, and continuity of basic services,” which was expected to “improve the urban quality of life and environmental sustainability.”

39. In addition, ADB expected to be able to “demonstrate solutions to the challenge posed by water scarcity and climate change.” This would be done through the promotion of “more efficient and sustainable water management in agriculture, cities, and industry, with a focus on investment projects, but including advice on policy and institutional reforms” (footnote 20). While the CPS did not provide details on how this would be done, this appears to be an important new direction in the ADB’s ESG-related support in India, potentially moving beyond the more traditional focus primarily on infrastructure development.

40. The environmental assessment summary annexed to the most recent CPS dedicates a specific section to climate change, which sets out the ADB’s assistance strategy in this regard. On the mitigation side, for example, it states that:

ADB’s assistance to India encompasses both demand- and supply-related programs to enhance the impact of the government’s initiatives, and will be achieved through a combination of lending and technical assistance. The interventions include (i) reducing technical and commercial losses in transmission and distribution networks and facilities; (ii) developing renewable and alternative energy sources, including hydro and solar power; and (iii) mainstreaming demand-side management and energy conservation while ensuring environmental and social sustainability. ADB’s Energy Efficiency Initiative (EEI), Carbon Market Initiative, and Asia Solar Energy Initiative are being employed to leverage resources for such interventions and to allow promotion of renewable energy and energy efficiency. In addition to core activities, involving state-level assistance, sector restructuring and critical investments to support transmission and distribution system efficiency improvements and system reliability (which play a role in climate change mitigation) will also be pursued.²¹

41. It also affirms that “many ADB programs and funding initiatives have promoted projects contributing to climate change mitigation,” including the following:

- (i) **Energy for all.** Includes the development of strategic approaches and partnerships to expand access by the poor to modern and clean forms of energy.
- (ii) **Carbon market program.** Seeks to harness the global carbon market to fund low-carbon development; mobilized over \$150 million to co-finance CDM projects. The program was started in 2005 as an EEI financing facility. The Clean Energy Financing Partnership Facility (CEPF) was set up in 2007, and was designed by EEI to fund small energy efficiency investments that require quick transactions, finance some technology transfer costs of clean technologies, and provide grant assistance for activities such as developing the knowledge base on clean energy technologies. As a result of its success, it evolved into the clean energy program in 2010. The program has an expanded mandate to support clean energy (through both energy efficiency and renewable sources) in energy sector

²⁰ ADB. 2013. *Country Partnership Strategy-India, 2013–2017*. Manila. para. 14, p. 4.

²¹ Footnote 20, Environmental Assessment. para. 11. p. 3.

projects and also in the urban (water supply and sanitation), transport, and agriculture sectors.

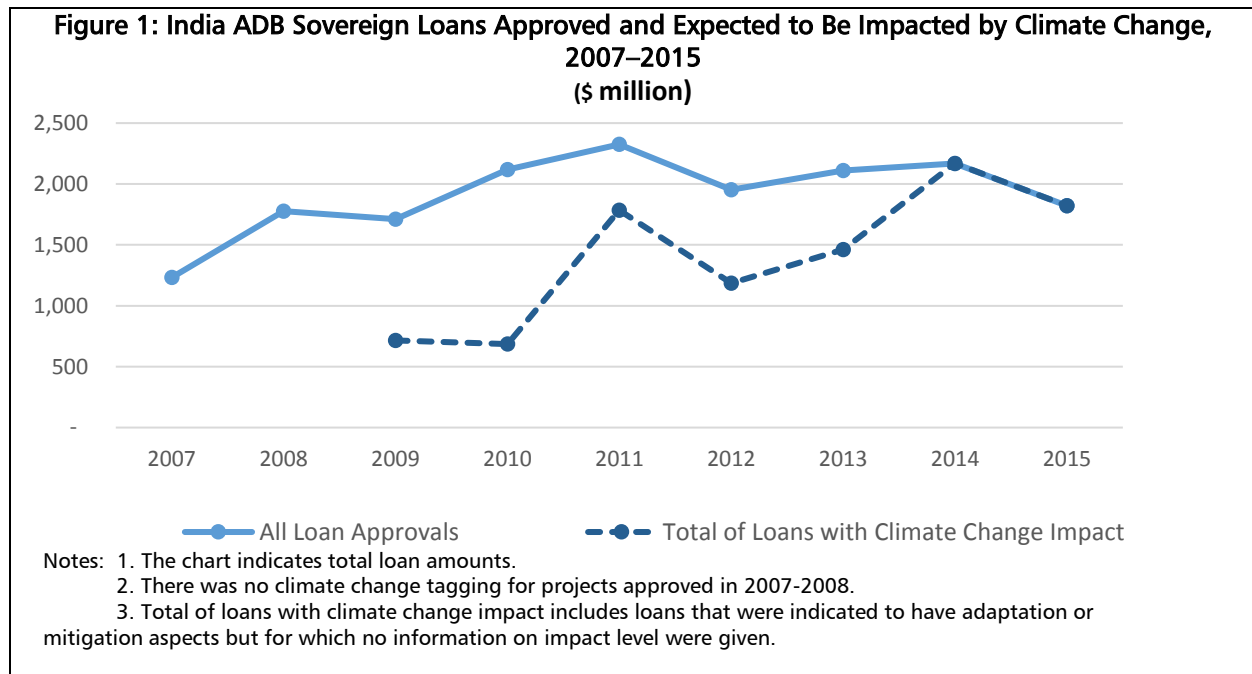
- (iii) **Sustainable transport initiative.** Goals call for synergistic land use and transport planning designs, plus sustainable and integrated transport solutions, including more public and non-motorized transports.
- (iv) **Cities and clean air development initiative for Asia.** This initiative works with cities, development partners, and the private sector to implement needed investments for sustainable urban development, including in public transport, solid waste methane capture, energy efficiency in buildings, and alternate energy sources (footnote 3).

42. The environmental assessment likewise refers to ADB's support in relation to India's adaptation needs. It states, for example, that "ADB is expanding its engagement in the water sector in India, in areas as varied as irrigation efficiency improvement, integrated water resource management, coastal zone management, and flood control" and that "significant progress has been made over the past 2 years in mainstreaming climate change adaptation concerns into ADB's India program." More specifically, "a close working relationship has been developed with the central government, including the Ministry of Water Resources and the Central Water Commission, and with various state-level water resources departments (e.g. in Assam, Himachal Pradesh, Karnataka, Madhya Pradesh, Punjab, and Tamil Nadu)." Finally, it argues that with an economy that is heavily dependent on natural resources and climate-sensitive sectors such as agriculture, water, and forestry, India is central to ADB's climate change strategy. Core priorities of ADB's climate change program that will be pursued in India include: (i) scaling up clean energy, including expanding the proportion of renewable energy supply in Asia and the Pacific, as well as promoting energy efficiency; (ii) promoting low-carbon, climate-resilient transport and urban development; (iii) investing in climate-resilient development; and (iv) supporting associated policy and institutional strengthening.

43. The extent to which ADB's sovereign (i.e., public sector) and nonsovereign (private sector) portfolios of lending and technical assistance operations have also taken the above considerations into account and how this may have evolved over the period presently under review is the subject of the following sections.

E. ADB's Climate Change-Related Sovereign Lending Portfolio for 2007–2015

44. Based on data provided by ADB, of the 109 sovereign loans to India totaling nearly \$17.3 billion between January 2007 and the end of 2015, 56 loans valued at more than \$9.8 billion, or 57% of the total, were tagged as potentially being impacted by climate change. The evolution of these loan commitments over the evaluation period is depicted in Figure 1. Projects tagged with a medium or high risk are subject to a climate risk vulnerability assessment (CRVA) during project preparation, which characterizes the potential climate risk in more detail and develops mitigation measures to be introduced in project design. All of the loans so identified were approved after January 2009, as this was the first year for which ADB started to tag its climate change-related lending operations. Since a number of these were parts of multitranche financing facility (MFF) programs whose contents were determined at the outset, it is possible to assume that the tagged classifications would apply retroactively to the previous operations in the series as well, many of which were approved in 2007 and 2008. This would increase the share of total commitments in projects that are of relevance in terms of potentially being impacted by climate change. Figure 1 indicates that ADB projects have increasingly been considered to be impacted by climate change to the point in 2014 and 2015 where all sovereign loans are considered to face some degree of impact from climate change. This reflects ADB's increasing awareness of India's high vulnerability to climate change, which could also affect its lending operations.

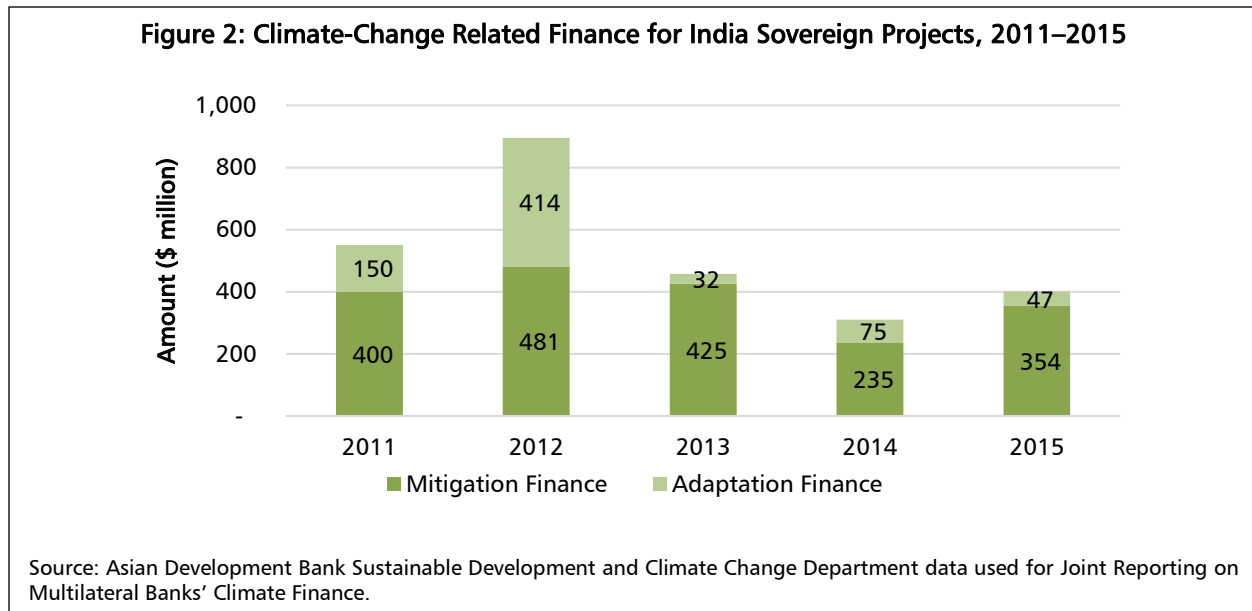


45. In addition to the above, since 2011, ADB has also been tracking the extent to which its sovereign lending operations have incorporated elements to help address climate change adaptation and/or mitigation. Figure 2 illustrates how the ratio of so-identified “mitigation” and “adaptation” projects in its India portfolio has changed since 2011, when ADB’s Climate Change Thematic Group began reporting these indicators as part of the joint reporting by multilateral development banks on climate finance.²² This is distinct from Figure 1 which tracks the climate change risk attribution for ADB projects, i.e. the degree to which climate change was considered likely to impact on projects. Since 2011, funding for mitigation projects in the India portfolio has been relatively stable, ranging from \$235 million to \$481 million per year. Adaptation has typically been a much smaller proportion of climate financed projects. The outliers are 2011 and, particularly, 2012, comprising three road projects for which the project design included climate proofing, which was deemed a significant adaptation element of the total loan. However, the bulk of the funding in all three of these operations²³ was allocated to road upgrading and improvements more generally and the incremental expenditures exclusively for adaptation to climate change are, in fact, likely to be significantly lower than those suggested in Figure 2, which thus probably substantially overstates the actual amounts for this purpose.²⁴ In any case, the reasons why such a large proportion of the respective loans were identified as having been for the purpose of climate change adaptation is unclear. The figures for 2013–2015 are likely to be more a reflection of actual mitigation and adaptation proportions, with adaptation comprising much smaller amounts, typically comprising design modifications to “climate proof” traditional infrastructure investments.

²² The latest of these reports is: World Bank. 2015. *2014 Joint Report on Multilateral Banks’ Climate Finance*. Washington, DC.

²³ Madhya Pradesh State Roads III (2011), and Bihar State Highways II Additional Financing and Rural Connectivity Investment Program (both approved in 2012).

²⁴ In contrast, other recent ADB road improvement projects in India, including the Second Jharkhand State Road Project and the third tranche of the Rural Connectivity Investment Program (both approved in 2015) had much smaller shares of their total commitments attributed to climate change adaptation, only 10.3% in the case of the latter operation, which seems much more realistic.



46. Appendix 1 considers the relevant projects in somewhat greater detail so as to provide a more specific idea as to how they seek to address climate change-related issues and potential impacts.

47. Overall, however, the review of ADB's climate change-related portfolio of sovereign lending operations in India approved between 2007 and 2015 reveals a number of patterns. First, as suggested at the outset, much greater attention has been given to mitigation than to adaptation in ADB loans over this period, despite India's acknowledged vulnerability to the likely increasingly adverse impacts associated with climate change, especially in the agricultural sector and coastal areas, but also in many cities. It appears likely, however, that greater attention may be given to climate change resilience in ADB's assistance for urban development in the future, as is indicated in the concept paper for a proposed new MFF to provide state-level support for national flagship urban programs, issued in October 2015.²⁵

48. Second, mitigation-related projects have been largely concentrated in the energy sector and in some urban development projects. In energy, the focus has been primarily on improving capacity and efficiency in state transmission and distribution systems, including in a couple of cases (e.g., Gujarat) for solar energy. Less attention has been given to increasing generation from renewable sources, although there are a few notable exceptions in this regard. While India will continue to rely significantly on its abundant and comparatively cheap coal resources for power generation, there does not seem to have been any ADB assistance, at least in terms of lending operations, for the application of clean coal technologies or carbon capture and storage. This will be important if India is to make a more substantial reduction in its present high and increasing rate of GHG emissions, most of which come mainly from coal-based energy generation and fossil-fuel consumption in the transport sector. Emissions from the transport sector have also grown considerably over time with rising urbanization and incomes, leading to a rapid expansion of the national vehicle fleet (and to increasing congestion and local urban air pollution as well).

49. Third, there are few ADB operations in the transport sector that involve non-vehicular sources, and these are limited to railways. More recent road projects do include design elements that seek to

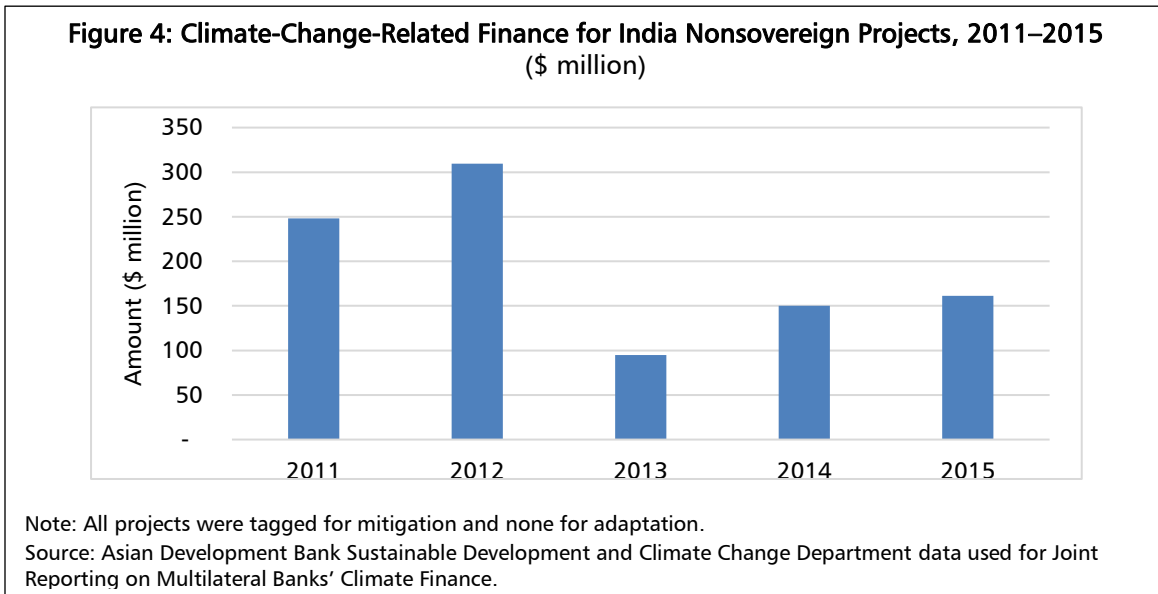
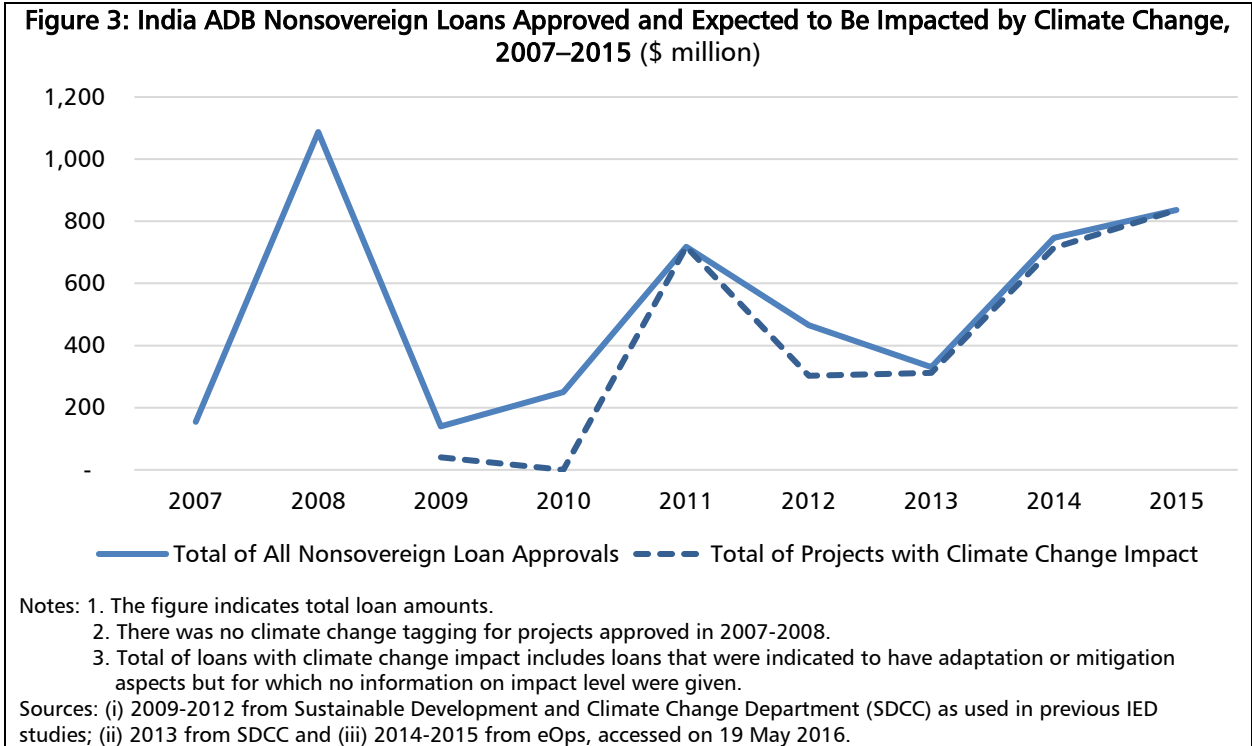
²⁵ See ADB. 2015. *Proposed Multitranches Financing Facility IND: State-Level Support for National Flagship Urban Programs*, Concept Paper, October, which specifically affirms (p. 3) without going into details that "all project outputs will include pro-poor, gender equity, and climate change resilience features where relevant," although the main output will be improvement and modernization of urban infrastructure services, including water supply, sanitation and wastewater management, storm water drainage, and solid waste management together with awareness building and behavior change campaigns.

make new investments for road improvements and rehabilitation more resilient to potential climate change impacts. In contrast to ADB's support to the PRC, however, there are few operations for urban mass transport, which could also contribute to GHG emissions reduction. Future opportunities in this regard should be actively explored together with provision of greater assistance to help India reduce its unacceptably high levels of urban air pollution.

50. Fourth, outside the energy and urban sectors, ADB loans to India over the period reviewed do not appear to provide support for institutional capacity development at either the national or subnational levels with regard to climate change mitigation or adaptation. For the most part, ADB-supported projects in India have concentrated on infrastructure development and basic service provision, in urban areas or by strengthening the national energy and, to a lesser extent, highway grids. These have resulted in pertinent energy efficiency and road safety improvements. But there have been few efforts to support improved water resource management at the river basin level, and while some projects have focused specifically on flood control and rehabilitation as well as coastal protection, these were partly in response to emergencies in specific states and were approved during the earlier years of the period under review. In short, much greater attention should be given by ADB to India's rising adaptation needs, particularly in the agricultural and water resource sectors, as well as in low-lying coastal and other vulnerable rural, as well as urban, areas and for disaster risk, including drought and flood, management, in future.

F. ADB's Climate Change-Related Nonsovereign Lending Portfolio for 2007–2015

51. ADB's climate-change-related nonsovereign (i.e., private sector) lending portfolio for India during the evaluation period was exclusively focused on mitigation and highly concentrated in the energy sector. The evolution of these loan commitments over the evaluation period is shown in Figure 3. Like sovereign projects, almost all nonsovereign loans in recent years face some potential impact from climate change. Of the 40 nonsovereign operations approved between 2007 and 2015, 19 involving nearly \$2.5 billion were for energy (with several covering multiple companies); 10 with commitments of just over \$1 billion were for finance; four for \$540 million were for transport and communications, two of which were later cancelled; two, one of which was later cancelled, for housing; two for agriculture, one of which was also dropped before signing; and one each for health, education, and multisectoral activities, all with comparatively small commitment amounts. Of the two transport loans that were not cancelled, one was to the Bangalore Metro Rail Corporation for \$250 million, which was approved in March 2011, for urban transport, and the other, for \$40 million, approved in October 2014, was for non-urban water transport.



52. Figure 4 illustrates the evolution of nonsovereign projects tagged by ADB’s Climate Change Thematic Group. All projects were tagged for mitigation and no loans were tagged as adaptation projects over this period. Mitigation-related projects have dropped since 2011 and 2012, but have been increasing since 2013 to a commitment value of \$161 million in 2015.

53. The energy sector operations approved during this period are listed in Table 6. Most are for renewable energy but some were later cancelled or dropped, including a \$150 million guarantee for a solar energy project. Some of the largest loans approved, totaling more than \$1.5 billion, however, were for conventional energy or transmission and distribution systems, while those for renewable energy, including both solar and wind sources, were generally smaller, in some cases considerably so.

Table 6: ADB Nonsovereign Operations in the Energy Sector, 2007–2015

Project	Approval Year	Loan Amount (\$ million)	Subsector	Status
Tata Power Company LTDA	2007	79.27	Renewable	
Coastal Gujarat Power Limited	2008	450.0	Conventional	
Gujarat Paguthan Energy Corp.	2008	45.0	Renewable	Split into two projects
CLP Wind Farms	2008	60.0	Renewable	Split into two projects
Rural Electrification Corp.	2008	225.0	Transmission and distribution	Cancelled
PPP for Rural Energy	2009	40.0	Renewable	
Solar Power Generation	2011	150.0	Renewable	Guarantee - Dropped
Powergrid	2011	250.0	Transmission and distribution	
Dahanau Solar Power Private	2011	48.0	Renewable	
Industrial Credit and Investment	2012	100.0	Renewable	Dropped
Rajasthan Sun Technique Energy	2012	103.0	Renewable	
Chattel Constructions Private	2012	19.09	Renewable	Divided in 6 companies Dropped
Ganges Green Energy Private	2012	20.74	Renewable	Divided in 6 companies Dropped
Hiraco Renewable Energy Private	2012	16.26	Renewable	Divided in 6 companies Dropped
Responsive Sutip Limited	2012	19.09	Renewable	Divided in 6 companies
Sand Land Real Estate Private	2012	13.67	Renewable	Divided in 6 companies
Ujiwala Power Private	2012	11.15	Renewable	Divided in 6 companies
Simpa Networks Off-Grid	2013	2.0	Renewable	
NSL Renewable Power	2013	30.0	Renewable	
Petronet LNG Limited	2013	150.0	Conventional	
BSES Rajdhani Power Limited	2013	80.0	Transmission and distribution	
Welspun Renewable Energy	2013	50.0	Renewable	
ReNew Power Ventures	2014	50.0	Renewable – wind	
ACME Gurgaon Power Private	2014	9.79	Renewable – solar	Divided in 6 companies
ACME Mumbai Power Private	2014	9.81	Renewable – solar	Divided in 6 companies
ACME Radjhani Power Private	2014	9.79	Renewable – solar	Divided in 6 companies
Medha Energy Private Limited	2014	9.81	Renewable – solar	Divided in 6 companies
Ranji Solar Energy Private	2014	10.79	Renewable – solar	Divided in 6 companies
ACME – EDF Solar Power	2014	50.0	Renewable – solar	For 100 MW of projects
Power Grid Corp of India	2015	500.0	Transmission and distribution	

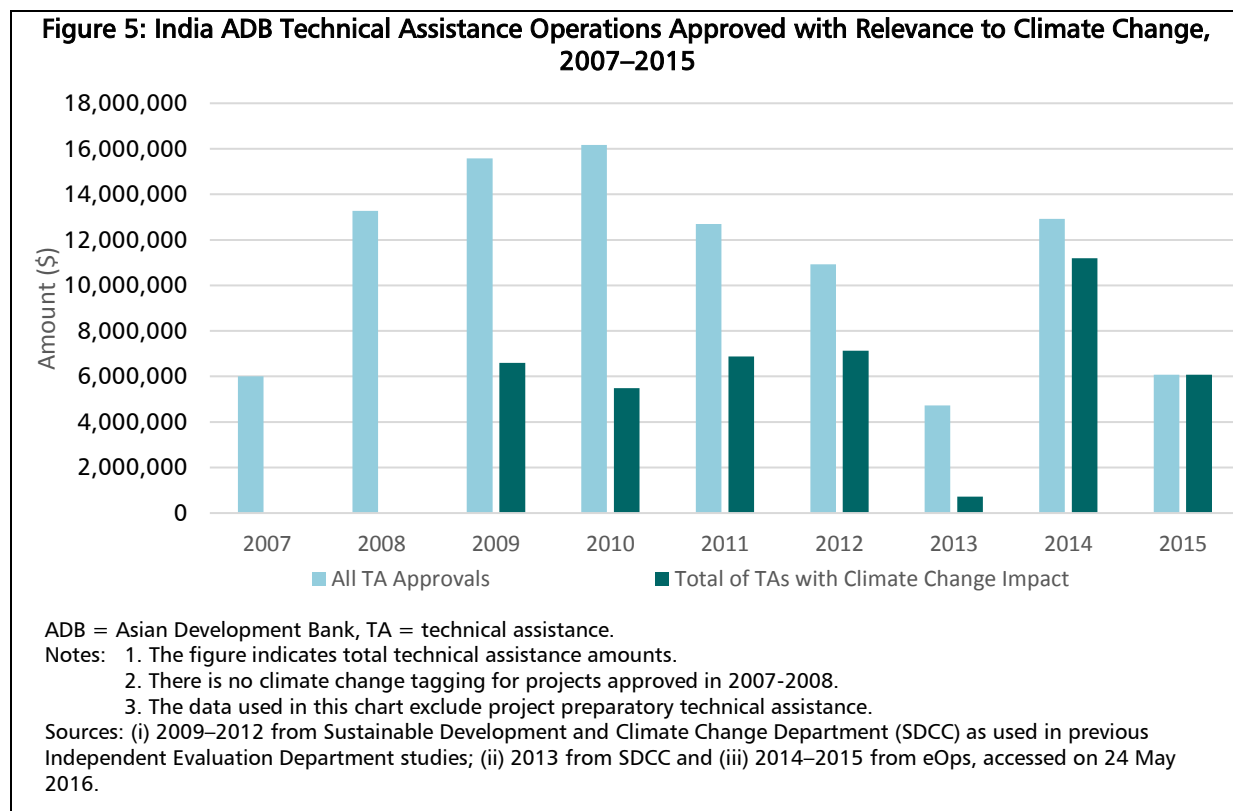
ADB = Asian Development Bank.

Source: ADB database.

54. While the number of nonsovereign loans for renewable energy appears to have increased over the period under review, ADB has also continued to finance other types of private sector energy investments, which may also entail climate change mitigation co-benefits to the extent that they involve non-fossil fuel or fossil sources with lower CO₂ emissions, such as natural gas, and/or enhance energy efficiency. Most of the remaining approved nonsovereign loans during the period were for financial sector beneficiaries, including three for finance sector development, three for housing finance, two for small and medium-sized enterprise (SME) finance, and one each for microfinance and money and capital markets. Again, two of these operations were subsequently canceled, specifically a \$250 million partial credit guarantee for microfinance and a \$75 million loan for SME finance. The extent to which the operations that have gone ahead may be of relevance in terms of climate change mitigation or adaptation, however, is unknown.

G. ADB's Climate Change-Related Technical Assistance Portfolio, 2007–2015

55. Nine ADB technical assistance operations with climate change-related elements for investment project preparation, were approved between 1 January 2007 and the end of 2015 (Figure 5). Each of the pertinent operations (with its respective approval date) is briefly described in Appendix 2.



56. Unlike ADB's recent sovereign and nonsovereign loans to India, these TA operations are more evenly focused on mitigation and adaptation issues, with those involving the energy sector concentrating on the former and the others on the latter, especially water resources, including flood, management and coastal protection and management. Many, if not most, of these operations, however, do not involve the use of ADB's own resources, but rather those from other sources, including the Urban Financing Partnership Facility, the Global Environment Facility (GEF), and other multi-donor trust funds, which ADB administers. Furthermore, while two such operations were approved in the second half of 2015, there was an average of only one climate change TA project that was not concerned with project preparation per year during the evaluation period—and none at all from 2010 through 2013—despite the rising importance of climate change both for India and the ADB.

H. Climate Change-Related Findings of CAPE Sectoral Assessments

57. Another source of relevant information with regard to ADB's support for climate-change-related activities between 2007 and 2015 comes from the sector assessments undertaken as part of the current CAPE exercise. These are briefly examined below.

58. **Water and other urban infrastructure and services (WUS).** The sector review was based on a desk review of 26 loans entailing nearly \$2.3 billion in total commitments, interviews with ADB staff, and field visits to several of these projects. As the assessment stresses, the growing importance of India's urban

areas is undeniable. It states, for example, that “it has been estimated that India’s urban population will grow from about 31% of the total in 2011 to 38% by 2025 with 538 million people living in cities by that time. In 2012, India had 54 metropolitan cities which, together with their hinterlands, accounted for 40% of India’s gross domestic product (GDP). It is estimated that by 2025 India will have 69 metropolitan cities which, together with their hinterlands, will account for 54% of India’s incremental GDP from 2012 to 2025 and 50% of India’s total income at the end of this period.” This rapid growth has also led to significant problems. To quote the same source: “the development of urban infrastructure in India’s cities has not kept pace with this rapid change in the rural-urban balance. The inadequate infrastructure and support services have resulted in both the loss of cities’ economic competitiveness and the deterioration of the urban environment, which is experiencing widespread pollution leading to negative impacts on the health of residents.”²⁶

59. The sector assessment finds that the WUS projects approved during the evaluation period were *relevant* and well-aligned with both the government’s and ADB’s strategies. It also notes that these “projects were primarily focused on the key targets of water supply, sewerage, solid waste management, slum development, drainage and flood protection, urban transport, policy preparation and institutional and capacity development.”

60. The assessment found that “although relatively small in expenditure terms, urban transport has probably been the best performing subsector with the majority of scheduled works, such as road-over bridges in Rajasthan and road resurfacing work in Karnataka being completed in a timely manner.” No mention is made in this context, however, of projects involving urban public transport—as opposed to road infrastructure—improvements, which might be expected to have a positive impact in terms of helping to reduce GHG emissions. At the other end of the spectrum, in contrast, it states that “solid waste management has been the most challenging subsector and, apart from moderate success under the North Eastern Region Capital Cities Development Investment Program, interventions have generally failed. While some works have been constructed and equipment purchased, facilities are often left lying idle due to the failure of the ULBs [Urban Local Bodies] to fulfill their role, or alternatively, have already reached the end of their useful lives due to the failure to segregate waste.” No mention is made of possible climate change mitigation benefits associated with solid waste management projects, such as methane capture and disposal from sanitary landfills, but it can be expected that these, if present in project designs, were most likely also underachieved.

61. While concluding that, on the whole, the projects reviewed are “less than likely to be sustainable due to the continued lack of ULB capacity and the clear lack of political will to charge for services provided,” the WUS sector assessment briefly touches on climate change aspects. It acknowledges that “climate change has become an increasingly significant risk over the time period of the CAPE. Water resources are becoming scarcer with very noticeable changes in river flow patterns and reduced replenishment of groundwater resources.” This situation has been recognized both in government strategy documents and the two most recent ADB country partnership strategies for India and, according to the sector assessment, “has been incorporated into the operating plans and appropriate consideration is now being made during loan preparation.” It observed further that “evaluation of project loans under the CAPE indicate that seven out of 26 project loans had climate change indicators for adaptation or mitigation included in the report and recommendation of the President (RRP) and/or climate change risk screening was conducted during project processing. Climate change indicators were medium for adaptation and low for mitigation across projects”.²⁷ The seven projects that contained such information were presumably the ones approved most recently, and the focus of their measures appears to have been

²⁶ ADB. 2016. Sector Assessment: Water and Other Infrastructure and Services (draft). p. 2.

²⁷ More specifically, in this regard, it stated (p. 42) that “the focus was mainly on NRW [non-revenue water] reduction, water use efficiency, improved sewage collection, treatment, and energy generation, wherever feasible. The latter would identify measures to reduce fugitive methane emissions by providing treatment systems for sewage and biodegradable waste. In the project loan for Kolkata, the sewer and drain systems are combined; improvements will alleviate waterlogging [and] future increases in rainfall intensity will be addressed during the detailed design to strengthen urban resilience under climate change.”

primarily in terms of increasing the resilience of associated infrastructure investments to potential climate change impacts rather than seeking to use these interventions to help contribute to mitigation goals.

62. It can be concluded that ADB's WUS portfolio in India during the evaluation period, while substantial both in terms of the number of operations and total loan commitments, has likely had limited impact on the ground in terms of advancing the country's climate change mitigation and adaptation objectives, although increasing attention now seems to be given to helping national and local governments increase city resilience to the likely increasing adverse effects of climate change as per a TA project in October 2015 that specifically focuses on this subject. However, this important initiative had barely begun by the end of the present evaluation period. In addition, there seem to have been a number of missed or failed opportunities to help the country mitigate GHG emissions in urban areas, particularly in the transport, sewerage, and solid waste subsectors, as well as to address serious increasing local urban air pollution problems, which are associated with significant negative public health effects. Nonetheless, the WUS program will inevitably support the NAPCC through improvements in water use efficiency, particularly through efforts to reduce nonrevenue water losses, which saves water and energy. Urban drainage, where it makes towns and cities more resilient to flooding, is also important. However, these activities can be characterized as good engineering practices rather than specific targeting to address climate change. Together with greater financial and institutional support for improved resilience to climate change in large cities and metropolitan areas, they should also become priorities for future ADB lending and technical assistance for urban development in India.

63. **Transport.** The CAPE sector assessment observes that the government's urbanization strategy seeks to ensure affordable public transport together with the creation of a "clean and healthy environment" in Indian cities. It adds that "to overcome the challenges posed by hitherto disjointed efforts and activities towards urban planning, all large urban areas have to prepare a development plan with at least a 10-year forward perspective." In this context, as indicated immediately above, ADB would seek to help India address environmental sustainability and climate change concerns, including through urban mobility improvements.

64. The main ADB climate change-related initiative in the transport sector during the evaluation period is the Jaipur metro line project approved in 2013 (see the brief description of this project in Annex 1 for further information). According to the sector assessment, "the fast paced industrial and commercial development in the city has resulted in a steep rise in travel demand, but existing public transport infrastructure is inadequate in terms of capacity and service." As a result, people were "shifting to private modes of transport, as evident from the rise in vehicle ownership, aggravating congestion and pollution." It likewise observed that "the modal share for public transport was 19% in 2009 — one of the lowest in cities with more than three million inhabitants in India." It is hoped that implementation of this project will increase this share and, in the process, help to reduce greenhouse gas (GHG) emissions associated with the growing use and congestion of private motor vehicles in the city. In addition to this project, a number of recent road projects have included measures to make infrastructure improvements more resilient to the effects of climate change.

65. According to the sector assessment, an "interesting" technical assistance project is being implemented in the city of Aizawl in Mizoram State. Its objective is to "find ways to improve safety and reduce pollution at relatively low cost. Demand control measures are being examined, including traffic management and public parking space control, together with pre-feasibility studies of eco-friendly alternative transport systems," which may also have some climate mitigation benefits. ADB also made technical assistance available for the preparation of documents and studies to enable India Railways to apply to the UNFCCC for funds for a nationally appropriate mitigation actions (NAPA) project. This would "enhance the railway sector investment program as a clean development mechanism." However, the initiative "hit unexpected obstacles" due to a drop in global carbon prices leading to a decision by the European Union (EU) to restrict the purchase of certified emission reduction credits to the least developed countries, which do not include India.

66. The transport sector assessment concludes by stating that “climate change initiatives were rarely found in the road sector in comparison to the railways, where the rationale was to switch goods traffic from road to rail with potential long-term energy savings. The focus in the road sector was to minimize the impact of climate change through better engineering design that anticipated frequent flood incidents and also through adopting a “green highway” approach whereby vegetative control would be used to combat erosion.” Thus, while indicating advances in terms of designing ADB-supported transport infrastructure so as to make them more resilient to the growing impacts associated with climate change in India, the assessment confirms that ADB did comparatively little during the evaluation period to promote modal shifts away from fossil fuel burning vehicles that contribute to global warming.

67. The general impression from sector assessment is that ADB was not very active with respect to climate change mitigation in the transport sector in India during the period considered, especially when compared with its performance in other large Asian countries such as the PRC. Except for the Jaipur metro project, there have been no free-standing urban transport operations, and ADB’s climate-related support in other subsectors (e.g., railroads and waterways) has been limited. Those actions that have been supported were mainly in multi-sector urban development projects, some of which have had comparatively small transport and mobility improvement components. Considerably more is clearly needed in this sector to help reduce both transport-related GHG emissions and local air pollution. ADB with its growing experience with urban transport in the PRC and elsewhere could play a useful future role in this regard.

68. **Finance.** The sector assessment highlights ADB’s approval of two MFFs in part to support environmentally sustainable growth and climate change mitigation: (i) the Accelerating Infrastructure Investment Facility to the India Infrastructure Finance Company Limited (IIFCL), the first tranche of which was approved in 2013, to provide intermediary loans for infrastructure projects, including clean and renewable energy; and (ii) the Clean Energy Finance Investment Program to the Indian Renewable Energy Development Agency (IREDA), the first tranche of which was approved in 2014, to support lending for renewable energy subprojects, including wind, biomass, hydropower, solar, and cogeneration technologies, and, on a limited basis, energy efficiency. According to the assessment, “the two facilities will leverage private capital to expand sector lending and thus add to India’s renewable energy capacity, noting also that ADB had provided a capacity building TA to strengthen IREDA’s safeguards compliance and assisted IIFCL and the Small Industries Development Bank of India in adopting a framework for environmental safeguards, thereby enabling the financing of environmentally compliant subprojects.”

69. In terms of its climate change impacts, ADB’s MFF and related capacity building TA to IREDA are expected to contribute to an estimated annual CO₂ reduction of 3.2 million tons. These initiatives are relevant to the government’s efforts to promote clean technologies and increase the share of renewables to power generation. They are also consistent with CPS, 2013–2017, which emphasizes clean and renewable energy expansion. Looking ahead, the finance sector assessment likewise recognizes the potential importance of further ADB support in this area, concluding that “India’s requirements for infrastructure and clean and renewable energy remain significant. The infrastructure investment funding gap during 2012–2017 has been estimated at \$113 billion. Demand for renewable energy investment is expected to be robust as the government targets an increase of 30GW renewable energy capacity by 2017 and a further increase of 175 GW by 2022.”

70. As in the case of transport, ADB climate-change-related support in the finance sector, while relevant, has been relatively recent and, thus, somewhat limited to date. Furthermore, it has been exclusively confined to the energy sector, mainly to help promote the expansion of renewable energy sources, and, to a lesser extent, energy efficiency. While it complements other climate-change-related activities that ADB has supported in the energy sector through both its sovereign and nonsovereign lending activities during the evaluation period, here too support needs to be stepped up in future,

including through increased financing for energy efficiency improvements in the industrial, transport, and other sectors.

71. **Social sectors.** The assessment, which covered both skills and education and health, indicated that ADB had financed only one health-related intervention during the evaluation period. This was a pioneering results-based lending (RBL) program, the National Urban Health Mission, involving a commitment of \$300 million. This ongoing project aims to improve the health status of the urban poor by facilitating equitable access to quality, essential health services and is one of the first of two RBL operations in the ADB's India portfolio, the other being for skills acquisition. No specific links to the need to address the likely health impacts associated with climate change, such as the spread of certain vector-borne diseases, were identified by the assessment, nor is ADB currently supporting public health services activities in rural areas.

I. Conclusions and Suggestions

72. India is both a major contributor to the greenhouse gas (GHG) emissions that are now widely recognized as being responsible for global climate change and one of the countries that is most vulnerable to climate change's increasingly negative impacts. The energy and transport sectors are primarily responsible for the continued rise in India's GHG emissions, which are associated both with its high dependence on fossil fuels, particularly coal, and its rapidly expanding vehicle fleet. Continued population expansion and rapid economic growth, as well as increasing urbanization, underlie these trends. At the same time, India's large population, much of which remains poor, and extensive coastal areas, together with its growing water scarcity and high susceptibility to extreme weather events, including tropical storms, floods, and droughts that are likely to become even more frequent and severe in the future, make adaptation to the impacts of climate change in both rural and urban areas an increasingly high priority. Both the government and its external development partners, including ADB, are now clearly aware of these challenges and have proposed comprehensive measures to help address them.

73. While ADB appears to have responded effectively to some of the priority areas identified by the government in its 2008 National Climate Change Action Plan and Second National Communication to the UNFCCC, issued in 2012, especially in the energy sector, during the period under review, it has approved significantly less financial and operational support for implementation of those in other areas, including urban transportation and adaptation to climate change, although such assistance is now being provided in selected cities. Much more climate-change-related support is needed in the agriculture, forestry, and water resource sectors, as well as for climate-related disaster risk management. ADB-financed urban infrastructure and development projects could also focus more effectively on strengthening city resilience to climate change, as well as on reducing local urban air pollution, as well as GHG emissions, from vehicular and other sources, than appears to have been the case in the past.

74. In short, there is considerable scope for ADB to provide greater and more focused climate-change-related support for both national and state mitigation and, especially, adaptation efforts across a variety of sectors. On the mitigation side, greater sovereign and nonsovereign lending is needed to develop renewable, particularly solar, energy sources. This could include assistance to help increase the efficiency of and reduce the emissions from the large coal-based portion of the energy sector through the adoption of clean coal technology and carbon capture and storage in coal-fired power plants, which it appears to have avoided until now.

75. ADB could also give greater attention to key mitigation-related policy issues such as encouraging India to reduce fossil fuel subsidies. A recently published ADB study concluded that fossil fuel subsidies in India were "extensive," at 2.7% of gross domestic product (GDP) in 2012 and that low-priced petroleum products accounted for over half of these subsidies. It also found that "total subsidies are higher than official government or international organization estimates, suggesting that more budgetary

transparency is needed to reveal the true scale of subsidies and to provide data to assess alternative, and potentially more effective, expenditures.”²⁸ ADB might consider using a policy-based loan, as has recently done in the PRC, to help combat urban air pollution,²⁹ for this purpose.

76. Finally, ADB should seek ways of substantially increasing its lending and technical assistance support for climate change adaptation in India in the years ahead. This must involve more than simply “climate proofing” new road improvement and other infrastructure investments, however, important this undoubtedly is. While helping to strengthen the resilience of India’s rapidly growing metropolitan areas and other cities to likely rising climate change impacts is necessarily a crucial part of this, considerably greater attention also needs to be given to decreasing the vulnerability of agricultural activities—and thus food security—and rural areas and communities more generally. Helping to address growing water scarcity problems, which will likely also require significant policy reforms and demand management as well as institutional and investment measures, improving the management of national water resources, both at underground aquifer and river basin levels, and strengthening the protection of coastal areas throughout the country are likewise urgent priorities, where ADB could play a more proactive and effective role.

²⁸ ADB. 2016. *Fossil Fuel Subsidies in Asia: Trends, Impacts, and Reforms - Integrative Report*. Manila. Executive Summary. This report was based on the findings of country case studies for India, Indonesia, and Thailand and was part of a technical assistance project entitled “Assessment and Implications of Rationalizing and Phasing Out Fossil Fuel Subsidies.”

²⁹ See, for example, the news release dated 15 December 2015 entitled “First ADB Policy-Based Loan to the PRC Supports Air Pollution Control in Beijing Capital Region.” <https://www.adb.org/news/first-adb-policy-based-loan-prc-supports-air-pollution-control-beijing-capital-region-0>

APPENDIX 1: INDIA'S CLIMATE-CHANGE-RELATED LENDING PORTFOLIO, 2007–2015

1. **Sustainable Coastal Protection and Management Program** (approved in 2010). The program sought to address immediate coastal protection needs and coastal instability using “environmentally and socially appropriate solutions,” with a focus on artificial reefs, beach nourishments, and dune management in the states of Goa, Karnataka, and Maharashtra. It was also intended to develop institutional capacities to meet long-term needs for sustainable coastal protection and management and support initiatives and increase private sector and community participation in coastal protection and management. While the impacts of climate change are not specifically mentioned in the project document for the program, it is likely that beach erosion due to storm surges and, over the longer-term, sea level rise are among the concerns that underlie the need for these interventions.
2. **Assam Integrated Flood and Riverbank Erosion Risk Management Investment Program**. (approved in 2010). The program was designed to support flood and riverbank erosion risk management planning, institutional development, and knowledge generation together with associated civil works in three subproject areas and provision of multidisciplinary project management systems in that portion of the Brahmaputra River basin situated in Assam. Again, climate change, as such, is not highlighted in the project document except insofar as strengthening resilience against “water disaster” was identified as one of the “key elements” of the National Action Plan on Climate Change approved in 2009.
3. **Uttarakhand Emergency Assistance Project** (approved in 2013). The project is also flood-related, although in this case, it is a response to a specific natural disaster that occurred in June of that year, which resulted in loss of life, destruction of livelihoods, and severe damage to basic infrastructure reportedly affecting close to 1 million people. The project mainly involved rehabilitating damaged infrastructure (e.g., roads, bridges, water supply systems, and tourism facilities), but also includes some resources for disaster preparedness and risk management even though adaptation to climate change is not mentioned *per se* in the respective project document.
4. **Karnataka Integrated and Sustainable Water Resources Management Investment Program-Project 1** (approved in 2014). The project sought to bring improved water and irrigation services to farmers by helping to improve river basin management in the state. According to the project document¹, “while millions of people in Karnataka rely on agriculture, the supply of water that farmers need to thrive is diminishing. The booming cities and rapidly growing industries are using an increasingly large amount of the state's water and leaving farms dry. Frequent droughts and the impact of climate change are expected to make the situation worse.” Strengthening an integrated approach to water resource management, the project intends to improve the efficiency of water utilization, particularly for irrigation and other uses.
5. **Infrastructure Development Investment Program for Tourism** (tranche 1 approved in 2010, tranche 2 in 2011, and tranche 3 in 2014). The program intended to make rural tourist destinations more visitor-friendly with better water supply facilities, upgraded restrooms and sanitation systems, new signs and street lights, and more efficient garbage disposal methods. It was primarily focused on the states of Himachal Pradesh, Punjab, and Uttarakhand (the three main states of the North West Himalayan Heritage Circuit) and Tamil Nadu (the anchor state of the South Heritage Circuit). It is also reportedly helping state governments to build basic infrastructure for tourism while encouraging private companies to provide services and facilities and to manage India's many heritage sites while encouraging greater local community participation in tourism activities. The link to climate change adaptation, however, is not immediately clear.

¹ ADB. 2014. Report and Recommendation of the President: Proposed Loan to India for the Karnataka Integrated and Sustainable Water Resources Management Investment Program. Manila.

6. **Second Jharkhand State Roads Project** (approved in 2015, the first project having been approved in 2009). The project was expected to improve about 175 kilometers of state roads and increase the capacity of the State Highways Authority with the aim of ensuring long-term sustainable development and maintenance of the state road network. It would also improve road safety. According to the project document, “the engineering designs were prepared to avoid or minimize land acquisition as well as social and environmental impacts, taking road safety into account, and minimizing climate change risks.” This is the only mention of climate change however.

7. **Rural Connectivity Investment Program** (tranche 1 approved in 2012, tranche 2 in 2013, and tranche 3 in 2015). The program sought to improve and sustain connections between selected rural communities to markets, district headquarters, and other centers of economic activities in the states of Assam, Chhattisgarh, Madhya Pradesh, Odisha, and West Bengal. Presumably, minimization of climate change risks was or would be part of the engineering designs at least for the third tranche of this program as well.

8. **South Asia Tourism Infrastructure Development Project** (approved in 2009). This regional project was relevant to both adaptation and mitigation. It also involved Bangladesh and Nepal and focused on improving connectivity to and destination infrastructure and services in key nature and culture-based tourism sites on selected high-priority subregional tourism circuits. Infrastructure interventions include airport upgrading, last-mile road connectivity, environmental improvements of destinations, such as for water supply, sanitation, and solid waste management; and visitor management infrastructure and services. The India portion of the project is in Sikkim state, where the connectivity and destination improvements would focus on (i) a world-renowned Buddhist site, the Rumtek monastery; (ii) the nature-based sites in west Sikkim that form a part of the greater Himalayan trail; (iii) village tourism development; and (iv) transformation of Sikkim into a center of subregional learning in nature and culture-based tourism.

9. **Madhya Pradesh State Roads III Project** (approved in 2011, project II having been approved in 2007). was expected to upgrade about 1,080 km of highways identified under the state road rehabilitation program and improve the road agency’s capacity for road safety. According to the project document, it had been “designed with the aim of minimizing the impact of climate change. Such an impact was assessed in terms of increased surface temperature, droughts, and flooding in certain areas, as well as fewer forests and less biodiversity.”²

10. **Bihar State Highways II Project** (additional financing approved in 2012, project I having been approved in 2008 and project II in 2010). The project would finance the construction and upgrading of an additional 254 km (on top of the 389 km under the original project) of state highways, improved institutional capacity for sustainable transport sector development, and better road safety. With regard to adaptation, the project document³ observed that “portions of state highways in northern Bihar are susceptible to floodwaters originating in the Himalayas” and that this part of the state had “experienced worsening flooding since the 1980s, highlighting the need for more stringent counter measures [in terms of project design] to ensure project objectives are sustained.” Interestingly, it also states that “to partly offset greenhouse gas emissions from increased traffic arising from road upgrading, the BSRDC [i.e., the

² More specifically according to this report, “drainage structures in the project have been designed to accommodate increased water flow, and road embankment levels have been planned in accordance with flood levels. Measures toward “green” highways have also been adopted, such as enhancing the environmental functions of the watersheds by using extensive vegetative control in addition to structural measures to combat erosion; 1:7 compensatory reforestation, which is more than the statutory requirement of 1:2; preservation of trees through minor geometric realignments; exclusive use of native tree species in reforestation; and inclusion of tree survival as part of post-project monitoring.”

³ ADB. 2012. Report and Recommendation of the President: Proposed Loan to India for the Bihar State Highways II Project - Additional Financing. Manila.

state road development corporation] has committed to implementing 1:10 compensatory plantation for all trees, regardless of ownership.”⁴

11. **Gujarat Solar Power Transmission Project** (approved in 2011). This project financed installation of the basic transmission infrastructure required to permit use of the energy generated by a 500 MW solar park developed by the Gujarat Power Corporation and financed by other sources. According to the respective project document,⁵ “in India, transmission expansion and optimization has been an area of focus for ADB operations and through the development of this power evacuation line from the Charanka solar park, ADB will be able to facilitate private sector participation and develop a model that can be replicated to scale up solar power in a significant manner in India.”

12. **Railway Sector Investment Program** (tranche 1 approved in 2011 and tranche 2 approved in 2014). The program supports the government’s intention to develop an “energy-efficient, safe, reliable, affordable, and environment-friendly railway system.” This MFF would support expanded physical infrastructure and more efficient infrastructure use, improved railway operations efficiency, and clean development mechanism (CDM) application and implementation for the associated investment program.

13. **Madhya Pradesh Power Sector Investment Program** (tranches 5 and 6, approved in 2009, tranches 1 through 4 having been approved in 2007) and **Himachal Pradesh Clean Energy Development Investment Program** (tranche 1 approved in 2008, tranches 2 and 3 approved in 2011). Turning to the much larger number of operations identified as being of relevance exclusively for mitigation purposes, these two programs have “high” climate change impacts. The Madhya Pradesh program was intended to finance the transmission and distribution component of the state’s investment program from 2007 through 2012 with the objective of building sufficient capacity for the evacuation of power from existing and planned power stations and substations and delivering it reliably to consumers. The program document⁶ refers specifically to the possibility of carbon emissions trading in association with these investments, noting that “co-financing of alternative energy projects is possible through the Kyoto Protocol CDM, second-tier carbon markets, commercial clean energy investment funds, and the Global Environment Facility. CDM and second-tier carbon markets might be the best options for carbon credit transactions.” It also affirmed that ADB would provide indirect support through an ongoing technical assistance project executed by the Ministry of Environment and Forests, the designated national authority for CDM.” The Himachal Pradesh program financed the expansion of the state’s run-of-river hydropower capacity and improved planning, implementation, management, and power system governance. In terms of climate change mitigation, the program document⁷ observes that the program’s “hydropower investments are candidates for earning revenue from selling emissions reductions under the CDM.”⁸

⁴ It also stated that “this [process] has strong community participation and performance-based agreements to ensure that at least 80% of the trees survive. The BSRDC will monitor, in coordination with the State Pollution Control Board and the Transport Department, roadside tailpipe emissions and ambient air quality to keep track of greenhouse gas emissions and air quality. Finally, to reduce reliance on fossil fuels, all contractors will be encouraged to install solar panels to power all lighting at campsites, with appropriate provision made in the bidding documents.

⁵ ADB. 2007. Report and Recommendation of the President: Proposed Loan to India for the Gujarat Solar Power Transmission Project. Manila.

⁶ ADB. 2007. Report and Recommendation of the President: Proposed Loan to India for the Madhya Pradesh Power Sector Investment Program. Manila.

⁷ ADB. 2014. Report and Recommendation of the President: Proposed Loan to India for the Himachal Pradesh Clean Energy Development Investment Program. Manila.

⁸ More specifically, it stated that “based on power generation potential of about 3,102 GWh per year, and as these projects are located the northern regional grid considering an emission factor of 750 tons per GWh, these projects collectively have the potential to generate up to 2.3 million emission reductions per year, or 2.3 million tons of carbon dioxide (CO₂) equivalent. However, a detailed assessment is required with respect to additionality issues and other requirements of the Kyoto Protocol before these projects are taken up for CDM development. In addition, most of these projects are likely to be commissioned in 2012 or beyond, so non-CDM markets that could offer carbon credit revenue opportunities should also be investigated. When taking into account all projects within the state in various stages of planning, there is a potential to avoid up to 21.8 million tons of CO₂ equivalent per annum.”

14. **National Grid Improvement Project** (approved in 2011) and **Assam Power Sector Investment Program** (first tranche approved in 2014). These are also mitigation programs and projects. The National Grid Improvement Project seeks to accelerate the development of the interregional grid system so it can deliver increased power supply to sustain the country's economic growth. Its outputs were expected to include a strengthened interregional transmission network between the northern and western grid regions through physical investment and improved access to and management of financial credit by promoting the diversification of funding sources through combined nonsovereign and sovereign guaranteed ADB loans. No specific climate change benefits were mentioned however. The investment program financed by the second operation is expected to have three outputs: (i) an upgraded and expanded generation system, (ii) upgraded and expanded distribution system, and (iii) strengthened institutional capacity of two key power sector agencies in Assam in pursuit of the objective of increasing the capacity and efficiency of energy generation and distribution systems in the state. This entire three-tranche MFF program, if successfully implemented, is estimated to result in a reduction of 534,000 tons of CO₂ per year, although it is not clear how this figure was determined.

15. **North Eastern Region Capital Cities Development Investment Program** (tranche 1 approved in 2009, tranche 2 in 2011). The next set of projects are expected to be impacted by climate change in the medium term, but are of relevance in terms of climate change mitigation and feature both energy and urban development operations. The North Eastern Region Capital Cities Development Investment Program was expected to improve the environment and well-being of the residents of five capital cities. Specifically, the program aimed to strengthen urban infrastructure and services—particularly water supply, sewerage and sanitation, and solid waste management—in these cities, including in slum areas. The institutional, managerial, and financial capacity of the urban governing bodies would be strengthened. According to the program document,⁹ “In line with the Government's 11th Plan objectives and ADB's long-term strategic framework 2008–2020 (Strategy 2020), [the program] will seek to identify opportunities for environmental improvement and climate change mitigation.”¹⁰ More generally, the program design reportedly benefited from a planned approach and followed the principle of the “integrated provision of urban infrastructure and services to harness synergies and realize the full potentials from individual sector improvements.”

16. **Madhya Pradesh Energy Efficiency Improvement Investment Program** (tranches 1 and 2, both approved in 2011). The program sought to support inclusive economic growth by providing more household access to a continuous, higher-quality electricity supply and improved operational efficiency in electricity distribution in rural areas of the state. The investment program was expected to benefit 2.68 million households who will be provided with a good quality power supply on a 24-hour basis. It will also aim to provide 1.3 million new power connections, thereby enabling beneficiary households to improve their economic, commercial, educational, and entertainment opportunities. According to the program document,¹¹ “additional benefits of the investment program include potential water conservation and reduction in peak demand for power. [while] its energy efficiency improvements also result in an estimated carbon emission reduction of 920,000 tons per annum, and an estimated 1,100 gigawatt-hour power savings per annum.”

17. **Himachal Pradesh Clean Energy Transmission Investment Program** (tranche 1 approved in 2011, tranche 2 in 2013). The program had two major components: (i) physical investments in transmission infrastructure, including high voltage lines and transmission substations; and (ii) capacity development for the state transmission utility company. The expected program impact was the transmission of clean

⁹ ADB. 2009. Report and Recommendation of the President: Proposed Loan to India for the North Eastern Region Capital Cities Development Investment Program. Manila.

¹⁰ More specifically, according to this source, the program would “promote improvements in urban sanitation and a reduction in fugitive methane emissions by providing treatment systems for sewage and biodegradable waste. Opportunities have been identified and a preliminary assessment of carbon emission reduction has been made to estimate the impact of the proposed composting and wastewater treatment subprojects and financing possibilities.”

¹¹ ADB. 2011. Report and Recommendation of the President: Proposed Loan to India for the Madhya Pradesh Energy Efficiency Improvement Investment Program. Manila.

energy to end users in Himachal Pradesh and the rest of India. As for potential climate-change-related benefits, according to the program document,¹² “since the investment program’s transmission capacity additions support further hydropower development in Himachal Pradesh, the investment program indirectly contributes to a reduction in the carbon intensity of India’s power supply mix.”

18. **Clean Energy Finance Investment Program** (tranche 1 approved in 2014). The program aimed to support renewable energy development in India through: (i) enhanced availability of long-term financing; and (ii) improved institutional capacity. Key activities that are expected to achieve these objectives are the use of MFF funds to finance renewable energy subprojects and an Indian Renewable Energy Development Agency (IREDA) capacity development program. The full \$500 million in loans for this planned three-tranche program was expected to contribute to climate change mitigation, and it is estimated that the associated reduction in CO₂ emissions, assuming it is successfully implemented, would be of the order of 3.2 million tons a year.

19. **Madhya Pradesh District Connectivity Sector Project** (approved in 2014). This was designed to improve road transport connectivity in the state. Intended project outputs were the reconstruction and rehabilitation of about 1,600 km of major district roads to all-weather standards and designed for road safety together with improved road maintenance and asset management. According to the project document,¹³ “the engineering design was prepared to avoid or minimize land acquisition as well as social and environmental impacts, take road safety into account, and minimize climate change risks.” As a result, some \$2.42 million of the \$350 million ADB loan for this project was estimated to be dedicated to climate change adaptation, and, thus, it should have been tagged as of relevance in this regard rather than for mitigation purposes.

20. **Assam Power Sector Enhancement Investment Program** (tranche 1 approved in 2009, tranche 2 in 2010, tranche 3 in 2011, and tranche 4 in 2014). The expected impact of this MFF is a sustainable state power sector with increased transmission and distribution capacity to support inclusive economic growth. Its anticipated outcome would be enhanced quality and expanded service delivery of electricity through improved technical, commercial, and financial performance and capability of power utilities. A special feature of this program was off-grid rural electrification and renewable energy which would be developed under a parallel technical assistance grant. According to the program document,¹⁴ “the Assam Energy Development Agency identified 2,000 villages suitable for solar photovoltaic power generation in remote villages. GOA has identified 90 potential mini-hydropower sites with total capacity of 148.5 MW and ratified the Small Hydro Power Policy in 2007 defining the project formulation structure where private sector groups will be selected through competitive bidding processes. The TA will develop pilot-testing projects of renewable energy, e.g., mini-hydropower, solar, and biomass, and structure the relevant operating model.”

21. **Bihar Power System Improvement Project** (approved in 2010). This involved transmission and distribution improvements in order to help produce a more sustainable state power sector and provide better service to end users. The anticipated outcomes would be stronger transmission and distribution capacity and system efficiency, and higher quality and reliability of service in the state. The project’s investment components would focus on seven towns within four of the 16 distribution circles in Bihar. While potential climate change mitigation benefits are not specifically mentioned in the project document, it does assert that “designs will be (i) consistent with overall least-cost expansion plans; (ii) have a least-cost basis; and (iii) reflect best-practice design, construction, and operation and

¹² ADB. 2011. Report and Recommendation of the President: Proposed Loan to India for the Himachal Pradesh Clean Energy Transmission Investment Program. Manila.

¹³ ADB. 2014. Report and Recommendation of the President: Proposed Loan to India for the Madhya Pradesh District Connectivity Sector Project. Manila.

¹⁴ ADB. 2009. Report and Recommendation of the President: Proposed Loan to India for the Assam Power Sector Enhancement Investment Program. Manila.

maintenance features [and that] investment components will feature performance-based design consistent with international benchmarks for system efficiency and operating risk.”

22. **National Capital Region Urban Infrastructure Financing Facility** (tranche 1 approved in 2010). The stated purpose of this MFF was to improve the quality of life and economic well-being of urban residents in India's National Capital Region (NCR) and “counter magnet areas” (CMAs).¹⁵ The desired outcome of the facility is that urban residents in the target cities of the NCR and CMAs use improved growth-supporting and public health and environmental urban infrastructure services in accordance with the priorities of Regional Plan 2021. With this objective in mind, the MFF would assist the NCR Planning Board (NCRPB) in: (i) leveraging its resources through a line of credit and other market access support services, and (ii) strengthening the design, implementation, and delivery of quality growth-oriented and public health and environmental urban services, enhancing its capacity to partner with the private sector, and supporting other capacity improvements. Program outputs would be: (i) urban public health and environmental infrastructure, including water supply, sanitation, and waste management projects; (ii) regional and urban infrastructure that would support economic growth and include investments in regional connectivity and multimodal public transit systems, among other things; and (iii) implementation support for strengthening NCRPB and participating subborrowers' capacity to scale up urban infrastructure and improve basic urban services. Although not specifically mentioned, presumably the climate change mitigation effects will be primarily associated with the public transport and sanitation and solid waste investments to be financed under the program.

23. **Uttarakhand Urban Sector Development Investment Program** (tranche 1 approved in 2008 and tranche 2 in 2011). The program sought to improve access to better quality urban infrastructure and services for the 3.8 million people projected to be living within 31 towns and to enhance the quality of services and experience enjoyed by more than 8 million tourists and pilgrims who visit these towns annually. The program consisted of: (i) investments in urban infrastructure and service improvements, including for rehabilitation, improvement, and expansion of water supply, sewerage and sanitation, solid-waste management, urban transportation and roads, and slum upgrading; and (ii) program management support and capacity development to assist in the implementation of an urban governance, finance, and service-delivery improvement action plan and to enhance the capacities of the urban service providers. Anticipated environmental benefits included: (i) reduced pollution of water resources due to discharge of untreated sewage and indiscriminate solid waste disposal from sewerage and sewage treatment, and municipal solid-waste management investments; (ii) increased availability of adequate potable water at appropriate pressure from water supply subprojects; (iii) better public health, particularly a reduction in waterborne and infectious diseases through water supply, sewerage and sewage treatment, and municipal solid waste management investments; (iv) improved aesthetics from the improvement of urban roads, sewerage and sewage treatment, and municipal solid-waste management works; (v) reduced exposure to suspended particulates and noise pollution; and (vi) increased pedestrian safety through urban roads and traffic management. However, possible climate change mitigation benefits are not specifically identified in the program document.

24. **North Karnataka Urban Sector Investment Program** (tranche 1 approved in 2007, tranche 2 in 2010, tranche 3 in 2012, and tranche 4 in 2013). The program has a basic design similar to the two preceding operations. According to the program document,¹⁶ its impact was expected to be “improved urban infrastructure and services resulting in overall improvement of quality of life in the Investment Program ULBs [urban local bodies], related increases in economic opportunities and growth, and reduced imbalances between north Karnataka and the rest of the state.” To achieve this, the investment program

¹⁵ The NCR is a 33,578 kilometer² area covering Delhi and subregions of the states of Haryana, Rajasthan, and Uttar Pradesh. The population of the NCR was 37 million (urbanization level of 54% as per the 2001 census), and this is expected to increase to 64 million by 2021. In addition to the NCR, the NCRPB supports Gwalior (Madhya Pradesh), Patiala (Punjab), Ambala and Hissar (Haryana), Dehradun (Uttarakhand), Kota (Rajasthan), and Kanpur and Bareilly (Uttar Pradesh) cities as part of the counter magnet areas (CMAs) where development strategies are implemented to ease the projected population pressure on the NCR.

¹⁶ ADB. 2007. Report and Recommendation of the President: Proposed Loan to India for the North Karnataka Urban Sector Investment Program. Manila.

was designed to help participating ULBs rehabilitate existing urban infrastructure facilities and construct new ones, including water supply and sewerage systems, together with drainage and urban transport improvements. Urban slums would also be improved through the provision of basic services. As with the preceding project, no specific climate change mitigation benefits were mentioned in the MFF program document even though, according to the project data sheet for the third tranche, net environmental benefits were expected to be “positive and large including: (i) improved urban environment from sewerage subprojects leading to improved public health; (ii) reduced flooding through drainage improvements; and (iii) improved water quality through lake development schemes.”

25. **Jammu and Kashmir Urban Sector Development Investment Program** (tranche 1 approved in 2007, tranche 2 in 2012, and tranche 3 in 2014). The program was designed to improve basic services in the main urban areas of Jammu and Kashmir, promote commerce, improve access to basic services by the poor, and help to revive the economy of the state. Specifically, it sought to improve public health, the urban environment and living conditions for the 2 million people living in the two principal cities of Srinagar and Jammu and other participating towns, as well as for the growing numbers of tourists. Program outputs were expected to include improved: (i) water supply, by rehabilitating and expanding distribution networks and setting up new supply systems; (ii) sewerage and sanitation, by extending existing systems, constructing new ones, and supplying sanitation maintenance equipment; (iii) municipal solid waste collection, processing, treatment, and disposal through sanitary landfills; (iv) road and intersection capacity, road safety, and pedestrian overpasses; and (v) other municipal facilities that may be prioritized as the respective master plans are updated and finalized in the participating towns and cities. The program would also provide management and implementation support to implement physical works and a comprehensive capacity building and institutional development program to produce a more responsive state systems, empowered local governments, establish a separate entity to manage water supply and sewerage services on modern business principles, improve the financial performance of the local bodies and service providers, and improve overall service levels. No specific climate mitigation benefits are identified either in the program document or in the project data sheet.

26. **Rajasthan Urban Sector Development Program** (tranche 1 approved in 2007, tranche 2 in 2009, and tranche 3 in 2010). The program sought to promote sustainable urban development and improve urban service delivery in the state. Its expected outputs included rehabilitation and expansion of water supply systems in five cities and wastewater systems in six cities, together with capacity building and program management. Interestingly, this project loan is accompanied by a policy-based loan to support reforms expected to support improved urban institutions and urban governance in the state. As concerns its relevance to climate change mitigation, the project document¹⁷ observes that “climate change projections indicate an increase of 2.4° C during 2071–2100 in Rajasthan [while] mean annual rainfall is predicted to decrease slightly; extreme rainfall is expected to increase in frequency and intensity. The key risk factors are frequent droughts, extremely low and erratic rainfall, and very limited surface water sources, resulting in greater dependence on groundwater resources. The [program] will focus on NRW [non-revenue water] reduction and water use efficiency, improved sewerage collection, treatment, and energy generation; and adaptation measures for risks related to earthquakes, landslides, floods, and climate change.” It also affirmed that “detailed design of the project components will consider findings from ongoing climate change analysis models.”

27. **Uttarakhand Power Sector Investment Program** (tranche 2 approved in 2008, tranche 3 in 2009, and tranche 4 in 2012). The program was expected to contribute to the state’s economic development and that of the northern region of India more generally by expanding the power supply at competitive prices. The third tranche, for example, would finance the construction of a 400 KV substation and the fourth an integrated transmission system for the Akananda basin. These projects were extended until March 2016 because of extreme flooding in 2013, but have been further delayed. According to the MFF

¹⁷ ADB. 2007. Report and Recommendation of the President: Proposed Loan to India for the Rajasthan Urban Sector Development Program. Manila.

program document,¹⁸ ADB would also support power generation in the state, including through renewable sources. The Uttaranchal Renewal Energy Development Agency had “requested ADB support for a broad range of renewable energy development activities, including commercialization of biofuel production, after-market solar energy services, and mini- and micro-hydropower expansion for rural and off-grid applications. The Global Environment Facility has responded positively to a preliminary concept paper for a parallel project to support these activities.” It also stated that a grant to this agency “for accelerated upgrading of micro-hydropower facilities has been approved from ADB’s regional TA for the Poverty and Environment Program [and would] partly finance watermill users’ associations, with the objective of commercializing locally-owned facilities that produce mechanical and electric power.”

28. **Rajasthan Urban Sector Development Investment Program** (tranche 1 approved in 2007 and tranche 2 in 2009). The general objective was to increase economic growth, reduce poverty, and sustain improvements in the urban environment and in the quality of life in the 15 urban local bodies (ULBs) in the state. The expected outcome would be more access to sustainable urban infrastructure and services for 1.6 million people in these ULBs and their improved capacity to manage urban services in a sustainable way. As in other multisectoral ADB-financed urban development programs in India, its specific activities would include improvement of: (i) water supply systems by rehabilitating, strengthening, and expanding networks and constructing new supply systems; (ii) sewerage and drainage by constructing new systems and extending existing ones; (iii) solid waste collection, processing and treatment, and disposal by developing sanitary landfill sites; (iv) road rehabilitation and road safety; (v) social infrastructure, such as slum improvements and other municipal facilities that may be prioritized as the master plans are updated and finalized; and (vi) infrastructure support for cultural heritage, such as access roads and sanitation facilities, together with capacity building and institutional development to make the state system more responsive, empower local government, improve the financial performance of the local bodies and service providers, and improve urban services overall for citizens as well as management and implementation support for the implementation of the investment program. According to the program document, it was “designed to maximize environmental and public health benefits”,¹⁹ but, as for similar programs reviewed above, climate change-related benefits were not specifically mentioned.

29. **National Power Grid Development Investment Program** (tranche 1 approved in 2008, tranche 2 in 2009, and tranche 3 in 2011). The expected outcome was enhanced transmission network reliability and efficiency through expansion and augmentation of the national transmission grid. This, in turn, was expected to lead to improved quality of supply in the major demand centers of the northern and western regions of the country. The program document also affirmed that “through the development of a sophisticated national grid to be linked with neighboring countries with untapped natural resources, the investment program will also contribute to enhancing regional and national energy security and energy efficiency as well as reducing greenhouse gas emissions.” The program had two subprojects: (i) upgrading of transmission line capacity from Uttarakhand and (ii) an approximately 800 kV high voltage direct current Northeastern-Northern/Western interconnector. Specific emissions reductions benefits from these investments are estimated to be substantial.²⁰

¹⁸ ADB. 2007. Report and Recommendation of the President: Proposed Loan to India for the Uttarakhand Power Sector Investment Program. Manila.

¹⁹ More specifically, it stated that “initial environmental examinations (IEEs) conducted for the Program show that net environmental benefits are positive and large including: more and better-quality drinking water from water supply subprojects; better public health, particularly fewer waterborne diseases through water supply, sewerage, drainage, and solid waste management investments; improved aesthetics as a result of the sewerage, drainage, and solid waste management works; reduced flooding through drainage improvements; reduced exposure to suspended particulates and noise pollution through the urban transport and road components; and social benefits from the slum improvement and civic infrastructure outputs.”

²⁰ According to Report and Recommendation of the President, the National Power Grid Development Investment Program would entail potential positive cumulative and induced impacts. POWERGRID would transfer low-carbon energy from hydropower plants in the northeastern and northern regions to other regions which experience power deficits. More specifically, “the proposed projects would reduce emissions by replacing thermal generation at demand sites (northern and western regions) through the transmission of clean, less polluting hydropower generated in phases from the remote northeastern region of the country with negligible environmental impacts. ADB estimates that Project 1 associated hydropower plants will offset more than 8 million tons per year of carbon dioxide (CO₂) equivalent by 2015, and cumulative offsets of more than 263 million tons of

30. **Rajasthan Renewable Energy Transmission Investment Program** (tranche 1 approved in 2013). The program sought to accelerate the development of renewable energy sources with the expected outcome of a cleaner electricity mix and a more efficient and effective generation and transmission system in the state. Physical outputs would include the construction of the bulk power transmission system in western Rajasthan. This three-tranche program would be financed in part with resources from the Clean Technology Fund (CTF), including \$90 million for the first tranche. The associated technical assistance grant for Rajasthan Renewable Energy Capacity Development and Implementation Support is estimated to cost \$2 million and would be attached to the first tranche of the MFF with the objective of providing technical support for, among others: (i) infrastructure planning for the subsequent phases of the Bhadla solar park, (ii) community development initiatives around the solar park, (iii) institutional capacity development; and (iv) system studies for the renewable energy integration road map.²¹

31. **Kolkata Environmental Improvement Investment Program** (tranche 1 approved in 2013). This had as its intended impact and outcome improved access to water supply and sanitation and improved water supply, sewerage and drainage service quality by the Kolkata Municipal Corporation (KMC), respectively. More specifically, the three-tranche program was expected to rehabilitate water supply assets, extend sewerage service to peripheral areas, and further develop KMC's financial and management capacity. The investments covered by tranche 1 would support 5% of the KMC area, but the program as a whole was expected to benefit 20% of this area. According to the program document, "sustained access to safe water and sanitation will contain waterborne and other diseases [would improve] public health," but no specific climate change benefits are mentioned.

32. **Jaipur Metro Rail Line 1 Phase B Project** (approved in 2013). The project was expected to have two outputs: (i) line 1-phase B, comprising the underground rail infrastructure of 2.3 km and two stations; and (ii) line 2 plans updated, including a detailed project report. More generally, it is intended to contribute to an improved rapid mass transport system in the city. While no specific climate change mitigation benefits are mentioned, the project's economic analysis considered the benefits of line 1-Phase B in terms of estimated savings in vehicle operating costs derived from a reduction of traffic on the east-west corridor from reduced and improved vehicle speed together with travel time savings for trips using the metro and for remaining vehicle users with improved speed. Savings resulting from reduced road accidents and reduced air pollution from reduced vehicle-km, which were quantified, were also considered in the analysis.

33. **Madhya Pradesh Power Transmission and Distribution System Improvement Project** (approved in 2013). This had three outputs: (i) transmission system upgraded and expanded; (ii) distribution system upgraded and expanded; and (iii) capacity building for executing agency staff. The project is expected to enable an estimated 570,000 households to receive new power connections. According to the project document, moreover, the transmission and distribution improvements that it is expected to produce

CO₂-equivalent during the 30-year project lifecycle (based on about 2,400 MW of hydropower available for transmission). ADB also estimates that Project 2 is expected to generate about 20 million tons in CO₂ emission reductions in the first phase (2010–2015) with the total amount of CO₂-equivalent emission reductions reaching 551 million t over the lifetime of the project. Additional cumulative offsets gained from the reduction in transmission losses in Project 2 account for 7 million tons CO₂ equivalent over the lifetime of the project. Potential revenues from carbon finance might, therefore, constitute a large percentage of annual interest payments and initial operation and maintenance costs during the first several years. Other positive impacts include: (i) the expansion of low-carbon energy, offsetting emissions from thermal power plants, (ii) transmission system efficiency improvements, and (iii) economic growth related to the improved power supply to millions of customers. The cumulative reduction of other pollutants is estimated as follows: (i) 2.8 million tons of sulfur dioxide, (ii) 1.4 million tons of nitrogen oxides, and (iii) 0.5 million tons of particulate matter (every 20 years)."

²¹ More generally, the use of a MFF for the Rajasthan Renewable Energy Transmission Investment Program program was justified in the following terms in the Report and Recommendation of the President: "The Government of India and Rajasthan requested support from ADB for the development of renewable energy projects in Rajasthan, including in its planned solar parks, as well as financing through an MFF to set up transmission and associated infrastructure to manage integration of renewable energy...The MFF is the modality most suited to a long-term partnership in these activities, given the phased nature of investments in electricity generation and the need for flexibility in project design and implementation. It is also possibly the best way to provide continuity when trying to combine investments in physical and nonphysical aspects of renewable energy development."

would result in energy savings of 878 million kilowatt-hours per year while its associated technical loss reductions would result in an estimated carbon emission reduction of 684,840 tons per annum.

34. **Accelerating Infrastructure Investment Facility in India Program** (tranche 1 approved in 2013). The expected outcome of the program was the enhanced availability of long-term finance for public-private partnership subprojects and improved project management. The indicative pipeline of subprojects would be subject to due diligence to ensure conformity with ADB requirements. Subprojects would be financed for roads, railways, airports, energy (including renewable energy), and urban infrastructure. According to the program document,²² the pipeline consisted of 31 subprojects for direct lending, including subordinate debt and take-out financing. Up to \$300 million of bank capital was expected to be released for new greenfield projects by financial year (FY) 2018. For tranche 1, 12–14 subprojects from the pipeline for the facility would be financed. As concerns climate change, it was observed that “a screening report for subprojects under the facility has been prepared for climate change risks on subprojects. Screening criteria to score subprojects used a score of 1 indicating low risk and 2 indicating higher risk for risks stemming from sea level rise, landslides due to precipitation, and others.” The facility was expected to prioritize subprojects by declining level of climate risk.

35. **Karnataka Integrated Urban Water Management Investment Program** (tranche 1 approved in 2014). The program sought to improve sustainable water security through better water resource management in urban areas in selected river basins in the state. Its expected outputs were expanded and upgraded urban water supply and sanitation infrastructure, improved water resource planning, monitoring, and service delivery and strengthened operational and administrative capacity. According to the program document,²³ “the investment program has been conceptualized to address water security problems accentuated by climate change and designed to incorporate IWRM [Integrated Water Resource Management] benefits.” It also observes that “achieving full sewerage coverage and connecting all households are expected to result in important river quality improvements. Effluent reuse is possible for agricultural purposes in the three towns, and reuse by small industry is being evaluated in Davangere. All towns have significant levels of NRW, which may increase after continuous water is supplied. As water loss management is essential, performance-based management contracts for water will be utilized in the project towns after establishing baselines and targets for NRW reduction.”

36. **Punjab Development Finance Program** (approved in 2014). This sought to improve capital investment in the state and create more sustainable fiscal space for the state government. Its expected outputs were improved capacity for fiscal management, rationalized expenditures focusing on power subsidies, and improved revenue generation efforts. Power subsidy rationalization (or improved targeting of power subsidies), more specifically, was expected to include: (i) introducing normative free power requirements for agriculture and incentivizing efficient uses of power; (ii) segregating agriculture feeder lines and using the agriculture feeder data for subsidy calculation, (iii) introducing 100% feeder metering, (iv) introducing distribution meters, (v) introducing a system of power demand forecasting and management, and (vi) implementing a debt restructuring plan for the state power corporation. According to the project document, despite the state government’s “efforts to reduce input cost through various subsidies, including free power to farmers, Punjab’s agriculture is currently facing serious challenges. Moreover, power subsidies have led to an unsustainable development paradigm without matching growth in food-grain yields. Indeed, high power subsidies have led to overconsumption of water, resulting in a reduction of underground water reserves as the water table declines, necessitating the use of higher capacity pump sets, which, in turn, consume more power and result in higher power subsidies.” This has implication for climate change adaptation, especially as concerns the management of the state’s increasing water scarcity.

²² ADB. 2013. Report and Recommendation of the President: Proposed Loan to India for the Accelerating Infrastructure Investment Facility in India Program. Manila.

²³ ADB. 2014. Report and Recommendation of the President: Proposed Loan to India for the Karnataka Integrated Urban Water Management Investment Program. Manila.

37. **Supporting National Urban Health Mission** (approved in 2015). This sought to support the National Urban Health Mission's goal to improve the health status of the urban population, particularly the poor and vulnerable, across India. The expected outcome would be increased access to an equitable and high-quality urban health system, as evidenced by increased institutional deliveries and complete childhood immunization. More deliveries in health institutions, with their quality assured, were expected to help reduce deaths among mothers and newborns. Improved immunization coverage would also help avert infant and child mortality. These outcomes would be achieved through the following outputs: (i) strengthened urban primary health care delivery system; (ii) improved quality of urban health care services; and (iii) strengthened capacity for planning, management, innovation, and knowledge sharing. The specific links to climate change are not mentioned in the project document,²⁴ however, other than an apparent assessment that it would have a "low" impact on project implementation.

38. **Orissa Integrated Irrigated Agriculture and Water Management Investment Program** (tranche 1 approved in 2008 and tranche 2 in 2015). The expect impact was enhanced rural economic growth and reduced poverty in existing irrigation system areas within four northern river basins and a part of the Mahanadi River Delta, and institutionalization of participatory irrigation management-based agricultural growth. The expected outcome was enhanced productivity, water use efficiency, sustainability of irrigated agriculture, and improved performance of irrigation service delivery and water resource management with empowered water user associations progressively taking over operation and maintenance roles. One subcomponent would support (i) studies to assess appropriate IWRM functions and institutional arrangements for setting up a commission for water tariff fixation and other regulatory functions such as water allocation and entitlement; (ii) preparation of multisector river basin plans with establishment of participatory river basin organizations, initially in the Baitarani River basin as a pilot; (iii) strengthening of the hydrological database and decision support systems; and (iv) staff training on IWRM, basin planning, and associated analytical methodologies. In addition, one of the program's special features was that, in contrast to conventional projects, it would have "a specific focus on extending field channel networks (to convert field-to-field flood irrigation into a more efficient plot-to-plot irrigation through channel turn-outs) and promoting conjunctive use of groundwater, as essential elements for improving water-use efficiency, crop intensification, and diversification," according to the program document.²⁵

²⁴ ADB. 2015. Report and Recommendation of the President: Proposed Loan to India for Supporting National Urban Health Mission. Manila.

²⁵ ADB. 2015. Report and Recommendation of the President: Proposed Loan to India for the Orissa Integrated Irrigated Agriculture and Water Management Investment Program. Manila.

APPENDIX 2: INDIA'S CLIMATE CHANGE-RELATED TECHNICAL ASSISTANCE PORTFOLIO, 2007–2015

- 1. Energy Efficiency Enhancement in the Power Generation Sector** (approved in 2007). This TA aimed to assist state utilities in preparing Clean Development Mechanism (CDM)-eligible energy efficiency projects in the thermal and hydro power generation subsectors, which would enhance efficiency rates and reduce greenhouse gas (GHG) emissions of existing power plants by replacing old units with more efficient new ones. Such projects were expected to generate verified emission reduction (VER) credits, which could be sold in voluntary carbon markets. The TA was also expected to include assistance for carbon benefits in green energy generation projects. The total cost of the TA was estimated at \$1.3 million, of which ADB would finance \$1 million.
- 2. Facilitating the Operations of the Energy Conservation Fund “Energy Smart” in Madhya Pradesh** (approved in 2008). The TA would facilitate the energy efficiency program of Madhya Pradesh by financially supporting initial stage operational activities of the Energy Conservation Fund (ECF). It would enable the ECF to be financially stable in the first 5 years and self-sustaining thereafter. It was expected to encourage commercial banks and financial institutions to overcome barriers to financing energy efficiency projects, and to produce a model that would reportedly facilitate implementation of energy conservation measures in Madhya Pradesh. The TA was estimated to cost the equivalent of \$2.1 million, which would be financed by a \$1.7 million grant from the Second Danish Cooperation Fund for Renewable Energy and Energy Efficiency in Rural Areas administered by ADB.
- 3. Study on Cross-Sectoral Implications of Biofuel Production and Use** (approved in 2009). The impact of this policy and advisory TA was expected to be improved energy security and low carbon energy sector development through appropriate bioenergy interventions. The indicators would be a reduction in projected oil imports and greenhouse gas emissions. The total cost of the TA was estimated to be \$625,000, of which \$500,000 would be financed on a grant basis by ADB’s TA funding program.
- 4. Support for the National Action Plan on Climate Change** (approved in 2009). The anticipated impact of this TA was enhanced resilience to climate change affecting vulnerable sectors and populations through strategic support to India’s NAPCC. The outcome of the TA was to be a preliminary Integrated Water Resource Management (IWRM) approach to climate adaptation, supported by government. Its expected outputs were: (i) studies in up to three pilot basins or sub-basins to develop strategy frameworks for addressing current and likely future scenarios of climate change; (ii) identification of intervention requirements, scope, and strategies to improve the efficiency of water systems and determine how improved efficiency may be applied to climate change adaptation; and (iii) provision of technical, institutional, and other expertise to identify requirements for establishing effective IWRM systems under likely climate change scenarios. The TA was estimated to cost \$925,000 equivalent, of which \$750,000 would be financed on a grant basis by the Climate Change Fund. A supplementary grant of \$200,000 was approved in December 2010.
- 5. Operational Research to Support Mainstreaming of Integrated Flood Management under Climate Change** (approved in 2012). The desired outcome was to improve knowledge for decision making and program implementation of integrated flood management (IFM). The TA was to undertake operational research to identify and test integrated flood mitigation and flood plain management strategies appropriate for India. These strategies would balance structural and nonstructural measures and provide the mechanisms for mainstreaming IFM at different government levels. The TA would study one focal sub-basin in depth and two secondary sub-basins in less detail. The study was to develop strategies and approaches appropriate for implementation in the focal sub-basin but which would also be replicable in other flood-prone sub-basins and states. The TA was estimated to cost the equivalent of \$1.45 million, of which \$1.25 million would be financed on a grant basis by the Government of the United Kingdom

and \$200,000 on a grant basis by the Multi-Donor Trust Fund under the Water Financing Partnership Facility, both administered by ADB.

6. **Climate Adaptation through Sub-Basin Development Investment Program** (approved in 2012). The TA for Support for the National Action Plan for Climate Change cited above produced a sub-basin profile and framework climate change adaptation plan for the Cauvery delta. The state was willing to implement the capacity development technical assistance outputs, including the road map and the investment strategy. This project preparatory technical assistance (PPTA) was deemed necessary to support modeling and other analysis recommended under that TA, and preparation of the investment program and project-1 in accordance with the standards and expectations of the government and the Asian Development Bank's (ADB).

7. **Climate-Resilient Coastal Protection and Management Project** (approved in 2014). The expected impact of this TA would be strengthened resilience of the Indian coast to the impacts of climate change. The anticipated outcome would be that climate change impacts are factored into coastal protection and management interventions in India. The TA would support mainstreaming of climate change resilience into coastal protection and shoreline management through carefully targeted measures, including (i) specialist support to the Sustainable Coastal Protection and Management Investment Program to incorporate climate change resilience in project 2 and 3 investments; (ii) preparation of officially endorsed climate change adaptation guidelines to be officially communicated to all maritime states and union territories; and (iii) successful implementation of pilot community protection subprojects. The investment program was designed to deal with immediate coastal protection needs and coastal instabilities through planning, design, and investment in environmentally and socially appropriate protection and management in the states of Karnataka and Maharashtra. The TA was estimated to cost \$2.05 million, of which \$2 million would be financed by a Global Environment Facility grant administered by ADB.

8. **Capacity Building of the Indian Renewable Energy Development Agency** (approved in 2015). The Indian Renewable Energy Development Agency (IREDA) is investing in clean and renewable energy projects and the TA was designed to help it use ADB funds. By improving IREDA's operating capacity and compliance, the TA would help it to mobilize development assistance more efficiently and effectively, catalyzing private sector investment and facilitating renewable energy development in India. The TA was estimated to cost \$1 million, of which \$750,000 would be financed on a grant basis by the Asian Clean Energy Fund under the Clean Energy Financing Partnership Facility (CEPF) administered by ADB.

9. **Strengthening Climate Change Resilience in Urban India** (approved in 2015). The expected overall impact of this TA would be that urban climate change resilience in selected states in India would be mainstreamed. The expected outcome would be the enhanced capacity of the government to successfully implement urban climate-change-resilient projects. The anticipated outputs included: (i) mainstreaming of climate change resilience in urban policies and plans; (ii) support for climate change resilience of infrastructure and project development; and (iii) strengthened institutional capacity, community awareness, and knowledge for sustaining climate-change-resilient cities. The TA outputs would be achieved by: (i) comprehensively assessing and selecting policy instruments which promote urban climate change resilience, (ii) conducting institutional and sector analyses, (iii) conducting risk and vulnerability assessments in selected cities, (iv) preparing city-level climate-change-resilience plans, (v) supporting feasibility studies for identified projects, and (vi) delivering climate change awareness programs. The TA was estimated to cost \$8.75 million, of which \$7 million would be financed on a grant basis under the Urban Financing Partnership Facility and administered by ADB.