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Viet Nam

Environment and Climate Change Assessment

Asian Development Bank

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Contents

Tables and Figures

Tables

Figures

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Currency Unit	=	dong (D)
D1.00	=	$0.00005
$1.00	=	D20,846.00

Abbreviations

ADB	–	Asian Development Bank
AFD	–	Agence Française de Développement
ANR	–	agriculture and natural resources
AusAID	–	Australian Agency for International Development
CCWG	–	Climate Change Working Group
CIF	–	Climate Investment Fund
DONRE	–	Department of Natural Resources and Environment
EIA	–	environmental impact assessment
GDP	–	gross domestic product
GHG	–	greenhouse gas
GMS	–	Greater Mekong Subregion
GMS EOC	–	GMS Environment Operations Center
ha	–	hectare
IFPRI	–	International Food Policy Research Institute
IMHEN	–	Institute of Meteorology, Hydrology and Environment
IPCC AR4	–	Intergovernmental Panel on Climate Change Fourth Assessment Report
km	–	kilometer
Lao PDR	–	Lao People's Democratic Republic
m^3	–	cubic meter
MARD	–	Ministry of Agriculture and Rural Development
MOC	–	Ministry of Construction
MOIT	–	Ministry of Investment and Trade
MONRE	–	Ministry of Natural Resources and Environment
MOT	–	Ministry of Transport
MPI	–	Ministry of Planning and Investment
MRC	–	Mekong River Commission
NGO	–	nongovernment organization
NTP-RCC	–	National Target Program to Respond to Climate Change
PMR	–	Partnership for Market Readiness
PRC	–	People's Republic of China
REDD	–	United Nations Collaborative Programme on Reducing Emissions from Deforestation and Forest Degradation in Developing Countries
SEA	–	strategic environmental assessment
TA	–	technical assistance
UNDP	–	United Nations Development Programme
UNFCCC	–	United Nations Framework Convention on Climate Change

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I Introduction

1. The Asian Development Bank (ADB) has approved its country partnership strategy for 2012–2015 to support the Government of Viet Nam (ADB 2012). The objective of this paper is to provide guidance to ADB's Viet Nam country program on applying ADB's corporate strategies on environment and climate change and responding to lessons learned in Viet Nam's operations to improve ongoing and future priority sector activities. The paper does not attempt to give a comprehensive scientific analysis of environment and climate change in Viet Nam; rather, it is a review of major environment and climate change issues in Viet Nam and their impact on socioeconomic development. It summarizes these major issues, reviews government initiatives to address them, and discusses ADB strategies for continued technical support and investment. The paper includes a discussion of sector risks and opportunities in the agriculture and natural resources (ANR), energy, health, transport, urban, and water sectors.

2. Viet Nam has made the transition from a centrally planned economy to a market-oriented system with unprecedented success. In 2010, Viet Nam's economy grew by 6.8% (ADB 2011a), supported by a recovery in the global economy, accommodative monetary policy, and consumption growth. In 2010, per capita income rose to above $1,000 per annum, and by 2008 poverty levels had fallen to 14% from 60% in 1993. Viet Nam became a member of the World Trade Organization in January 2007. In 2010, the country achieved low middle-income status (ADB 2011c).

3. A key challenge for Viet Nam is to manage its rapid economic development in a sustainable manner and to prevent adverse impacts of environmental degradation and climate change. Industrialization, urbanization, and agricultural intensification have had harmful effects on air, land, and water, and have far-reaching implications for the energy and transport sectors leading to increased greenhouse gas (GHG) emissions and reduced resilience to climate change.

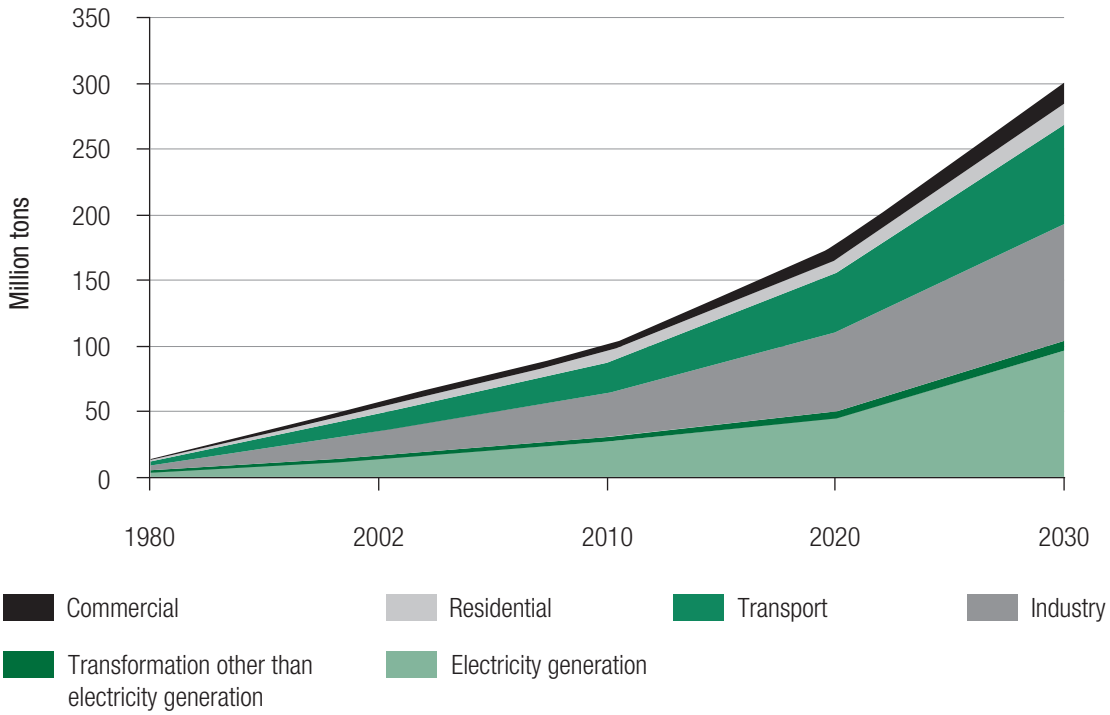
4. Viet Nam is extremely vulnerable to climate change impacts given its extensive coastline and river deltas, and highlands that have poor water retention capacity and are susceptible to severe erosion. Reducing environmental degradation and improving resilience to climate change can have mutually reinforcing benefits for sustainability if effectively managed. Adaptation planning to improve resilience should contribute to ecological sustainability—acknowledging that long-term resilience is built on resilient natural systems—and not simply increase the capacity of infrastructure to absorb more damage.

II Environment and Climate Change in Viet Nam: Issues and Challenges

A. Drivers of Environmental Degradation and Climate Change

5. **Industrialization.** Industrialization has intensified contributing to 2 decades of strong economic growth fueled by intense exploitation of natural resources. In 2008, industry's share of gross domestic product (GDP) reached 40% while agriculture's share declined to 22%. Viet Nam's industrial growth has driven annual increases in energy consumption, and corresponding GHG emissions (Figure 1). In 2008, growth in energy consumption was 11.3%, a consistent trend over the past decade (Asia Pacific Energy Research Centre 2011). Energy consumption comprises primarily oil and coal, and amounts to 28,479 kilotons of oil equivalent. In contrast to the People's Republic of China (PRC), where energy intensity is decreasing, the energy intensity of Viet Nam's economy has risen 4% annually since 1990

Figure 1 Carbon Dioxide Emissions in Viet Nam by Sector, 1980–2030



Source: Asia Pacific Energy Research Centre. 2006. *APEC Energy Demand and Supply Outlook 2006.* Tokyo.

(ADB 2009a). Due to the growth trend in total energy use and the heavy dominance of fossil fuels, national GHG emissions, 177 tons of carbon dioxide equivalent in 2005, are projected to triple by 2030 (World Bank 2011a).

6. **Urbanization.** Viet Nam is undergoing one of the fastest urban transitions in the world. It is the main driving force for economic growth. Viet Nam is home to 85 million people, of which 27% live in urban areas. That number is expected to increase to 45%, or 46 million people, by 2020 and to 50% by 2030. Cities already account for 70% of gross national product. Aggregate population growth is not high, but people are moving rapidly to urban centers and leaving agriculture for industry and services (World Bank 2011a). Urbanization for residential dwellings and industrial expansion focuses on lowland areas that are optimal for high-value agricultural production. According to the Ministry of Labour – Invalids and Social Affairs, Viet Nam was losing 73,300 hectares (ha) of cultivated land annually between 2001 and 2005 due to urbanization, affecting the lives of 2.5 million farmers.[1]

7. The rapid growth of industry and urban expansion have meant that the absolute levels of land, water, and air pollution are rapidly increasing. Untreated domestic, hospital, and industrial wastewater, poor urban drainage, and an expansion in the use of rivers, lakes, and ponds as dumping grounds for solid waste has seriously affected water quality through increases in the concentration, toxicity, and variety of pollutants (International Center for Environmental Management 2007). Air pollution is worsening with increasing costs and harm to public health and the environment. Some 667,000 tons of sulfur oxides, 618,000 tons of nitrogen oxides, and 6.8 million tons of carbon monoxide are generated annually in Viet Nam (Ministry of Environment 2011). There is a strong correlation between the sharp rise in absolute levels of nitrogen oxides and sulfur oxides emissions and increased GDP. Particulate matter is also a problem affecting public health (World Health Organization 2005). An initiative to grade Asian cities for air quality ranked Ha Noi's particulate problem as worse than that of Bangkok but better than those of Jakarta and Manila (Clean Air Initiative 2010).

8. **Agricultural intensification and encroachment.** Land use intensity is high, with yields above the mean level for Asia and an average of nearly two rice crops per year. Much of this intensity is achieved through high applications of agricultural inputs. Pressure to develop land and the conversion of marginal lands previously regarded as unsuitable for agriculture, with consequent deforestation and over-intensive land utilization is leading to greater levels of soil erosion and reduced soil fertility. High-intensity rainfall, suboptimal irrigation techniques, and a lack of incentives for farmers to adopt sustainable natural resources management lead to high levels of soil loss and pesticide and fertilizer runoff, which result in decreased productivity, and groundwater and surface water contamination.

9. Pressure to further intensify agriculture is increasing as arable land decreases. During 2000–2007, the total area under rice cultivation declined by 6%, or 360,000 ha, mostly due to rapid industrialization and urbanization (ADB 2010a). The land area allocated to rice production is projected to drop by nearly 10% by 2030, to 3.8 million ha. While current rice yields in Viet Nam are high compared to those in other Southeast Asian countries, yields have begun to stagnate at about 4.7 tons/ha (International Food Policy Research Institute 2010).

10. Viet Nam has seen a total transformation of the forest landscape since *Doi Moi*.[2] The combined forces of industrialization, urbanization, and agricultural encroachment have reduced forest cover. During 2000–2010, official figures show an increase in forest area, but this is due to increases in plantation forest and poor quality secondary forest. Intense exploitation and conversion led to a cover

[1] Ministry of Labour – Invalids and Social Affairs website – Job creation for agricultural workers in urbanization and industrial zone development, 31 March 2008.

[2] *Doi moi* is the Vietnamese phrase describing the economic reforms initiated by the government in 1986 to transition toward a socialist market economy.

decline from 43% in 1943 to about 27% in 1990; but this then rose, approaching 40% in 2009. The loss of mangrove forests has been and continues to be particularly acute. Mangrove cover has declined from 400,000 ha in 1943 to less than 60,000 ha in 2008 (World Bank 2011a). Terrestrial and aquatic biodiversity continues to decline undermining climate resilience.[3]

B. Viet Nam's Natural and Mineral Resources

11. **Biophysical resources.** About 80% of land in Viet Nam is categorized as tropical lowlands, hills, and densely forested highlands, with approximately 39% of the country classified as forest by the Ministry of Natural Resources and the Environment (MONRE) (2008). Level land suitable for high-intensity crop production makes up less than 20% of the total land surface area, and all of it is located in the Red River Delta in the north, the Mekong River Delta in the south, and the coastal lowlands.

12. Viet Nam ranks 16th worldwide in terms of species richness (World Conservation Monitoring Centre 1992 and World Bank 2011b). Biodiversity contributions to the economy are significant in agriculture, fisheries, and tourism. However, overextraction, continuing loss of species, and damage to natural systems has had significant economic impacts. One estimate suggests that gross national savings as a percentage of GDP should be adjusted downward from 35.5% to 15.2% if natural asset depletion were fully taken into account (World Bank 2011b). Biodiversity damage is especially evident in Viet Nam's forests. Viet Nam has about 10 million ha of natural forest, of which 2 million ha is special use forest (analogous to protected areas), 5 million ha is protection forest (for watershed and coastal protection), and 6 million ha is production forest (plantations and natural forests for production). Only 500,000 ha of primary forest remain, located mostly in the Central Highlands. Much of Viet Nam's forest land is of relatively poor quality, consisting of a mix of exotics and native species in plantation settings.

13. Viet Nam has a 3,200-kilometer (km) coastline. Its coastal waters are home to 11,000 different known species, which are supported by undersea currents that meet off the coast to form nutrient-rich upwellings. Fish and shellfish make up a large part of the protein in the diet of the Vietnamese people, and fisheries contribute directly to livelihoods. However, overfishing is a growing problem. In response, the government has already shortlisted 16 marine protected areas and established 4 of these; however, enforcement of fishing regulations is often weak. The freshwater ecosystems are extensive and not well understood. With extensive hydropower and irrigation reservoir development throughout Viet Nam, including some small basins with hundreds of dams, freshwater biodiversity is in decline without monitoring and management programs in place or even complete knowledge of what is being lost.

14. **Energy resources.** Viet Nam has significant energy resources, with proven reserves of 615 million tons of crude oil, 600 billion cubic meters (m^3) of natural gas, and 5,883 million tons of coal (Asia Pacific Energy Research Centre 2011). It is the third largest petroleum producer in Southeast Asia after Malaysia and Indonesia. Most natural gas and petroleum production occurs off the southern coast of Viet Nam, although a recent discovery of 50 billion m^3 of natural gas at the Hac Long field in the Red River Basin is leading to increasing development in the north of Viet Nam. The development of reserves located around the Spratly Islands is complicated by ongoing territorial disputes with the PRC.

15. **Water, hydropower, and aquaculture.** A total of 60% of Viet Nam's total river flow and 95% of the Mekong River's flow originates from outside its borders causing increasing water insecurity. Investments in water resource–dependent developments, particularly those with long-term time horizons for return on investment, are constrained by variability in water supply. Upstream damming of

[3] Recent studies have shown the benefits of maintaining mangroves for building flood resilience in coastal communities in the Mekong Delta. Pilot investments from the Australian Agency for International Development (AusAID) and GIZ are supporting community-based adaptation efforts that include mangrove replanting.

the Mekong River in the PRC for hydroelectric power is already affecting flows and sediment deposition in the Mekong Delta. Similarly, intensive hydropower development in Viet Nam is having significant effects on water flow and quality with impacts on agriculture, fisheries, industry, and biodiversity (ICEM 2010). Large-scale deforestation and reduction in forest density for conversion to plantation monoculture impacts evapotranspiration and alters stream flows reducing water availability. Current average annual countrywide water availability is 9,800 m^3 per capita, although there are significant regional variations due to local microclimatic and geological conditions. In some basins, demand will exceed supply by 2020 based on current rates of development and water resource projections (ADB 2009b).

16. Viet Nam has abundant groundwater resources and an estimated total renewable potential of 63 billion m^3 per year; however, it is subject to countrywide variations. High-yielding aquifers are located near the Red River, the Mekong River, and the coastal plains. Some aquifer levels have shrunk by as much as 30 meters in Ho Chi Minh City and Ha Noi due to overuse, causing land subsidence and water shortages (ADB 2009d). In areas with naturally forming arsenic, such as in the Red River Delta, overextraction can contribute to increased contamination of shallow wells. Expansion of brackish aquaculture, particularly in the Mekong Delta, has led to contamination of groundwater from both seawater and pollution from aquaculture inputs.

17. **Agriculture.** Approximately 28% of Viet Nam's total land area is suitable for agriculture, although there are significant variations by region, with the highest production capacity in lowland areas. The agriculture sector is dominated by rice production, which comprises approximately 75% of total national crop production value. Viet Nam is the world's second-largest rice exporter after Thailand. Other significant crops include coffee, tea, rubber, and cashews. Viet Nam is the world's largest producer of pepper. The export market is constrained by insufficient infrastructure, particularly non-trunk road quality and penetration, as well as limited port capacity and efficiency. Export value and revenue is also limited as most products leave the country as bulk commodities due to the limited processing in Viet Nam.

C. Predicted Climate Threats

18. In recent years, numerous studies have been undertaken to determine the scope and extent of predicted climate change threats in Viet Nam. Owing to their relative higher vulnerability (density of human population and economic activity), most of the studies have focused on the Mekong Delta, and to a lesser extent the Red River Delta. These studies have employed a variety of tools, models, and approaches.

19. The studies' key findings show Viet Nam's acute vulnerability to sea-level rise, temperature increases, precipitation changes, and extreme weather events. Viet Nam's Second National Communication under the United Nations Framework Convention on Climate Change summarizes the key studies conducted prior to 2010 and constraints to applying this knowledge. Table 1 gives a snapshot of the studies reviewed for this paper. A brief review of this literature is included in Appendix 1.

20. MONRE (2010) summarizes limitations, constraints, and capacity-building needs that Viet Nam faces in assessing and adapting to the impacts of climate change (and also GHG mitigation). These include the following:

- The application of the MAGICC/SCENGEN 5.3 model in the development of climate change scenarios, which produces low-resolution grid maps (300 km × 300 km) and makes it difficult to accurately reflect the local specificities of climate change in Viet Nam.
- The database for impact assessments and adaptation cost–benefit analyses is incomplete.
- There is currently a lack of in-depth analysis to distinguish and assess impacts induced by climate change from other natural phenomena (e.g., El Niño and the Southern Oscillation).

Table 1 Key Climate Change Scenario and Impact Assessment Studies

Author	Year	Title
MONRE	2003	Vietnam Initial Communication to the UNFCCC
IPCC	2007	Fourth Assessment Report (AR4)
Carew-Reid	2007	Rapid Assessment of the Extent and Impact of Sea Level Rise in Vietnam
SIWRP	2008	Study on Climate Change Scenarios Assessment for Ca Mau Province
Eastham et al.	2008	Mekong River Basin Water Resources Assessment: Impacts of Climate Change
MONRE	2009	Climate Change, Sea Level Rise Scenarios for Vietnam
ISPONRE	2009	Vietnam Assessment Report on Climate Change
IMHEN	2010a	Impacts of Climate Change on Water Resources and Adaptation Measures
IMHEN	2010b	Sea Level Rise – Scenarios and Possible Risk Reduction in Vietnam
MONRE	2010	Vietnam's Second Communication to the UNFCCC
MONRE	2012	Climate Change, Sea Level Rise Scenarios for Vietnam

IMHEN = Institute of Meteorology, Hydrology and Environment; IPCC = Intergovernmental Panel on Climate Change; ISPONRE = The Institute of Strategy and Policy on Natural Resources and Environment; MONRE = Ministry of Natural Resources and Environment; SIWRP = Southern Institute for Water Resources Planning; UNFCCC = United Nations Framework Convention on Climate Change.

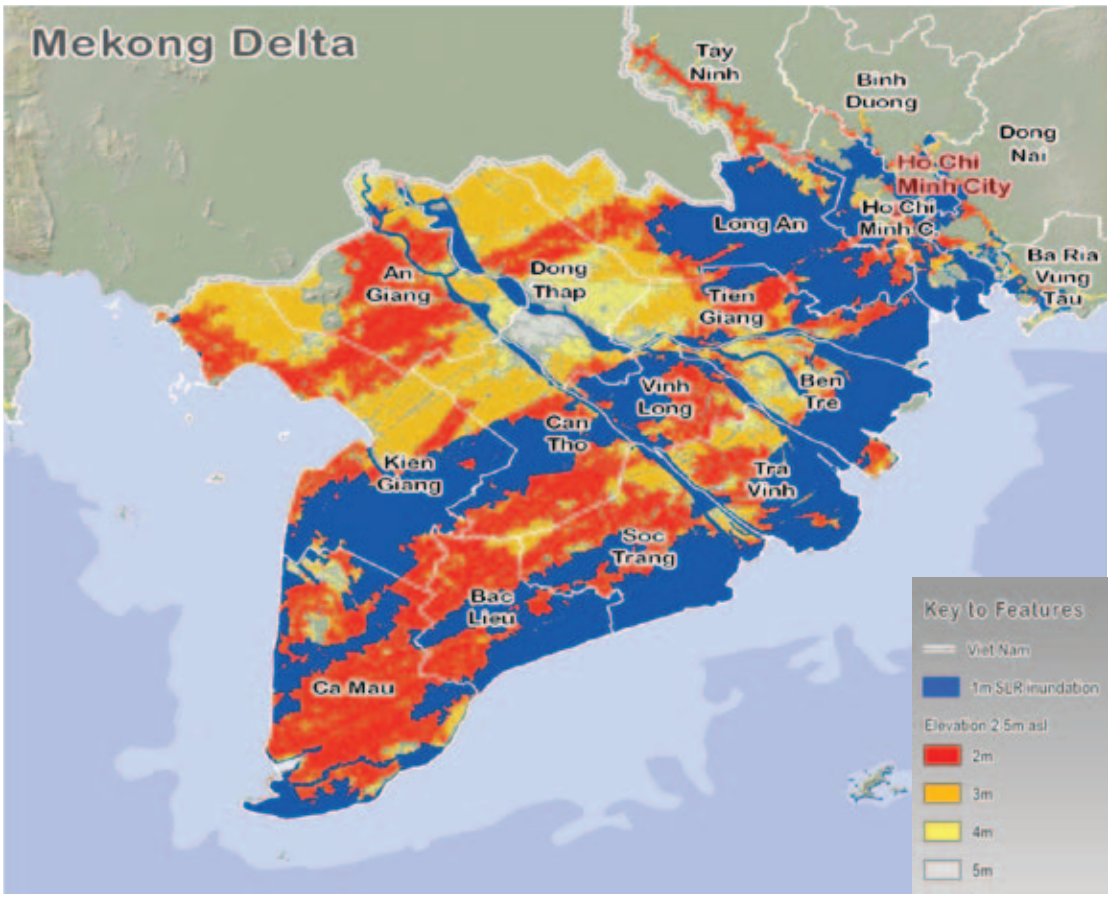
Source: ADB.

- Impact assessment and adaptation response development models and tools are insufficient, in particular for cross-sector or interregional assessments.
- There is a shortage of technical experts capable of running studies focused on climate change impact assessment and adaptation strategies.
- The current hydro-meteorological observation network is insufficient and inadequately distributed across climate zones and therefore unable to meet the demands for climate monitoring and/or early disaster warning.
- Broad national and/or multi-sector studies that assess climate change impacts and develop adaptation measures for the most vulnerable sectors and ecosystems have not been conducted.
- Climate change education, training, and awareness-raising plans and programs are unavailable at the national level.

21. It is necessary to assess the level of climate change–related technological and analytical needs at the ministerial, agency, and provincial levels. Technical experts and professionals in Viet Nam need to be trained in order to facilitate the prompt and successful adoption of new climate change-related technologies. More importantly provincial and district officials must understand the implications of applying or not applying climate change-related technologies in their work. Furthermore, Viet Nam would benefit from a review of how existing guidance could be applied to minimize climate risks identified by the above analyses.

22. **Recent or ongoing studies.** Comprehensive climate scenario modeling work, which represents an update to the scenarios produced in MONRE (2009), has recently been completed by the Institute of Meteorology, Hydrology and Environment (IMHEN). The latest MONRE scenarios give further insight into the wider band of climatic variability predicted for Viet Nam. The 2012 reports show average temperature increases from 1.9°C–3.1°C over large parts of the country with most extreme increases in the Central Region from Ha Tinh to Quang Tri of more than 3.1°C. Worth noting is that days with temperatures above 35°C are predicted to increase by 10–20 days in large parts of the country. Furthermore, changes in precipitation show the risk of drought rising in the South and North Central Coast regions during the dry season. The combination of sea-level rise and increased precipitation in

Figure 2 Areas under Inundation in the Mekong Delta Region of Viet Nam in 2100 under an Assumed 1.0-Meter Sea-Level Rise



asl = above sea level, m = meter, SLR = sea level rise.

Note: The Ministry of Natural Resources and Environment (2009) has projected a rise of 100 centimeters (compared with the 1980–1999 period) by 2100 under the A1F1 Scenario. While the Government of Viet Nam applies the more conservative B2 Scenario, the A1F1 Scenario is consistent with current global emissions patterns and relevant for long-term planning.

Source: J. Carew-Reid. 2007. Rapid Assessment of the Extent and Impact of Sea Level Rise in Viet Nam, Climate Change Discussion Paper 1. Brisbane, Australia: International Center for Environmental Management.

the rainy season, on the other hand, increase the risk of extreme events countrywide, and in particular in the Mekong River Delta (Figure 2). Specific impacts on socioeconomic development are discussed in the next section. Studies have employed a variety of tools, models, and approaches. In 2012, MONRE published this work in Vietnamese and English under the title *Climate change, sea level rise scenarios for Viet Nam*. IMHEN, with support from the Commonwealth Scientific and Industrial Research Organisation will produce more precise regional and provincial modeling for Viet Nam in 2013.

D. Impact of Climate Change on Development

23. **Human impacts.** Climate change is expected to worsen the already worrisome impacts of natural disasters on the population of Viet Nam, which are felt primarily by the poor and vulnerable, especially women, children, and the elderly. Four main sources of health impacts are (i) extreme weather events causing injuries and deaths, water contamination, infectious diseases, food shortages, and mental

health problems; (ii) droughts and heavy rainfall causing significant reductions in crop yields and productivity of subsistence agriculture, which may lead to malnutrition, micronutrient deficiencies, or, in more extreme cases, starvation; (iii) an increase in the number of very hot days in large cities, along with forest fires and dust storms adversely impacting air quality over broad areas (both urban and rural) and exacerbating the occurrence and intensity of health complications associated with high temperatures (e.g., heat stroke) and respiratory diseases (e.g., asthma); and (iv) changes in temperature and rainfall patterns impacting not only the occurrence of vector-borne diseases such as malaria and dengue, but also changing and possibly extending the geographical habitat of the vectors of such diseases (ADB 2011d).

24. In addition, sea-level rise and more frequent extreme weather events are expected to increase climate-induced migration. Various studies have estimated the impacts of climate change on migration in Viet Nam, including a recent multiagency study that estimated that a 1 m sea-level rise could displace more than 7 million residents and flood the homes of more than 14.2 million residents in the Mekong Delta as well as submerge half of the region's agricultural land (Warner et al. 2009). Relocation of human settlements and agricultural production on this scale would require a concerted government response to respond to ensuing health, economic, and safety concerns.

25. **Water resources.** Altered precipitation patterns will lead to less reliable and reduced river flows during dry periods. Further pressure on the water supply will come from the projected increases in evaporation from paddy fields that are brought on by climate change. The agriculture, industry, and energy sectors will be negatively impacted at times of reduced water availability, and they will be forced to compete for limited water supplies. In 2020, water use is expected to increase to 120 billion m^3 from 2008 consumption of about 80 billion m^3 (ADB 2009). Upstream–downstream water management issues will become acute with climate change. For example, the development of upstream hydropower can affect flow and sediment deposition patterns for downstream irrigation and agriculture, especially in the Mekong and Red river deltas. There are increasing but poorly understood effects on agricultural productivity due to constraints on water access for irrigation during the dry season and reduced sediment deposition on agricultural lands from irrigation and floodwaters.

26. The implications of climate change for the relationship between the energy and agriculture sectors requires thorough analysis. Hydropower generates a third of Viet Nam's electricity, and agriculture accounts for 80% of the surface-water consumption (ADB 2009b). With increases in energy demand to supply urban and industrial centers, conflicts over water management are likely to increase. Much of the potential shortfall in absolute water supply is a consequence of inefficiencies in rural and urban water management practices and suboptimal water utilization. Water loss in Asia is estimated to cost between $9 billion and $10 billion per year (ADB 2011b) and includes a large component of wasted energy to pump it. Low flows may also magnify the effects of surface water contamination and render some surface water unsuitable for agricultural and human use.

27. **Agriculture.** In 2050, total GDP could be reduced by 0.7%–2.4% as a result of climate change impacts on agriculture (World Bank 2010). Some 1.1 million ha, or 70% of land under cultivation in the coastal areas, are threatened by a sea-level rise of 1 m and resulting saltwater intrusion, of which more than 930,000 ha is in the Mekong Delta. Kien Giang is the most affected province, with almost 75% of its cultivation land being threatened (IMHEN 2010). The International Food Policy Research Institute (IFPRI) projects the impact of a sea-level rise of 1 m to be greater, resulting in over 2 million ha of lost land for crop cultivation (ADB and IFPRI 2009). By 2030, rising sea levels in the delta would expose 45% of the land to extreme salinization and crop damage, with rice productivity falling by 9% (United Nations Development Programme 2007). Also, climate change will affect temperature and precipitation patterns, both with a direct effect on crop production and indirect effects through changes in irrigation water availability and potential evapotranspiration.

28. Table 2 provides a summary of potential impacts of climate change in Viet Nam.

Table 2 Predicted Climate Change Impacts in Viet Nam

	Climate Change and Natural Disaster Impacts
Short term	• Increased number and severity of typhoons striking Viet Nam, leading to loss of life and large-scale damage to property and infrastructure. Recent natural disasters: ▸ Typhoon Linda (Nov 1997): 3,111 casualties and more than 1 million people affected, approximately 77,000 houses destroyed ▸ Central Viet Nam Flood (Nov 1999): 749 casualties, destroyed 49,094 houses ▸ Tropical Storm Kammuri (Aug 2008): hit Northern Viet Nam, causing heavy rains and storm wind, and subsequent floods and landslides; 133 casualties with 34 missing, 990 houses destroyed • Reduced productivity of coastal fisheries • Reduced agricultural land and productivity in coastal and other areas prone to flooding and erosion
Medium term	• Increased migration of people from susceptible areas, especially in mountainous and delta regions and in floodplains of large rivers, due to more frequent and extensive flooding • More frequent outbreaks and spread of old and new diseases due to more regular flooding and more intensive wet season • More extensive saline intrusion reducing water quality for agriculture, drinking, and industrial uses due to reduced dry season rainfall and flow along with sea-level rise • Increased energy and water consumption due to increases in temperature
Long term	• Permanent inundation of coastal and low-lying areas due to sea-level rise • Permanent losses of land for cultivation and aquaculture due to increased intensity and duration of drought periods in some areas • Changes in the ecosystems and failure of some agricultural crop species due to increased temperatures

Source: Adapted from Mekong River Commission. 2009. *Climate Change Adaptation in the Lower Mekong Basin Countries, Regional Synthesis Report*. International Centre for Environmental Management, Ha Noi.

29. **Energy.** Viet Nam's growing population, rising living standards, and overall pace of development are driving increased energy demand, with per capita energy consumption projected to reach 5,400 kilowatt-hours by 2030 from 985 kilowatt-hours in 2010. The share of electricity consumption is 52% from industry, 39% from residential areas, and 8% from agriculture. The large increase in energy demand and requisite infrastructure investment required to satisfy energy needs in an environmentally sustainable manner pose a significant challenge, especially as climate change takes hold. Increased temperatures and reduced dry season rainfall will increase power demand for cooling and pumping. Medium-term government plans to meet these growing needs include a mix of new coal and hydropower projects. Hydropower has GHG emission benefits compared to other energy options, but it has serious implications for competing water uses and for biodiversity. Coal usage, promoted by controlled pricing, will increase GHG emissions and further reduce air quality even with plans to utilize more efficient technology.

30. A clean, affordable, and reliable power supply is needed to meet the energy demand and minimize environmental impacts. Current plans estimate that energy demands by 2015 will be met through coal, hydroelectricity, and natural gas, and increasingly supplemented by nuclear and renewable energy sources such as solar, wind, and small-scale hydropower. The Government of Viet Nam has committed to market-oriented pricing that would reduce the demand for coal compared to cleaner-burning natural gas and other energy sources.

31. **Transport.** During 2001–2005, extreme weather events cost the transport sector D2,571 billion in damage. If mean sea level rises by 1 m, MONRE estimates that 11,000 km of roads could be submerged. The total length of national highways threatened would be 695 km, including 495 km in the Mekong Delta alone (MONRE 2010). About 4.3% of existing national and local roads would be permanently submerged with a sea-level rise of 1 m, including 574 km of dikes. Almost 90% of affected road infrastructure is in the Mekong Delta region, most in Soc Trang, Kien Giang, Bac Lieu, and Tra

Vinh provinces (Carew-Reid 2007). At the same time, GHG emissions from the transport sector are expected to triple between 2010 and 2030 (MONRE 2010).

32. **Industry.** A recent study suggests that if Viet Nam experiences a 1 m rise in sea level, manufacturing enterprises in 20 provinces would be inundated. Most provinces with large numbers of firms affected are in the Mekong River Delta and southeast regions, which contribute 56% of national industrial production by value.[4] In Long An Province, 100 enterprises would be inundated. Close to 500 large and medium-sized enterprises would be affected in Ho Chi Minh City. Many of the 24,000 small manufacturing enterprises operating in the city would also be affected; most are located in areas that are already vulnerable to inundation. Ho Chi Minh City has 16 industrial estates that would be affected; 9 of them would be inundated and the others would be within reach of storm surges. In the southeast region overall, 55 industrial estates would either be inundated or at high risk of disruption due to storm surges and other impacts related to sea-level rise (Carew-Reid 2007).

33. The same study points out that damage to industrial enterprises and estates is critical with respect to lost production, property, and revenue, as well as toxic contamination. There are many seriously polluted areas, including land areas, lakes, ponds, and river beds and banks, where concentrations have accumulated over many years. The implications for fisheries, water quality, and public health of having contaminated sites inundated due to sea-level rise and storm surges have not been analyzed but are likely to lead to substantial economic and social impacts (International Center for Environmental Management 2007a).

34. **Urbanization.** Climate change and environmental degradation will impact urban development. The ADB *Ho Chi Minh City Adaptation to Climate Change* study analyzed climate impacts on Ho Chi Minh City, where half of the land area is less than 1 m above sea level (ADB 2010). The rapid urbanization of low-lying areas will increase the amount of assets at risk from extreme events. This is of national concern as Ho Chi Minh City accounts for 23% of Viet Nam's total GDP. Urbanization and infrastructure projects will be increasingly disrupted by inundation in low-lying areas as hard surfaces proliferate, reducing infiltration. Effective management of runoff during higher intensity inundation events will become a more pressing issue. The urban poor will be increasingly vulnerable to extreme events because they live in areas most at risk typically along canals and riverbanks, and in swampy coastal lands.

35. **Forest and biodiversity loss.** The impacts of predicted temperature increases are likely to have significant effects on land, forest, and biodiversity. The relationships are complex but, with other development pressures, many areas and natural systems will be negatively affected due to a lack of adaptive capacity. The degradation of mangrove systems, for example, is likely to increase due to more frequent forest fires and the lack of undeveloped areas that would allow the ecosystem to shift inland. Mangrove loss will make coastal fishing communities more vulnerable to extreme events. Sea-level rise, combined with other climate change and development influences, will increase saltwater intrusion and degrade freshwater resources, reducing the viability of agricultural land. A 1 m mean sea-level rise in the southern region could permanently inundate 300 km^2 of mangrove forest, corresponding to 15.8% of the total national mangrove forest area (MONRE 2010).

36. Plant species composition is likely to alter due to changing climate conditions, causing shifts in ecoclimatic zones, and increasing prevalence and influence of invasive exotic species. Higher demand for timber products and the conversion of forests to cropland will impact forest sustainability and biodiversity. The degradation of the quality of forestry resources and of biodiversity will disproportionately affect the poor, women, and minority groups who are most dependent on subsistence forestry practices. Perhaps the most serious losses of biodiversity will occur in aquatic systems both freshwater and marine; but so little is

[4] Information on the manufacturing sector of Viet Nam is available through the World Bank/International Center for Environmental Management country environmental analysis, which uses provincial level information from the General Statistics Office enterprise survey of 2004 (International Center for Environmental Management 2007a).

known about them that current losses due to hydropower and other development and future losses due to climate change will largely go unnoticed except by local communities dependent on them.

E. Transboundary Issues Linked to Environmental Management and Climate Change

37. **Management of the Mekong River and Red River.** A high-priority transboundary issue linked to environmental degradation and climate change will be the management of the Mekong River and Red River. With decreasing water availability due to shifting seasonal precipitation patterns and upstream hydropower, agricultural, and urban development, tensions between riparian countries may increase over water allocation, management, and quality. In addition, forest and land degradation pressures are likely to continue along Viet Nam's borders, affecting transboundary protected areas with the Lao People's Democratic Republic (Lao PDR) and Cambodia due to increasing economic activity and demographic changes. Commitment to regional power transmission and transport connectivity is a growing issue throughout the Greater Mekong Subregion (GMS), with extensive infrastructure, and cumulative environmental and social implications that require strategic planning and assessment.

38. **Management of shared natural resources.** Important transboundary environmental concerns include water flow and quality, sediment transport, wildlife trade and biodiversity conservation, timber extraction, fisheries, and air pollution. In most situations, those issues are dealt with through bilateral relations. There are a number of regional forums that include consideration of transboundary natural resource and environmental issues, such as the Association of Southeast Asian Nations, the ADB–GMS consultative planning forum, and the Mekong River Commission (MRC). Yet, they have not had a convincing or systematic influence, as countries have been reluctant to compromise national sovereignty over development rights and controls. This lack of genuine collaboration on transboundary environmental issues may be changing. In recent years, there have been cases where upstream development has caused such social and political concern in downstream countries that the MRC in particular has gradually begun to show potential as a regional facilitator and moderator in environmental and resource use matters.

39. **Hydropower development.** The current conflict and negotiations over the proposed development of 12 hydropower projects on the mainstream Mekong River is the most important transboundary case to date and one that is testing as never before the arrangements for dialogue and resolution of shared resource use and management. Already, the PRC—one of six Mekong riparian countries—has dammed the upstream portion of the river with the first four projects in a planned cascade of up to eight storage hydropower schemes. This unilateral action and its potential environmental consequences have caused great concern among lower Mekong countries. With the Lao PDR pressing to proceed with mainstream development, the MRC member countries are faced with the most significant strategic decision ever made affecting the Mekong River.[5] The proposed damming of the Mekong River would have negative effects on downstream water availability, and sediment and nutrient supply, potentially reducing the size and shape of the Mekong Delta. Impacts on agriculture and freshwater and marine fisheries would reduce the capacity of farmers and fishers in the Tonle Sap and delta region to adapt to the impacts of climate change.

[5] The MRC's full procedure for notification, prior consultation and agreement was triggered for the first time on 22 September 2010 with the official notification from the Lao PDR of the proposed Xayaburi mainstream project. The mainstream hydropower project proposals are an important test for the procedure and regional cooperation in implementing the 1995 Mekong Agreement. To support informed decision making, the MRC commissioned a strategic environmental assessment (SEA) of the 12 proposals—the first SEA to be conducted by the MRC. It recommended a 10-year moratorium on mainstream development while effective mechanisms and capacities for management and regulation of transboundary issues were put in place, in addition to building and more complete understanding of its environmental implications. ADB is about to conduct a second SEA, this one on the GMS energy and transmission plan, which provides another important opportunity for enhancing regional collaboration on the management of shared resources.

III Institutional Framework for Environment and Climate Change

40. The **National Council of Sustainable Development** was established in 2005 to steer implementation of the Strategic Orientation for Sustainable Development in Viet Nam (Vietnam Agenda 21) (Table 3). The Deputy Prime Minister serves as the chair of the council, which includes about 50 members from line ministries, the private sector, and unions. The Ministry of Planning and Investment (MPI) provides secretariat functions for the council. It operates to organize and facilitate cross-sectoral and cross-regional activities in terms of development planning and effective implementation of Vietnam Agenda 21 by all arms and levels of government.

41. Environment and climate change initiatives and responsibilities are spread across all ministries. The Prime Minister provides ultimate approval on all climate change policy instruments, including the National Target Program to Respond to Climate Change (NTP-RCC) (Table 3). The Prime Minister heads the National Steering Committee on Climate Change, which comprises ministers of MONRE, the MPI, the Ministry of Finance, the Ministry of Agriculture and Rural Development (MARD), and the Ministry of Foreign Affairs. MONRE provides secretariat functions for the steering committee and is the coordinating ministry for the NTP-RCC, including its implementation, management, and monitoring of progress. MONRE is also the national focal point responsible for implementing the United Nations Framework Convention on Climate Change and the Kyoto Protocol, and is the designated national authority for the Clean Development Mechanism. Much of the existing institutional knowledge and analytical capacity relating to climate change is held by MONRE and associated institutes such as the Institute of Meteorology, Hydrology and Environment.

42. MONRE has the primary responsibility for the oversight and facilitation of environmental quality standards, land administration, and sustainable natural resources use and conservation, including land use planning and integrated water management at the river basin level. Environmental management responsibility in Viet Nam is spread over many ministries and implementation responsibility is often devolved to provincial and district levels. MONRE is responsible for preparing the 10-year strategy and 5-year action plans for natural resources and environment protection. It also administers laws relating to environment protection, biodiversity, water resource management, and land administration and planning. Most of the natural system conservation functions remain with MARD.

43. MARD is responsible for rural development, governance, and the promotion of agriculture, fisheries, forestry, and irrigation in Viet Nam. It is also the standing chair of the Central Steering Committee for Flood and Storm Control, responsible for organizing responses to natural disasters. It has the capacity for targeted local-level implementation of adaptation and mitigation measures through its nationwide network of 63 provincial offices and its relatively large cadre of field staff. MARD assists the Climate Change Steering Committee in supervising, guiding, and facilitating agencies to implement climate-change-responsive agriculture and rural development projects. Areas under its umbrella of responsibility include irrigation, water management, forest and marine biodiversity management, and flood control—all of which are vulnerable to climate change. Deforestation and

Table 3 Key Government Strategies and Plans on Environment and Climate Change

Strategy/Plan	Priorities	Responsible Agency	Implementing Legislation
Socio-Economic Development Plan (SEDP) for 2011–2015	• Emphasize actions to cope with climate change, increase forest coverage, improve water supply coverage, improve treatment of industry waste, improve treatment of solid waste, and prosecute pollution violators. • Emphasize response to sea-level rise and vulnerability of low-lying coastal regions.	Ministry of Planning and Investment (MPI)	
Strategic Orientation for Sustainable Development in Vietnam (2004) (National Agenda 21)	• Develop an institutional system supporting sustainable development (e.g., National Sustainable Development Council) • Develop and implement local and sector Agenda 21 ▸ 6 pilot provinces: Son La, Thai Nguyen, Ninh Binh, Quang Nam, Lam Dong, Ben Tre ▸ 4 pilot sectors: agriculture, fishery, construction, industry • Mobilize and allocate resources for implementation of Vietnam Agenda 21	Vietnam Agenda 21 Office MPI	
National Strategy for Environmental Protection until 2010 and Vision to 2020 and 5-year action plans	• Promote environmental protection, pollution prevention, area-specific environmental management, and biodiversity conservation	Ministry of Natural Resources and Environment (MONRE)	• Revised Land Law (2003) • Amended Law on Environment Protection (2005) • Law on Water Resources
National Biodiversity Action Plan to 2010 and Orientations towards 2020	• Conserve terrestrial biodiversity • Conserve biodiversity in wetlands and marine areas • Conserve and develop agricultural biodiversity • Use biological natural resources sustainably • Strengthen state management capacity on biodiversity and biosafety	MONRE	• Forest Protection and Development Law (2004) implemented through MARD • Biodiversity Law (2009) • Law on Water Resources
National Strategy On Climate Change for 2050 and the Vision to 2100 National Target Program to Respond to Climate Change (2008)	• Focus on construction of coastal breakwaters and irrigation works to combat seawater intrusion and high tides • Require all sectors and local governments to prepare and implement climate change action plans in their areas of responsibility, as well as report on progress	MONRE	• Benefits of a Climate Change Act being considered by the National Assembly • Law on Electricity 2004 • Amended Law on Environment Protection (2005)

continued on next page

Table 3 *Continued*

Strategy/Plan	Priorities	Responsible Agency	Implementing Legislation
Second National Strategy and Action Plan for Disaster Mitigation and Management 2001–2020	• Stress importance of coexistence with floods in situations that demand it • Establish disaster forecast centers in the north, center, and south of the country • Construct flood corridors and flood retention areas in southern Viet Nam • Design principally to address short-term climate extremes	Central Committee of Storm and Flood Control Department of Dike Management and Flood Control of the Ministry of Agriculture and Rural Development (MARD)	Disaster Risk Reduction and Management Law under consideration by the National Assembly
Agriculture and Rural Development Action Plan on Climate Change (2011)	• Ensure stable agricultural production and food security and the maintenance of dike and infrastructure systems • Focus on the Cuu Long and Red river deltas and the central and mountainous areas • Reduce emissions from deforestation and forest degradation	MARD	• Forest Protection and Development Law (2004)
National Target Program on Energy Efficiency and Conservation for 2006–2015	• Undertake greenhouse gas mitigation actions • Improve energy efficiency in major industries, with objective achieving 8% reduction in energy consumption by 2015, with emphasis on renewable sources	Ministry of Investment and Trade	• Law on Electricity (2004)
Transport Climate Change Action Plan 2011–2015 (2010)	• Assess impacts of climate change on transport infrastructure and activities • Identify suitable mitigation and adaptation options for transport projects	Ministry of Transport	
Provincial climate change action plans	There are a growing number of climate change actions plans at the provincial level as required under the National Target Program to Respond to Climate Change	Provincial people's committees and departments of natural resources and environment	
Strategic Environmental Assessment, Environmental Impact Assessment, Environmental Protection Commitments	• Improve capacity for the review of Strategic Environmental Assessment, Environmental Impact Assessment, and Environmental Protection Commitments for master plans (socio-economic development plans), and large and complex projects in Viet Nam • Develop capacity of line ministries to review plans and projects for environmental issues • Decentralize responsibility for smaller projects to provincial authorities	MONRE, departments of natural resources and environment, MPI, various line ministries	• 2011 Environment Decree (29/2011/NĐ-CP)
The National Strategy on Disaster Risk Management to 2020 and the Ordinance on Flood and Storm Control	• Mandate the creation of provincial and other subnational disaster risk management strategies and plans and establish subordinate provincial and district committees for flood and storm control	MARD, departments of agriculture and rural development, provincial departments	• Draft Law on Disaster Prevention for approval in 2012

Source: ADB.

associated land degradation, as well as inefficient intensive rice irrigation, fertilization, and processing are two of the largest contributors to GHG emissions in Viet Nam. MARD therefore has a lead role in policy and planning for the United Nations Collaborative Programme on Reducing Emissions from Deforestation and Forest Degradation in Developing Countries (UN-REDD). MARD is responsible for implementing Viet Nam's national Payment for Forest Environmental Services Decree: 99/2010/ND-CP which requires collection of payments from forest ecosystem services users and disburses the funds to forest managers to support sustainable resource management and livelihoods.

44. MARD's fisheries functions include marine protected areas. Its forest management cover special-use forests (or terrestrial protected areas), protection forests (for watershed and coastal protection), and production forests (including both plantations and natural forests designated for production purposes). In most cases, day-to-day forest management responsibility is devolved to state entities at provincial, district, and commune levels. Only a small proportion of forest land has been allocated to the community and household level.

45. The MPI is responsible for state management of planning and investment, including national socioeconomic development plans, and official development assistance throughout the country. It is responsible for mainstreaming sustainable development and climate change into Viet Nam's strategies and development plans. The MPI facilitates implementation of the National Sustainable Development Strategy (Agenda 21) in sectors and local government areas, although the specific role and influence of the Agenda 21 on government development policy and action is not clear. The MPI, with international support, has undertaken a study into low-carbon, climate-resilient development in Viet Nam as the first step in designing a low-carbon growth strategy as identified in the NTP-RCC.

46. The Ministry of Industry and Trade (MOIT) is also a key stakeholder in addressing climate and environmental issues. MOIT leads the development and management of key industrial sectors including iron, steel, cement, machinery, metallurgy, power generation, renewable energy, oil and gas, mining, fertilizers and chemicals, and explosive materials, which are some of the most GHG-intensive industries. MOIT owns over 2,000 industries, including 51 large general companies and enterprises and numerous enterprises concerned with steel, petroleum, chemicals, textiles, paper manufacturing, and coal mining. By June 2005, only 300 of the MOIT state-owned enterprises (15%) had been equitized. MOIT prepares inventories of GHG emissions from industry and is responsible for managing national target programs on energy efficiency and conservation. In line with several government directives, MOIT and the Ministry of Transport (MOT) have established environment departments to help improve sector environmental management and performance.

47. The MOT governs rail, road, and water transport in Viet Nam. The transport sector, as the main user of petroleum fuels, contributes to the production of GHGs, mainly carbon dioxide. Key strategic decisions on the technologies and mix in transport modes will have far-reaching impacts on national GHG emissions and on the capacity of the country to adapt to climate change. The MOT plans and implements national infrastructure development, such as major roads and rail and port facilities. Poorly planned and located road development is a significant factor in biodiversity and forest loss in Viet Nam.

48. The provincial, municipal, and district authorities have the responsibility for implementing the central government's environmental policy. At each of these levels, departments of natural resources and environment (DONREs) are responsible for facilitating and enforcing regulations of natural resources and the environmental. Enforcement of forestry and fisheries regulations is the responsibility of departments of agriculture and rural development and linked departments and divisions. Viet Nam has introduced a special environment police force, which now operates in most provinces with increasing effect across the environment and natural resource fields, for example, in enforcement of pollution control and wildlife trade regulations.

49. The Ministry of Construction is responsible for urban and regional infrastructure planning and development control. It administers the national building code and, through its urban planning institutes, prepares plans for most cities, towns, and other settlements in the country—in addition to supporting MONRE and the DONREs in preparing their land use plans. The Ministry of Construction has extensive responsibilities for promoting and implementing climate change adaptation and mitigation measures in the built and urban environment.

50. Viet Nam has had a long-running weakness in the institutional arrangements for protected area management. All but three national parks have now devolved to provincial management. Although covering close to 10% of the nation's land territory, management boards have little status, authority, or resources, so other sectors such as transport, energy, mining, and irrigation tend to dominate when they have competing development plans for the areas. In practice, the Forest and Fisheries Laws under MARD are the key statutes defining how protected areas are managed, but the evolving role of the Biodiversity Law[6] reflects the ongoing fluid situation concerning the roles and authority of MARD and MONRE.

51. The Viet Nam National Mekong Committee under MONRE is responsible for oversight of MRC activities through the 1995 Agreement on Cooperation for the Sustainable Development of the Mekong River Basin, between Cambodia, the Lao PDR, Thailand, and Viet Nam. The committee is participating in the implementation of the MRC Climate Change Adaptation Initiative, which includes the establishment of a Mekong panel on climate change and a network of demonstration projects throughout the Lower Mekong Basin.

[6] MONRE is drafting a protected areas decree to fall under the Biodiversity Law. At the same time, MARD is revising its decrees and circulars on protected areas.

IV Environmental and Climate Change Mainstreaming

52. Table 4 sets out the main strategies, plans, and legislation promoting the mainstreaming of environmental and climate change responses. A number of tools and programs supplement these policy frameworks to further embed their provisions in decisions. Viet Nam introduced a system of national pollution standards and environmental safeguards and guidelines in the mid-1990s. This framework, against which development is assessed, has evolved into a comprehensive set of sector-specific environmental standards and controls.

53. The main tool for the application of the framework in new developments is a system of environmental impact assessment (EIA) and area-based land use plans and zones. Several hundred EIAs of varying quality are prepared each year for designated categories of development proposals, mainly at the local government level. Improving the performance of existing old and inefficient enterprises has been a special challenge. Environmental audits are conducted and environmental management plans imposed on existing plants, but enforcement is difficult when DONREs have only a few technical staff that often cover thousands of enterprises.

54. The land use or spatial planning process is not effective in Viet Nam as a foundation for environmental mainstreaming. There is no comprehensive spatial planning legislation or process. Under the Land Law, land use plans are required for all areas, but they have proved to be more an instrument for land administration and recording existing land uses and tenure arrangements than an effective framework for environmental management. This is a very significant gap in Viet Nam's efforts to shift to sustainability in natural resource use and environmental quality.

55. The Law on Environment Protection requires mandatory strategic environmental assessment (SEA) for a wide range of national, provincial, and inter-provincial strategies, planning, and plans, including socioeconomic development strategies, planning, and plans, and river basins. All plans have potential implications for the use and management of natural resources and the safeguarding of environmental quality. Following a directive from the government, all provinces are required to conduct SEAs of their socioeconomic development plans, and this has led to a significant increase in SEAs conducted through government budgets and applying a rapid assessment approach. To date, the quality and influence of SEAs have been variable, and government agencies do not yet have the systems in place or commitment to SEAs as a strategic planning tool. SEAs have the potential to play a wider role in mainstreaming climate change responses in policy and planning. MONRE is preparing guidance on climate change considerations in SEAs for implementation by government sectors.

56. The National Target Program to Respond to Climate Change (NTP-RCC), adopted in 2008, identifies climate change trends in Viet Nam as well as broad regional and sectoral vulnerabilities, and sets out legislative, planning, and investment priorities in response to climate change. The NTP-RCC identifies nine targets for 2009–2015, providing financial and technical support for climate change planning across all sectors. However, it contains few concrete policy commitments and rather constitutes a first step in directing ministries and provinces to formulate specific sector and regional plans of action based on more detailed impact assessments. Moreover, the NTP-RCC is predominantly focused on adaptation measures, not mitigation (MONRE 2008).

57. The National Target Program on Energy Efficiency and Conservation for 2006–2015 is the responsibility of MOIT. It includes the formulation and implementation of GHG mitigation options, and primarily provides financial and technical support for energy efficiency improvements in major industries with objectives of achieving reductions in energy consumption of 8% by 2015 and deriving 2,500 megawatts of energy usage from renewable sources by 2015. To encourage this, a supporting policy framework has been established that requires Vietnam Electricity to purchase electricity from renewable suppliers. Progress in implementing the program has been limited. Despite the goals of increasing energy efficiency and renewal energy usage, per capita energy intensity has risen by approximately 4% per year since 1990, with the amount sourced from renewable sources still small and the majority of increased capacity met by coal-fired power generation.

58. The MARD Action Plan on Climate Change seeks to mobilize development assistance for climate change mitigation and adaptation. The main objectives of the plan are to

- enhance the government's capacity for climate change adaptation and mitigation to minimize its adverse impacts and then ensure sustainable development of the agriculture and rural development sector;
- ensure the stability and safety of residents in cities and different zones and regions, especially the Cuu Long and Red River deltas and the central and mountainous areas;
- ensure stable agricultural production and food security in an agricultural area of 3.8 million ha with two seasonal rice crops;
- ensure the maintenance of dike and infrastructure systems to meet disaster prevention and mitigation requirements;
- strengthen international cooperation by promoting the link with international and regional programs, and receive technical and financial assistance from international communities in climate change adaptation and mitigation; and
- ensure financial support for the plan's implementation from the government budget and by mobilizing official development assistance, international cooperation support programs, and other sources of national and international assistance.

59. MARD has established a standing committee on mainstreaming climate change considerations within natural resources and rural development sectors.

60. The MOT enacted a framework for the Transport Action Plan of the NTP-RCC in early 2011. The action plan focuses on assessing the impacts of climate change on transport infrastructure and activities based on MONRE scenarios; identifying suitable mitigation and adaptation options for transport projects; and collaborating with ministries, institutes, and international agencies to raise awareness and build the MOT's management capacity to respond to climate change.

61. Within MOIT, the Office of the General Director of the Industrial Safety Techniques and Environment Agency has developed the **MOIT Climate Change Action Plan**, approved in August 2010 (Decision 4103/QD-BCT). MOIT has established its own climate change steering committee to coordinate activities with other departments, corporations, groups, institutes, and enterprises. The plan identifies the need to develop a robust approach to adaptation and mitigation planning with appropriate decision support tools. In addition, it stresses the need for capacity strengthening within the ministry and its constituent industries, and support for the development of enabling regulations and implementing rules.

V ADB's Support Program

62. **Environment support.** ADB has traditionally addressed environmental issues through specific technical assistance (TA) projects and the application of its system of environmental safeguards. The application of safeguards and more proactive environmental sustainability measures (including climate change measures) are increasingly addressed through components in the lending and TA portfolio. In the agriculture and natural resources sector, ADB has focused on asset creation and access to markets and inputs in the poorest regions. ADB has looked to replicate small-scale planting innovations in forestry, bringing them into the mainstream of forestry practice. In the energy sector, ADB has supported TA to improve cross-cutting environmental issues in the power sector, and has supported an SEA to look at the effect of the Quang Nam Hydropower Plant on the Vu Gia–Thu Bon River Basin and to build capacity in MOIT and Vietnam Electricity. In the water sector, ADB has worked to support a government policy of encouraging growth away from main cities and has supported enhanced environmental services in the Central Region. ADB's Greater Mekong Subregion (GMS) initiative includes a focus on transboundary environmental issues, and the GMS Core Environment Program includes pilot conservation activities that have been scaled up to a $30 million loan for the Biodiversity Conservation Corridors Project, as well as a component on experience sharing on climate change impacts and adaptation responses. The Forest Livelihood Improvement in the Central Highlands Project improves livelihoods and helps facilitate forest improvement and natural resource management.

63. **Climate change support.** ADB has supported a number of climate-related initiatives, including the first climate change impact and adaptation assessment focusing on Ho Chi Minh City—a study that has influenced government policy and methods. ADB is now conducting a larger-scale climate change impact and adaptation study in the Mekong Delta in collaboration with the Government of Australia. The delta region has been the target of groundbreaking infrastructure-focused climate resilience studies—one on a power plant complex in Can Tho and another on two large bridges and connecting roads.

64. ADB conducted the 2009 Regional Review of the Economics of Climate Change, based on data from five Southeast Asian countries, including Viet Nam, that reiterated the need for early, up-front investments and "no-regrets"[7] adaptations. A follow-on TA project Strengthening Planning Capacity for Low Carbon Growth in Developing Asia, launched in 2010 and continuing until 2013, will assist the Government of Viet Nam in refining its response strategy to address climate change and green growth issues. This recent ADB work on the economics of climate change includes guiding the Government of Viet Nam on the likely financial implications of adaptation and mitigation costs. Additional assistance is planned for 2012–2014 focusing on the energy, transport, and agriculture sectors in selected cities and provinces. The results of the TA projects are shared with development partners to help the Government of Viet Nam secure financing for priority projects. Low carbon development provides an opportunity to reduce costs through the reduction of inefficient consumption subsidies. ADB continues to encourage Viet Nam to consider low carbon development programs and to seek both ADB financing and global funding opportunities for this purpose.

[7] 'Climate change adaptation decision-making supporting positive development outcomes, whether or not specific climate change impacts actually materialize' (definition from http://www.adb.org/sites/default/files/pub/2009/Under-Weather-Rising-Tide.pdf).

65. ADB provided support for energy efficiency, mini-hydro, and forest protection for reducing GHGs through the Forest Livelihood Improvement in the Central Highlands Project and the Core Environment Program Biodiversity Corridors Initiative project. ADB is also supporting MARD's standing committee on climate change to (i) assess sector and provincial climate change options, (ii) develop the planning cycle from 2011–2015, and (iii) build capacity in climate change adaptation.

66. A TA grant of $2.5 million from the Nordic Development Fund, administered by ADB, will be used to help Ho Chi Minh City and Da Nang City, the MOT, MOIT, and Thanh Hoa Province plan and implement effective climate change response measures. The project will also support the Government of Viet Nam's NTP-RCC for building a more climate-resilient economy with lower GHG emissions. MOIT is the executing agency for the project, which began in late 2011 and will run to the end of 2013.

67. The Nordic Development Fund is also providing support to integrate climate change concerns into an ADB initiative to improve road connectivity in the northern mountainous provinces. Another planned project with the MOT is linked to the rural roads program and includes a Global Environment Facility grant to enhance the climate change resilience of rural road infrastructure in several northern highland provinces. Another effort to enhance sector resilience is a study cofinanced by ADB and Agence Française de Développement (AFD) on irrigation efficiency and agriculture in the Red River Delta.

68. ADB is also making a concerted effort to address the human impacts of climate change, particularly gender issues. In 2011, ADB approved the TA project Harnessing Climate Change Mitigation Initiatives to Benefit Women in Viet Nam, the Lao PDR, and Cambodia to improve women's livelihoods through the application of clean technologies. Similarly, the Quality and Safety Enhancement of Agricultural Products and Biogas Development Project will improve women's livelihoods while promoting clean energy and sustainable agriculture. ADB will continue to engage with development partners in Viet Nam through Oxfam, the International Committee of the Red Cross, and the United Nations–Viet Nam Programme Coordination Group on Gender to increase awareness of potential hazards resulting from climate change impacts. This will include financing a multimedia campaign with the Asia Pacific Media Alliance for Social Awareness. Appendix 4 identifies opportunities for financing climate change and environment initiatives through ADB and reflects ongoing investments that will be implemented during the country partnership strategy period.

69. **Regional support: GMS Core Environment Program.** In 2006, ADB and partners set up the GMS Core Environment Program and Environment Operations Center (EOC) to provide technical support to the GMS Environment Working Group, one of several sector and thematic working groups that make up the larger GMS Economic Cooperation Program, which promotes sustainable economic development through regional integration. The GMS EOC is a technical support and coordination body that promotes and demonstrates good environmental practices for sustainable development. Demonstration projects strengthened landscape management approaches to reduce the fragmentation of forests that have high conservation value across 2.29 million ha of forest in six biodiversity conservation corridor sites in Cambodia, the Lao PDR, Myanmar, Thailand, and Viet Nam.

70. From 2012–2016, ADB's Viet Nam country program will have the opportunity to expand cooperation with the program and coordinate mainstreaming better environmental assessment and natural resource management approaches at the national level. The GMS EOC can also provide a platform to connect the ADB Viet Nam program to (i) regional climate change response programs, (ii) transboundary agreements to sustain access to resources and markets, and (iii) transboundary biodiversity conservation efforts to increase the efficiency of environment and climate investments and support the Government of Viet Nam in achieving its own national targets.

71. **Greater Mekong Subregion Flood and Drought Risk Program.** In 2012, ADB approved a loan to improve the capacity of over 1 million people in Cambodia, the Lao PDR, and Viet Nam to respond

to the negative impact of floods and droughts across 130,000 ha of land in the tributaries and along the main stream of the Mekong River. The project will strengthen regional cooperation and integration on water resources management in general and flood drought management in particular, and support in-country structural and nonstructural investments to manage and mitigate the potential impacts of climatic extremes. The Flood Management and Mitigation Program of Mekong River Commission is mandated to deal with regional and transboundary flood issues. The project, which will become effective in 2013 will develop greater capacity to link the national and regional flood and drought forecasting systems to improve the effectiveness of the national response to these events.

72. Furthermore, ADB promotes, through the GMS framework, regional connectivity and linked investment. A key strategy in this regional policy is the development of economic corridors, mainly for transport infrastructure but with extensive multiplier development implications. To date, there has been inadequate strategy planning and assessment of options for transport routes linking countries and transport mode options to minimize environmental damage, including biodiversity loss and GHG emissions. Often, the planning and assessment process is broken down into smaller units that prevent the kind of regional strategic overview that can optimize good environmental and climate change performance. The second phase of the GMS EOC will provide SEA support to national and regional sector master plans.

VI Development Cooperation

73. **Activities of other development partners and major funding initiatives.** Bilateral and multilateral donors are implementing projects with a direct environment or climate change focus in Viet Nam. Projects have tended to have distinct climate change or environment focuses. Ongoing and upcoming initiatives increasingly recognize the inextricable links between the two and tend to integrate environment and climate change aspects.

74. A number of funding pools are available for climate change and biodiversity projects. ADB is working with other development partners to implement projects and to blend funding pools, minimize overlap, and leverage comparative advantages. One of the pivotal climate financing cooperation efforts, the Climate Investment Funds (CIFs) are a pair of funds to help developing countries pilot low-emissions and climate-resilient development. With CIF support, 45 developing countries, including Viet Nam, are piloting transformations in clean technology, sustainable forest management, increased energy access through renewable energy, and climate-resilient development. ADB is one of five multilateral development bank delivery partners for the CIF. During 2010–2014, ADB will process loans with grant support from the Clean Technology Fund in the energy and transport sector. A newer initiative, the Partnership for Market Readiness (PMR) is a World Bank Trust Fund that provides developing country governments with grant financing to promote market mechanisms that encourage low-carbon growth. In 2011, Viet Nam submitted an expression of interest, which was accepted by the PMR secretariat. ADB has been selected by the Government of Viet Nam to serve as the principal delivery partner for the trust fund activities in the country and will work closely with the World Bank to implement PMR activities.

75. **Donor harmonization in Viet Nam.** The International Support Groups of MARD and MONRE help coordinate international support to the sectors and include members from line ministries. There are a number of key partnerships that address environmental issues directly, including the Technical Working Group on Environmental Impact Assessment and Strategic Environmental Assessment under the multi-donor Aid Effectiveness Forum, the Natural Disaster Mitigation Partnership, the Forest Sector Support Program and Partnership, and the Rural Water Supply and Sanitation Partnership. The Support Program to Respond to Climate Change is another increasingly important partnership that has led to the establishment of a multidonor climate change fund. It is a joint Agence Française de Développement (AFD), the Australian Agency for International Development (AusAID), the Japan International Cooperation Agency, and World Bank effort to help support implementation of policies and strategies relevant to the NTP-RCC and also to serve as a coordination platform for further technical and financial assistance.

76. ADB has increased involvement in knowledge partnerships, funding partnerships, and technical working groups to deliver a more coordinated response to challenges related to the environment and climate change in Viet Nam and the region. ADB knowledge partnerships are networks of organizations with a shared goal, where members contribute and exchange knowledge on a continuous basis. They include the GMS EOC, which supports the GMS Environment Working Group under the GMS Economic Cooperation Program, among other objectives, as well as other emerging partnerships on regional power transmission, and carbon capture and sequestration modeling. Partnerships with the United States National Center for Atmospheric Research, the United Kingdom Met Office, and the Rockefeller Foundation have also been established. Funding partnerships include cofinancing with the AFD and AusAID on capacity building and TA. ADB technical working group

involvement includes participation in the Aid Effectiveness Forum, the GMS Economic Cooperation Program, the Six Banks Initiative, and the climate policy activities of the Support Program to Respond to Climate Change.

77. A number of globally available funds and facilities are also available for carbon finance, adaptation, and environmental initiatives, as summarized in Appendix 5.

78. **Civil society and environment.** Civil society increasingly influences the debate on environmental issues in Viet Nam through environmental nongovernment organizations (NGOs) and the media. Contrary to their role in the 1980s and 1990s, in Viet Nam, NGOs now tend to respond to issues rather than lead and set environmental agendas. In part, this is due to the government's more proactive and systematic approach to environment and climate change concerns. NGOs have had some concrete successes and some local NGOs have formed partnerships with larger international NGOs and donors, for instance, on issues such as the illegal trade in timber and wildlife (Vietnam Institute of Development Studies, United Nations Development Programme, and SNV Netherlands Development Organization 2006). In addition, the Vietnam Union of Friendship Organisations NGO Resource Centre, an umbrella group of NGOs, has successfully consolidated NGO feedback on relevant issues such as providing inputs to the draft Socio-Economic Development Plan and various national target programs, and to the annual Viet Nam development reports. Growing links between NGOs, research groups, and the media have also led to increased coverage in the mainstream media on environmental degradation and the national impacts of climate change.

79. The Climate Change Working Group (CCWG) of the NGO Resource Centre is a forum for Vietnamese and international NGOs to participate in climate change debates. The CCWG recognizes that NGOs are often effective at encouraging grassroots responses to climate change. Its key objectives are to coordinate NGO initiatives to maximize impact and minimize overlap, to provide a structure for NGOs to develop a common advocacy agenda, and to ensure that NGOs have equal access to information, training, and funding opportunities in Viet Nam. The CCWG contributed to the development of the NTP-RCC, the Viet Nam National Strategy on Responding to Climate Change and the National Green Growth Strategy. It has also participated in recent initiatives to prepare guidelines on community-based adaptation responses.

80. **Regional cooperation: Mekong River Commission.** The 1995 Mekong River Commission (MRC) Agreement on Cooperation for the Sustainable Development of the Mekong River Basin makes provisions for the maintenance of flows and territorial integrity. Under the agreement, Viet Nam makes policy and planning decisions to promote improved environmental management of Mekong water supply; however, effectiveness relies on upstream water supply. The Climate Change Adaptation Initiative of the MRC and the Mekong Panel on Climate Change (World Bank 2011c) aims to provide scientific advice on adaptation in the Lower Mekong Basin and improve decision making. For example, the MRC Climate Change Adaptation Initiative and Environment Program is conducting a study on wetlands and climate change using local case studies in the Mekong Delta. The objective is to determine climate change effects and appropriate adaptation responses for this critical ecosystem, which covers 42% of the lower basin.

VII Mapping an ADB Strategy for Viet Nam Operations

81. ADB's Strategy 2020 selects the environment (including climate change) as one of five core areas of ADB operations. Over time, the environment has become an important part of the investment portfolio and is increasingly integrated across ADB operations. In line with Strategy 2020, central emphasis is placed on climate change, livable cities, and a range of complementary activities. ADB operations on the environment will be guided by three mutually-supportive operational directions: (i) promoting transitions to sustainable infrastructure, (ii) improving natural resource management and maintaining ecosystem integrity, and (iii) building sound environmental governance and management capacities.

82. Viet Nam is one of the most vulnerable countries to climate change impacts and is simultaneously in a position to reduce its growing GHG emissions. ADB has taken a leadership role in the region and in Viet Nam to mitigate the causes and adapt to the consequences of climate change. In line with Strategy 2020, ADB is integrating climate change into planning and investment to ensure continued economic growth and a sustainable future for the region. In a white paper approved by the Board of Directors in April 2011, ADB set out five strategic priorities for addressing climate change:[8] (i) expanding the use of clean energy, (ii) promoting sustainable transport and urban development, (iii) managing land use and forests for carbon sequestration, (iv) building climate resilience, and (v) strengthening governance. The environment and climate change strategic priorities for ADB can be combined as follows: (i) promoting transitions to sustainable infrastructure (including clean energy and sustainable transport and urban development), (ii) improving natural resource management and managing ecosystem integrity (including land use management and forestry), (iii) building resilience, and (iv) strengthening environmental governance and management capacities.

83. Three primary modalities will be employed to support ADB's work. The first is mobilizing and innovating to meet financing needs. ADB can help mobilize and channel public concessional funds to its developing member countries, facilitating the increased flow of private capital into environmentally sustainable, low-carbon, and climate-resilient investments. The global carbon market will change dramatically, with regional, country and sector level market mechanisms taking shape. ADB will help Viet Nam to gain access to these resources. The second modality is generating and disseminating knowledge. Strong TA programs in the sectors to be most affected by environment and climate change threats will be used as platforms for developing and disseminating knowledge about effective responses to the climate change challenge. The third modality is cultivating and fostering partnerships. ADB will continue to work closely with international and bilateral partners, the government, the private sector, and civil society to expand its capacities and outreach in achieving its sustainable economic growth objectives. Environmental management, mitigation, and adaptation programs function best if stakeholders, especially intended beneficiaries, are closely involved in the entire program cycle, from identification through to design, implementation, monitoring, and evaluation. ADB's five environment and climate change priorities and associated strategies in Viet Nam are now described in more detail.

[8] http://www.adb.org/documents/addressing-climate-change-asia-and-pacific-priorities-action

84. **Promoting transitions to sustainable infrastructure: expanding the use of clean energy.** Viet Nam's energy sector is the single largest source of emissions in Viet Nam. There is a close and strengthening relationship between GDP and emissions in Viet Nam, as energy intensive sectors become increasingly important drivers of growth.[9] A growing dependency on fossil fuels, whose share in total primary energy supply is expected to account for 63% by 2030, will increase emissions further (Asia Pacific Energy Research Center 2006). A shift to clean and efficient energy production and consumption will be needed to decouple GDP and GHG emissions.

85. In line with its 2009 Energy Policy, ADB will support clean energy in three key areas: (i) demand- and supply-side energy efficiency improvements, (ii) renewable energy development, and (iii) the introduction of new clean energy technologies. Demand-side interventions, such as the introduction of lighting, cooling, heating, appliances, and production systems with lower energy intensities, and policy measures to promote their use, will continue to be supported. Supply-side efficiency improvements include the rapid expansion of renewable energy and support for more efficient, smart, and clean technologies in power generation, transmission, and distribution, especially focusing on increasing access to energy by the poor. ADB will work with governments, venture funds, and other partners to mobilize adequate financing and will continue to extend incentives for the public and private sectors to invest in clean technologies.

86. **Promoting transitions to sustainable infrastructure: sustainable transport and urban development.** GHG emissions from Viet Nam's transport sector are expected to triple between 2010 and 2030 (MONRE 2010). In line with ADB's Sustainable Transport Initiative, the Viet Nam program will promote: development of mass transit; more efficient vehicles, use of biofuels, and the introduction of other low-carbon technologies coupled with sound urban planning to facilitate mobility. ADB will promote efficient, low-carbon intercity transport. ADB will devise more systematic responses to the growing demands for greener cities and the integration of mitigation and adaptation actions to make urban infrastructure more climate-resilient and climate-friendly.

87. **Improving natural resource management and managing ecosystem integrity: managing land use and forests for carbon sequestration.** Sustainable forest management and land use improvements to promote biodiversity conservation, rural development, and carbon sequestration will be a focus of ADB's work in Viet Nam. ADB will focus on improving the implementation of existing payment for forest ecosystem services schemes. This will help the country prepare for and gain access to REDD+ financing for improved environmental management and economic development.[10] Efforts will be programmed in coordination with other multilateral and bilateral programs—such as the World Bank's Forest Carbon Partnership Facility, the United Nations Collaborative Programme on Reducing Emissions from Deforestation and Forest Degradation in Developing Countries (REDD), and the Climate Investment Fund's Forest Investment Program.

88. **Building climate resilience.** Viet Nam is extremely vulnerable to climate change impacts and achieving climate-resilient development will be a focus of ADB's work. ADB will support the integration of climate change adaptation measures into economic development through training, awareness raising, and education measures. ADB will help ensure that poverty reduction strategies and targets, including social development objectives, take better account of climatic conditions and disaster risks, and include measures to enhance the resilience of vulnerable groups. Special attention will be given to improving capacities for climate-resilient water management through investments and TA. ADB will

[9] Carbon dioxide intensity has increased from 1.3 kilograms of carbon dioxide per unit of GDP in 1995 to 2.3 kilograms of carbon dioxide per unit of GDP in 2005.

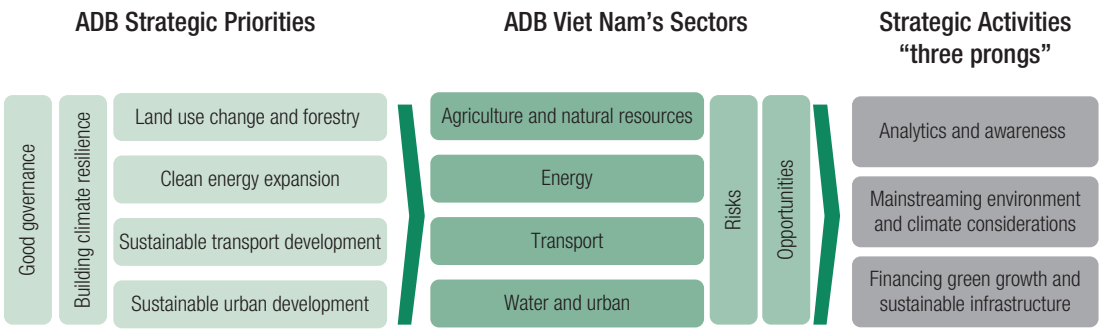
[10] The REDD+ approach combines efforts to reduce emissions from deforestation and forest degradation, conserve biodiversity, and enhance forest carbon stocks through sustainable forest management.

join with partners to analyze and respond to long-term food security risks from climate change threats. Innovative financing and risk-sharing approaches promoting the integration of adaptation and disaster risk reduction will be developed, and ADB will encourage greater involvement of the disaster risk management community in a strategic expansion of existing frameworks and plans to address climate risk preparedness and response.

89. **Strengthening governance.** In response to the Copenhagen Accord, Viet Nam has pledged to reduce GHG emissions in anticipation of nationally appropriate mitigation actions that are expected to become part of the post-2012 climate change regime. The Government of Viet Nam has requested ADB's assistance in refining its policies, building associated capacities, and identifying the substance and financing for project and program interventions needed to implement them. ADB will use its development policy and poverty reduction dialogues—as well as targeted policy and institutional interventions—to support the integration of climate change considerations into development plans and actions, including ADB's own regional and country partnership strategies. Through regional cooperation activities, ADB will work with countries to address transboundary issues and share experiences in tackling common challenges brought about by climate change. The private sector's role will be assessed, developed, and better integrated into ADB's actions.

90. In Viet Nam, ADB has further organized the five approaches outlined to strategically address both climate change and environmental issues, into a three-pronged approach (Figure 3), which represents increasingly concentrated support for climate and environmental priorities. The three prongs are analytics and awareness, mainstreaming environment and climate considerations, and financing green growth and sustainable infrastructure. The approach has been adopted by ADB as an effective framework for responding to the challenges of climate change. The three strategic activity prongs are executed simultaneously, in support of government climate change and environment priorities.

Figure 3 ADB's Strategic Approach to Environmental Management and Climate Change



ADB = Asian Development Bank.

Source: ADB.

VIII Moving from Strategy to Action

91. ADB's Viet Nam country partnership strategy, 2012–2015 proposes to continue operations in the following sectors: agriculture and natural resources (ANR), education, energy, finance, health, transport, public sector management, and water supply and other municipal services with a varying level of engagement, scope, and subsector selectivity based on specific needs and expected impact. Of the eight sectors indicated for continued engagement, analysis of environmental challenges and climate change threats indicates that ADB's mainstreaming efforts should focus on ANR, energy, health, transport, and water and urban development; implementation experience in these fields enables lessons to be drawn that inform ADB's operations in Viet Nam. This section describes upcoming opportunities in ADB's main sectors of operations. It also outlines means to measure the success of environment and climate interventions that are reflected in the sector strategies of both the Government of Viet Nam and ADB. Table 4 provides a detailed list of lessons, opportunities, projects, and indicators by priority sector and ADB division.

1. Agriculture and Natural Resources

92. **Environment and climate change opportunities.** Based on lessons learned in ANR, ADB will continue to support development policies and strategies that lead to the maintenance and enhancement of biodiversity within and outside protected areas as a vital component of Viet Nam's ecological sustainability and adaptation and mitigation to climate change. Adaptation opportunities in Viet Nam will be supported to prepare the ANR sector to better cope with the physical impacts of a changing climate. Potential adaptation measures to increase resilience include climate proofing steep terrain; reducing the vulnerability of irrigation systems to extreme events not only through dikes, but also by incorporating natural buffer zones; and assisting in the identification and uptake of more salt- and drought-resistant crops, as well as expanding agro-forestry and agro-biodiversity.

93. **Priority actions.** Under Prong I: analytics and awareness, ADB will support MARD and MONRE in advancing the implementation of the Environment Decree, the Payment for Forest Ecosystem Services Decree, and the emerging REDD+ policy framework through two main interventions: the Capacity Development for National Roll out of Benefit Sharing Mechanism and Payment for Forest Ecosystem Services, and the Biodiversity Conservation Corridors Initiative. ADB will also focus on future opportunities to incorporate spatial and landscape approaches in planning. Under Prong II: mainstreaming environment and climate considerations, ADB will continue to support the efforts of MARD and MONRE to conserve and sustainably use natural resources, especially water and land resources. Future natural resource management projects need to better account for climate change impacts, and in this vein, ADB is supporting a TA project for Strengthening Water Resources Management and Irrigation Systems Rehabilitation, which will mainstream climate change considerations in planned agricultural investments in Northern Viet Nam. ADB has established a leadership role in water resource management, a focus that will be improved through ongoing policy work. This includes efforts undertaken in 2011 to provide support to MONRE in adopting and implementing the revised Water Resources Law. Under Prong III: financing green growth and sustainable infrastructure, investments in land-based natural resources management will be pursued through ongoing forestry sector activities and GMS biodiversity activities, including the GMS Core Environment Program and the $30 million Biodiversity Conservation Corridors Project Loan to Viet Nam, approved in 2011.

2. Energy

94. **Environmental and climate change opportunities.** Key features in the upcoming ADB project portfolio will be (i) adopting cleaner fuel technologies, (ii) focusing on energy efficiency and conservation, and (iii) increasing the uptake of renewable energy technologies. In addition, the ADB Safeguard Policy is applied to all power generation projects to ensure minimal environmental impacts.

95. **Priority actions.** Under Prong I, ADB is planning a number of projects in the energy sector to mitigate environmental impact, such as a TA for Environmental Management Plan Improvement and Implementation and Downstream Impacts Management for Son La Hydro Power Project, which will build the capacity of Vietnam Electricity in best practices in relation to developing hydropower. Strategic support is also provided under a TA for Capacity Building for the Implementation of the New Environment Decree and the GMS Core Environment Program. This will enable Viet Nam to better assess the ecological and social trade-offs involved in full implementation of the national Power Development Plan and linked provincial power development plans and find a more balanced approach to the pace and scale of hydropower development. The recent SEA of the Viet Nam Power Development Master Plan by the GMS Core Environment Program has been accepted by the Government of Viet Nam. ADB will continue to build on this initiative to increase the sustainability of the power sector, and will seek opportunities to apply SEAs to future master plans. Furthermore, ADB is planning investments to raise consumer and industry awareness about the direct economic benefits of energy savings, in particular in the cement and water sectors. ADB also plans to carry out its strategic plan to finance green growth by leveraging carbon market financing for renewable and energy efficiency projects.

96. Under Prong II, ADB will assist the Ministry of Investment and Trade (MOIT) to set up a renewable energy development office, and through TA projects and project preparatory TA will help establish the organization and provide capacity-building support to translate renewable energy targets into specific opportunities. ADB recognizes that coal is a part of the energy mix, but it plans to only support projects utilizing cleaner-burning and more efficient supercritical and ultra-supercritical technologies for coal-fired power generation. All projects will continue to apply the ADB Safeguard Policy to minimize social and environmental impacts. Under Prong III, several projects will be financed to increase the efficiency and minimize the environmental impact of the conventional power supply, including the Northern Power Transmission and Expansion Project. Other projects will increase the share of renewable energy in Viet Nam, including the Sector Quality and Safety Enhancement of Agricultural Products and Biogas Development Project, and the Strengthening Project Management and Developing Strategies and Options for Biogas Development Program Expansion Project implemented by MARD.

3. Health

97. **Environmental and climate change opportunities.** Building human resilience to the impacts of environment and climate change will be increasingly mainstreamed into ADB sector operations. ADB's investments in environmentally sustainable growth, in particular clean technologies, will be planned to achieve maximum co-benefits for the health sector.

98. **Priority actions.** Under Prong I, ADB will conduct studies that guide investments in climate-resilient infrastructure, in particular providing water and sanitation systems that can withstand more extreme weather events in order to minimize the spread of water- and vector-borne illnesses in Viet Nam. Furthermore, ADB will cooperate with development partners to support analysis of the impact of climate change and environmental degradation on human migration, and plan appropriate responses. ADB may also use its multimedia campaigns to develop and implement community education plans to raise knowledge and awareness on environmental hygiene and health under the impacts of climate change, in collaboration with the International Committee of the Red Cross and other development

partners. Under Prong II, ADB will support the Ministry of Health, the Ministry of Construction, and other ministries and provincial and city governments to develop programs to adapt to climate change and natural disasters and minimize health impacts. In the context of ADB's support to the GMS Economic Cooperation Program, and under Prong III, ADB will support regional efforts to control diseases and prevent infection; and promote technological solutions, equipment, and control systems that will limit illnesses related to climate change, particularly in response to natural disasters.

4. Transport

99. **Environmental and climate change opportunities.** Opportunities for ADB to assist in reducing the impact of the transport sector in Viet Nam include offset measures to reduce the risk of impacts from main arterial routes and rural transport on biodiversity, especially where the building of roadways cuts through fragile ecosystems. In line with ADB's Sustainable Transport Initiative, there are significant opportunities to increase the utilization of safe, affordable, and environment-friendly public transport that reduce GHG emissions and air quality impacts. These opportunities will be pursued in major urban areas.

100. **Priority actions.** Under prongs I and II, in order to improve adaptation in the transport sector and better prepare for changing physical conditions, especially more extreme weather events, new ADB projects will continue to focus on integrating climate change adaptation in infrastructure planning, including engineering and structural adjustments, such as altering drainage and materials, and enhancing structural protection. For example, two upcoming capacity development TA projects financed by ADB—Climate Change Adaptation in the Mekong Delta and Support for the National Target Program on Climate Change with a Focus on Energy and Transport—will help develop road and rail transport infrastructure, evaluate climate risks on current and planned infrastructure, and identify adaptation measures. The TA project Improvement of Road Safety and Climate Resilience on National Highways (TA7900-VIE) and upcoming loan will assess the safety of the national highway between Nha Trang and Ninh Thuan and its ability to incorporate and withstand climate change effects. Under Prong III, in order to improve the quality of urban living and reduce reliance on private modes of travel, ADB is supporting Ho Chi Minh City and Ha Noi in implementing mass rapid transit and reducing transport sector emissions.

5. Water and urban development

101. **Environment and climate change opportunities.** The ADB portfolio will continue to improve environmental management and water use efficiency by (i) incorporating localized reuse of wastewater, beginning with industrial wastewater; (ii) focusing on scaling up decentralized wastewater treatment options; and (iii) improving the knowledge base on groundwater quantity and quality. Opportunities to reduce the contribution of the urban and water sectors to GHG emissions will be captured through projects to recover or avoid fugitive methane release from landfills and wastewater treatment, as well as the improvements in urban transport mentioned in para. 100.

102. **Priority actions.** Under Prong I, for infrastructure and basic municipal service planning, both rural and urban, there is a need to apply integrated urban planning and improved development coordination. ADB will therefore focus its support on city planners and policy makers to help them cope with climate change impacts by improving multisector city planning. A new tool, the Global Environment and National Information Evaluation System, will be introduced for urban impact analysis to ensure that new infrastructure has sufficient resilience to cope with extreme events. Under Prong II, ADB will provide support to the Government of Viet Nam to improve spatial planning and water sector efficiency, capture methane from waste and wastewater, and build the resilience of the water and waste

management sectors. These actions are expected to yield multiple economic, environmental, social, and climate benefits. A focus on improving water sector operational efficiencies will assist in climate mainstreaming due to the direct correlation between reduced GHG emissions and reducing energy use from pumping and water losses. ADB has provided inputs into the draft Amended Water Resources Law that will place limits on surface and groundwater abstraction, a precondition for sustainable water use.

103. Under Prong III, ADB will support pilot attempts to provide financing for adaptation and mitigation in cities. For adaptation, disaster risk financing needs will be assessed in pilot cities, and products will be designed to respond to both natural disasters and climate change risks. To reduce GHG emissions through improved wastewater treatment, ADB will support the leveraging of global green finance schemes and will subsequently facilitate the scaling up of such initiatives. ADB will seek to do this, in particular, under the Multitranche Financing Facility for Viet Nam Water Sector Investment Program. Upcoming project preparatory TA for industrial wastewater management will prepare sovereign loans for centralized wastewater treatment in industrial areas, include a sector industrial pollution control action plan, and help industrial users perform the necessary pretreatment so that centralized processes are more effective and are not overwhelmed with untreated waste. For infrastructure and basic municipal service planning, both rural and urban, there is a need for integrated urban planning and better development coordination.

IX Guiding Principles

104. This thematic paper provides a review of environment and climate change issues in Viet Nam and their impact on socioeconomic development. ADB can expand its contribution to addressing these issues. ADB's ongoing and planned environment and climate change responses reflect a practical approach to improving natural resource management, adopting clean technology, improving environmental governance, and in particular improving SEA and EIA for investment projects to ensure long-term sustainability. With billions of dollars invested in infrastructure improvements, climate change responses will focus on adapting critical infrastructure and building resilience in coastal and low-lying areas in order to safeguard productive sectors of the Vietnamese economy. Combining guidance from ADB's overall strategies with an informed country-based approach to addressing strategic environmental and climate change priorities provides a useful framework for guiding ADB's Viet Nam program in partnership with the government. The following principles should guide the development of that program so that it has the maximum impact on achieving ecological sustainability and environmental quality while enhancing climate change resilience:

1. **Recognize the role of natural systems.** Recognize that healthy natural systems are a foundation for the development and well-being of socioeconomic systems and are essential for building resilience and sustaining economic growth.
2. **Maximize co-benefits.** Mitigation and adaptation actions should always contribute to sustainable ecological and social development as well as reducing climate change vulnerability and/or GHG emissions. The corollary to this principle is to ensure that adaptation actions do not contribute to environmental and biodiversity degradation.
3. **Pursue synergies.** Seek out opportunities to integrate adaptation and mitigation and to incentivize environmentally sustainable growth.
4. **Address the adaptation deficit.** What some refer to as "no regrets" options;[11] that is, addressing many day-to-day environmental and development challenges will enhance resilience to future climate change.
5. **Utilize a spatial planning approach.** Look at adaptation and mitigation options and their environmental implications from an integrated, area-wide perspective.
6. **Integrate with development planning.** Recognize that environmental safeguards and strategic assessments as well as adaptation and mitigation actions are part of development planning cycles. This means that priorities must be set early and some less urgent things left until later.
7. **Adapt in linked stages.** Seek to implement climate adaptation on a phased basis so that lessons can be learned, adjustments made, and each step prepares the ground for the next if required.
8. **Support mainstreaming.** Work with those most affected by environmental degradation and climate impacts and those whose actions can most enhance resilience of natural systems.

[11] 'Climate change adaptation decision-making supporting positive development outcomes, whether or not specific climate change impacts actually materialize' (definition from http://www.adb.org/sites/default/files/pub/2009/Under-Weather-Rising-Tide.pdf).

Table 4 ADB Approach to Climate and Environment Activities in Viet Nam (by Sector)

Sector and Division	Lessons Learned in Viet Nam	Opportunities/Options for Investment	Ongoing and Planned Investments in Viet Nam	Viet Nam CPS Outcomes and Indicators (numbering consistent with CPS)[a]
SEER: agriculture, land use management and conservation, land use change and forestry	(i) Limited capacity of provincial and local institutions to incorporate social and environmental aspects in project design and implementation (ii) Need for greater emphasis on establishing data sharing agreements and baselines before project implementation as a part of an extended inception phase (iii) Need to recognize agricultural biodiversity as a critical ingredient in building resilience in that sector and in rural livelihoods (iv) Need to view effective management of protected areas as an essential development strategy for climate change resilience and adaptive capacity (v) Weak institutional enforcement capacity for biodiversity conservation within and outside protected areas; need to establish corridors linking protected areas in landscapes for the rehabilitation and expansion of biodiversity assets and integration in provincial and sector plans	• Biomass-to-energy projects, and biogas digesters for livestock waste • Control of methane emissions from rice paddies (e.g., system of rice intensification) and livestock farms; conservation tillage and pest management • GHG mitigation through development of biogas and mini-hydro projects • Avoided deforestation through REDD pilot testing (Biodiversity Conservation Corridors Project) • Reducing carbon footprint of transport corridors through afforestation • Community-based power generation activities in rural areas (all countries) • Coral reef and mangrove rehabilitation and adaptive capacity of coastal communities • Coastal zone vulnerability mapping and erosion control • Adaptation of water resources (including improvement of small-scale aquaculture ponds and enhancement of rural water infrastructure)	Capacity Development for National Roll Out of Benefit Sharing Mechanism and Payment for Forest Ecosystem Services Biodiversity Conservation Corridors Project Forest for Livelihood Improvement in the Central Highlands The Quality and Safety Enhancement of Agricultural Products and Biogas Development Project GMS Flood and Drought Risk Management Strengthening Project Management and Developing Strategies and Options for Biogas Development Program Expansion Geo-Information Technology for Hazard Risk Assessment Climate Change Impact and Adaptation Study in the Mekong Delta Strengthening and Use of Country Safeguards	**Outcomes:** Better management, protection and use of land and forests. **Indicators:** (i) Total land area forested (from 40% to 42.5%), forest area/ hectares of forest (natural, protected, production), and hectares of forest under improved management (ii) Pattern of sustainable exploitation of forest resources (iii) Avoided GHG emissions due to community energy generation, afforestation, avoided deforestation (iv) Improved food security and increased child nutrition (v) Reduction in GHGs from farming practices (e.g., increased use of no-till agriculture, energy savings from irrigation improvements, or reduction in chemical inputs to agriculture)
SEER and SEUW: water management, water supply and sanitation	(i) Need to initiate integrated management plans at basin level to efficiently allocate and distribute water source to different sectors (ii) Improvement needed for plans to control water quality and water pollution control plans at basin level, covering all pollution sources	• Water conservation (including energy efficiency in water pumping systems) • Water conservation and climate proofing of water infrastructure and community-based flood management systems and strategies in MFF on flood management in selected river basins • Community water reservoirs and irrigation systems	Strengthening Water Resources Management and Irrigation Systems Rehabilitation Hai Phong Water Supply Integrated Rural Development Project in Central Province Emergency Rehabilitation of Calamity Damage (Supplementary)	**Outcome 1:** Improved urban environmental infrastructure and services (leading to reduced GHG emissions) **Indicators:** (i) Drainage, sewerage, and sanitation: Collection and treatment of domestic waste water to increase from 10% in 2010 to 20% in 2015 in Class III towns and larger. Track reduction in GHG emissions from water and wastewater treatment (WWT) in three projects

continued on next page

Table 4 *Continued*

Sector and Division	Lessons Learned in Viet Nam	Opportunities/Options for Investment	Ongoing and Planned Investments in Viet Nam	Viet Nam CPS Outcomes and Indicators (numbering consistent with CPS)[a]
	(iii) Further analysis and responses required to respond to the effects of upstream development of hydropower affecting downstream sectors such as agriculture and fisheries, industrial areas, and urban settlements (iv) Need to apply integrated spatial planning of urban areas covering all sectors in an area	• Restoration of coastal water infrastructure and development of early warning systems in the above MFF project; improved management of surface waters to reduce pressure on groundwater, especially in periods of drought • Integration of adaptation and disaster risk reduction and assessment of prospects for catastrophic risk insurance facility • Assessment of Clean Development Mechanism opportunities in waste management • Solid waste management including methane recovery from landfills • Wastewater treatment and wastewater sludge management to capture methane and use it as fuel for households • Energy efficiency through existing building retrofits • Integration of climate and pollution concerns in urban land use planning, including urban green spaces, landfill siting, and landfill management	Strengthening Water Management and Irrigation Systems Rehabilitation Project MFF Water Sector Investment Program GMS Flood and Drought Risk Management GMS Border Towns Development Project Thanh Hoa City Comprehensive Socioeconomic Development Coastal Cities Environment and Climate Change Phuoc Hoa Water Resources Supporting Viet Nam Water Sector Climate Change Impact and Adaptation Study in the Mekong Delta	(ii) Solid waste management: Domestic solid waste collected and disposed of in improved landfills (80% of urban solid waste collected in 2010 to 90% in 2015; 19 of 91 landfills classified as "sanitary" in 2010 to increase to 50% of landfills). Track reduction in GHG emissions from WWT in three projects. **Outcome 2:** Stronger subnational agencies responsible for provision of basic urban services improve resilience to climate change **Indicators:** (i) Improved delivery by subnational agencies in provision of water and sanitation services, including increased resilience to climate change (ii) Technical procedures on disaster and climate risk and pilot case studies demonstrating sector leverage of climate finance **Outcome 3:** Increased treatment of industrial wastewater leads to reduction in GHG emissions **Indicator:** Number of industrial zones with a functioning centralized WWT facility, to increase from below 40% in 2010 to 80% by 2015. GHG emissions reductions tracked in all ADB industrial WWT projects
SEEN: energy efficiency, renewable energy	(i) Progress is hampered by consistently low energy prices that have restricted the pursuit and adoption of clean technology (ii) Limited political will to reexamine tariffs and bring them closer to cost recovery levels, which has complicated efforts to incorporate demand management	• Safeguards successfully applied to all upcoming power generation projects to ensure minimal environmental impacts • Energy efficiency in power transmission and distribution • Capturing and recycling of excess heat and steam in coal-fired power plants through cogeneration and recovery of coal mine methane and coal bed methane for energy	Capacity Development on Environmental Management to the Power Sector Strengthen the Institutional, Legal and Regulatory Environment for Renewable Energy in Viet Nam Regional: Building Resilience in Energy Sector Projects	**Outcome 2:** Improved energy efficiency **Indicators:** (i) Decrease in energy and emissions intensity of production (ii) Decrease in percentage loss in newly built transmissions systems relative to baseline (iii) Tons of sulfur oxides and nitrogen oxides, and particulates per megawatt-hour emitted from new plants relative to baseline

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Table 4 *Continued*

Sector and Division	Lessons Learned in Viet Nam	Opportunities/Options for Investment	Ongoing and Planned Investments in Viet Nam	Viet Nam CPS Outcomes and Indicators (numbering consistent with CPS)[a]
	(iii) Minimal coordination and lack of linkages between environment sector specialists and the energy sector need to be overcome to ensure energy considerations are better reflected in Viet Nam's environment and climate agenda (iv) Few inclusive efforts have been made to scale up renewable energy usage in an inclusive manner (v) Minimal coordination of environmental efforts, with the Electricity Regulatory Authority of Vietnam and Ministry of Agriculture and Rural Development developing competing payment for environmental services schemes, where developers might face overlapping requests (vi) Quantifiable targets for mitigation are lacking in environment and climate change strategies	• High efficiency electric arc furnace in iron and steel plants, and gradual fuel switch from coal to gas in power plants • Energy efficiency improvement in power plants, cement, pulp and paper (e.g., use of waste energy from industrial processes such as cement, steel, and combined heat and power plants) • Demand-side management; energy efficiency improvement in the residential sector • Transmission and distribution of district heating • Assessment of Clean Development Mechanism and other market mechanisms including energy service companies and electric cooperatives for energy efficiency improvement • Guaranteed carbon audits of all thermal power plants supported by ADB • Support to develop regulatory frameworks for energy efficiency • Assessment of impacts of climate change on hydropower production and measures to overcome such impacts	Climate Change Risk Assessment for O Mon IV Capacity Building of National Power Transmission Corporation in a Competitive Power Market Improvement and Implementation and Downstream Impacts Management for Son La Hydro Power Project Supporting the Energy Efficiency Program Implementation Project Northern Power Transmission/ Expansion Sector Song Bung 4 Hydropower Project	**Outcome 3:** Promotion of renewable energy development **Indicator:** Proportion of renewable energy produced to total energy production **Outcome 4:** Climate-proofing of key energy infrastructure **Indicator:** (i) Reduction in greenhouse effects and carbon footprints from relevant energy sources (ii) Energy infrastructure with increased resilience to climate threats (e.g., improved institutional capacity for responding to natural disasters, technical guidelines for upgrading and constructing energy infrastructure).
SETC: transport (urban, rural, national, and regional)	(i) Review and increase of the flexibility of design standards against environmental and climate change imperatives (ii) Reexamination of transport modalities and the strategic planning processes leading to their definition nationally and in areas of the country	• Reduction of carbon footprint in road construction, GMS north provincial road development, by looking at prospects utilizing biofuels, and in railway rehabilitation • Integration of GHG mitigation concerns in road asset management and regional roads development	Improvement of Road Safety and Climate Resilience on National Highways of Roads Support Central and Local Governments to Implement Urban Environmental Improvement Program	**Outcome 1:** Increased efficiency in the transport of goods and people **Indicator:** All district and commune roads are accessible all year and maintained properly by 2020 (2004 baseline: 83.5% of rural population accessible), including resilience to natural disasters and climate impacts

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Table 4 *Continued*

Sector and Division	Lessons Learned in Viet Nam	Opportunities/Options for Investment	Ongoing and Planned Investments in Viet Nam	Viet Nam CPS Outcomes and Indicators (numbering consistent with CPS)[a]
	(iii) More careful assessment of transport routing options and modalities for the GMS economic corridors affecting Viet Nam to minimize environmental quality and biodiversity impacts and GHG emission (iv) Promotion of integrated urban transport planning and modalities that minimize fossil fuel and natural resource consumption and enhance resilience	• Assistance to develop a transport regulatory framework introducing fuel economy standards, biofuel mandates and fuel switch (e.g., diesel to compressed natural gas) • Assessment of prospects for growing biofuels along the road projects • Diffusion of bioethanol and biodiesel (all countries) • Electric vehicles for private transport • Climate proofing of roads northern GMS road network • Integration of vulnerability concerns and potential adaptation costs in road asset management	National Target Program Action Plan for Transport and Industrial Sectors and Three Provinces and Cities (Ho Chi Minh, Thanh Hoa, and Da Nang) Ha Noi MRT3 Sustainable Urban Transport Ho Chi Minh City MRT2 Sustainable Urban Transport Sustainable Rural Infrastructure Development in Northern Mountainous Provinces	**Outcome 2:** Sustainable urban transport **Indicators:** (i) Adequate reliable public transport in Ha Noi and Ho Chi Minh City with 35%–45% coverage by bus lines and elevated railways and subways (ii) Change in percentage of people using public transport and patterns of use (iii) Reduced GHG emissions from transport sector
SEHS: health	(i) Weak institutional capacity (ii) Need for improved management of health data and coordination between national and regional health organizations	• Assessment of climate-change-induced disease outbreaks (malaria, dengue) • Inclusion of preventive measures in health plans by local and national agencies (including strengthened disease surveillance) • Assessment of health improvement benefits of GHG mitigation • Investment in nutritional supplementation or other food security measures in areas at a high risk for natural disasters caused by environmental degradation and climate change	GMS Communicable Diseases Control Project Air Pollution, Poverty and Health Effects in Ho Chi Minh City	**Outcome 3:** Universal coverage and access to health services **Indicators:** • Under-5 child malnutrition reduced from 18%[b] to 15.0% by 2015 • Malaria reduced from 0.65[b] to 0.5 cases per 1,000 people by 2015

CPS = country partnership strategy, GHG = greenhouse gas, GMS = Greater Mekong Subregion, MFF = multitranche financing facility, MRT = metro rail transit, REDD = United Nations Collaborative Programme on Reducing Emissions from Deforestation and Forest Degradation in Developing Countries, SEEN = Southeast Asia Energy Division, SEER = Southeast Asia Environment, Natural Resources and Agriculture Division, SEHS = Southeast Asia Human and Social Development Division, SETC = Southeast Asia Transport and Communications Division, SEUW = Southeast Asia Urban Development and Water Division, WWT = wastewater treatment.

[a] Outcome and Indicator numbers refer to the numbers given in the draft Viet Nam Country Partnership Strategy 2012–2015. Additional components have been added to these proposed indicators to capture environment and climate benefits.

[b] Figures taken from SEDP 2011–2015.

Note: In 2009, A. Srinivasan put forward a policy paper suggesting Southeast Asia Department-wide priorities, many of which have been adopted in current programming, including closer alignment of department activities with national climate change action plans, joint programming of climate change investments with other donors, the establishment of country-specific climate change funds to tap into the private sector resources, and scaling up the current subregional initiatives. These opportunities are discussed in the table.

Appendix 1
Review of Climate Change Scenario and Impact Assessment Studies

1. **Viet Nam's Initial National Communication to the United Nations Framework Convention on Climate Change (Ministry of Natural Resources and Environment 2003).** The Government of Viet Nam has designated the Ministry of Natural Resources and Environment (MONRE) as the national focal point to coordinate the implementation of the United Nations Framework Convention on Climate Change (UNFCCC) and its Kyoto Protocol in Viet Nam. Viet Nam submitted its Initial National Communication to the UNFCCC Secretariat in December 2003, which contained a comprehensive synthesis of climate change impact assessments of Viet Nam and options for adaptation to climate change and the mitigation of greenhouse gas emissions. This work has now been updated and the Second National Communication to the UNFCCC was submitted in December 2010.

2. **Intergovernmental Panel on Climate Change Fourth Assessment Report (Intergovernmental Panel on Climate Change 2007).** The Intergovernmental Panel on Climate Change Fourth Assessment Report (IPCC AR4) summarizes the latest information relating to observed changes in climate and their effects, projected future changes to climate and their effects under various greenhouse gas (GHG) emissions scenarios, and the adaptation and mitigation options with which to respond to climate change. However, because the IPCC AR4 concentrates on the sub-continental to global scale (in the IPCC AR4 the Asian continent is split into six regions—South Asia, Southeast Asia, North Asia, East Asia, Central Asia, and Tibet), the information contained in the report does not reflect the intraregional nuances of climate change in Viet Nam, and is therefore not helpful for planning purposes.

3. **Rapid Assessment of the Extent and Impact of Sea Level Rise in Viet Nam (Carew-Reid 2007).** Given the evolving nature of climate science, and large amounts of uncertainty, associated with projecting the impacts of climate change on sea level, Carew-Reid (2007) avoids the debate of the timing, magnitude, and regional variability of sea-level rise and adopts a scenario of a 1-meter sea-level rise by 2100 for all coastal areas of Viet Nam. The digital surface model provided by the Shuttle Radar Topographic Mission is then used to estimate coastal inundation. This type of rapid assessment is useful for national (as opposed to local or province-level) studies whose purpose is to help define priorities for more detailed analysis and actions; however, it does not allow for regional-specific analysis or for the assessment of impacts of sea-level rise that is less than, or fractions of, a meter. The rapid assessment also does not consider future actions by the government, future demographic trends, or adaptations by development sectors, but instead aims to assist the government in fine-tuning and focusing its priorities for adaptive policies and actions and to provide some simple methods and guidance in the more detailed assessments that are needed to prepare actions plans. The scope and intent of the rapid assessment is therefore to provide material to trigger a discussion that would guide more detailed and accurate scientific assessments. These more detailed scientific assessments relating to climate change impacts on sea-level rise in Viet Nam have now been, or are being, undertaken (e.g., Southern Institute for Water Resources Planning [SIWRP] 2008, MONRE 2009, Institute of Meteorology, Hydrology and Environment [IMHEN] 2010b, MONRE 2012) and are discussed in paras. 4, 6, and 12.

4. **Southern Institute for Water Resources Planning Study on Climate Change Scenarios for Ca Mau Province (2008).** The objective of the study was to assist authorities and people in Ca Mau Province in revising and achieving the best development plan, which is sustainable and resilient to future climate change. This study identified sea-level rise, and cyclones (and subsequent flooding), together with subsidiary effects of water shortages (both domestic and for farm use) and waterborne diseases as the most significant risks affecting the Ca Mau community. In addition, these major risks can be further divided by their expected probability of occurrence. Cyclones and extreme weather events, although the most severe single risks, occur sporadically, while sea-level rise and water shortages are expected to have continuous effects on the community.

5. **Mekong River Basin Water Resources Assessment: Impacts of Climate Change (Eastham et al. 2008).** This report, funded by the Australian Agency for International Development, was prepared by the Australian Commonwealth Scientific and Research Organization (CSIRO) and assessed the impacts of climate change on water resources for the entire Mekong River Basin. While the study area is the entire Mekong River Basin, data are presented for smaller areas including the Mekong Delta. Results indicate an increase (by 2030) in mean annual temperatures (averaged across the basin) of between 0.68°C and 0.81°C (with most of the increase occurring in the northern parts of the basin) and an increase in mean annual precipitation (averaged across the basin) of between 2% and 24% (mostly as a result of an increase in wet season precipitation that is common across all catchments of the basin). For catchments in the south of the basin (including Cambodia, central and southern Lao People's' Democratic Republic, eastern Thailand, and Viet Nam), dry season rainfall is projected to decrease by about 8%. As a result, relative to historical conditions, surface water availability in the Mekong Delta region is expected to reduce during dry season months but there is also a high probability of increased flooding during the wet season. This study also provides useful information on the impacts of climate change on saline intrusion and agriculture in the Mekong River Basin. However, as with the results already discussed, the information is only available for 2030 and only under the A1B scenario (i.e., mid-range).[1]

6. **Climate Change, Sea Level Rise Scenarios for Viet Nam (MONRE 2009).** In June 2009, MONRE released official climate change and sea-level rise scenarios for Viet Nam. These scenarios were developed for the 21st century (every 10 years from 2020 to 2100) using IPCC AR4 global circulation model outputs (obtained from MAGICC/SCENGEN model) using both statistical and dynamical downscaling approaches. Projected changes, relative to the 1980–1999 baseline period (consistent with the IPCC AR4), were obtained for annual mean temperature and precipitation under B1, B2, and A2 emission scenarios for the seven Viet Nam climate zones and for mean sea-level change under B1, B2, and A1FI.

7. MONRE (2009) appears to be the main source of climate change impact information for Viet Nam with subsequent studies (e.g., IMHEN 2010a, 2010b; MONRE 2010, 2012) relying on the information produced in MONRE (2009). However, there are significant limitations and knowledge gaps within the MONRE (2009) scenarios are the focus of ongoing studies by the government and

[1] In order to obtain information about future climate conditions, several GHG emission scenarios have been developed that explore alternative development pathways, covering a wide range of demographic, economic, and technological driving forces and resulting GHG emissions. The GHG emission scenarios are further described in the Intergovernmental Panel on Climate Change Special Report on Emissions Scenarios (IPCC 2000). In summary, the A1 storyline assumes a world of very rapid economic growth, a global population that peaks in mid-century and rapid introduction of new and more efficient technologies. A1 is divided into three groups that describe alternative directions of technological change: fossil energy intensive (A1FI), non-fossil energy resources (A1T), and a balance across all sources (A1B). B1 describes a convergent world, with the same global population as A1, but with more rapid changes in economic structures toward a service and information economy. B2 describes a world with intermediate population and economic growth, emphasizing local solutions to economic, social, and environmental sustainability. A2 describes a very heterogeneous world with high population growth, slow economic development, and slow technological change. In summary, predicted global temperature increase is lowest in the B1 scenario and increases through B2 to A2 and is highest in the case of A1FI.

donors, including ADB's technical assistance Support for the National Target Program on Climate Change with a Focus on Energy and Transport. They include the following:

- SRES A1FI is not considered for temperature or precipitation (particularly relevant as this appears to be the emission scenario that observed global carbon dioxide levels are tracking at, however, various GHG emission scenarios do not diverge significantly until after about 2030).
- Climate scenario information is restricted to precipitation, average temperature, and sea-level rise (with evaporation inferred from temperature). No scenarios exist for other important variables (e.g., maximum temperature, minimum temperature, wind speed, typhoon activity, humidity, and extreme rainfall) other than those that can be inferred by assuming all variables change in the same way as, or in relation to, temperature.
- Climate scenario information is restricted to annual or seasonal time scales. No scenarios exist at the daily scale (e.g., change in number of rain days, change in rainfall intensity, and change to daily temperature extremes).
- No baseline (i.e., historical) or future scenario information is included relating to the climate change impacts on secondary variables (e.g., streamflow, flood risk, drought risk, saline intrusion, and coastal inundation).
- No information is provided on the historical or future role of natural climate variability (e.g., El Niño/Southern Oscillation).

8. Some of these points have been addressed—maximum and minimum temperature projections, for example—in recent projects by IMHEN (2010a, 2010b, 2012), but significant issues and knowledge gaps still remain.

9. **Viet Nam Assessment Report on Climate Change (Institute of Strategy and Policy on Natural Resources and Environment 2009).** This report is produced by the Institute of Strategy and Policy on Natural Resources and Environment (ISPONRE), under MONRE, in collaboration with national and international experts. The report provides a comprehensive overview of Viet Nam's baseline climate information, climate change scenarios, and sector impacts under various future scenarios. The report concentrates on the seven climatic zones of Viet Nam.

10. **Impacts of Climate Change on Water Resources and Adaptation Measures (IMHEN 2010a).** This study analyzed the impact that projected changes to rainfall and temperature would have on Viet Nam's seven largest river basins, including the Mekong Delta. Changes to annual flows, wet season (flood) flows, and dry season (drought) flows were inferred by using the temperature and precipitation scenarios developed in MONRE (2009) as inputs to rainfall–runoff models. Only scenarios A2 and B2 were assessed (i.e., no A1FI information) and the time-slices for which information is available are 1980–1999 (baseline), 2020–2039, 2040–2059, and 2080–2099 (i.e., 2030 scenario is available but not 2070). For some of the river basins analyzed, information is also provided on the impact of climate change on flood inundation, saline concentration, salinity intrusion, water required for irrigation, and hydropower capacity (but only for the A2 and B2 scenarios and time-slices differ for some of the variables). Possible or proposed adaptation measures are also discussed for some sectors. This study is useful in providing an overall picture of the impact of climate change on water resources in the Mekong Delta as a whole.

11. **Sea Level Rise—Scenarios and Possible Risk Reduction in Viet Nam (IMHEN 2010b):** This study is a companion study to IMHEN (2010a). Sea levels for coastal Viet Nam were calculated based on nominal increases of 0.50 m, 0.75 m, and 1.00 m, independent of emissions scenarios or global climate modeling. However, IPCC AR4 emissions scenarios (A1FI, B1, A2) were used to determine the year in which a sea-level rise scenario would be reached. Importantly, it was assumed that the changes to sea

levels, and resulting coastal inundation, were as a result of changes to mean sea levels only. This is unlikely to be the case, as precipitation, river flooding, and storm surges will also play a role.

12. **Viet Nam's Second National Communication to the United Nations Framework Convention on Climate Change (MONRE 2010).** This report is the follow-up to Viet Nam's Initial Communication to the UNFCCC. As with MONRE (2003), this national report, which draws on all the studies previously mentioned, provides an overview of the national approach taken to assessing the impacts of climate change and presents a useful summary of available information and existing knowledge gaps. The report summarizes historical variability and trends for the seven Viet Nam climate zones for temperature; precipitation; cold fronts; typhoons (frequency, intensity, location, and path); and sea level. This information is very useful for ADB to establish an understanding of current (i.e., not impacted by anthropogenic climate change) conditions for the variables mentioned.

13. MONRE (2010) utilizes the climate scenarios that were the most up to date and available for Viet Nam at the time (i.e., those discussed in Section 24, MONRE, 2009). MONRE (2010) also summarizes what is known about the impacts of climate change on Viet Nam's water resources. The annual mean temperature and precipitation scenarios discussed in MONRE (2009) were used in conjunction with rainfall–runoff models to obtain information on the impacts of climate change on annual flows, wet season (flood) flows, dry season (low) flows, and potential evapotranspiration (calculated using the temperature scenarios) (see IMHEN [2010a] for details). As discussed in Section 28, only scenarios A2 and B2 were assessed (i.e., no A1FI information) and the time-slices for which information is available are 1980–1999 (baseline), 2020–2039, 2040–2059, and 2080–2099 (i.e., the 2030 scenario is available but not the 2070 scenario). MONRE (2010) also summarizes what was known at the time about the impacts of climate change on coastal zones, agriculture, forestry, aquaculture, energy and transport, and human health. Apart from coastal impacts, much of the analysis is focused at the national level or on a few specific locations.

14. An important part of MONRE (2010) is the final section, which focuses on limitations, constraints, and capacity-building needs that Viet Nam currently faces in assessing and adapting to the impacts of climate change (and GHG mitigation). These include the following:[2]

- The application of the MAGICC/SCENGEN 5.3 model in the development of climate change scenarios, which produces low-resolution grid maps (300 km by 300 km) and makes it difficult to accurately reflect the local specificities of climate change in Viet Nam.
- The database for impact assessments and adaptation cost–benefit analyses is incomplete.
- There is currently a lack of in-depth analysis to distinguish and assess impacts induced by climate change from other natural phenomena (e.g., El Niño/Southern Oscillation).
- Impact assessment and adaptation-response development models and tools are insufficient, in particular for cross-sector or interregional assessments.
- There is a shortage of technical experts capable of running studies focused on climate change impact assessment and adaptation strategies.
- The current hydrometeorological observation network is insufficient and inadequately distributed across climate zones, and therefore it is unable to meet the demands for climate monitoring and/or early disaster warning.

[2] It is important to note that in the time between the drafting of the report and publication, CSIRO initiated a major climate modeling initiative in partnership with the Government of Viet Nam to fill many of the capacity building needs. Furthermore, a small regional consortium of universities with modeling capacity in strategic environmental assessment began a partnership on downscaled modeling (contact the Universiti Kebangsaan Malaysia for more information). Any future technical assistance should review the results of CSIRO and planned regional work to identify remaining gaps.

- Broad national and/or multisector studies that assess climate change impacts and develop adaptation measures for the most vulnerable sectors and ecosystems have not been conducted.
- Climate change education, training, and awareness-raising plans and programs are unavailable at the national level.

15. It is necessary to assess the level of climate-change–related technological and analytical needs at the ministerial, agency, and provincial levels. Technical experts and professionals within Viet Nam need to be trained in order to facilitate the prompt and successful adoption of new climate-change–related technologies. More importantly, at the provincial and district levels, officials must understand the implications of applying or not applying climate-change–related technologies in their work. To date, the Ministry of Construction, for example, has more than 1,000 safe building codes; however, they are not widely implemented to reduce risks from climate change and natural disaster.

Appendix 2
ADB Country and Regional Assistance for Environment and Climate Change in Viet Nam

Sector	Project Code	Name of Project	TA/ Loan	Strategic Priority	Location	Key Related Climate Change Activities
Agriculture and Natural Resources	2513	Quality and Safety Enhancement of Agricultural Products and Biogas Development Project	Loan	Expanding the use of clean energy	Da Nang, Ha Noi, and Ho Chi Minh City	One of the project's components deals with biogas development. It is estimated that the proposed biogas operation will reduce carbon dioxide emissions by the equivalent of about 40,000–60,000 tons per annum, while providing power to small farmers.
Agriculture and Natural Resources	7251	Strengthening Project Management and Developing Strategies and Options for Biogas Development	TA	Expanding the use of clean energy	Bac Giang, Ben Tre, Binh Thuan, Da Nang, Ha Noi, Hai Duong, Hai Phong, Ho Chi Minh City, Lam Dong, Ninh Thuan, Phu Tho, Son La, Thai Nguyen, Tien Giang, Vinh Phuc, and Yen Bai	The TA will be working to design an investment program for the expansion of biogas development in Viet Nam that responds to clients' needs and fulfills ADB's requirements and safeguard policies.
Agriculture and Natural Resources	7215	Sustainable Rural Infrastructure Development Project in Northern Mountain Provinces	TA	Promoting climate-resilient development	Northern mountain region	The TA will (i) identify and develop appropriate climate-proofing measures adapted to the rural areas of Viet Nam, particularly for steep terrain; (ii) demonstrate a range of appropriate and effective methods to increase the climate resilience of rural infrastructure.
Agriculture and Natural Resources	2357	Integrated Rural Development Sector Project in Central Provinces	Loan	Promoting climate-resilient development	Coastal Central Provinces: Thanh Hoa, Nghe An, Ha Tinh, Quang Binh, Quang Tri, Thua Thien-Hue, Quang Nam, Quang Ngai, Kon Tum, Binh Dinh, Phu Yen, Ninh Thuan, and Binh Thuan	Loan aims to improve rural infrastructure in the Central Region through the construction and rehabilitation of transport, irrigation and water infrastructure schemes, as well as markets.

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Sector	Project Code	Name of Project	TA/ Loan	Strategic Priority	Location	Key Related Climate Change Activities
Agriculture and Natural Resources	2273	Emergency Rehabilitation of Calamity Damage (Supplementary)	Loan	Promoting climate-resilient development	Ha Giang, Ha Tinh, Nam Dinh, Nghe An, Phu Tho, Phu Yen, Quang Binh, Quang Tri, Thanh Hoa, and Yen Bai Provinces	The project will rehabilitate and strengthen infrastructure in four sectors: (i) flood protection, (ii) irrigation, (iii) roads and bridges, and (iv) social services.
Agriculture and Natural Resources	2996	Phuoc Hoa Water Resources (Supplementary)	TA	Promoting climate-resilient development		The project will develop the water resources of the Song Be River and transfer them to the Saigon and Vam Co Dong rivers for irrigation to increase agricultural production, provide bulk water for Ho Chi Minh City and control saline intrusion thereby providing social, economic, and environmental benefits.
Agriculture and Natural Resources	2970	Greater Mekong Subregion Flood and Drought Risk Management and Mitigation	Loan	Promoting climate-resilient development	Cambodia, Lao PDR, and Viet Nam	The project aims to reduce the vulnerability of flood-affected communities to the negative impacts of floods and emphasize risk reduction strategies aimed at preventing major floods from becoming disasters.
Agriculture and Natural Resources	8102	Promoting Climate Resilient Rural Infrastructure in the Northern Mountain Provinces	TA	Promoting climate-resilient development	Bac Giang, Hoa Binh, Vinh Phuc, Thai Nguyen, Ha Giang, Cao Bang, and Bac Can	The TA facilitates (i) the mainstreaming of climate risk reduction into policy and planning; (ii) increased understanding about climate risks and promotion of climate resilience at central and local planning levels; and (iii) a meaningful demonstration of low cost measures to reduce the vulnerability of rural infrastructure to extreme climate events.
Agriculture and Natural Resources	7926	Modernizing Irrigation Systems in the Mid- and Northeast Red River Delta (Water Resources Development in the Mid- and Northeast Red River Delta)	TA	Promoting climate-resilient development	Northeast portion of the Red River Delta (Bac Ninh, Bac Giang, Vinh Phuc, and Phu Tho)	Improve irrigation and drainage infrastructure on approximately 10 water resources control schemes. The project will also promote economic development through associated rural development support activities; promote the sustainability of improved systems through participatory irrigation management (PIM) and the training of personnel of irrigation and drainage management companies (IDMC); and strengthen the cadre of personnel engaged in water resources infrastructure improvement and management. The project is consistent with government's priorities for modernizing the agriculture, natural resources and environment (ANRE) sector, and promoting economic growth and sustainable use of the country's natural resources.
Agriculture and Natural Resources	7220	Geo-Information Technology for Hazard Risk Assessment	TA	Strengthening policies, governance, and capacities	Training in country-wide with a pilot in Yen Bai	The TA will support increased disaster preparedness to mitigate the worst impacts of climate change through the provision of staff training for the Ministry of Agriculture and Rural Development's Disaster Management Center and the Water Resources University on the use of advanced technology.

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Sector	Project Code	Name of Project	TA/ Loan	Strategic Priority	Location	Key Related Climate Change Activities
Agriculture and Natural Resources	2636	Strengthening Water Management and Irrigation Systems Rehabilitation	Loan	Strengthening policies, governance, and capacities	Northern Viet Nam	Improvement of Basic Household Irrigation System and strengthening of local decision making bodies will decrease vulnerability to climate change in the Red River Delta. (The outputs of a climate change study in this region funded by Agence Française de Développement will be integrated in the design of the irrigation system)
Energy	4689	Develop Benefit Sharing Mechanisms for People Affected by Power Generation Projects	TA	Expanding the use of clean energy	Northern Mountainous and Central Highland	The projects supports the preparation and pilot testing of guidelines to introduce benefit sharing mechanisms on hydropower in Viet Nam.
Energy	7262	Capacity Building of Renewable Energy Development	TA	Expanding the use of clean energy	Lai Chau and Dien Bien, Quang Nam and Hue Tra Vinh, and Soc Trang Quang Tri	The TA will (i) develop a policy framework for renewable energy development in Viet Nam by supporting the government in developing a new renewable energy law and implementing decrees and guidelines, and (ii) building capacity for sustainable small-scale hydropower plants.
Energy	7222	Capacity Building of the National Power Transmission Corporation in a Competitive Power Market Environment	TA	Expanding the use of clean energy	Ha Noi	The small-scale TA will support government efforts to introduce a competitive electricity market in Viet Nam by providing capacity building to the newly incorporated transmission entity, the National Power Transmission Corporation.
Energy	4966	Capacity Building on Environmental Management to the Power Sector	TA	Expanding the use of clean energy	Quang Ninh	The TA will focus on strengthening Vietnam Electricity staff capacity in environmental management and adopting best environmental practices to ensure sustainable development of thermal power projects in Viet Nam.
Energy	7377	Climate Change Impact and Adaptation Study in Mekong Delta	TA	Expanding the use of clean energy	Mekong Delta region in southern Viet Nam: An Giang, Bac Lieu, Ben Tre, Ca Mau, Can Tho, Dong Thap, Kien Giang, Long An, Soc Trang, Tien Giang, Tra Vinh, and Vinh Long	Provided comprehensive vulnerability in Ca Mau and Kien Giang, combining bottom up evaluation of key socioeconomic trends, poverty indicators, and sector development plans for the agriculture, energy and transport sectors and climate projections for Viet Nam including statistically downscaled data for temperature and rainfall, together with the regionally downscaled scenarios for sea level rise and region's latest hydrological river flow scenarios.
Energy	4711	Implementation of the Environmental Management Plan for the Son La Hydropower Project	TA	Expanding the use of clean energy	Viet Nam	The TA focuses on achieving sustainable and environmentally sound development of the energy sector in Viet Nam. The TA aims at building the capacity of Vietnam Electricity in environmental management best practices in relation to developing its hydropower.

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Sector	Project Code	Name of Project	TA/ Loan	Strategic Priority	Location	Key Related Climate Change Activities
Energy	2353	Mong Duong 1 Thermal Power Project—Tranche 1	Loan	Expanding the use of clean energy	Northern Viet Nam	The project comprises the construction of the 1,000 MW Mong Duong 1 Thermal Power Plant, the power complex that will have an installed generating capacity of 2,000 MW or 2,200 MW upon completion, depending on the boiler technology selected for the second phase.
Energy	2128/ 2225	Northern Power Transmission Expansion Sector	Loan	Expanding the use of clean energy	Northern Viet Nam	The majority of energy produced in the north of Viet Nam is supplied through hydropower. This project funds the expansion and upgrading of the transmission systems to broaden the use of renewable energy. A modern grid will also be more energy efficient.
Energy	2517	Renewable Energy Development and Network Expansion and Rehabilitation for Remote Communes Sector	Loan	Expanding the use of clean energy	Lai Chau, Dien Bien, Quang Nam, Hue, Tra Vinh, and Soc Trang Quang Tri province	The project will finance the development of 5–10 mini-hydropower plants, of less than 7.5 MW capacity each in the northern and central provinces of Viet Nam. The project will also finance the connection of these mini-hydropower plants to the national grid.
Energy	2429	Song Bung 4 Hydropower Project	Loan	Expanding the use of clean energy	Quang Nam	The project consists of the construction of a 156 megawatt hydropower plant in the Vu Gia-Thu Bon River Basin in Quang Nam province, central Viet Nam. Aside from the generation benefits, the addition of this renewable energy source will contribute to Viet Nam's targets of sourcing 30% of its needs from renewable sources by 2020.
Energy	7024	Supporting the Implementation of the National Energy Efficiency Program Project	TA	Expanding the use of clean energy	Viet Nam	The TA will promote energy conservation in the industry sector in Viet Nam so as to substantially reduce energy consumption while delivering a higher level of energy services to the sector.
Energy	43302	Wind Power Development	Loan	Expanding the use of clean energy	N/A	N/A
Energy	41436	Energy Efficiency in the Industry of Vietnam	Loan	Expanding the use of clean energy	Viet Nam	Upgraded and commissioned production lines in 5 cement and 2 steel plants. Strengthened capacity of personnel on environmental monitoring, to operate and maintain new commissioned equipment and structure energy contracting investments in five cement and two steel plants.
Energy	7942	Energy Efficiency in the Industry Project	TA	Expanding the use of clean energy	Viet Nam	The proposed project will refurbish and upgrade the production lines of five cement and two steel plants that were identified as high priority under ADB ADTA 7024 based on energy audit and investment grade audit.

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Sector	Project Code	Name of Project	TA/ Loan	Strategic Priority	Location	Key Related Climate Change Activities
Energy	N/A	Wind Power Development	Loan	Expanding the use of clean energy	N/A	N/A
Energy	7575	Determining the Potential for Carbon Capture and Storage in Southeast Asia	TA	Strengthening policies, governance and capacities	Viet Nam	The TA will implement the carbon capture and storage demonstration road map in at least one country in Southeast Asia. The outcome will be greater capacity to plan and manage carbon capture and storage demonstration projects in the focus countries.
Energy	7779	Support for the National Target Program on Climate Change with a Focus on Energy and Transport	TA	Strengthening policies, governance and capacities	Industrial and transport sectors, Ho Chi Minh City, Da Nang cities, and Tanh Hoa provinces	The TA will estimate the current and future contribution of the industry, trade, and transport sectors to GHG emissions and determine mitigation opportunities. The TA will also review and strengthen related policies and implementing rules; build institutional capacity to implementing the plans.
Transport	2741	Ha Noi Metro Rail System	Loan	Encouraging sustainable transport and urban development	Ha Noi	Reduces emissions from private vehicle travel by providing a safer, cleaner, and more efficient urban transport system.
Transport	39500	Ho Chi Minh City Metro Rail System	Loan	Encouraging sustainable transport and urban development	Ho Chi Minh City	The first stage of a mass transit transport system, that will improve urban livability by addressing the constant urban degradation and traffic congestion, reduce traffic accidents, and improve the city's air quality.
Transport	7892	Sustainable Urban Transport for Ho Chi Minh City MRT Line 2	TA	Encouraging sustainable transport and urban development	Ho Chi Minh City	Support effective utilization of HCMC MRT 2. Facilitate connectivity and greatly enhance access to transport services in five districts of HCMC. Support the HCMC Urban Transport Master Plan (HUTMP) objective of increasing public transport usage to over 40% of demand and reducing dependency on private vehicles. Support Ho Chi Minh City's CC mitigation efforts in adopting a low carbon transport growth path, which is more energy efficient and lowers GHG emissions.
Transport	2741	Ha Noi Metro Rail System Project (Line 3: Nhon-Ha Noi Station Section)	Loan	Encouraging sustainable transport and urban development	Ha Noi	Develop a new double track metro rail line in Ha Noi, Metro line 3 will (i) facilitate public transport connectivity, (ii) greatly enhance access in five districts of Ha Noi, and (iii) be an important integral part of an improved public transport system, which aims to achieve increased public modal share through low-carbon transport that reduces GHG emissions.

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Sector	Project Code	Name of Project	TA/ Loan	Strategic Priority	Location	Key Related Climate Change Activities
Transport	7894	Strengthening Sustainable Urban Transport for Ha Noi Metro Line 3 Project	TA	Encouraging sustainable transport and urban development	Ha Noi	Develop an integrated public transport system in five districts of Ha Noi to support effective utilization of Ha Noi MRT 3. Improved public transport will facilitate public transport connectivity and greatly enhance access in five districts of Ha Noi, as well as support the Ha Noi Urban Transport Master Plan (HUTMP) objective of increasing ridership on public transport to over 40% of demand and reducing dependency on vehicle ownership. The project will support Ha Noi's climate change mitigation efforts in adopting a low carbon transport growth path, which is more energy efficient and lowers GHG emissions.
Urban and water	2511/ 0147	Thanh Hoa City Comprehensive Socioeconomic Development	Loan	Encouraging sustainable transport and urban development	Thanh Hoa City, Thanh Hoa province	The proposed project will comprise three main interrelated investments: (i) core urban environment upgrading; (ii) integrated peri-urban development; and (iii) investments in key economic sectors, such as industry and tourism.
Urban and water	41456-2961	Water Sector Investment Program	Loan	Encouraging sustainable transport and urban development	Binh Duong Province, Dak Lak Province, Da Nang City, Hai Phong City, Thua Thien Hue Province, and Quang Tri Province	The objectives of the multitranche financing facility are to strengthen the commercial operation of water supply companies and boost investment to expand system capacity.
Urban and water	41068	Industrial Wastewater Management	TA	Encouraging sustainable transport and urban development	Viet Nam	Include sovereign loans for central wastewater treatment and nonsovereign loans to improve pre-treatment, as well as funding for improvement of environmental regulations.
Urban and water	7856	Comprehensive Urban Development of Ha Tinh, Tam Ky, and Buon Ma Thuot – Secondary Cities Development Project	TA	Encouraging sustainable transport and urban development	Ha Tinh, Tam Ky, and Buon Ma Thuot	High consideration was provided to the protection of communities from floods and natural disaster risks, therefore completion of flood control and drainage works from the Central Regions Urban Environment Improvement Project (CRUEIP) where there were gaps in essential flood protection work in Ha Tinh and Tam Ky was given highest priority.
Urban and water	7885	Support Central and Local Governments to Implement Urban Environmental Improvement Programs	TA	Encouraging sustainable transport and urban development	Viet Nam	Help prepare, support, and advise central and local government agencies in the implementation of large-scale programmes and projects that are to bring environmental improvements to urban areas, by planning and implementing appropriate interventions in the collection, treatment, and disposal of wastewater. Climate change will be at the core of the urban environment planning process.

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Sector	Project Code	Name of Project	TA/ Loan	Strategic Priority	Location	Key Related Climate Change Activities
Urban and water	8357	Improving Operational Performance of the Water Supply Sector	TA	Encouraging sustainable transport and urban development	Viet Nam	1. Improved performance and accountability of selected water companies 2. Introduction of pragmatic procedures for implementing the Non-Revenue Water Reduction Program 3. Support for monitoring and evaluation mechanisms for water supply services
Urban and water	N/A	Coastal Cities Urban Environment and Climate Change	TA	Encouraging sustainable transport and urban development	N/A	N/A
Urban and water	7151	Preparing the Hai Phong Water Supply	TA	Promoting climate-resilient development	Hai Phong	The project will (i) improve the living conditions and health of residents, (ii) redress water-supply inadequacy as a factor limiting economic growth and development, and (iii) help to improve institutional constraints affecting the sector.
Urban and water	N/A	Study on Climate Impact Adaptation and Mitigation in Asian Coastal Mega Cities—Ho Chi Minh City Phase II: Impacts and Options	TA	Promoting climate-resilient development	Ho Chi Minh City	This pilot will provide an overall assessment of climate change impact and adaptation of major Asian coastal cities, and will collectively, along with other initiatives supported by the Japan Bank for International Cooperation and the World Bank, improve climate resilience in selected Asian cities.
Urban and water	N/A	Strengthen the Institutional, Legal and Regulatory Environment for Renewable Energy in Viet Nam	TA	Strengthening policies, governance, and capacities	N/A	N/A

ADB = Asian Development Bank, GHG = greenhouse gas, HCMC = Ho Chi Minh City, MW = megawatt, TA = technical assistance.

Source: ADB database.

Appendix 3
Climate Change Donor Assistance

Viet Nam receives international support from a number of partners to address environment and climate change issues. A list of specific donor projects is included below.

(i) The Nordic Development Fund is providing support to integrate climate change concerns into an ADB initiative to improve road connectivity in the northern mountainous provinces. The Nordic Development Fund is also supporting the Ministry of Investment and Trade, the Ministry of Transport, Ho Chi Minh City, Da Nang, and Thanh Hoa Province in developing and implementing detailed climate change action plans in support of the National Target Program to Respond to Climate Change (NTP-RCC).

(ii) The World Bank funds a protected area support program through the Viet Nam Conservation Fund and coordinates projects on industrial pollution and a natural resources management project. The World Bank has selected Viet Nam as a pilot country for the Forest Carbon Partnership Facility and is assisting the country to prepare for funding from the United Nations Collaborative Programme on Reducing Emissions from Deforestation and Forest Degradation in Developing Countries (REDD) to address climate change issues. Through the Global Environment Facility, it is also supporting a Ha Noi urban transport initiative and a rural electricity project.

(iii) The United Nations Development Programme (UNDP) has supported the initiation of the NTP-RCC with the Ministry of Natural Resources and Environment (MONRE), disaster risk reduction with the Ministry of Agriculture and Rural Development, and sustainable development and climate change initiatives with the Ministry of Planning and Investment, in addition to leading the REDD pilot program. It is also taking part in two energy efficiency programs, one in public lighting and the other in labeling.

(iv) Australia has a long history of supporting community-based disaster risk management and improved efficiency and adaptation in the agriculture sector. The Australian Agency for International Development (AusAID) and ADB are cofinancing the Mekong Delta Climate Change Impact and Adaptation Assessment Project. AusAID has a major collaboration with GIZ on climate change and coastal protection in five delta provinces. AusAID is contributing to the climate change fund set up to support NTP-RCC implementation, and is planning to introduce a substantial grant facility to support the implementation of adaptation projects by nongovernment organizations.

(v) Danish International Development Assistance provides support on environmental mainstreaming, which includes environmental impact assessment and strategic environmental assessment support, marine conservation, industrial pollution, and climate change adaptation and mitigation. Denmark has a $40 million program with MONRE in support of NTP-RCC implementation, including support to MONRE in developing official climate change scenarios.

(vi) In addition to supporting the Support Program to Respond to Climate Change with Japan, Agence Française de Développement is establishing an energy saving scheme in the steel sector and is also doing an internal study on climate change and urban planning.

(vii) Germany provides a range of support in the forest sector for plantation development, sustainable forest management, biodiversity conservation, and integrated water resources management. It also supports the Megacity Research Project that is developing spatial planning and adaptation approaches for Ho Chi Minh City and is implementing the delta climate change program with Australia.

(viii) The Japan International Cooperation Agency has provided a broad range of support for environmental management, especially forestry management, and is now incorporating a climate change approach. New initiatives include capacity building for reforestation utilizing the Clean Development Mechanism and the joint Support Program to Respond to Climate Change with France.

(ix) The Netherlands provides support for forests and biodiversity conservation, and coastal zone management.

(x) Norway provides support through UNDP for REDD capacity building as well as carbon capture and sequestration technology for coal-fired power generation.

(xi) The Department for International Development of the United Kingdom (DFID) is an important partner in climate change economics and low-carbon growth planning in strategic environmental assessments with ADB.

(xii) The United States Agency for International Development is setting up two regional programs on climate change mitigation and adaptation. One is Low-Emissions Asian Development, which will focus on building capacity for monitoring and verification of activities and emissions reduction activities. The other focuses on strengthening capacity in the Mekong Basin to implement climate change adaptation plans and strategies.

Snapshot of other bilateral and multilateral climate change activities include the following:

Donor	Key Projects
Asian Development Bank	• RETA 6438: Implementation of the Technical Support Facility under Carbon Market Initiative, 2009–2011 • TA 7024-VIE: Supporting Implementation of the National Energy Efficiency Program Project • TA 41013: Preparing the Thanh Hoa City Comprehensive Socioeconomic Development Project • TA Climate Change Impact Assessment and Adaptation in Ho Chi Minh City, 2008–2009 • TA Mekong Delta Climate Change Impact and Adaptation Assessment
Agence Française de Développement	• TA regarding the implementation of the support program to respond to climate change in Viet Nam, 2010–2012 • Internal study on urban planning and climate change in Viet Nam • Establishment of an Energy Savings Scheme In the Steel Sector in Viet Nam (2011–2012)
Danish International Development Agency	• Supporting Implementation of the National Energy Efficiency Program, 2008–2013 • TA for development of the Government of Viet Nam official climate change scenarios • Ongoing support for the implementation of climate change activities under the NTP-RCC
Rockefeller Foundation	• Asian Coastal Cities Climate Resilience Network Program, 2008–2012
Mekong River Commission	• Climate Change Adaptation Initiative, 2010–2015 • Climate Change Vulnerability and Adaptation Assessment for Wetlands in the Mekong Basin (Tram Chim and Ca Mau) (2011)
UK Official Development Assistance/Department for International Development	• Media Net Programme (Journalists training in communicating environmental and climate change issues), 2008–2011
Australian Agency for International Development	• Mekong Delta Climate Change Forum 2009 • Mekong Delta Climate Change Impact and Adaptation Assessment

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Donor	Key Projects
Japan International Cooperation Agency	• Climate Change and Forests • Capacity Building for Afforestation and Reforestation according to Clean Development Mechanism Promotion • Control of greenhouse gas emissions in Viet Nam
United Nations Development Programme	• Strengthening national capacities to respond to climate change in Viet Nam reducing vulnerability and controlling greenhouse gas emissions, 2008–2012 • Barrier Removal to Implement Cost Effective Energy Efficient Standards and Labelling, 2008–2012 • Viet Nam National Energy Efficiency in Public Lighting
United Nations Industrial Development Organization	• Advisory support to the formulation of the Ministry of Investment and Trade's Action Plan in Response to Climate Change, 2009–2010
United States Agency for International Development	• The Low-Emissions Asian Development Program, 2011–2016 • The Mekong River Basin Climate Change Adaptation Programme (2011–2016)
World Bank	• Ha Noi Urban Transport Development Project (Global Environment Facility component), 2007–2013 • Economics of Adaptation to Climate Change (EACC) – Social Issues Study in Viet Nam, 2009–2010 • Viet Nam Global Environment Facility Rural Energy II 2004–2011
German Official Development Assistance	• Megacity Research Project (Derive adaptation options for urban land use planning) Ho Chi Minh City, 2009–2014

RETA = regional technical assistance, TA = technical assistance.

Source: ADB database.

Appendix 4
Funds Through ADB for Carbon Finance, Adaptation, and Environmental Initiatives

Fund	Character	Purpose
Capital resources as loans	ADB's Strategy 2020 targets 40% of the portfolio will be earmarked for environmental sustainability and climate change initiatives by 2015.	Can be drawn down by developing member countries for environmental sustainability and climate change initiatives
Asian Development Bank (ADB) Climate Change Fund	• Has committed $40 million for projects • $25 million is available for clean energy development • $5 million for REDD (United Nations Collaborative Programme on Reducing Emissions from Deforestation and Forest Degradation in Developing Countries), and land management • $10 million for adaptation	To reduce greenhouse gas emission reductions and carbon sequestration, prioritizing energy security in developing member countries
Clean Energy Partnership Financing Facility	Consists of three funds: • Multi-donor Clean Energy Fund supported by Australia, Norway, Spain, and Sweden • Single-donor Asian Clean Energy Fund supported by Japan • Newly established Carbon Capture and Storage Fund supported by Australia • Target of leveraging $2 billion per year by 2013	Clean energy investments
Regional technical assistance on the Strengthening and Use of Country Safeguard Systems	Provides grants up to $250,000	To strengthen regulatory frameworks, conduct institutional strengthening, and improve environmental management systems
Mekong Brahmaputra Clean Development Fund	• Managed privately by Dragon Capital • $45 million in commitments including a $15 million contribution from ADB	• To fund clean energy projects in the Greater Mekong Subregion and South Asia • Invests in renewable energy, energy efficiency, water conservation, and waste recycling projects
Poverty Environment Fund	Multi-donor trust fund administered by ADB provides grants of up to $250,000	For natural resource conservation, disaster risk reduction, and pollution control initiatives
Urban Financing Partnership Facility	• Provides investment cofinancing and technical assistance • Commitment of $14 million from Sweden, with a guarantee facility of $70 million	• For urban environmental infrastructure that benefits the poor • Climate change mitigation and adaptation initiatives by local government and cities are a strategic priority
Water Financing Partnership Facility	Has $48 million in commitments, with an original target of $100 million	For rural water services, urban water services, and river basin water management

Source: ADB database.

Appendix 5
Globally Available Funds and Facilities for Carbon Finance, Adaptation, and Environmental Initiatives

Fund	Character	Purpose	Secretariat
Adaptation Fund ($300 million by 2012)	• Established under the United Nations Framework Convention on Climate Change (UNFCCC) Kyoto Protocol • Financed by a 2% levy on Certified Emission Reductions issued for Clean Development Mechanism projects	Supports adaptation programs in developing countries	• The Global Environment Facility serves as the secretariat • In Viet Nam, the Ministry of Natural Resources and Environment is the national implementation entity
Carbon Partnership Facility		Aims to scale up carbon finance by integrating carbon into investment decisions from an early stage for energy, transport, or urban development that reduce greenhouse gases	The World Bank
Global Environment Facility Trust Fund ($250 million annually)	A UNFCCC financial mechanism	• Focused on energy efficiency, renewable energy, new clean energy technology, and sustainable transport • Specific funding for climate change and biodiversity initiatives in Viet Nam	United Nations Development Programme, United Nations Environment Programme, and the World Bank Ministry of Natural Resources and Environment is the focal point
Climate Investment Funds	Private sector and multilateral development bank financing	Fund low-carbon and climate-resilient projects	
Clean Technology Fund (part of Climate Investment Fund)	In Viet Nam, a $250 million plan for concessional lending was accepted for Clean Technology Fund support, conditional on the approval of relevant multilateral projects in energy and transport	• Finances the scaled-up demonstration, deployment, and transfer of clean technologies • Includes programs in the power sectors, transport sector, and energy efficiency	Multilateral development banks

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Fund	Character	Purpose	Secretariat
Strategic Climate Fund (part of Climate Investment Fund)		Supports pilot approaches with potential for scale-up and transformational action	
Clean Development Mechanism	Embedded in the Kyoto Protocol	• Allows industrialized countries to invest in emissions reductions where they are cheapest globally • Industrialized country seeking emissions credits must select a project that would not otherwise happen	UNFCCC secretariat overseen by the Clean Development Mechanism Executive Board
Green Climate Fund	Aims to raise and disburse $100 billion annually by 2020	To protect developing countries and assist with low-carbon development	• World Bank as trustee • Managed by a board of 24 members from both developed and developing countries
Technology Transfer Mechanism (to become active in 2012)	• Under the UNFCCC • A Technology Executive Committee and Climate Technology Centre will facilitate implementation of enhanced technology development and transfer	Supports action on mitigation and adaptation to climate change	UNFCCC secretariat
United Nations Reducing Emissions from Deforestation and Forest Degradation (REDD) program		• To generate economic value from carbon stored in forestry offering incentives for developing countries to reduce forestry emissions • The REDD+ scheme incorporates conservation, sustainable management of forests and enhancement of forest carbon stocks	
Nordic Development Fund	• A joint partnership between Denmark, Iceland, Finland, Norway, and Sweden • Grants sizes vary between €500,000 and €4 million	• Provides grant financing for climate change mitigation and adaptation initiatives in developing countries	• Nordic Development Fund secretariat • Projects are typically identified through multilateral development banks like the Asian Development Bank

Note: Other sources of funding from bilateral partners include Japan's Cool Earth Partnership ($10 billion), and the joint funding of Norway's Climate and Forest Initiative and Australia's International Forest Carbon Initiative ($580 million).

Source: ADB database.

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Viet Nam: Environment and Climate Change Assessment

The Asian Development Bank (ADB) is preparing sector assessments, thematic papers, strategies, and road maps to help align future ADB support with the needs and strategies of developing member countries and other development partners. A thematic paper is a working document that addresses a crosscutting theme to help inform the development of country partnership strategies (CPSs). This environment and climate change thematic paper highlights development issues, needs, and strategic assistance priorities of Viet Nam and ADB, focusing on environmentally sustainable growth during the 2012–2015 CPS period. It analyzes priority development constraints, the government's strategy and plans, other development partner support, lessons learned from past ADB support, and possible future ADB assistance. The product serves as a basis for further dialogue on how ADB and the government can work together to tackle the challenges of climate change and environmental sustainability in the coming years.

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