SECTOR ASSESSMENT (SUMMARY): MULTISECTOR (AGRICULTURE, NATURAL RESOURCES, AND RURAL DEVELOPMENT; ENERGY; FINANCE; AND TRANSPORT)

Sector Road Map

1. Sector Performance, Problems, and Opportunities

1. Rapid economic growth of the People's Republic of China (PRC) since the 1990s has lifted about 500 million people out of poverty but has been resource and energy intensive because of heavily polluting industries, coal-fired energy production, and a huge expansion in automobile use. Air quality, in particular, has suffered. The Government of the PRC has made significant efforts to control environmental pollution by improving energy efficiency and resource utilization, and increasing pollution reduction. However, environmental pollution remains a concern and will ultimately undermine the PRC's balanced socioeconomic growth. The Ministry of Environmental Protection has estimated that the cost of pollution damage in the PRC is about 6% of the national gross domestic product (GDP).[1] Less than 1% of the PRC's 500 largest cities meet the World Health Organization's standard for inhalable particulate matter less than 2.5 micrometer in diameter ($PM_{2.5}$). Heavily populated areas include the Beijing–Tianjin–Hebei (BTH) region, the Yangtze River Delta, and the Pearl River Delta. The PRC is the world's largest energy consumer with a coal-dominated energy mix, and is also the largest greenhouse gas (GHG) emitter, contributing close to 30% of the global total in 2015. In the greater BTH region, which has a very dry climate with little precipitation and a high concentration of pollutants, the effects have been more pronounced. The region accounted for 42.0% of the PRC's total carbon dioxide (CO_2), 39.6% of sulfur dioxide (SO_2), and 39.5% of nitrogen oxide (NO_x) in 2015.

2. Beijing Municipality (Beijing), Tianjin Municipality (Tianjin), Hebei Province (Hebei), Henan Province (Henan), Shandong Province (Shandong), Shaanxi Province (Shaanxi), Inner Mongolia Autonomous Region (IMAR), and Liaoning Province (Liaoning) together form the greater BTH region, which spans more than 20% of the PRC's total landmass and is home to 30% of the country's population. The region also generates more than 34% of the PRC's GDP. The region's rich endowment of energy and mineral reserves, availability of excellent land and sea transport infrastructure, and proximity to major consumption centers have led to rapid industrialization with a high concentration of energy-intensive industries. Its sustainable growth is affected by poor air quality and associated public health impacts.[2] The concentrations of major air pollutants such as SO_2, NO_x, ozone, and $PM_{2.5}$ reach levels that pose a significant risk to public health. In 2015, the average annual $PM_{2.5}$ level reached 80.3 micrograms per cubic meter (μg/m^3) in Beijing, 71.5 μg/m^3 in Tianjin, and 77.3 μg/m^3 in Hebei—significantly exceeding regulated levels in the PRC and most developed countries.[3] About 41% of the world's estimated 3.3 million premature deaths attributable to outdoor air pollution per year occur in the PRC.[4] $PM_{2.5}$ in the BTH region is

[1] The PRC's outdoor air pollution may cost $635–$864 billion (9.7%–13.2% of GDP in 2010, current price). The Global Commission on the Economy and Climate. 2014. *The New Climate Economy – Better Growth, Better Climate*. Washington, DC.

[2] Among the pollutants, $PM_{2.5}$ has the most severe impact on health. The World Health Organization concluded that no level of $PM_{2.5}$ is safe. An epidemiological study by the Chinese Academy of Sciences in Beijing during 2003–2006 showed the correlation between levels of ambient particulate matter and mortality from cardiovascular and respiratory diseases. The results confirmed research from the United States and Europe.

[3] The new air quality standard for $PM_{2.5}$ in the PRC (GB 3095-2012) is 35 μg/m^3. The United States and Japan have set a standard of 15 μg/m^3, while the World Health Organization standard is 10 μg/m^3.

[4] J. Lelieveld, et al. 2015. The contribution of outdoor air pollution sources to premature mortality on a global scale. *Nature*. Vol. 525. London/New York: Macmillan Publishers. pp. 367–371.

generated and formed in the atmosphere by industrial emissions, coal burning for electricity generation and heating services, motor vehicle emissions, dust from construction activities, and agricultural waste burning.

2. Government's Sector Strategy

3. The central government is committed to scaling up its air pollution-control efforts. The national air-quality standards were upgraded in 2009 and 2012 to levels equivalent to those in most developed countries. The law on environmental protection, promulgated in 1989 and revised in 2014, imposed greater responsibilities on enterprises and local authorities to mitigate and report pollution. In 2013, the State Council issued the Comprehensive Action Plan on Prevention and Control of Air Pollution, 2013–2017. The BTH region's governments formulated their own action plans on air-pollution prevention and control for 2013–2017.

4. **Agriculture.** The agriculture sector provides food and employment to the BTH region's population of 371.3 million but has contributed to increased environmental degradation, GHG emissions, and air pollution. Shandong is the largest agricultural province in the PRC, producing about 10% of the country's biomass stalk. In 2015, agriculture contributions to provincial GDP in Hebei were 11.5 % and in Henan were 11.4%, higher than the national average of 8.9 % in the same year. In 2015, the sector produced 20% of the PRC's GHG emissions.[5] Ammonium salts (i.e., ammonium sulfate and ammonium nitrate) released as by-products of chemical fertilizer use and livestock farming account for 7%–57% of the total ambient $PM_{2.5}$, an air pollutant that poses severe health risks.[6] Nitrous oxides, further by-products of excessive fertilizer use, also contribute to $PM_{2.5}$ formation, GHG imbalance in the atmosphere, and stratospheric ozone loss. Their terrestrial impacts include soil acidification and freshwater eutrophication that threaten long-term food security and marine ecosystems.

5. **Energy.** The PRC's rapid economic development has driven energy demand growth. In 2009, the PRC became the world's largest energy consumer. In 2015, it consumed 4.3 billion tons of standard coal equivalent, accounting for 23.1% of global energy consumption. Because 64% of the PRC's primary energy consumption came from coal in 2015, economic growth has also been carbon intensive. From 1990–2015, CO_2 emissions from the PRC increased by 279%, from 2.360 billion to 8.948 billion tons per year. However, the PRC made significant progress in increasing the share of non-fossil fuel consumption in its energy mix—from 9.4% in 2010 to 12% in 2015—and is a world leader in wind power and hydropower generation, and in solar photovoltaic manufacturing. The PRC's energy sector has grown at a slower rate than the overall economy since 2006, in response to government efforts to reduce the energy intensity.[7] The PRC's energy intensity declined by 18.4% during the Twelfth Five-Year Plan (2011–2015), and the government set a target of further energy intensity reduction of 15.0% during the 13th five-year plan (2016–2020). As for carbon intensity, it declined by over 20% during the 12th plan period, and the government set a target of 18.0% further reduction during the 13th plan period.[8]

6. **Environment.** Recognizing the importance of combating air pollution as part of its wider plan for economic restructuring and sustainable, low-carbon development, the Government of the

[5] Mainly from rice paddies, livestock, manure management, and nitrous oxide emissions from fertilizer application, and energy-related CO_2 emissions that account for about 8% of the total (0.82 billion equivalent tons CO_2).

[6] Studies conducted in Europe indicate that the contribution from agricultural ammonia (NH_3) to $PM_{2.5}$ is between 10% and 40%. In Europe, total emissions of NH_3 from the agriculture sector are about 94%, thus control strategies to reduce NH_3 emissions can considerably influence particulate matter concentrations.

[7] Energy intensity is the ratio between energy consumption and GDP measured at constant prices.

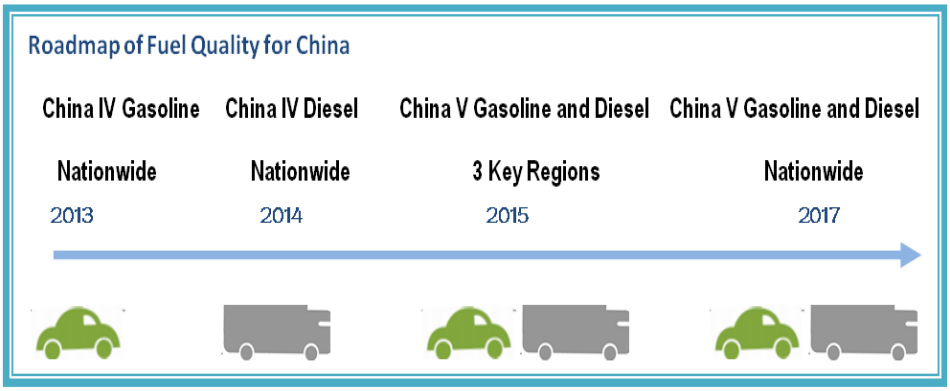
[8] CO_2 emission intensity is the ratio between energy consumption and GDP measured at constant prices.

PRC has taken steps to improve air quality. Significant progress has been made. Compared with 2014, SO_2 emissions in 2015 declined by 5.8%, and NO_x emissions by 10.9%. However, the air quality in the greater BTH region is still consistently the worst in the country. A study that analyzed $PM_{2.5}$ concentration levels in 190 Chinese cities from 2014 to 2015 found that not one city had an annual mean $PM_{2.5}$ concentration that met the World Health Organization guidelines. The study also found that more than 95% of the BTH region's urban population had annual mean $PM_{2.5}$ concentrations that exceeded National Ambient Air Quality Standards.[9] More recently, the Ministry of Environmental Protection, which measures the status of air quality in key regions and 74 prefecture-level cities,[10] reported that the top 10 cities with the poorest air quality in 2016 were all in the BTH region.[11]

7. **Green Funding.** The development of green industries and the restructuring of traditional industries toward more energy-saving and environmentally friendly systems require substantial investment. State budgetary funds are an important source of investment. Most private sector investment comes as commercial loans or from company revenues. Bond and equity markets for green investment are less developed. The levels of investment in green development fall far short of what is needed. More diversified and innovative market-based financing mechanisms must be developed to meet the government's investment targets.

8. **Transport.** Private motor vehicle use increased from 8.16 million in 1990 to 141 million in 2015. In 2013, road transportation contributed 83.32% of the total passenger transport volume and 75.43 % of the total freight transport volume. By the end of 2015, 561,800 buses were in operation in urban PRC, of which 45.1% used diesel, 32.5% were natural gas driven, and 1.7% were gasoline driven. Transport sector investments have contributed to the PRC's impressive economic growth but have also resulted in increased air pollution, congestion, and accidents. The sector is a large contributor of GHG emissions. In 2012, it produced 8% of the country's CO_2 emissions and is set to account for 13% of CO_2 emissions by 2040. In the PRC, GHG emissions from private passenger vehicles, business passenger vehicles, and taxis accounted for 79% of GHG emissions from the transport sector. The main causes of air pollution from the transport sector are inadequate fuel standards and over-reliance on private vehicles in cities. The Comprehensive Action Plan on Prevention and Control of Air Pollution has targets to phase out all yellow label vehicles (registered before 2005) by 2017.[12] By the end of 2015, 1.26 million yellow label vehicles had been successfully phased out. In 2015, 379,000 vehicles using clean energy were produced, four times the production level of 2014. There is also a clear timeline of clean fuel supply, as shown in the following roadmap. In the greater BTH region, quality of gasoline and diesel has been improved from China IV to V in 2015.

[9] F. Cao and Y.L. Zhang. 2015. Fine particulate matter ($PM_{2.5}$) in China at a city level. *Nature, Scientific Reports.* p. 5.
[10] Nine out of 10 cities were in Hebei Province, with one city in Shandong Province.
[11] Air quality indicators include the following pollutants: $PM_{2.5}$, PM_{10}, SO_2, NO_x, carbon monoxide, and ozone.
[12] Yellow label vehicles are high-emitting vehicles that cannot meet the National I standard for gasoline vehicles and National III standard for diesel vehicles.



Source: http://cleanairasia.org/node12066/

3. ADB Sector Experience and Assistance Program

9. The Asian Development Bank (ADB) is one of the PRC's main development partners. During 2010–2015, ADB focused its energy sector experience on innovative low-carbon energy technologies, cleaner heating services in urban areas, and industrial energy efficiency by facilitating access to credit for better technologies. The transport sector experience was based on ADB's Sustainable Transport Initiative.[13] Financial support for the transport sector was targeted at integrated and sustainable urban public transport systems, traffic management, and non-motorized transport. In the agriculture sector, ADB promoted environmental sustainability and climate change through projects supporting renewable biomass energy. The proposed project is the third in a multiyear, multisector ADB support program for air quality improvement in the greater BTH region. The first loan, approved in 2015, focused on policy reforms and strengthening regulatory capacity in Hebei province.[14] The first loan was fully disbursed in June 2016 and key policy actions have been implemented in the following areas, including: (i) adjustment of energy structure by reducing coal consumption and promoting clean energy, (ii) promotion of public transport in urban area, (iii) reduction of seasonal stalk-burning and promotion of clean energy in rural area, (iv) development of comprehensive monitoring and analytical system, and (v) provision of good quality training and support for employment. The second loan, approved in 2016, targeted better access to finance, especially for small and medium-sized enterprises, to scale up investments in pollution reduction projects in the region.[15] The second loan has become effective in August 2017 and it is now being implemented to reinforce and expand the first loan's implementation throughout the greater BTH region by offering tailored financing solutions. This proposed third project will complement previous projects and will directly help remove barriers to deploying advanced technologies that reduce air pollution from industries, urban infrastructure services, and agriculture by targeting the major emitters.[16]

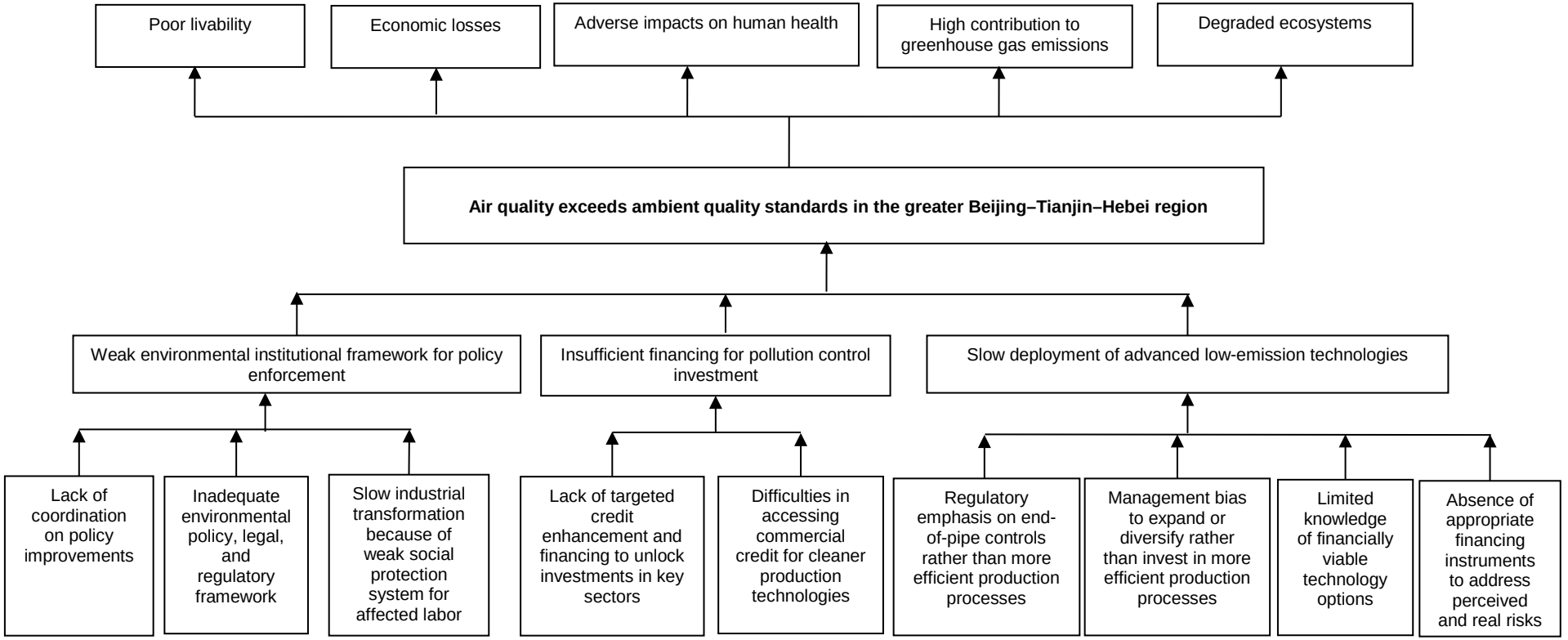
[13] The initiative's action plan for 2010 defined four areas of future ADB operations—urban transport, response to climate change, cross-border transport and logistics, and road safety and social sustainability.

[14] ADB. 2015. *Report and Recommendation of the President to the Board of Directors: Proposed Policy-Based Loan to the People's Republic of China for Beijing–Tianjin–Hebei Air Quality Improvement—Hebei Policy Reforms Program.* Manila.

[15] ADB. 2016. *Report and Recommendation of the President to the Board of Directors: Proposed Loan to the People's Republic of China for Air Quality Improvement in the Greater Beijing–Tianjin–Hebei Region—China National Investment and Guaranty Corporation's Green Financing Platform Project.* Manila.

[16] "Advanced technologies" refers to technologies that have higher upfront costs but better life-cycle value, or which have been proven at scale in other countries but are not widely deployed in the PRC.

Problem Tree for Sectors



Source: Asian Development Bank staff estimates.