

**PROGRAM-FOR-RESULTS INFORMATION DOCUMENT (PID)
APPRAISAL STAGE**

Report No.:PIDA0060389

Program Name	Hebei Pollution Prevention and Control Program
Region	East Asia and Pacific
Country	China
Sector	Other Industry (55%), General agriculture, fishing and forestry (15%), General Energy (15%), urban Transport (15%)
Lending Instrument	Program for Results
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Parent Program ID	Not applicable
Borrower(s)	People's Republic of China
Implementing Agency	The Development and Reform Commission of Hebei Province
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I. Country Context

1. China faces some of the world's most difficult environmental challenges due to its rapid development and resource-intensive growth model. Air pollution is a complex problem—stemming from reliance on coal but increasingly from vehicular emissions, dust, and secondary particulates (formed when ammonia [NH₃], from fertilizers and livestock waste, interacts with nitrogen oxides [NO_x] and sulfur dioxide [SO₂], from industrial and vehicular emissions). Air quality has improved in general over the past few years but levels of pollution remain high and economic costs from health impacts are rising, partly due to higher exposure levels in urban areas with higher population densities. The costs of environmental degradation and resource depletion are high, estimated to equal up to 9 percent of the gross national income¹ in 2009, of which air pollution accounts for 3.3 percent.
2. Episodes of severe air pollution in the Beijing-Tianjin-Hebei region (hereafter referred to as the JingJinJi) from January 2013 onwards brought air quality into the center of environmental policy concerns. In the first response in 2013, the State Council issued the Air Pollution Prevention and Control Action Plan (APPCAP) with a set of ten air pollution prevention and control measures. The measures can be organized around three complementary principles: (a) promote market mechanisms for enterprises to decrease emissions and increase efficiency; (b) increase the coverage and effectiveness of enforcement; and (c) improve planning and regional coordination.
3. The specific indicators of the APPCAP are that by 2017, the urban ambient concentration of particulate matter 2.5 (PM_{2.5}) nationwide shall decrease by 10 percent compared to 2012 and the annual number of days with fairly good air quality will gradually increase. Concentration of ambient PM_{2.5} in the country's three main urban and industrial regions, JingJinJi, Yangtze River Delta, and Pearl River Delta, shall all decrease by 25 percent, 20 percent and 15 percent, respectively, compared

¹ China 2030. World Bank and China Development and Reform Commission (DRC).

to 2012. All provinces were mandated to develop their respective action plans. In 2013, Hebei prepared the Hebei Pollution Prevention and Control Implementation Action Plan (HAP) 2013–2017. The goal is to reduce ambient PM_{2.5} by 25 percent by 2017 compared to 2012.

II. Sectoral (or multi-sectoral) and Institutional Context

4. According to the World Health Organization (WHO), an estimated 7.0 million people died worldwide in 2012, from either chronic or acute effects of inhaling atmospheric pollutants, with a total of 3.3 million deaths linked to indoor air pollution and 2.6 million deaths related to outdoor air pollution in the Southeast Asia and Western Pacific regions. For China, published estimates range between 350,000 and more than 1.3 million cases of premature deaths annually.
5. Children, older adults, and women are among the most vulnerable to air pollution. The American Academy of Pediatrics² concluded that children and infants are among the most susceptible to many of the air pollutants. In addition, there is evidence of associations between air pollution and respiratory symptoms, asthma exacerbations, and asthma hospitalizations. There is also evidence that older adults are more vulnerable to particulate matter (PM) than to other pollutants, with particular effect on daily cardiorespiratory mortality and acute hospital admissions³ of children. Studies in China indicate that the effect of PM_{2.5} were greater in women than men.⁴
6. Since 2013, the government of China (GoC) has been focusing on PM_{2.5}. This is the most critical pollutant for public health in China. PM_{2.5} is a particle matter with an aerodynamic diameter equal to or less than 2.5 microns, which is 20 to 30 times smaller than the human hair. Thus, PM_{2.5} penetrates deep into the lung and enters the bloodstream, causing a broad range of health effects, especially to the respiratory and cardiovascular systems.⁵
7. Ambient PM_{2.5} is a good indicator for air quality because it encompasses many pollutants. PM_{2.5} can be classified as primary and secondary particles. Primary PM_{2.5} particles are fine particles directly emitted from a source such as dust from construction sites. Secondary PM_{2.5} particles are produced through chemical reactions in the atmosphere, which include mainly SO₂, NO_x, or NH₃. These substances are emitted from the combustion of fossil fuels, use of fertilizers, livestock waste, and industrial production from certain sectors (for example, resins, iron/steel, cement, or biomass burning). Recognizing the importance of controlling ambient PM_{2.5} concentration, the GoC issued strict standards,⁶ which are comparable with interim targets defined by the WHO.
8. Hebei had the highest annual average ambient PM_{2.5} concentration in the JingJinJi region in 2012, with 112.9 µg/m³, followed by Tianjin with 112.7 µg/m³, and Beijing with 88.3 µg/m³. Thus, the annual average ambient PM_{2.5} concentration for the JingJinJi region was three times higher than the new Standard II of 35 µg/m³ set by the GoC.
9. Hebei is also the largest contributor to ambient PM_{2.5} concentrations in JingJinJi, being responsible for about 70 percent of the emissions in the region. This is the result of the concentration of highly

² American Academy of Pediatrics. 2014. “Ambient Air Pollution: Health Hazards to Children.” *Pediatrics* Vol. 114, no. 6, December.

³ Simoni, M. et al. 2015. “Adverse Effects of Outdoor Pollution in the Elderly.” *Journal of Thoracic Disease* Vol. 7.

⁴ Gu, D. 2012. Air Pollution Shortens Life Expectancy and Health Expectancy for Older Adults: The Case of China. *The Journals of Gerontology* Vol. 67, issue 11.

Guo, Y. et al. 2013. The Burden of Air Pollution on Years of Life Lost in Beijing, China, 2004–2008: Retrospective Regression Analysis of Daily Deaths. *BMJ* Vol. 347.

⁵ WHO (World Health Organization). 2005. Air Quality Guidelines for Particulate Matter, Ozone, Nitrogen Dioxide and Sulfur Dioxide.

⁶ GB3095–2012, in effect since January 1, 2016.

polluting industries, vehicles, and a large agricultural sector. Hebei is the largest iron and steel producer in China, accounting for about one-quarter of the national output. The power sector is almost entirely fueled by coal and nearly one-third of total installed capacity (15 out of 49 GW) has been added in the past five years. Hebei is also an important cement producer, having 21 plants with a total production capacity of 58.3 Mt/year, which is nearly ten times the combined production capacity of Beijing and Tianjin of 6.3 Mt/year. In addition, the province accounts for 17 percent of national flat glass production.

10. The high level of economic activity only partially explains the high level of emissions. Hebei has much higher annual emissions of NO_x, SO₂, and PM_{2.5} than industrialized countries such as Germany and France. In fact, Hebei's total PM_{2.5} emissions in 2012 (863 kt) was more than twice the total annual PM_{2.5} emission by Germany and France combined in 2010 (330 kt).
11. The source apportionment for primary PM_{2.5} and NO_x and SO₂ for JingJinJi indicates that industrial processes are the main source of primary PM_{2.5} (54 percent of emissions) as well as the precursor of secondary PM_{2.5} NO_x (43 percent of emissions) and SO₂ (63 percent of emissions). Residential emissions from stalk burning and coal, mainly to fuel stoves, is the second largest source of primary PM_{2.5} (33 percent of emissions). The power sector is an important source of NO_x and SO₂ (27 and 20 percent, respectively) while transport is an important source of NO_x (26 percent).
12. This analysis validates the focus of the HAP and this Program on curbing emissions from the industrial and power sectors and from transport and heating stoves. This analysis did not cover NH₃ but other studies⁷ by the same group concluded that NH₃ emissions have increased by 16 percent from 2006 to 2015 in China and that, at this pace, further increase of NH₃ would offset the benefit to air quality from the reduction of SO₂ achieved due to the 12th 5-year plan. This corroborates the focus on agriculture and livestock as these are the sources of NH₃.
13. Tsinghua University and the China Council for International Cooperation (CCICED) conducted studies in 2014 to evaluate the capacity of the Beijing, Tianjin, and Hebei Action Plans to reach their respective 2017 targets. The findings of the studies indicate that the full implementation of the action plans would deliver significant improvements in the air quality in the region by 2017. However, the studies concluded that at the current pace the HAP would achieve a decrease of annual average ambient PM_{2.5} concentrations from 112.9 µg/m³ in 2012 to 96.3 µg/m³, a 14.7 percent decrease, which is far below the 25 percent reduction target.
14. The studies concluded that the HAP is supporting many investments in infrastructure and dedicated pollution control equipment but with inadequate technical quality and coverage. In addition, Bank's assessment indicates that Hebei is not spending all resources earmarked annually for the HAP on time owing to budgeting issues.

III. Program Scope

15. The Bank Program will support the original geographic coverage (the entire province) and timeline (2017) and almost the entire APPCAP with the exception of two of the seven main subplans, as summarized in section II.A.1. The HAP subplan 5 'elimination of overcapacity and promotion of industrial transformation and upgrade', was excluded from the Program because, according to the environmental and social screening, it presents complex social, economic, and environmental challenges not well suited to be addressed through a PforR. The HAP subplan 6 'Adjustment of the energy structure and increase the clean energy supply' was excluded because it is being supported

⁷ Wang, Y., et al. 2013. "Sulfate-nitrate-ammonium Aerosols over China: Response to 2000–2015 Emission Changes of Sulfur Dioxide, NO_x, and NH₃." *Atmospheric Chemistry and Physics*, 13, 2635–2652.

through another PforR for the entire JingJinJi⁸ region (P154669 - Innovative Financing for Air Pollution Control in Jing-Jin-Ji), as part of the Bank's integrated approach to support China to combat air pollution in JingJinJi.

16. This PforR operation supports a broad multisectoral Hebei government Action Plan. To ensure a sharper focus on key activities, the results areas and disbursement-linked indicators (DLIs) cover a subset of each of the four result-oriented subplans and subplan 5 which includes supporting measures to all other subplans. The results areas and ensuing DLIs were selected considering that they: (i) directly address the underlying weaknesses among those identified by Tsinghua University and the CCICED and confirmed by the Bank; (ii) can benefit from the Bank's experience in China or international good practices, which are readily available; and (iii) can make a significant contribution to the achievement of the HAP's 2017 target. As the Hebei provincial government has an overarching target of 25 percent reduction of ambient PM2.5 concentration, the Bank's PforR operation is to support a sizeable portion of the HAP through translating this overall target into sectoral emission reduction targets and enhanced implementation actions. Specifically, the proposed Program will focus on the following results areas:

Results Area 1: Comprehensive control of industrial enterprises and reduced emission of multi-pollutants emissions (SO₂, NO_x, and primary PM2.5) from key industrial sectors

17. The goal is to ensure that industrial enterprises meet the government's emissions standards on a daily basis, especially that investments in the end-of-pipe and other emission-reduction solutions actually result in lower emissions. This should be achieved by implementing a robust continuous emissions monitoring (CEM) system and use it to enforce the existing emission standards.
18. The HAP is currently based on reimbursing the heavy polluting companies (iron/steel, cement, glass, and power plants) between 10 and 20 percent of the cost of the desulfurization, denitrification, and dust removal equipment once their adequate installation is verified. The HAP also provides CEM equipment to the provincial and municipal Environmental Protection Bureaus (EPBs) along with a protocol of data collection, transfer, and storage. CEM equipment is installed in 241 industrial and power generating enterprises comprising 806 production lines in Hebei.
19. The definition of the enterprises that must install CEM is determined by the Ministry of Environmental Protection (MEP). The national government has a list of the most polluting companies. The top ones responsible for 65 percent of the emissions are mandated to be part of the CEM system.
20. The Program will support the strengthening of the CEM system through the implementation of international good verification and management practices and the further expansion of CEM into additional industrial and other point-source locations to ensure a more extensive and integrated CEM coverage.

Results Area 2: Area pollution control and dust control

21. The goals are to promote the use of clean and efficient stoves, optimize the use of nitrogen-based fertilizers in crops, improve crop residue management, and improve waste management in animal husbandry farms. The type of measures to be supported under the Program include: (i) incentivizing the adoption of clean and efficient stoves by households using different solid fuels, preferably with

⁸ For that operation, JingJinJi region refers to Beijing-Tianjin-Hebei and its neighbors, including Shandong and Shanxi Provinces, and Inner Mongolia Autonomous Region.

processed biomass or coal briquettes; (ii) promoting the adoption by farmers of environment-friendly, slow-release formula fertilizers based on the results of soil testing and nutrient needs of crops during different growth periods; and (iii) installing livestock waste management facilities in animal husbandry farms for energy cogeneration, biogas, and to produce organic fertilizer.

22. Clean stoves. The Program will support: (i) the development and update of clean and efficient stoves standards; and (ii) the adoption of those clean and efficient stoves by rural households.
23. The HAP, and hence the Program, targets stoves that have space heating as the primary function and cooking as the supplementary function, which is not always used. These stoves often use water as a heating agent and include a combustion chamber, heat exchanger, ash collector, and chimney. They are designed to run continuously for many days with low, medium, and high fire. The lifetime is at least 5 years.
24. Agriculture. The Program will support the adoption by farmers of environment-friendly, slow-release formula fertilizers based on the results of soil testing and nutrient needs of crops during different growth periods. Among the measures in the agricultural sector, the formula fertilizer application measure has the best available information for evidence-based support.
25. Livestock waste management. The Program will support improving the waste management of existing medium- and large-scale farms, including: (i) dry-wet separation facilities; (ii) crop-animal integrated systems; and (iii) production of biogas.

Results Area 3: Prevention and control of emissions from mobile sources.

26. The goal is to ensure implementation of key measures for reducing vehicular emissions and fuel-related activities. The type of measures to be supported under the Program include: (i) accelerating the elimination of yellow sticker vehicles and disposing of them properly; (ii) strengthening the environmental management of vehicles through stricter emission standards to ensure compliance with new government standards, including piloting the adoption of catalyst and filter devices on heavy duty vehicles in selected areas; (iii) promoting the use of NEVs, especially for public transport, city services, and government agencies; (iv) encouraging a more rapid adoption of stricter transport fuel standards; and (v) implementing VOC controls to ensure oil and gas vapor recovery at refueling stations.
27. This Program will have a sharper focus on urban public transport. This should decrease emissions from diesel burning, contributing to the reduction of NO_x emissions in the province, improving the air quality in urban areas, and generating climate change mitigation cobenefits.

Result Area 4: Establishment of monitoring and warning systems, and planning tools.

28. The goal is to develop modern air quality management systems and strengthen institutional capacity for the short- and medium-term planning and implementation of measures to continuously reduce ambient PM_{2.5} concentration in the province over the next 10–15 years. The program is currently based on the ambient air quality monitoring (AAQM) network established in 207 locations in Hebei Province mainly for public information purposes. The program also collects information on rural emissions through satellite-based tools.
29. The measures to be supported under the Program include: (i) establishing a smart platform for monitoring the ecological environment covering the whole province, which integrates all environmental elements (AAQM, CEM, rural emissions), with the Meteorological Department to set up a heavy pollution weather monitoring and early warning system through an online information

sharing system; (ii) strengthening the data collection system to have a more detailed and complete source and composition inventory of the source structure of both primary and secondary PM to guide future planning and interventions; and (iii) developing the 13th 5-year plan for air pollution prevention and control, using modern AAQM planning tools to ensure cost-effectiveness and prioritization.

Program Beneficiaries

30. Program beneficiaries include: (i) the residents of the JingJinJi region who benefit from reduced air pollution and the resulting improved health impacts, particularly such vulnerable groups as women, children, and elders; (ii) the national government, particularly the National Development and Reform Commission (NDRC), and the MEP, which can apply the lessons learned from this operation in the other two regional air pollution control programs; and (iii) provincial and municipal governments in Hebei, particularly the Hebei Development and Reform Commission (DRC), the EPB, and the Finance Bureau (FB), which will have improved their technical capacity to implement the air quality prevention and control measures, and to design new multi-year plans.

Total Financing

31. The expenditure of the Program will be US\$968 million. The national level earmarked funds are not being made available to Hebei until midyear but ‘budget carryover’ is allowed for these earmarked resources. Therefore, part of the expenditure is actually taking place in the year following the allocation of earmarked funds. Thus, some expenditures from the 2017 budget should still take place in 2018.
32. Most of the expenditures associated with the Program are partial reimbursements made by third-parties. For example, the HAP reimburses the heavy polluting companies (iron/steel, cement, glass, and power plants) between 10 and 20 percent of the cost of the desulfurization, denitrification, and dust removal equipment. As a result in 2015, the RMB 2.82 billion (US\$ 440 million) earmarked funds associated with the areas to be supported under the Program were matched by an additional 69 percent of expenditures, or RMB 1.95 billion (US\$305 million), from spending by local governments and enterprises. Therefore the expenditure of the Program will leverage at least US\$671 million over the next two years.
33. This operation is set to close at the end of calendar year 2018 to allow for: (i) the full expenditure of the earmarked resources; and (ii) the time for reporting, including audits, and verification of the DLIs

IV. Program Development Objective(s)

34. The PDO is to reduce emissions of specific air pollutants in the key sectors in Hebei.
35. This PDO addresses one of the main necessary conditions for the government to achieve the 25 percent reduction of ambient PM_{2.5} concentration established in its HAP. However, such reduction of emissions to be achieved under the Program might not be sufficient to meet the HAP target because: (i) 25 percent to 30 percent of emissions that affect ambient PM_{2.5} concentrations in Hebei are generated outside the province (that is, outside the governance of the Hebei government); and (ii) the Program excluded two HAP subplans, which also contribute to decreasing ambient PM_{2.5} concentration. Therefore, the PDO focuses on measurable and achievable emissions reductions from the specific sectors supported under the Program.

PDO Indicators:

- Indicator 1: Reduction of SO₂ emissions from enterprises included in the CEM (tons)

- Indicator 2: Reduction of NO_x emissions from enterprises included in the CEM (tons)
- Indicator 3: Reduction of PM2.5 emissions from the 800,000 clean stoves deployed (tons)
- Indicator 4: Reduction of NO_x emissions from the transport sector (tons)

V. Environmental and Social Effects

36. The implementation of the activities under the PforR (Program) will rely on the existing country and local legal framework and institutional systems that the counterpart uses to manage environmental and social safeguards issues. A draft ESSA was prepared for this Program as a separate document and the Chinese and English versions were disclosed in Hebei on February on 17. The purpose of the ESSA is to provide a comprehensive review of relevant environmental and social safeguards systems and procedures in China and in Hebei Province, identify the extent to which the country/local systems are consistent with PforR Bank Policy⁹ and PforR Bank Directive,¹⁰ and recommend necessary actions to address eventual gaps as well as opportunities to enhance performance during implementation. A summary of the findings of the ESSA are provided here.
37. **Environmental and social benefits.** As an environmental pollution control operation, the Program will positively contribute to reduce air pollution emission and enhance environmental monitoring and management capacity in Hebei Province of China. The activities to be supported under the Program will contribute to the achievement of the objectives set in the HAP. Therefore, the Program is expected to have significant positive benefits of environmental quality improvement and public health.
38. The Program will contribute to significant social benefits for Hebei through air quality improvement, specially to: (i) achieving sustainable socioeconomic development; (ii) enabling residents to breathe fresh and clean air, thus improving people's health, mitigating risks of diseases due to air pollution deterioration, reducing disease-related expenditure, and improving people's quality of life; and (iii) contributing to increase living standards.
39. **Environmental and social risks.** Some activities supported under the Program may have limited adverse environmental or social impacts if not well managed. These include: (i) inadequate waste management and vocational health and safety support in the industrial enterprises with installation/operation of desulfurization, denitrification, and dust removal facilities; (ii) inadequate licensing of livestock waste management facilities by farmers and lack of skills for using new technologies for rural non-point-source pollution management; (iii) elimination of yellow-sticker vehicles used for private business that may lead to some loss of income for their owners and the disposal of vehicles in dismantling enterprises which are not operated in conformity with China's Regulation; (iv) potential permanent or temporary loss of land to a small number of affected people; (v) dissemination of initiatives supported under the Program might not have adequate communication and coverage to enable effective participation by ethnic majorities; and (vi) potential downstream environmental and social impacts of new laws, policies and regulations.
40. The ESSA concluded that, in general, the rules and regulations are consistent with the Bank PforR Policy and Bank PforR Directive, but the capacity of few agencies to effectively enforce certain regulations could be improved. Thus, recommendations are made to address these shortcomings and are included in the PAP or DLIs.
41. The overall environmental and social risk rating of this Program is considered Substantial.

⁹ OPCS5.04-POL.01.

¹⁰ OPCS5.04-DIR.01.

42. **Consultations and information disclosure.** The Bank organized several consultations during the preparation of this Program:
43. Between July and November, 2015, meetings were held with representatives from a number of Hebei institutions and villages to discuss the environmental management system relevant to activities to be supported by the Program
44. In September 2015, meetings were held with representatives from a number of Hebei government institutions to discuss policies and procedures governing elimination of “yellow-sticker” vehicles, land acquisition, structure demolition, ethnic minority development, and other issues related to activities to be supported under the Program.
45. On March 3, 2016, two multistakeholder consultations were organized to receive feedback on the draft ESSA: one at the provincial level in Shijiazhuang, and the other in a village where most participants were civil society organizations and individuals. The purpose of the consultation was to: (i) introduce on the Environmental and Social Systems Assessment approach under the proposed Program for Results operation; (ii) seek opinions and feedback on the key findings and recommendations of the ESSA; and (iii) identify possible recommendations for the proposed action plan. A description of the workshop, participants, and main issues raised is provided in annex 6 and the ESSA.
46. During the consultation, the Bank team presented the detailed information on the PforR instrument, activities to be supported under the Program, and key findings and recommendations of the ESSA. The participants concurred with findings and recommendations presented on the ESSA and voiced their strong support in implementing the proposed Program in the province, because all of them recognized air pollution as an urgent issue that needs to be tackled.

VI. Program Institutional and Implementation Arrangements

47. This Program will rely on existing structures and mechanisms used for implementing and monitoring the current HAP. Overall, the assessment concluded that adequate staffing and infrastructure exist in all executing agencies and commitment is in place to implement the Program.
48. A comprehensive structure is in place, which supports the implementation of the HAP. The overall guidance is provided by the highest-level leadership of the province, and its execution is led by sectoral agencies and municipal governments in a coordinated manner. Given the cross-disciplinary nature of the air quality management, the institutional coverage includes many agencies within the provincial government’s structure.¹¹ Implementation takes place at the municipal and prefecture level, so the institutional arrangement is a matrix that, in addition to the horizontal coordination, involves a vertical structure where each line agency is mirrored at the municipal/prefecture level and down to the county level.

VII. Contact point

World Bank

¹¹ The line agencies include the provincial Environmental Protection Bureau, Development and Reform Commission, FB, Industry and Information Bureau, Transport Bureau, Agriculture Bureau, Public Security Bureau, Housing and Construction Bureau, Land and Resources Bureau, and Commerce Administration and Quality Inspection Bureau.

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