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Report no. 105757 - CN

PROGRAM APPRAISAL DOCUMENT

ON A

PROPOSED LOAN

IN THE AMOUNT US$500 MILLION

TO THE

PEOPLE'S REPUBLIC OF CHINA

FOR A

HEBEI AIR POLLUTION PREVENTION AND CONTROL PROGRAM

May 13, 2016

Environment and Natural Resources Global Practice
East Asia and Pacific Region

CURRENCY EQUIVALENTS
(Exchange rate effective May 13, 2016)

Currency Unit = Chinese renminbi (RMB)
US$1.0 = RMB 6.40

ABBREVIATIONS AND ACRONYMS

AQM	Air Quality Management
AAQM	Ambient Air Quality Monitoring
ADB	Asian Development Bank
APPCAP	Air Pollution Prevention and Control Action Plan
CCICED	China Council for International Cooperation
CEM	Continuous Emission Monitoring
CMAQ	Community Multi-scale Air Quality modeling system
CNAO	China National Audit Office
CNG	Compressed Natural Gas
DLIs	Disbursement-linked Indicators
DRC	Development and Reform Commission
EA	Environmental Assessment
EEA	European Environment Agency
EIA	Environment Impact Assessment
EPB	Environmental Protection Bureau
ESSA	Environmental and Social Systems Assessment
EU	European Union
EV	Electric Vehicle
FB	Finance Bureau
FFA	Formula Fertilizer Application
GAINS	Greenhouse Gas and Air Pollution Interactions and Synergies
GEF	Global Environmental Facility
GDP	Gross Domestic Product
GFMIS	Government Fiscal Management Integrated Platform
GoC	Government of China
GoH	Government of Hebei
GPAO	Government Procurement Administration Office
GPL	Government Procurement Law of China
GRM	Grievance Redress Mechanism
GRS	Grievance Redress Service
HAP	Hebei Pollution Prevention and Control Implementation Action Plan
HGPAM	Hebei Provincial Government Procurement Administration Measures
HPAO	Hebei Provincial Audit Office
IHD	Ischemic Heart Disease
IRGPL	Implementation Regulations of the GPL
KfW	*Kreditanstalt für Wiederaufbau*
LPG	Liquefied Petroleum Gas

M&E	Monitoring and Evaluation
MEP	Ministry of Environmental Protection
MOF	Ministry of Finance
NDRC	National Development and Reform Commission
NEV	New Energy Vehicle
NH_3	Ammonia
NOx	Nitrogen Oxides
NUE	Nitrogen Use Efficiency
PAP	Program Action Plan
PDO	Program Development Objective
PforR	Program-for-Results
PM	Particulate Matter
PMEH	Pollution Management and Environmental Health Program
PWE	Population Weighted Exposure
QAQC	Quality Assurance/ Quality Control
RED	Resource and Environment Division
SO_2	Sulfur Dioxide
SOP	Standard Operational Procedures
TOR	Terms of Reference
TSP	Total Suspended Particulate
VOC	Volatile Organic Compound
WGO	Working Group's Office
WHO	World Health Organization

Regional Vice President:	Victoria Kwakwa
Global Practice Vice President:	Laura Tuck
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Task Team Leader(s):	Garo J Batmanian

PEOPLE'S REPUBLIC OF CHINA
Hebei Air Pollution Prevention and Control Program

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PAD DATA SHEET

People's Republic of China

Hebei Air Pollution Prevention and Control Program

PROGRAM APPRAISAL DOCUMENT

East Asia and Pacific
Environmental and Natural Resources Global Practice

Basic Information					
Date:	May 13, 2016		Sectors:	Other Industry (55%), General Agriculture, Fishing and Forestry (15%) General Energy (15%), Urban Transport (15%)	
Country Director:	Bert Hofman		Themes:	Pollution Management and Environmental Health (60%) Other Urban Development (20%) Other Rural Development (10%) Environmental Policies and Institutions (10%)	
Practice Manager Global Practice Vice President:	Iain Shuker Laura Tuck				
Program ID:	P154672				
Team Leader(s):	Garo Batmanian				
Program Implementation Period: Expected Financing Effectiveness Date: Expected Financing Closing Date:		Start Date: July 6, 2016 December 31, 2018	June 6, 2016	End Date:	December 31, 2018

Program Financing Data					
[X]	Loan	[ ]	Grant	[ ]	Other
[ ]	Credit				

For Loans/Credits/Others (US$, millions):			
Total Program Cost:	968	Total Bank Financing :	500
Total Cofinancing:	468	Financing Gap :	0

Financing Source	Amount
BORROWER	468
IBRD	500
Total	968

Borrower: People's Republic of China

Responsible Agency: The Development & Reform Commission of Hebei Province

Contact:	Qiao Xiaolin	Title:	Deputy Director General
Telephone No.:	0311-8860051	Email:	qiaoxiaolin@126.com

Expected Disbursements (in US$, millions)

Fiscal Year	17	18	19					
Annual	170	260	70					
Cumulative	170	430	500					

Program Development Objective(s)

To reduce emissions of specific air pollutants in the key sectors in Hebei.

Compliance		
Policy		
Does the program depart from the CAS in content or in other significant respects?	Yes [ ]	No [X]
Does the program require any waivers of Bank policies applicable to Program-for-Results operations?	Yes [ ]	No [X]
Have these been approved by Bank management?	Yes [ ]	No [X]
Is approval for any policy waiver sought from the Board?	Yes [ ]	No [X]
Overall Risk Rating: Substantial		

Legal Covenants			
Name	**Recurrent**	**Due Date**	**Frequency**
Program Institutions	**X**		
Description of Covenant: *PA, Schedule, Section I.C.1:* Hebei shall, throughout implementation, maintain the High-level Provincial Working Group, the Working Group Office, and the Coordination Office; all with composition, powers, functions, staffing, facilities and other resources satisfactory to the Bank, and the responsibilities described in the PA.			
Name	**Recurrent**	**Due Date**	**Frequency**
Program Action Plan	**X**		
Description of Covenant: *PA, Schedule, Section I.C.2:* Hebei shall: (a) undertake the actions set forth in the Program Action Plan; (b) not amend, revise or waive, nor allow to be amended, revised or waived, the provisions of the Program Action Plan, or any provision thereof, without the prior written agreement of the Bank; and (c) maintain policies and procedures adequate to enable it to monitor and evaluate, in accordance with guidelines acceptable to the Bank, the implementation of the Program Action Plan.			
Name	**Recurrent**	**Due Date**	**Frequency**
Annual Work Plan, Targets and Budget Allocations		**December 31**	**Annual**
Description of Covenant: *PA, Schedule, Section I.C.3:* Hebei shall: (a) carry out activities under the Program during each fiscal year in accordance with Annual Work Plans, Targets and Budget Allocations; (b) prepare and furnish to the Bank by December 31 in each year, beginning in 2016, the Annual Work Plan, Targets and Budget Allocations, summarizing the Program activities to be undertaken and projected targets for the following calendar year, including the proposed overall annual budget allocations for the Program; and (c) thereafter, ensure the implementation of the Program during the following calendar year in accordance with the Annual Work Plan, Targets and Budget Allocation, in a manner satisfactory to the Bank.			
Name	**Recurrent**	**Due Date**	**Frequency**
Mid-term review		**September 5, 2017**	
Description of Covenant: *PA, Schedule, Section III.A.2:* Hebei shall prepare, under terms of reference satisfactory to the Bank, and furnish to the Bank not later than September 5, 2017, a consolidated mid-term review report for the program, summarizing the results of the monitoring and evaluation activities carried out from the inception of the program and setting out the measures recommended to ensure the efficient completion of the program and to further the objectives thereof.			
Name	**Recurrent**	**Due Date**	**Frequency**
Independent Verification Agents		**One month after the Effectiveness Date**	
Description of Covenant: *PA, Schedule, Section III.C.* Hebei shall, not later than one (1) month after the Effective Date, hire, and thereafter maintain, throughout the period of Program Implementation, verification agents having experience and qualifications in the relevant technical fields, acceptable to the Bank, and under terms of reference, including a time-table and adequate budget for its activities, satisfactory to the Bank, to monitor and verify the achievement of the Disbursement Linked Results..			

Team Composition			
Bank Staff			
Name	**Title**	**Specialization**	**Unit**
Garo J. Batmanian	Team Leader (ADM responsible)	Lead Environmental Specialist	GENDR
Susan Shen	Manager, Operations	Technical advisor	LLIOP
Etel Bereslawski	Lead Procurement Specialist	Lead Procurement Specialist	GGODR
Guoping Yu	Procurement Specialist	Senior Procurement Specialist	GGODR
Regis Cunningham	Financial Management	Financial Management Hub Leader	GOV PRMM
Yi Geng	Financial Management Specialist	Senior Financial Management Specialist	GGODR
Kai Kaiser	Senior Economist	Senior Economist	GGO14
Dafei Huang	Team Member	Environmental Specialist	GENDR
Erick C.M.Fernandes	Team Member	Adviser	GFADR
Feng Ji	Safeguards Specialist	Senior Environmental	GENDR
Gailius J. Draugelis	Team Member	Lead Energy Specialist	GEE02
Jostein Nygard	Team Member	Senior Environmental Specialist	GENDR
Junxue Chu	Team Member	Division Manager	WFALN
Zhuo Yu	Finance Officer	Finance Officer	WFALN
Aristeidis I. Panou	Counsel	Counsel	LEGOP
Songling Yao	Safeguards Specialist	Senior Social Development Specialist	GSURR
Todd M. Johnson	Team Member	Lead Energy Specialist	GEE02
Zhang Yabei	Senior Energy Specialist	Senior Energy Specialist	GEE03
Wang Xiaoping	Senior Energy Specialist	Senior Energy Specialist	GEEES
Xieli Bai	Team Member	Program Assistant	EACCF
Non-Bank Staff			
Name	**Title**		**City**
Kristin Aunan	Economist		
Weijian Zhang	Agriculture Specialist/ Consultant		

Markus Amann	AQM expert/International Consultant	
Steinar Larssen	AQM expert/ International Consultant	
Crispin Pemberton-Pigott	International Cook Stove Expert/Consultant	
Shaojun Chen	Senior Social Development Specialist/ Consultant	
Wang Peishen	Senior Environmental Specialist/ Consultant	
Li Lina	Short Term Consultant	
Xing Shubin	Consultant	

I. STRATEGIC CONTEXT

A. 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 and increasingly from vehicular emissions, dust, and secondary particulates (formed when ammonia [NH_3] from fertilizers and livestock waste interacts with nitrogen oxides [NO_x] and sulfur dioxide [SO_2] 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 income[1] 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 JingJinJi) from January 2013 onwards brought air quality into the center of environmental policy concerns. 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 (PM2.5) 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 PM2.5 in the country's three main urban and industrial regions, the JingJinJi region, Yangtze River Delta, and Pearl River Delta, shall all decrease by 25 percent, 20 percent, and 15 percent, respectively, compared 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 PM2.5 by 25 percent by 2017 compared to 2012.

B. Sectoral (or Multisectoral) 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.

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

5. Children, older adults, and women are among the most vulnerable to air pollution. The American Academy of Pediatrics[2] 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 PM than to other pollutants, with particular effect on daily cardiorespiratory mortality and acute hospital admissions[3] of children. Studies in China indicate that the effect of PM2.5 was greater in women than men.[4]

6. Since 2013, the government of China (GoC) has been focusing on PM2.5. This is the most critical pollutant for public health in China. PM2.5 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, PM2.5 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 PM2.5 is a good indicator for air quality because it encompasses many pollutants. PM2.5 can be classified as primary and secondary particles. Primary PM2.5 particles are fine particles directly emitted from a source such as dust from construction sites. Secondary PM2.5 particles are produced through chemical reactions in the atmosphere, which include mainly SO_2, NO_x, or NH_3. 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 PM2.5 concentration, the GoC issued strict standards,[6] which are comparable with interim targets defined by the WHO (Table 1).

Table 1. Ambient PM2.5 (µg/m^3) Concentration Defined by China (GB3095-2012) and (WHO)

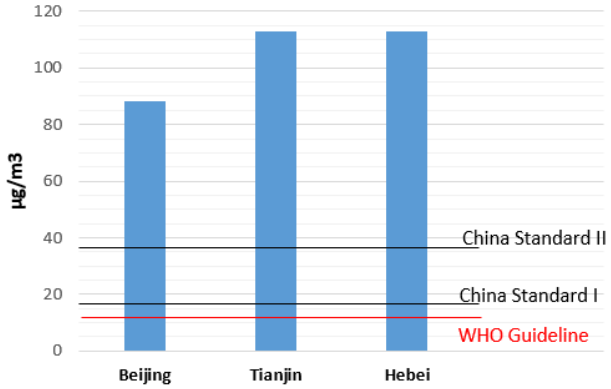
	Annual Mean Concentration PM2.5 (µg/m^3)	**24-hour Concentrations PM2.5 (µg/m^3)**
WHO Interim Target 1	35	75
GB3095-2012 Standard II	**35**	**75**
WHO Interim Target 2	25	50
WHO Interim Target 3	15	37.5
GB3095-2012 Standard I	**15**	**35**

[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.

	Annual Mean Concentration PM2.5 (µg/m^3)	24-hour Concentrations PM2.5 (µg/m^3)
WHO Air Quality Guideline	10	25

8. Hebei had the highest annual average ambient PM2.5 concentration in the JingJinJi region in 2012, with 112.9 µg/m^3, followed by Tianjin with 112.7 µg/m^3, and Beijing with 88.3 µg/m^3. Thus, the annual average ambient PM2.5 concentration for the JingJinJi region was three times higher than the new Standard II of 35 µg/m^3 set by the GoC (Figure 1).

Figure 1. Annual Ambient PM2.5 Concentration by Province in 2012[7]



9. Hebei is also the largest contributor to ambient PM2.5 concentrations in JingJinJi, being responsible for about 70 percent of the emissions in the region. This is the result of the concentration of highly 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, with a population of about 72 million, has much higher annual emissions of NO_x, SO_2, and PM2.5 than industrialized countries such as Germany and France, with populations of about 80 million and 66 million respectively. In fact, Hebei's total PM2.5 emissions in 2012 (863 kt) was more than twice the total annual PM2.5 emission by Germany and France combined in 2010 (330 kt).

11. The emissions per unit of gross domestic product (GDP) between Hebei, France, and Germany (Figure 2) clearly indicate that it should be possible for Hebei to decouple emissions from economic growth. Hebei's emission per unit of GDP is much higher than that of Germany

[7] Clean Air Alliance of China Policy Report. 2014. *Can Beijing, Tianjin and Hebei Achieve their PM2.5 Targets by 2017?*

and France, varying from 10 times more than France for NO_x to 50 times more than Germany for PM2.5.

12. The source apportionment for primary PM2.5 (figure 3) and NO_x and SO_2 (figure 4) for JingJinJi indicates that industrial processes are the main source of primary PM2.5 (54 percent of emissions) as well as the precursor of secondary PM2.5 NO_x (43 percent of emissions) and SO_2 (63 percent of emissions). Residential emissions from stalk burning and coal, mainly to fuel stoves, is the second largest source of primary PM2.5 (33 percent of emissions). The power sector is an important source of NO_x and SO_2 (27 and 20 percent, respectively) while transport is an important source of NO_x (26 percent).

Figure 2. SO_2, NO_x, PM2.5 Emissions per unit on GDP (nominal)

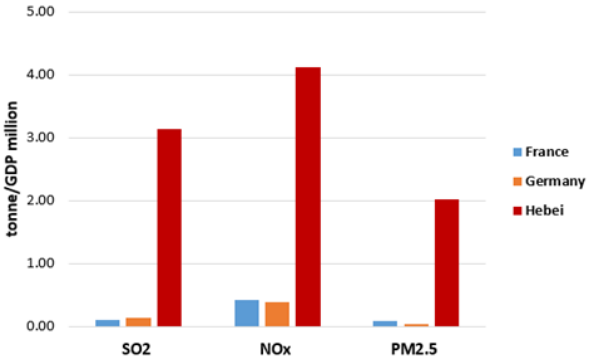


Figure 3. Primary PM2.5 Source Apportionment in JingJinJi[8]

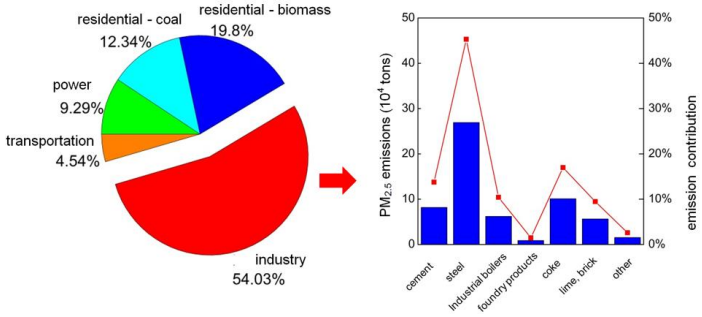
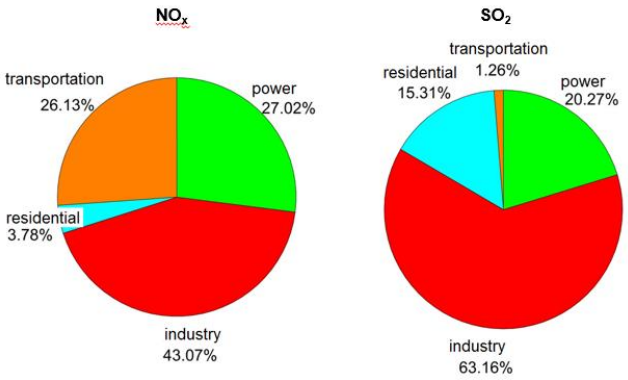


Figure 4. NO_x and SO_2 Source Apportionment in JingJinJi[8]

[8]He Kebin. *Source and Control of PM2.5 in Beijing-Tianjin-Hebei (Jing-jin-ji) Region*. At Innovation Workshop on Air Quality and Energy Efficiency, November 25, 2014. Beijing



13. 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 NH_3 but other studies[9] by the same group concluded that NH_3 emissions have increased by 16 percent from 2006 to 2015 in China and that, at this pace, further increase of NH_3 would offset the benefit to air quality from the reduction of SO_2 achieved due to the 12th Five Year Plan. This corroborates the focus on agriculture and livestock as these are the sources of NH_3.

14. 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 PM2.5 concentrations from 112.9 $\mu g/m^3$ in 2012 to 96.3 $\mu g/m^3$, a 14.7 percent decrease, which is far below the 25 percent reduction target.

15. 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.

C. Relationship to the CAS/CPF and Rationale for Use of Instrument

16. **The proposed operation is fully consistent with the Country Partnership Strategy for China for FY2013–2016.** In particular, the operations supports Outcome 1.6, "Demonstrating Pollution Control Measues," of Strategic Theme 1, "Supporting Greener Growth." The operation also contributes to improving the implementation of the State Council's APPCAP. In addition, the operation is aligned with the World Bank Group's objective of decreasing impact on vulnerable groups (women, children, and older adults).

17. The World Bank is well positioned to support Hebei in its air pollution reduction efforts by focusing on the reduction of emissions. This type of Program requires a multisectoral

[9] Wang, Y., et al. 2013. "Sulfate-nitrate-ammonium Aerosols over China: Response to 2000–2015 Emission Changes of Sulfur Dioxide, NO_x, and NH_3." *Atmospheric Chemistry and Physics*, 13, 2635–2652.

approach, which is relatively new in China. The Bank has been working in China and other countries on the key sectors that need to be covered by the HAP—environmental management, energy, transport, and agriculture—and in many cases, using an integrated multisectoral approach. The experience from those projects will be applied to improve the effectiveness of the HAP.

18. This operation is an integral part of the World Bank's effort to support transformative change in air quality and energy conservation to meet China's long-term goals for green development. The initial focus of the World Bank effort is in JingJinJi. In addition to this proposed operation, the Bank has recently approved another PforR operation, the Innovative Financing for Air Pollution Control in Jing-Jin-Ji (P154669), which also contributes to decreasing emissions of air pollutants in the region. The Innovative Financing for Air Pollution Control in Jing-Jin-Ji aims at reducing coal consumption in the power sector—its development objective is to to reduce air pollutants and carbon emissions through increasing energy efficiency and clean energy, with a focus on Jing-Jin-Ji and neighboring regions. That PforR operation supports the private sector to increase energy efficiency and availability of clean energy. It is expected that some of the activities will take place in Hebei. To avoid duplication among the two operations, the HAP's subplan 6 "Adjustment of the energy structure and increase the clean energy supply" has been excluded from the proposed Program.

19. These two PforRs complement each other in decreasing air pollution. The Innovative Financing for Air Pollution Control in Jing-Jin-Ji focuses on decreasing coal consumption while the proposed Program will ensure that any emissions from coal used in energy efficient power plants are curbed through end-of-pipe measures and effective enforcement of emissions standards.

20. **The proposed operation will adopt the Program-for-Results (PforR) lending instrument.** The PforR provides incentives to improve the technical quality of the HAP implementation to international good practices and increase the efficiency of its implementation. The PforR is the instrument of choice when the focus of the operation is to improve the effectiveness and efficiency of government's existing program to achieve the expected results of the program. The use of the PforR instrument will add significant value to the implementation of the HAP by:

- Ensuring a sharper focus on the key results to be achieved and which require the adoption of improved practices and actions to achieve them; and
- Bolstering support to Hebei through its own systems and procedures and reinforcing the institutional capacity needed for the program to achieve its desired results.

II. PROGRAM DESCRIPTION

A. Program Scope

1. Government Program

21. The HAP consists of an extensive list of measures and actions across all sectors. It has synthesized all actions which should be taken and that are in line with the existing agenda of

each sectoral leading agency. This list of measures is not ranked in priority order and some of the measures include quantified targets, while some others do not. Overall, the HAP can be organized under seven main subplans:

i. **Comprehensive control of industrial enterprises and reduced emission of multi-pollutants.** Specific activities include control of end-of-pipe emissions of: SO_2, NO_x, and PM with aerodynamic diameter equal or smaller than 2.5 microns (PM2.5) in key industries; and (ii) and volatile organic compound (VOC) control in petrochemical and organic chemical industrial sectors.

ii. **Area pollution control and dust control.** Specific activities include: (i) strengthening the non-point-source pollution control in rural areas (for example, from fertilizers, burning of crop residues, and inadequate animal waste management); (ii) promoting the adoption of clean and efficient stoves in households for heating and cooking, preferably using processed fuel (for example, biomass briquettes or coal briquettes); and (iii) controlling the dust in construction sites.

iii. **Prevention and control of emissions from mobile sources.** Specific activities include: (i) improving fuel quality (gasoline and diesel with lower sulfur concentrations); (ii) eliminating old, high emission vehicles (known as yellow sticker vehicles);[10] promoting new energy[11] vehicles (NEVs); and (iii) strengthening environment management of vehicles (for example, taxis to replace the exhaust purification devices annually).

iv. **Establishment of monitoring and warning systems and planning tools.** Specific activities include: (i) strengthening the cooperation of the environmental protection departments with the meteorological departments to set up heavy pollution weather monitoring, early warning, and high-resolution weather-aerosol impact modeling systems; (ii) accelerating the revision of the Regulations on Environmental Protection in Hebei Province and Regulations on Air Pollution Prevention and Control in Hebei Province, with focus on total emission control, emission permit system, emergency and warning, and legal responsibility system; (iii) increasing the capacity on environment monitoring, information, emergency plan, supervision, research, publicity, and instruction; (iv) carrying out various forms of communication and education to spread the scientific knowledge of the prevention and control of PM2.5; and (v) strengthening professional training on air quality management.

v. **Elimination of overcapacity and promotion of industrial transformation and upgrade.** Specific activities include reducing excessive capacity of high-polluting

[10] According to the "Implementation Plan on Phasing Out Yellow Sticker and Old Vehicles" published by the Ministry of Environmental Protection (MEP) in 2014, "yellow sticker vehicles" are gasoline vehicles that do not meet State Grade I standards and diesel vehicles that do not meet State Grade III. State Grade I for gasoline vehicles: CO emission does not exceed 3.16 g/km, hydrocarbon emission does not exceed 1.13 g/km; State Grade III for diesel vehicles: CO emission does not exceed 2.1 g/km, hydrocarbon emission does not excess 0.66 g/km, PM does not exceed 0.1 g/km and NO_x does not exceed 5 g/km.

[11] For the purpose of the HAP, NEVs are electric or plug-in hybrid vehicles.

industries and controlling the expansion of high-polluting industries (for example, iron and steel industry, cement, electrolytic aluminum, flat glass, and ship-building).

vi. **Adjustment of the energy structure and increase the clean energy supply.** Specific activities include (i) implementing the coal consumption cap; (ii) increasing the supply of natural gas and liquefied petroleum gas (LPG) and substituting natural gas, hydropower, and other clean fuels; (iii) increasing the use of clean coal; (iv) developing green buildings; and (v) controlling small coal-fired boilers.

vii. **Supporting measures.** Specific activities are to carry out studies and capacity building to continuously improve and manage air quality with regard to PM2.5 in the key cities in the province, including: (i) circular renovation of industrial zones and parks; (ii) waste exchange utilization; (iii) land and water conservation and efficient farmland use through improved crop and input management practices, and nutrient use efficiency improvements through reduced fertilizer inputs; (iv) recycling of crop residue and animal manures; (v) development of emerging strategic industries, such as energy saving and environmental protection industries and new energy industries; and (vi) enhancements in the use of environmental protection and energy saving indicators.

22. The HAP—a four year program—is receiving earmarked resources of about RMB 4 billion (US$ 625 million) per year and RMB 800 million (US$125 million) per year from the national and provincial governments, respectively. In 2014, this RMB 4.8 billion (US$750 million) leveraged an additional RMB 20 billion (US$3.1 billion) from the private sector and other government funds in support of the HAP. The HAP's funding allocation is assigned each year according to the annual work plan. The HAP has been functioning adequately since 2013 and with adequate levels of funding. The relevant institutions are in place and following their respective mandates. Most of the HAP activities use a result-based approach, combining government subsidy, policy support and market mechanisms.

2. PforR Program Scope

23. 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 through another PforR for the entire JingJinJi [12] region (P154669 - Innovative Financing for Air Pollution Control in Jing-Jin-Ji), as part of the Bank's integrated approach to support China in combatting air pollution in JingJinJi.

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

24. 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 (subplans 1 to 4 in section II.A.1) and subplan 7 which includes suporting 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 (SO_2, NO_x, and primary PM2.5) from key industrial sectors

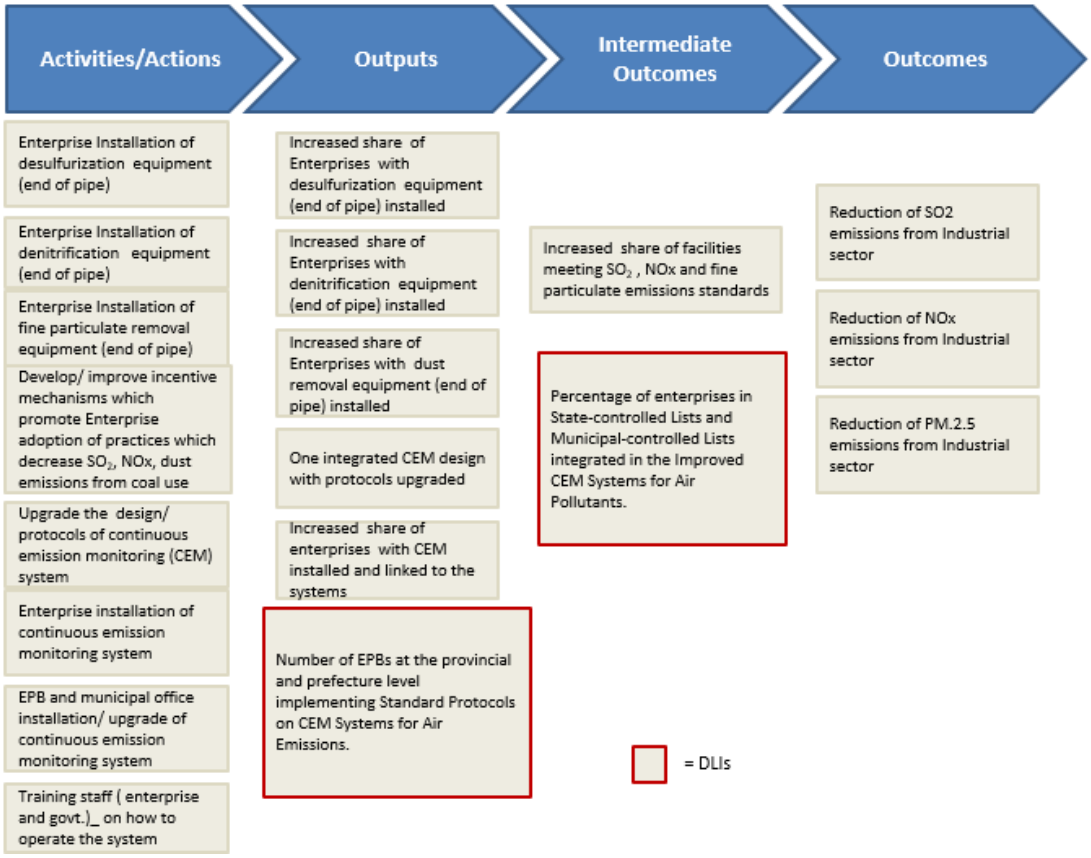
25. The goal is to ensure that industrial enterprises meet the government's emissions standards on a daily basis, especially that investments in the end-of-pipe and other emission-reduction solutions actually result in lower emissions. This should be achieved by implementing a robust continuous emissions monitoring (CEM) system and use it to enforce the existing emission standards.

26. 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.

27. 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.

28. 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 (Figure 5).

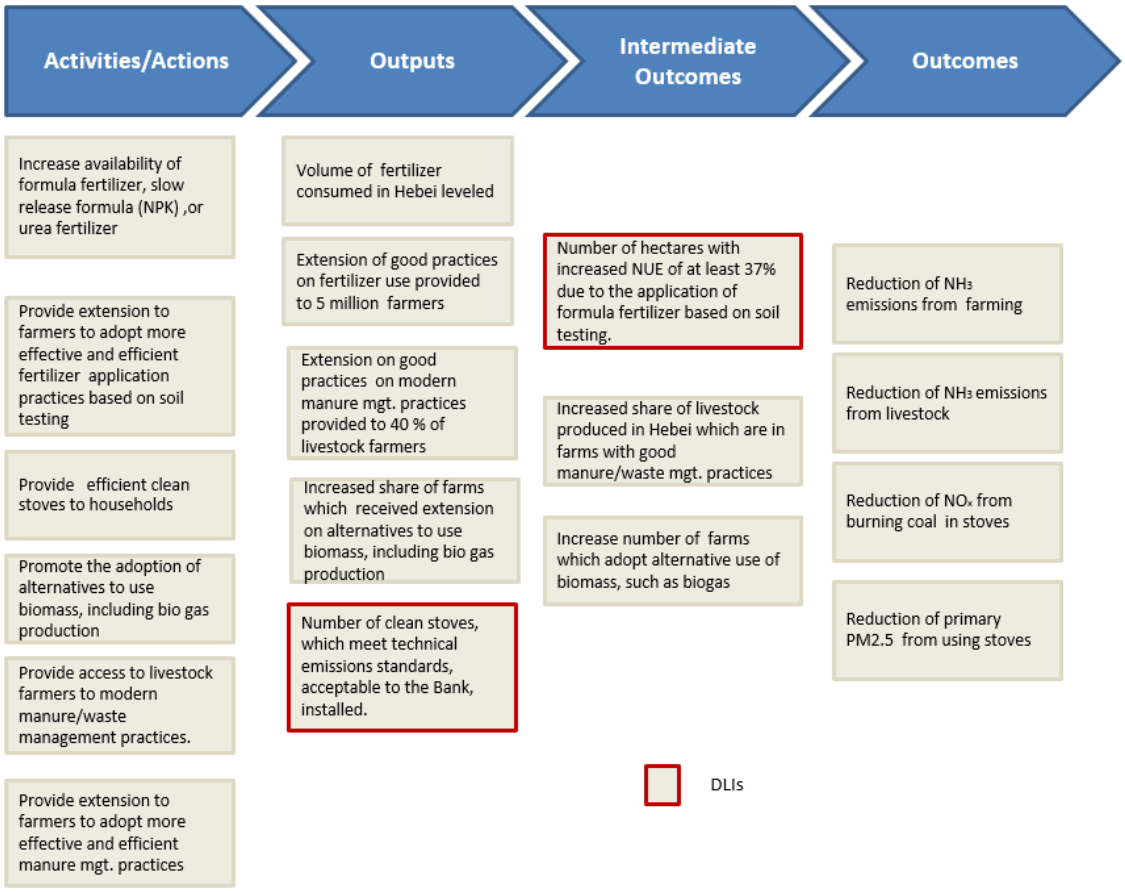
Figure 5. Result Chain for Reducing Emissions from Key Industrial Sectors (Results Area 1)



Results Area 2: Area pollution control and dust control

29. 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 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 (figure 6).

Figure 6. Result Chain for Reducing Emissions from Rural Areas (Results Area 2)



30. **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.

31. 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.

32. **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.

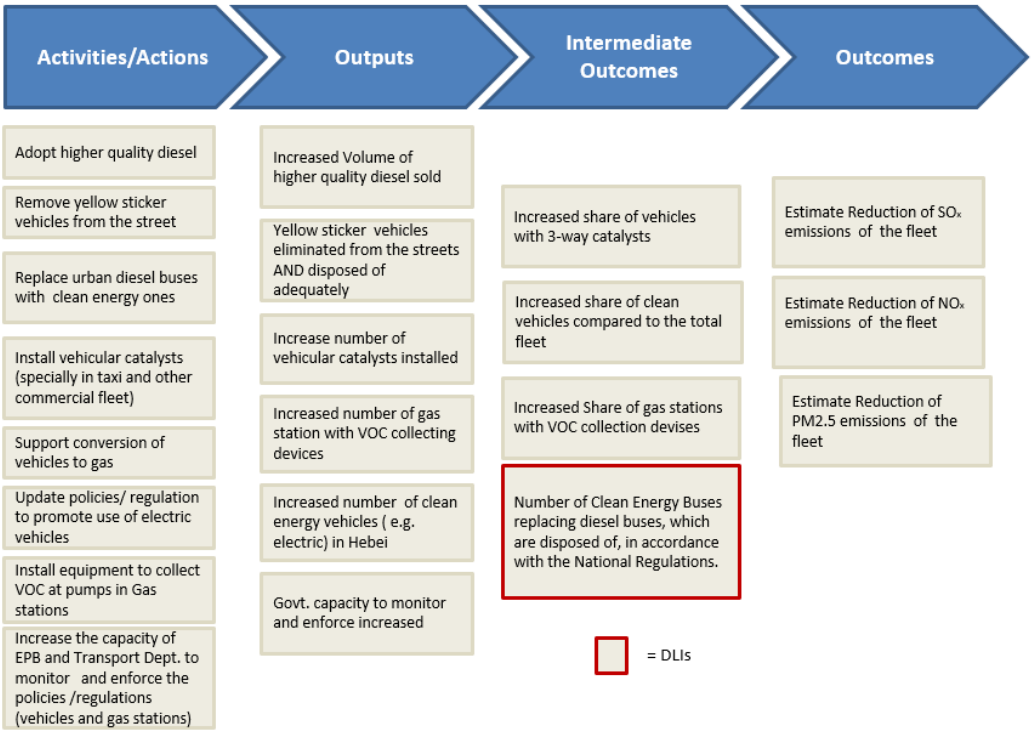
33. **Livestock waste management.** The Program will support improving the waste management of existing medium- and large-scale farms, including: (i) dry-wet separation facilities; (ii) crop-animal integrated systems; and (iii) production of biogas.

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

34. 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.

35. 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 (figure 7).

Figure 7. Result Chain for Reducing Vehicular Emissions (Results Area 3)

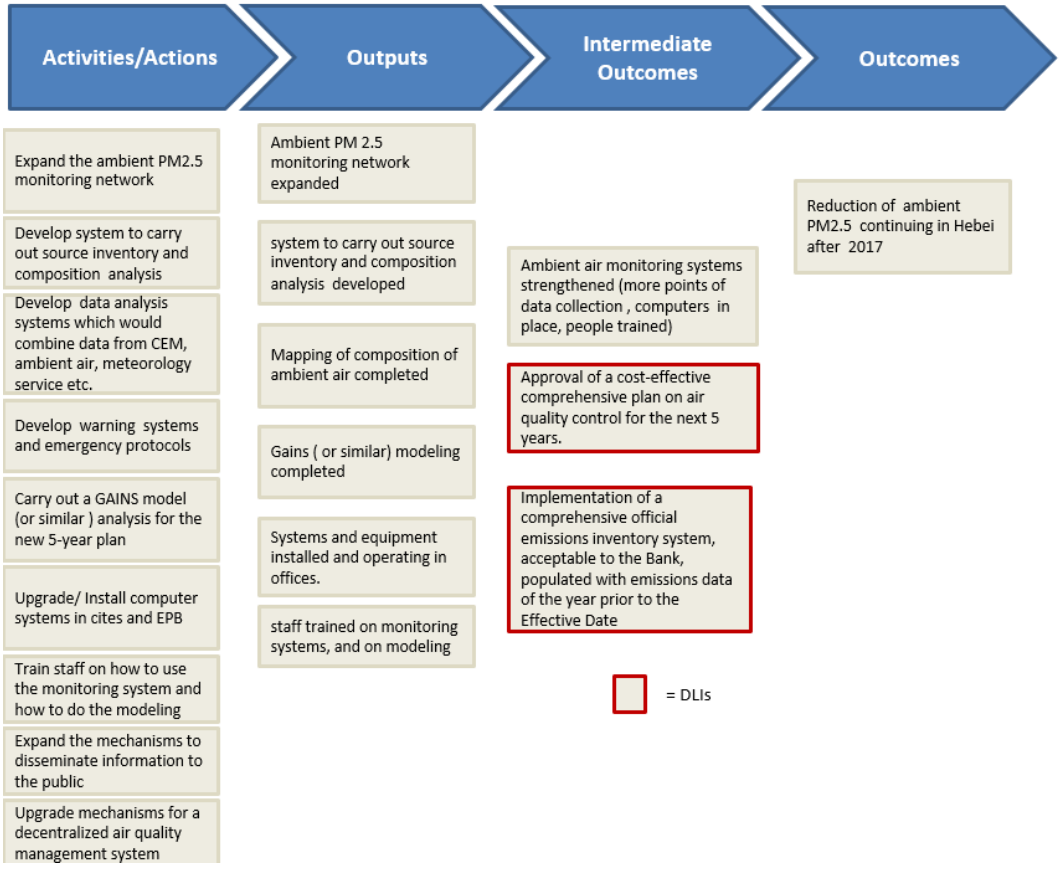


Results Area 4: Establishment of monitoring and warning systems and planning tools

36. 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 PM2.5 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.

37. 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 (figure 8).

Figure 8. Results Chain for Improving the Air Quality Monitoring and Planning Capacity of Hebei (Results Areas 4)



Program Beneficiaries

38. 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

39. The expenditure of the Program will be US$968 million (Table 2). 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.

Table 2. Program Financing (US$, millions)

Source	Amount	% of Total
Government earmarked funds for HAP	**468**	**48**
IBRD/IDA	**500**	**52**
Total Program Financing	**968**	–

40. 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 (Table 3) over the next two years.

Table 3. Program Leveraging (US$, millions)

Source	Amount	% of Total
Other government funds (national, provincial, county level)	**241**	**36**
Private Sector	**427**	**64**
Total Program **Leveraging**	**671**	

41. 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.

42. The Bank team worked in close coordination with the Asian Development Bank (ADB) team who developed a US$450 million lending operation with Hebei on air pollution similar to a Bank development policy operation with co-financing from *Kreditanstalt für Wiederaufbau* (KfW). The discussions aimed at identifying synergies to prevent and control air pollution in Hebei. The ADB/KfW operation supports areas which over time will contribute to decreasing air pollution in Hebei but are not supported by the PforR and not considered under the Program Indicators. Examples of policy actions under the ADB /KfW operation include: (i) natural gas network expansion plan with time-bound investment approach to accelerate its implementation drafted by Hebei energy administration and issued by Hebei provincial government; (ii) action plan for accelerated decommissioning of decentralized heat only boilers and substitute them with

centralized combined heat and power plants with enhanced emission reduction measures drafted by Hebei DRC and issued by Hebei provincial government; and (iii) provincial government opinion on improvement in employment and entrepreneurship drafted by human resources and social security bureau and issued by Hebei provincial government.

B. Program Development Objective/s (PDO)

43. The PDO is to reduce emissions of specific air pollutants in the key sectors in Hebei.

44. This PDO addresses one of the main necessary conditions for the government to achieve the 25 percent reduction of ambient PM2.5 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 PM2.5 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 PM2.5 concentration. Therefore, the PDO focuses on measurable and achievable emissions reductions from the specific sectors supported under the Program.

C. Program Key Results, Disbursement Linked Indicators and Verification Protocols

45. **PDO Indicators**:

- Indicator 1: Reduction of SO_2 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)

46. Consistent with the PforR framework, seven DLIs have been identified over four disbursement periods corresponding to the 2.5 years of the Program implementation period. The DLIs are designed to measure key results generated from a combination of activities planned under each Results Area of the Program.

Results Area 1: Comprehensive control of industrial enterprises and reduced emission of multi-pollutants emissions (SO_2, NO_x, and primary PM2.5) from key industrial sectors

47. The Program includes two DLIs for this Results Area, designed to provide incentives for all environmental agencies involved in the CEM to upgrade the three key aspects of the systems:

robustness and reliability of the data from the production lines, the processing of this data in an integrated system, and the use of the data to enforce the existing standards and regulations.

DLI 1: Number of EPBs at the provincial and prefecture level implementing Standard Protocols on CEM Systems for emissions of air pollutants

48. **Verification protocol.** The verification will be done by a third-party entity, which will review the report prepared by the EPB, considering the following criteria for each office:

- Standard operational procedures (SOP) for regular checking of emission reduction equipment operation and performance, including design and actual reduction efficiency (%) for each compound/pollutant; parameters that can be used to verify performance; specifications of maintenance procedures;

- SOP for CEM operation, calibration, maintenance, data base at the plant, and verification in plants on sampling basis;

- SOP for EPBs checking/auditing work on the CEMs;

- Verification of the performance of the various types of CEM used within the Province in terms of their agreement with Standard gases (for gas measurements) and with Standard emission measurement methods (manual methods) regarding the emissions of the various compounds; and

- Verification, on a sampling basis, of the application of the different SOPs.

DLI 2: Percentage of enterprises in State-controlled Lists and Municipal-controlled Lists integrated in the Improved CEM and Enforcement Systems for Air Pollutants

49. **Verification protocol.** The verification will be done by a third-party entity, which will review the report prepared by the EPB with data from CEM, considering the following:

- The list of the industrial plants that includes all the plants in the state-controlled and the municipal-controlled lists;

- The list of installed CEMs, with specifications regarding plant and emission point/detailed location where it is installed, CEM type/manufacturer, compounds, and other parameters measured;

- Operational procedures for how data from the CEMs, as they exist in the data register of each of the CEMs, are transferred unaltered to the provincial central CEM database;

- Operational procedures for all procedures carried out within the CEM system and evaluation of those procedures as to their completeness and guarantee for data quality and integrity; and

- Procedures for compliance checking and enforcement follow-up organized by the provincial CEM center, based upon automatic alarms showing exceedances hour-by-hour.

Results Area 2: Area pollution control and dust control

50. The Program includes two DLIs for this results area, designed to provide incentives to improve the air quality at the household level in rural areas and to promote a phased approach to improving agriculture practices and decreasing emissions from agriculture.

DLI 3: Number of clean stoves installed

51. **Verification protocol.** It builds on the existing HAP reporting mechanism to check the evidence provided by counties that stoves were purchased by end users, including the model and type of stove, to pay the subsidy to the manufacturers. The Program verification will be done by a third-party entity, which will review the report prepared by the Agriculture Department that would include:

- The catalog of eligible clean stoves that meet the project technical criteria, which includes manufacturer information and stove model information;

- For each eligible stove model, the stove testing report from an authorized testing agency that confirms technical eligibility;

- Sales evidence of the number of eligible stoves sold such as purchase order, shipping/installation information, and related receipts; and

- Sales records, which include stove model, stove price, transaction date, and customer information (resident ID number, address, contact phone number).

52. Considering the large number of stoves expected to be installed in the entire province, the verification will be done on a sampling basis, checking sales evidence to confirm the reported number of stoves sold and calling the customers to confirm the stove sales transaction and whether the stove is being used.

DLI 4: Number of hectares with increased NUE of at least 37% due to the application of formula fertilizer based on soil testing

53. **Verification protocol.** It builds on the existing HAP reporting mechanism to check the evidence provided by counties that fertilizers were purchased as part of the process to pay the subsidy to the producer. The verification will be done by a third-party entity, which will review the report prepared by the Agriculture Department considering:

- Evidence of soil testing;

- Area planted by main crops; and

- The ratio between the amount of fertilizer N removed with the crop and the amount of fertilizer N applied, or NUE.

54. Considering the large number of farmers expected to participate in the Program in the entire province, the verification will be done on a sampling basis, checking with farmers to obtain information on soil testing, volume and type of fertilizer applied, and yields.

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

55. The Program has one DLI for this results area designed to raise the share of clean energy vehicles from 71 percent to 88 percent in the bus fleet of the province, including 33 percent electric vehicles (EVs). Currently, it is not possible to completely eliminate diesel buses from the fleet because there are a small number of areas where it is not technically possible to connect to a gas pipeline needed to supply a gas-fueled bus fleet due to hilly geographic conditions and/or where the cold climate is unsuitable for electric buses.

DLI 5: Number of Clean Energy Buses replacing diesel buses, which are disposed of, in accordance with the National Regulations

56. **Verification protocol.** It builds on the existing HAP reporting mechanism to check the evidence provided by counties that buses were purchased, to provide the subsidy to bus companies. The verification will be done by a third-party entity, which will review the report prepared by the Transport Bureau considering:

- Evidence of purchase, which includes the model, type, transaction date, and customer information;

- Vehicle parameters (including driving range, length, weight, and so on) to prove that the vehicles meet the national subsidy standards;

- The logbooks of the bus companies to identify the operational situation and efficiency of each bus;

- The statistical data of all bus companies in Hebei to identify the final proportion of the clean energy buses and new energy buses; and

- Records of diesel buses retired and then delivered to vehicle dismantling facilities which are in compliance with National Regulations. Considering the large number of buses expected to be involved in the Program in the entire province, the verification will be done on a sampling basis focusing on metropolitan areas.

Results Area 4: Establishment of monitoring and warning systems and planning tools

57. The Program includes two DLIs for this Results Area, designed to provide incentives to improve the quality and the coverage of data collection for planning and monitoring in Hebei, and to design the next 5-year plan, which will achieve the national defined targets, efficiently and effectively.

DLI 6: Implementation of a Comprehensive Official Emissions Inventory System

58. **Verification protocol.** The verification will be done by a panel of three independent experts, who will check whether the inventory was done respecting the air pollutants emissions inventory technical guidelines issued by the MEP, and following international technical guidelines similar to those of the European Environment Agency's (EEA) "Air Pollutant Emission Inventory Guidebook".

DLI 7: Approval of a Cost-effective Comprehensive Plan on Air Quality Control for the next 5 years.

59. **Verification protocol.** The verification will be done in two steps:

(a) A panel of three independent experts to validate the model used to develop the Plan. This validation will use as a basis, internationally recognized tools similar to the Greenhouse Gas and Air Pollution Interactions and Synergies (GAINS), and the Community Multi-scale Air Quality modeling system (CMAQ); and

(b) Evidence provided by the EPB that the Plan was officially approved by Hebei authorities.

D. Key Capacity Building and Systems Strengthening Activities

60. Based on the Program assessments, capacity building is an important element of this operation to enhance the capacity of the different agencies to improve the effectiveness of their work.

61. The technical assistance and capacity building being provided during preparation and which will continue to increase during implementation uses several Bank mechanisms, including but not limited to:

- The World Bank Pollution Management and Environmental Health Program (PMEH). The objective of this Multi-donor Trust Fund is to help client countries in reducing particularly air pollution and impacts on health through technical assistance to support improved air quality and land pollution management. China has already been identified as one of the priority countries for receiving support from the PMEH,

- The Energy Sector Management Assistance Program (ESMAP), which has been focusing on the clean stove initiative. A number of capacity building and institutional strengthening activities have been identified and summarized in Table 4.

- The Bank plans to mobilize US$4.5 million as part of the US$18 million Global Environmental Facility (GEF) project Developing Market-Based Energy Efficiency Program in China under preparation. This potential parallel grant funding would support local capacity building, proactive outreach, and independent third-party verification of the results to complement this PforR.

Table 4. Capacity Building and Technical Assistance to Program Implementation

Area	Objectives	Activities
Results Area 1	To ensure the CEM system is run in the most robust manner to support enforcement with highly competent staff at all levels	• Technical assistance to develop detailed air emissions CEM operation manual, penalty guidelines, compliance enforcement SOPs, and staff compliance review procedures
	To create a single CEM platform to enhance data completeness, quality, and economic efficiency	• Technical assistance to develop the technical design of the CEM system and to address compatibility issues connecting the provincial CEM system with the municipal-level systems • Technical assistance to improve the reporting and monitoring using the CEM data
Results Area 2	To improve the technical standards of clean stoves in Hebei	• Technical assistance to further strengthen the lab testing capacity and manufacturing capacity of design and manufacturing of PM2.5-compliant stoves • Support Hebei to design informational campaigns targeting stove manufacturers and existing and potential users at the county level
	To enhance monitoring and data collection for fertilizer NUE	• Technical assistance to develop comprehensive field experiments and standardized NUE calculation • Technical assistance to improve field monitoring of impacts of formula fertilizer application on NH_3 emissions • Technical assistance to design a more efficient soil sampling strategy to increase coverage of the farming area so that fertilizer recommendations can be further refined • Technical assistance to design initiatives which would promote the use of organic fertilizers as part the formula fertilizer application (FFA) technique
Results Area 3	To upgrade the existing vehicle dismantling enterprises	• Strengthen the capacity of local authorities to review the dismantling service provider on applicable national standards and technical specifications.
	To strengthen the environmental management of road transport	• Review traffic management measures, international best practice, and provide recommendations to Hebei.
Results Area 4	To establish systematic air quality management planning capacity in Hebei	• Technical assistance to establish Hebei's provincial source apportionment system according to internationally accepted good practices • Technical assistance to use internationally accepted modelling tools for cost benefit analysis as part of the air quality management planning for the 13th Five Year Plan
ESSA	To improve capacity for work safety supervision on industrial enterprises	• Support Hebei to design a training initiative for at least 60 work safety supervision staff at both provincial and municipal level

Note: ESSA = Environmental and Social Systems Assessment.

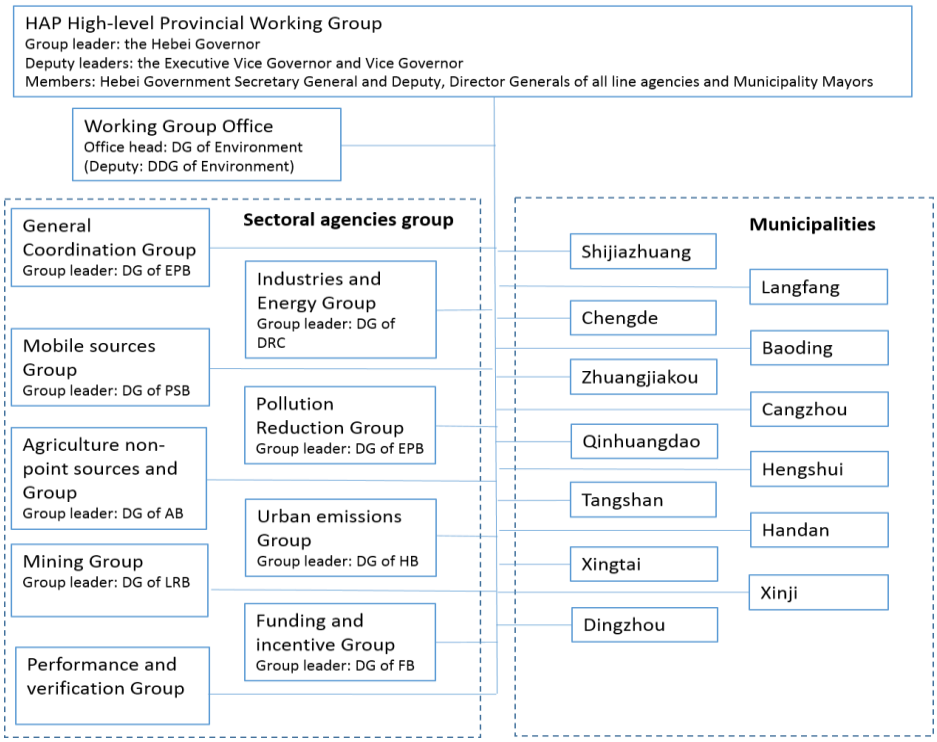
III. PROGRAM IMPLEMENTATION

A. Institutional and Implementation Arrangements

62. 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.

63. 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.[13] Figure 9 provides the operational structure of the HAP, including agencies and roles. 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.

Figure 9. Institutional Matrix under the HAP High-level Provincial Working Group



Note: PSB = Public Security Bureau; LRB = Land Resources Bureau; EPB = Environment Protection Bureau; HB = Housing Bureau; AB = Agriculture Bureau; DDG = Deputy Director General; DG = Director General.

64. Since the inception of the HAP, the different executing agencies have been implementing their assigned tasks accordingly e.g. CEMs are being installed, stoves being deployed, fertilizers being supplied as planned. The current structure of the executing agencies is adequate to implement the main approach adopted by the HAP and which will continue in place during the implementation of the Program. Most of the HAP activities use a result-based approach,

[13] 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.

combining government subsidy, policy support and market mechanisms. Thus, executing agencies do not procure and distribute CEMs, clean stoves, new buses, or formula fertilizers. The role of the agencies is to provide the technical specifications for the products, and later partially reimburse manufacturers upon verification of direct sales made between them and users.

65. Overall coordination of the HAP is carried out by the High-level Provincial Working Group comprising the governor (the working group leader), the vice governors responsible for sectors covered in the plan (deputy leaders), and leaders of relevant departments and municipalities. The Working Group's Office (WGO) has been established within the Hebei EPB serving as the secretariat to the Working Group for day-to-day management and coordination of the HAP. An annual work plan is developed by the EPB WGO, which also works jointly with the FB in allocating the annual HAP budget. Each activity defined in the annual work plan is assigned to a specific line agency, which should lead its implementation. This WGO is operating adequately. It monitors HAP implementation progress and has its authority respected when ordering temporary shutdown of factories, construction sites or traffic restrictions during special occasions or heavy pollution episodes. The provincial CEM center, as part of the WGO, is responsible for daily data collection and maintenance of the provincial CEM system. It is staffed with 42 engineers, 79 monitoring technicians, and 12 engineering assistants. These team are managing the CEM adequately, with data being collected and processed continuously. The adoption of the Standard Operations Protocols will improve the quality of their work but will not change the current arrangement or demand larger number of additional staff.

66. To address the additional coordination and support required by the Program, the Hebei DRC has set up a coordination office to liaise with the respective line bureaus involved in the implementation of the HAP, especially in the four results areas of the Program. Hebei DRC's multisectoral nature is expected to bring in additional valuable convening channels to the program's coordination. The coordination office will coordinate directly and primarily with the EPB WGO and the FB to ensure that the EPB WGO and the FB are fully engaged in the Program's implementation.

B. Results Monitoring and Evaluation

67. The official mandate of the EPB is to improve environmental conditions in Hebei. The Bank has been working with the EPB and DRC to ensure that a solid result framework exists to monitor the HAP as defined by the Hebei circular 35.[14] Special attention has been given to monitoring the four results areas, focused on the DLIs.

68. The Hebei EPB, as the secretariat of the HAP Leading Group Implementing Agency, is already responsible for monitoring and evaluating the emissions reduction from the different activities, as well as ambient PM2.5 concentration. Most of the activities use an evidence-based approach. Payments are made to suppliers/enterprises that provide evidence that actions have been taken (for example, stoves deployed fertilizers based on soil testing delivered and

[14] No. 35: Circular of Hebei Provincial Leading Group Office of Air Pollution Prevention and Control on Issuing Action Program of Hebei Provincial In-depth Governance of Air Pollution for Three Years (2015–2017).

denitrification equipment installed). Thus, the Program monitoring and evaluation (M&E) builds on that existing capacity and structure of the different agencies. The focus will be on providing technical assistance to allow disaggregation of the data to the level more directly linked to the Program (for example, emissions from different industrial sectors).

69. Verification of the reports prepared by the executing agencies regarding the achievement of DLIs will be carried out by third-party entities/experts. Firms, non-for-profit organizations, and academia can serve as third-party entities/experts as long as they fit the following the principles: (i) financially and hierarchically independent of the agency responsible for the report or for the initiative covered by DLI; and (ii) capacity to complete the verification task with a minimum of 5 years of experience in the technical area of the report/DLI. The TOR for each selection process and the final selected third-party entity/expert should be acceptable to the Bank.

C. Disbursement Arrangements

70. The Bank will advance to the borrower US$121.5 million of the total Program financing (details on Annex 3). When the DLI against which an advance has been disbursed is achieved, the amount of the advance will be deducted from the total amount due to be disbursed under such DLI. The Bank will record an amount of the advance as disbursed for an achieved Disbursement Linked Result ("recovered") after it has notified the Borrower of its acceptance of the evidence of achievement of the result for which the advance was provided. The amount so reclassified will become available for further advances in accordance with the preceding paragraph.

71. Each participating agency will be responsible for verifying the achievements of the DLIs under its purview, through independent verification agencies, based on the agreed verification protocol.

72. The Hebei DRC will be responsible for collecting the reports from each provincial agency participating in the Program and respective independent verifications and will periodically submit a consolidated report to Hebei FB. Hebei FB will prepare disbursement applications and submit them to the Bank.

73. Disbursements will be made upon verification of the results of the DLIs. The actual disbursed amount will depend on the verified results as all DLIs are scalable except DLIs 6 and 7. The annual DLIs targets are indicative. The Hebei FB can apply for reimbursement as soon as it meets targets and provides the necessary documentation. The Hebei FB can also ask to be reimbursed for any results achieved beyond the indicative annual target up to the total PforR target and amount allocated for the respective DLI.

IV. ASSESSMENT SUMMARY

A. Technical

74. **Strategic relevance.** Reducing air pollution is a top priority for the GoC, particularly given the severe air pollution in the JingJinJi region and the impact on public health. Hebei had the highest annual average ambient PM2.5 concentration in the region with 112.9 $\mu g/m^3$ in 2012.

Hebei is also responsible for about 70 percent of total emissions in the region. Thus, the proposed Program is strategically relevant and fully aligned with the GoC's priorities.

75. **Technical soundness.** In-depth assessments have been conducted specifically on each of the four results areas included in the Program, to identify the areas that would benefit from further technical improvements.

Results Area 1: Comprehensive control of industrial enterprises and reduced emission of multi-pollutants emissions (SO_2, NO_x, and primary PM2.5) from key industrial sectors

76. The HAP includes a rather detailed plan on how to reduce the emissions from the four main sectors, iron and steel, electric power, cement, and glass, as well as to implement a system for monitoring the emissions as a basis for checking the compliance of the various sources to meet the emissions standards.[15]

77. The assessment concluded that such a plan and system, when including all heavy emission industrial plants, is a proper and necessary part of an action plan to meet the air quality targets. However, several problems are associated with the CEM platform, monitoring, and data acquisition and application that make the system presently less effective than it should have been, such as: (i) monitoring platforms are sometimes not installed or fail to meet standards with regard to station installation quality and integrity; (ii) sampling points are sometimes in wrong positions, so data are not representative of the real emissions; (iii) there are a multitude of brands of monitoring equipment and operators of the equipment, leading to difficulties in standardizing operations and quality; and (iv) there is a lack of staff to carry out daily operations (less than 50 staff in the entire system).

78. To overcome these problems, the activities to be supported under the Program will include: (i) strengthen existing institutions and improve management systems; (ii) strengthen the data management and the application of the monitoring data from the CEMs; and (iii) consolidate a single database with the provincial CEM Center receiving online data from all the plants/stacks in the province with CEM installed.

Results Area 2: Area pollution control and dust control

79. **Clean stoves.** International experience shows that to promote clean heating and cooking in households, it is important to understand local conditions and the needs of the end users and find appropriate technical solutions that can be accepted and adopted by them. In the current Hebei context, promoting clean stoves that can burn raw coal in a much cleaner form can make a significant contribution to air pollution control. The assessment concluded that focusing on clean stoves is an important initiative, which should contribute to improved air quality in rural areas. However, the assessment's main finding is about the quality of the clean stoves. While the current provincial clean stove standard has an impressive requirement of 70 percent thermal

[15] Reference: Report on air pollution emission and control in key industries of Hebei Province.

efficiency,[16] it falls short in measuring emission reductions. The current HAP initiative lacks testing data and analysis on PM2.5 emission levels of eligible clean stoves compared to the baseline stoves.

80. To overcome these problems, the activities to be supported under the Program will include: (i) additional testing report to show the performance indicator of PM2.5 emissions per unit of heat delivered compared to the baseline; (ii) update of the catalog of eligible products based on updated technical performance criteria and testing results, to include only the stoves which reach at least a 60 percent reduction in PM2.5 emission per unit of heat delivered compared to the baseline; and (iii) education and informational campaigns targeting existing and potential users on which stoves to buy and how to use them properly.

81. **Agriculture.** The increased use of formula fertilizer based on soil testing and analysis is a good initiative to increase NUE and decrease NH_3 emissions. It is well known that balanced fertilizer application with new mechanical fertilizer application methods can greatly increase NUE. For example, Integrated Plant Nutrient Management is widely recommended by the Food and Agriculture Organization. According to field experiments in 2014, this initiative could increase wheat and corn yields by 398 kg/ha and 477 kg/ha, respectively, and reduce chemical fertilizer application by 59 kg/ha for wheat and 48 kg/ha for corn. However, several problems are associated with the current HAP initiative: (i) the intensity of soil sampling is currently low; (ii) the type of nitrogen used in the fertilizers has low use efficiency; and (iii) organic fertilizers are not considered in the initiative.

82. To overcome these problems, the activities to be supported under the Program will include: (i) improving the formula design; (ii) developing more comprehensive field experiments and a standardized NUE calculation; and (iii) developing a pilot initiative, which will promote the use of organic fertilizers as part of the initiative.

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

83. Reducing air pollution from the road transport sector is one of the main strategies in the Hebei provincial government action plan for air pollution prevention and control. While the transport sector in JingJinJi only accounts for 4.5 percent of primary PM2.5 emissions, it is a major contributor to precursors of secondary PM2.5. Transport is estimated to be responsible for 26 percent of NO_X emissions.

84. The NEVs, such as battery electric vehicle (BEV) and plug-in electric vehicle, are mainly used in the public transport sector in Hebei. The assessment of the operation of electric buses indicates that those buses are widely accepted and praised by passengers for good environmental performance. In addition, the operation cost of the BEV buses has become competitive compared to the compressed natural gas (CNG) buses due to operating subsidies provided by the government. However, the assessment identified the following shortcomings: (i) lack of charging infrastructure for EVs, including buses; and (ii) weak environmental management of vehicles.

[16] Heat gained by the water heating unit attached to the stove immediately behind the combustion chamber, divided by the heat energy available in the fuel loaded during the test.

85. To overcome part of these problems, the activities to be supported under the Program will include: (i) replacement of diesel buses with clean energy ones; (ii) increase in the charging infrastructure; and (iii) faster implementation of the latest emission standard for vehicles.

Results Area 4. Establishment of monitoring and warning systems and planning tools

86. The HAP[17] and the 2015 circular 35[18] from the Hebei Provincial Leading Group Office of Air Pollution Prevention and Control provide specifications for measures that shall be taken before 2017 to reduce the concentration of fine particular matters in the Hebei Province by 25 percent compared to 2012. More stringent reductions for the most polluted cities are also defined (for example, -33 percent in Shijiazhuang, Tangshan, Baoding, Langfang, Dingzhou and Xinji). Systematic air quality management (AQM) planning is applied on a routine basis in many industrialized countries throughout the world, especially by the European Union and in the United States. Emissions inventory is a fundamental tool for designing and monitoring the implementation of AQM plans. However, the assessment identified the following shortcomings: (i) the absence of a comprehensive source apportionment to inform the modelling and planning; (ii) the action plans do not build upon robust AQM principles, including a needed understanding of the increased complexity of air pollution sources; (iii) the action plans do not include a needed understanding of negative impacts from high air pollution concentrations, particularly on human health; and (iv) the action plans have not developed an investment portfolio that is prioritized based upon estimating cost effectiveness of the abatement options.

87. To overcome part of these problems the activities to be supported under the Program will include: (i) developing a comprehensive official emissions province wide inventory system; and (ii) adopting modeling tools for cost-effective analysis as an integral part of Hebei's multiyear AQM planning.

88. **Supporting measures.** The activities grouped under this subplan 7 are defined periodically according to training and research and development needs identified in the other subplans. The advantage of having a separate subplan for supporting measures instead of including the training and research activities under each respective subplan is that it assures a budget allocation which can be used during the year in response to emerging needs. The activities under this subplan were assessed as part of the four results areas presented in the section.

89. **Economic evaluation.** This economic evaluation is based on the health benefits that may be achieved from alternative scenarios for PM2.5 reductions in Hebei from 2017 onwards. The estimated population weighted exposure to ambient PM2.5 population weighted exposure (PWE)

[17] Circular of Provincial Party Committee of Communist Party of China and Provincial People's Government of Hebei on Printing and Distributing the Implementation Scheme of Hebei Province of the Air Pollution Prevention and Control Action Plan, September 6, 2013).

[18] No. 35: Circular of Hebei Provincial Leading Group Office of Air Pollution Prevention and Control on Issuing Action Program of Hebei Provincial In-depth Governance of Air Pollution for Three Years (2015–2017).

of 95 μg/m^3 in the province is for the base year 2012. The area weighted concentration is 51 μg/m^3. In nearly all parts of the province, the annual average PM2.5 concentrations exceeds China's Air Quality Standard of 35 μg/m^3 PM2.5 (annual mean). The number of annual premature deaths due to PM2.5 pollution in the base year is estimated at approximately 69,448, with a monetized value of RMB 254 billion (127–381), corresponding to 9.6 percent of the province GDP. Considering the additional PM2.5 exposure burden due to household air pollution from traditional cooking fuels in the province, the estimate reaches 86,000 premature deaths with a monetized value which corresponds to almost 12 percent of the province GDP.

90. A general 15 percent reduction in PM2.5 concentration in Hebei results in an estimated 3,424 avoided deaths annually according to our model. A 25 percent reduction would result in an estimated 6,159 avoided deaths annually. The impact of strengthening the HAP with the support of the Program may thus contribute to an additional 2,735 avoided deaths per year.

91. The present value (PV) in the base year of the 15 percent reduction HAP is estimated at RMB 150 (61–263) billion, whereas the PV of a 25 percent reduction is estimated at RMB 271 (110–474) billion. Thus, the PV of the benefit of expanding the HAP that reduces the PM pollution by 25 percent within 2017 is estimated at RMB 120 (49–210) billion corresponding to US$19 (8–34) billion.

92. **Expenditure framework.** The expenditure framework assessment included the following dimensions: (i) fiscal sustainability and resource predictability; (ii) well-functioning budget allocation and execution; and (ii) incentives for efficient service delivery and value for money.

93. Key characteristics of the HAP structure are: (i) the centrality of higher level earmarked transfers from the central (and provincial) government to the implementation of the program at lower levels of government; and (ii) the role that 182 subprovincial governments play in the spending of earmarked grants/co-budgeting and implementation of the program. The assessment was conducted based on a review of the budget law, budget and budget expenditure reports, and interviews with a sample of subnational governments (province, city/district, and county).

94. The expenditure framework presents an adequate basis for the Program. To ensure effectiveness and medium term sustainability for the Program, three main areas should be strengthened and closely monitored: resource predictability, timely execution, and allocative Program value for money. These center on improved alignment of higher-level earmarked grants with the local budget cycle, measures to strengthen expenditure allocation and execution tracking, and more timely and systematic performance evaluations of air pollution prevention and control measures. The recommendations of the expenditure assessment are closely aligned and complementary to those presented in the fiduciary assessment. The Program could also support progressive institutional arrangements and provide information to introduce more advanced budgeting practices for air pollution prevention and control in Hebei.

95. The HAP does not pose a major risk to subnational fiscal sustainability in Hebei. HAP expenditures represent only a small share (around 6 percent) of overall subnational expenditures in Hebei. Total HAP expenditures were estimated at RMB 29.4 billion, compared to aggregate consolidated revenues of RMB 533 billion in 2014. The HAP is subject to a diverse set of

funding sources. The 2014 Budget Law imposes a hard budget constraint on subnational governments in China. Expenditure adjustments to maintain aggregate fiscal sustainability are likely to come from a tapering of public infrastructure investments—which have been exceptionally high by international standards—across China at the subnational level. Conversely, the prominence of air pollution abatement and control priorities, coupled with the relatively small fiscal costs of an effectively targeted HAP, means that aggregate fiscal considerations do not pose the primary risk for a crowding out of HAP expenditures in Hebei over the short to medium term.

96. The tracking of Program budget allocations and execution can be improved through greater use of automation. Budgeting and budget execution systems were found to be relatively robust and automated as part of the fiduciary assessment. Existing functional and administrative coding classifications provide for generally systematic and comparative accounting of budget and budget execution across the large number of local governments implicated in Program expenditures. The existing overall summary, however, is subject to a manual compilation process. Economic officers at each level of government in effect manually tag particular expenditure items from the integrated financial management system (IFMS). This is likely to introduce some ad hoc tracking across local governments and/or time. The fiduciary assessment makes specific suggestions on how this tracking can be more mainstreamed and automated for greater consistency. Despite some limitations, the existence of the tracking process does provide a useful foundation and budget baseline for the Program to build on.

B. Fiduciary

97. An integrated fiduciary assessment was carried out to assess whether the existing HAP's system provides reasonable assurance that financing proceeds will be used for the intended purposes, with due attention to the principles of economy, efficiency, effectiveness, transparency, and accountability. Based on the assessment and agreed actions to strengthen the system, which are reflected in the Program Action Plan (PAP) detailed in annex 8 and other mitigation measures, the HAP's fiduciary systems are considered adequate to meet the requirements in the Bank's PforR Policy and Directive.

98. **Procurement.** There are no large contracts for procurement of goods to be expected valued at or above current Operational Procurement Review Committee thresholds (that is, US$50 million) under the Program. The procurement profile of the activities to be supported by the Program primarily focuses on purchasing: (i) environmental monitoring equipment; and (ii) new energy buses. No civil works and consulting services are expected under the Program.

99. The Government Procurement Law of the People's Republic of China (GPL), the Implementation Regulations of the GPL (IRGPL), and the Hebei Provincial Government Procurement Administration Measures (HGPAM) are applicable for all the government procurement in Hebei Province, including the proposed PforR Program. Assessment of the existing procurement management system and arrangements for government procurement has identified some gaps or weaknesses with potential risks: (i) prevalent rejection of bids due to bid prices exceeding pre-bid cost estimates disclosed in the bidding document and minor, non-substantive deviations; (ii) subjective application of technical scoring criteria in bid evaluation; (iii) non-application of Bank debarment/temporary suspension lists which may result in

unacceptable contract awards to firms and/or individuals under temporary suspension or cross debarment by the Bank or other Multilateral Development Banks; and (iv) anonymous complaints not accepted and resolved. Measures to address these risks have been included in the Program Action Plan summarized in Section E and presented in details in annex 8.

100. The procurement carried out by the entities in Hebei is subject to audit or inspection/supervision by various government authorities such as audit offices, the government procurement administration offices, and the law and regulations divisions under the financial department/bureaus at each level. The government procurement administration office (GPAO) has a supervision role for procurement activities to be carried out at the county, municipal, and provincial levels.

101. **Financial management.** The Program funds are earmarked government funds and will flow through the public financial management system. Although the implementation of the activities under the Program are carried out by various sector agencies, financial management, including payments, associated with the earmarked funds are centralized in FBs at each government level. The assessment included the FB, Audit Office, and Environment Protection Office in the provincial government, three prefectures, and four counties (or same level governments) that cover the different fiscal modalities existing in the province. This sample is representative of Program implementation throughout the province.

102. The HAP budget, including national and provincial earmarked funds, is prepared with due regard to national strategy, provincial action plan, and local government policy. The HAP implementation plan and budget are prepared on an annual basis and normally approved after People's Congress, and thus always available in the middle of the year. The implementation may be carried forward to the next year.

103. Adequate program documents and financial records are systematically maintained. A monthly program financial report is prepared that shows expenditures by activity financed by national and provincial earmarked funds, as well as local government contributed resources. However, since the Chart of Accounts issued by the Ministry of Finance (MOF) does not include programmatic coding, the consolidated financial reports are currently prepared manually by identifying program expenditures in the governments' budget execution reports at each level of government (provincial, municipal, and county) and consolidating these reports. The current manual process to prepare the program report has been in use for more than two years and is well known to the staff responsible for said reports. However, to standardize the financial report preparation work and ensure consistency across the Province, the Bank will assist Hebei to develop program report preparation instructions and guidance which Hebei FB will issue before the end of 2016. The Program's financial report will reflect the annual budget and actual expenditures paid with national and provincial earmarked funds. The detailed reporting format has been agreed with MOF, Hebei FB and auditor.

104. The Treasury system maintained by Hebei is advanced, as all processing including payment request, review, payment processing, recording, and settlement with agent banks are automated and efficient. Sufficient and timely funds are available to finance Program implementation.

105. Program implementation is governed by HAP general regulation. Specific regulations are issued by sector governments to standardize practices. There are inspection and performance evaluation functions at each FB level to exercise control and validate results for government funds. Though the internal audit staff is limited, as is the case throughout much of China, other internal reviews conducted by FBs, sectoral agencies and annual special inspections jointly conducted by the member agencies of the leading groups compensate and strengthen internal controls.

106. HAP funds are included, but not separately identified, in the government budget execution report, which is audited on an annual basis. This audit is largely a compliance audit but includes elements of financial audit testing. There is currently no financial audit of the government budget execution report, the primary financial report of the government. To gain reasonable assurance on proper usage of Program funds, the China National Audit Office and Hebei Provincial Audit Office will agree an audit terms of reference (TOR) with the Bank and conduct an annual Program financial statement audit that will be publicly disclosed. The audit report will be submitted to the Bank within nine months after calendar year-end.

107. **Fraud and corruption risks.** Applicability of the Anticorruption Guidelines of the Bank for the Program; the government of Hebei (GoH) is fully committed to ensuring that the Program's results are not affected by fraud or corruption. Through the Program's legal documents, China (as the recipient of the Bank) and Hebei are formally committed to the obligations under the Anticorruption Guidelines for PforR operations. In particular, in the context of this Program, Hebei has agreed to promptly inform the Bank of all credible and material allegations of fraud/and/or corruption regarding the Program as part of the overall Program reporting requirements. Hebei will also inform the Bank of the summary of complaints every six months. The Bank will inform the recipient and Hebei about any allegation that it receives. Hebei has also agreed to issue specific guidelines instructing all the relevant agencies to comply with the requirements of the Anticorruption Guidelines, including all the procuring entities, procurement agents, and FBs at all levels under the Program when the loan for the Program is effective. Details of the guidelines are included in annex 5. Such a protocol can ensure that persons or entities debarred or suspended by the Bank are not awarded a contract by verifying the same before award under the Program during the debarment or suspension period.

108. The Bank's right to conduct an inquiry into such allegations or other indications, independently of or in collaboration with the borrower, regarding the Program's activities and expenditures and the related access to required persons, information, and documents will be observed in accordance with the standard arrangements for this purpose between the GoC and the Integrity Vice-Presidency of the Bank.

C. Environmental and Social

109. 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. An ESSA was prepared for this Program as a separate document. The Chinese and English versions of the draft ESSA were disclosed in Hebei on February 17, 2016. The final ESSA in English was disclosed on April 11, 2016. 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 Policy[19] and PforR Bank Directive,[20] 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.

110. **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.

111. 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 increased living standards.

112. **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.

113. The ESSA concluded that, in general, the relevant rules and regulations in Hebei 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 (annex 8) or DLIs.

114. The overall environmental and social risk rating of this Program is considered Substantial.

115. **Consultations and information disclosure.** The Bank organized several consultations during the preparation of this Program:

[19] OPCS5.04-POL.01.
[20] OPCS5.04-DIR.01.

- 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

- 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.

- 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.

116. 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.

117. The recommendations to improve environmental and social systems and respective mitigations measures are presented in annex 6 and the PAP (annex 8).

118. **Hebei grievance redress.** Communities and individuals who believe that they are adversely affected as a result of this Program may submit complaints to the grievance redress mechanism (GRM) of the Hebei EPB. The GRM has a clear structure and operational protocol, and a complaint hotline is available to the public. The Program Action Plan specifies completion measurement of the establishment of the GRM as the publication of the hotline telephone number on the publically accessible website, submission of operations log or reports of at least one month and a case report.

119. **World Bank grievance redress.** Communities and individuals who believe that they are adversely affected as a result of this PforR operation, as defined by the applicable policy and procedures, may submit complaints to the Program GRM or the Bank's Grievance Redress Service (GRS). The GRS ensures that complaints received are promptly reviewed to address pertinent concerns. Affected communities and individuals may submit their complaints to the Bank's independent Inspection Panel, which determines whether harm occurred, or could occur, because of the Bank's noncompliance with its policies and procedures. Complaints may be submitted at any time after concerns have been brought directly to the Bank's attention and the Bank management has been given an opportunity to respond. For information on how to submit complaints to the Bank's corporate GRS, please visit www.worldbank.org/grs. For information

on how to submit complaints to the World Bank Inspection Panel, please visit www.inspectionpanel.org.

D. Integrated Risk Assessment

120. The overall risk is substantial. The assessments (annexes 4, 5, 6) undertaken by the Bank have identified few areas that require capacity building. However, this is the first PforR in China implemented by a sub-national entity and while mitigation measures have been proposed, Hebei might face some challenges in implementing them. The fiduciary risk is rated substantial because: (i) the current preparation of the Program's financial reports is not standardized which affects its accuracy and reliability; (ii) the Program financial report is not subject to financial audit; and (iii) while Hebei agreed to comply with the requirement of the Bank's debarment/temporary suspension lists, there is a risk that this requirement may not be followed consistently at all levels of government. The environmental and social aspects risks are rated substantial because while the rules and regulations in Hebei are consistent with the Bank's PforR Policy and the Bank's PforR Directive, the capacity of few agencies to effectively enforce certain regulations could be improved.

121. To address the risks mentioned above, the training needs have been identified during the assessments and will be mitigated through actions included in the PAP. The Bank team will provide implementation support and technical assistance to address difficulties that might arise during Program implementation.

Systematic Operations Risk-Rating Tool (SORT)	
Risk Category	**Rating (H, S, M, L)**
1. Political and Governance	L
2. Macroeconomic	M
3. Sector Strategies and Policies	L
4. Technical Design of Program	M
5. Institutional Capacity for Implementation and Sustainability	S
6. Fiduciary	S
7. Environment and Social	S
8. Stakeholders	L
OVERALL	**S**

E. Program Action Plan

122. The PAP (annex 8) addresses the inadequacies and gaps identified in different assessments. The adequate implementation of the PAP is a covenant of this operation. The issues covered by the PAP are:

123. **Capacity building for environmental supervision in rural areas.** The capacity of agencies to enforce environmental regulations at municipal and county levels shall be strengthened with adequate resources, staff, monitoring equipment, and capacity training to ensure enterprises in rural areas (especially the polluting enterprises such as large livestock

farms) are adequately supervised and monitored. To address this issue, the PAP establishes that at least 480 monitoring and enforcement staff at the EPBs at all levels will receive relevant training.

124. **Capacity building for work safety supervision on industrial enterprises.** Work safety and health supervision capacity shall be strengthened at all levels to address the challenge of supervision, especially at the municipal/county level administration of work safety offices. To address this issue, the PAP establishes that at least 60 work safety supervision staff will receive relevant training.

125. Establish a social and environmental GRM and a complaint hotline for activities to be supported by the Program. These mechanisms shall be created at the provincial level in the EPB and made accessible to the local EPBs. To address this recommendation, the PAP establishes that such mechanism should be created.

126. **Improve public participation mechanism.** Activities such as policy formulation, public communication and education, and capacity building need to adequately consider the participation of vulnerable groups, including women, the poor, and ethnic minorities. To address this issue, the PAP establishes that the Government Plan and Implementation report of 2016 to be published on publicly accessible website and the grievance redress mechanism be operating properly.

127. **Fraud and corruption.** While Hebei agreed to comply with the requirement of the Bank's debarment/temporary suspension lists, there is a risk that this requirement may not be followed consistently at all levels of government. To address this issue, Hebei FB will send an official notification to all agencies responsible for the ear-marked fund with the requirement of following the Bank's Anti-Corruption Guidelines, a list of debarred firms by the Bank and restriction of procurement involving the firms on the list. Hebei will also report on all credible and material allegations of fraud/and/or corruption received regarding the Program.

128. **Program audit.** The annual audit is largely a compliance audit but includes elements of financial audit testing. Program funds are included, but not separately identified, in the government budget execution report which is audited on an annual basis. To address this issue, the China National Audit Office (CNAO) will prepare an audit TOR acceptable to the Bank, before conducting the annual audits of the Program.

Annex 1: Detailed Program Description

1. The Program does not include any high-value contracts. Most of the expenditures use a results-based approach, reimbursing providers or beneficiaries.

2. This PforR operation supports a broad multisectoral Hebei government Action Plan. To ensure a sharper focus on key activities, the results areas and DLIs cover a subset of each of the four result-oriented subplans (subplans 1 to 4 on paragraph 21 of the PAD). The results area and the ensuing DLIs were selected considering that they (a) directly address the underlying weaknesses among those identified by Tsinghua University and the CCICED and confirmed by the Bank, (b) can benefit from the Bank experience in China or international good practices, which are readily available, and (c) can make 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 (SO_2, NO_x, and primary PM2.5) from key industrial sectors

3. 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 CEM system and use it to enforce the existing emission standards.

4. 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 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.

5. The definition of the enterprises that must install CEM is determined by the 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.

6. The EPB has guidelines for the type of equipment eligible to be supported under the HAP. Each enterprise makes its own selection, buys and contracts the installation, and then applies for the partial reimbursement by the government.

7. 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 the CEM into additional industrial and other point-source locations to ensure a more extensive and integrated CEM coverage.

8. Meeting the current strict emissions standards would result in reduced emissions as some enterprises have not yet installed required equipment or are not operating it properly. The type of

measures to be supported under the Program include (a) upgrading the verification, calibration, and data collections SOPs based on similar ones adopted in the United States and Europe which have shown strong technical capacity in managing main polluters and bring air quality in line with WHO standards; (b) expanding the CEM system to cover the main polluting enterprises of the entire province; (c) promoting the proper installation and operation of desulfurization facilities in coal-fired power plants, sintering machines and pellet production equipment of iron-steel enterprises, and catalytic cracking units in oil refineries, among others; (d) promoting the proper installation and operation of denitrification facilities in coal-fired units and in cement kilns; and (e) promoting the upgrade of dust removal facilities in coal-fired power plants, iron and steel enterprises, and cement work.

Results Area 2: Area pollution control and dust control

9. 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 (a) supporting adoption of clean and efficient stoves by households using different solid fuels preferably with processed biomass or coal briquettes; (b) 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 (c) installing of livestock waste management facilities in animal husbandry farms for energy cogeneration, biogas and to produce organic fertilizer.

10. **Clean stoves.** The Program will support (a) the development and update of clean and efficient stoves standards and (b) the adoption of those clean and efficient stoves by rural households.

11. The HAP, and hence the Program, targets stoves that have space heating as the primary function and cooking as the supplementary function and 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 five years.

12. The Program will support a market-oriented approach, combining government subsidy, policy support, and market mechanisms. Products are prequalified and sales are made directly between the dealers/distributors and users. Subsidies are deducted from the sales price and reimbursed to the manufacturer upon verification of the sales. Educational and informational campaigns are conducted to target the users to raise awareness and ensure selection of quality products. Grassroots organizations such as village committees are heavily involved in promotional and educational campaigns. Provincial and local governments are held accountable for the performance of the program in their jurisdiction.

13. **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.

14. The Program will support an evidence-based approach. Soil sampling is provided for free to participating farmers. The results of the tests are used to design balanced formula fertilizers according to nutrient demand calculations and fertilizer use efficiency tests. These fertilizers are made available to the farmers at subsidized price. Subsidies are deducted from the sales price and reimbursed to the manufacturer upon verification of the sales.

15. **Livestock waste management.** The Program will support improving the waste management of existing medium- and large-scale farms, including (a) dry-wet separation facilities, (b) crop-animal integrated systems, and (c) production of biogas.

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

16. 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 (a) accelerating the elimination of yellow sticker vehicles and disposing of them properly; (b) 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; (c) promoting the use of NEVs, especially for public transport, city services, and government agencies; (d) encouraging a more rapid adoption of stricter transport fuel standards; and (e) implementing VOC controls to ensure oil and gas vapor recovery at refueling stations.

17. This Program will have a sharper focus on urban public transport. This should decrease emissions from diesel burning, contributing to the reduction to NO_x emissions in the province, improving the air quality in urban areas, and generating climate change mitigation co-benefits. The Program will support battery electric bus manufacturers, who can receive up to RMB 500,000 per bus from the HAP earmarked funds, while public bus companies (purchaser) can receive an equal amount from the provincial government. In addition to subsidies for bus acquisition, the central government also provides subsidies to cover bus operation costs, which, in 2015, amounted to RMB 80,000 per bus per year. The assessment of the operation of electric buses indicates that they are widely accepted and praised by passengers for good environmental performance. In addition, the operation cost of the BEV buses has become competitive with CNG buses because of operating subsidies provided by the government.

18. The Program will also support improving the mechanism of elimination of old and highly polluting vehicles and disposing of them properly. By the end of 2014, all yellow sticker buses used for public transport were eliminated. About an additional 4,500 diesel buses will be replaced as part of the bus replacement initiative described above, although they are not labeled as yellow stickers.[21] Thus, those buses too must be disposed properly.

[21] In the case of diesel vehicles the "Implementation Plan on Phasing Out Yellow Sticker and Old Vehicles," published by the MEP in 2014, defines as 'yellow sticker vehicles' those that do not meet State Grade III: CO emission does not exceed 2.1g/km, hydrocarbon emission does not excess 0.66 g/km, PM does not exceed 0.1 g/km, and NO_x does not exceed 5g/km.

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

19. 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 PM2.5 concentration in the province over the next 10–15 years. The program is currently based on the 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.

20. The measures to be supported under the Program include (a) 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 heavy pollution weather monitoring and early warning system through an online information sharing system; (b) 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 (c) developing the 13th 5-year plan for air pollution prevention and control, using modern AAQM planning tools to ensure cost-effectiveness and prioritization.

Institutional Arrangement

21. This Program will rely on existing structures and mechanisms used for implementing and monitoring the current HAP. Overall, the assessment concluded that adequate capacity and commitment is in place to implement the Program.

22. 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.[22] 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 (Table 1.1).

23. Overall coordination of the HAP is carried out by the High-level Provincial Working Group comprising the governor (the working group leader), the vice governors responsible for sectors covered in the plan (deputy leaders), and leaders of relevant departments and municipalities. The WGO has been established within the Hebei EPB serving as the secretariat to the Working Group for day-to-day management and coordination of the HAP. An annual work plan is developed by the EPB WGO, which also works jointly with the FB in allocating the

[22] 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.

annual HAP budget. Each activity defined in the annual work plan is assigned to a specific line agency, which should lead its implementation. To address the additional coordination and support required by the Program, the Hebei DRC has set up a coordination office to liaise with the respective line bureaus involved in the implementation of the HAP especially in the four results areas of the Program. Hebei DRC's multisectoral nature is expected to bring in additional valuable convening channels to the program's coordination. The coordination office will coordinate directly and primarily with the EPB WGO and the FB to ensure that the EPB WGO and the FB are fully engaged in the Program's design and implementation.

Table 1.1. HAP Measures and Sectoral Agencies

HAP Subplan	HAP Activities	DRC	FB	EPB	IIB	PSB	LSB	SAA	HB	AB	CB	QCB	TB	TrB	FrB	SB
1. Comprehensive control of industrial enterprises and reduce emission of multi-pollutants	Control end-of-pipe emissions (SO_2, NO_x, PM) in key industries	P	P	L	P	P	P	-	P	P	P	-	-	-	-	-
	Strengthen VOCs control in petrochemical and organic chemical industrial sectors	P		L	P	P	P	-	P	-	P	P	-	-	-	-
2. Area pollution control and dust control	Strengthen the control of non-point-source pollution in rural areas (for example, fertilizers waste from livestock farms and biomass burning)	P	-	P	-	-	-	-	P	L	-	-	P	P	P	-
	Promote the adoption of cleaner stoves	P	-	P	-	-	-	-	P	L	-	-	P	P	P	-
	Control the dust in construction sites	-	-	P	-	-	-	-	L	-	P	-	-	-	-	-
	Control oil and smoke treatment in catering services industry	-	-	P	-	-	-	-	L	-	P	-	-	-	-	-
	Increase the green area	-	-	P	-	-	-	-	L	-	P	-	-	-	-	-
3. Prevention and control of emissions from mobile sources	Eliminate yellow sticker vehicles	-	-	P	-	L	-	-	-	-	P	-	-	P	-	-
	Strengthen environmental management of vehicles	P	-	L	P	P	-	-	-	-	-	P	P	P	-	-
	Promote NEVs	L	-	-	P	-	-	-	-	-	-	-	P	P	-	-
4. Establishment of monitoring and warning systems and planning tools	Establish and improve the ambient air monitoring and warning system	P	P	L	P	P	P	-	P	P	P	-	-	-	-	-
	Design a complete plan for an environmental emergency plan	P	P	L	P	P	P	-	P	P	P	-	-	-	-	-
	Take emergency measures on time	P	P	L	P	P	P	-	P	P	P	-	-	-	-	–

HAP Subplan	HAP Activities	DRC	FB	EPB	IIB	PSB	LSB	SAA	HB	AB	CB	QCB	TB	TrB	FrB	SB
	Strengthen the organization and leadership	P	P	L	P	P	P	-	P	P	P	-	-	-	-	-
	Clarify the duties and responsibilities among the different agencies	P	P	L	P	P	P	-	P	P	P	-	-	-	-	-
	Improve the laws, regulations, and policies	P	P	L	P	P	P	-	P	P	P	-	-	-	-	-
	Prepare a new multiyear plan	P	P	L	P	P	P	-	P	P	P	-	-	-	-	-
	Improve environmental regulation capacity	P	P	L	P	P	P	-	P	P	P	-	-	-	-	-
5. Supporting measures	Implement environmental information disclosure	P	P	L	P	P	P	-	P	P	P	-	-	-	-	-
	Implement the reward and punishment system	P	P	L	P	P	P	-	P	P	P	-	-	-	-	-
	Implement pilot and demonstration projects	P	P	L	P	P	P	-	P	P	P	-	-	-	-	-
	Mobilize social participation	P	P	L	P	P	P	-	P	P	P	-	-	-	-	-
	Enhance the use of environmental protection and energy saving indicators	P	P	L	P	P	P	-	P	P	P	-	-	-	-	-
	Strengthen scientific and technological development and promotion	L	-	P	P	-	-	-	P	-	P	P	-	-	-	P
	Promote clean production	L	-	P	P	-	-	-	P	-	P	P	-		-	P
	Develop a circular economy	L	-	P	P	-	-	-	P	-	P	P	-	-	-	P
	Promote energy saving and environmental protection industries	L	-	P	P	-	-	-	P	-	P	P	-	-	-	P
6. Elimination of overcapacity and promotion of industrial transformation and upgrade	Reduce excessive capacity of high-polluting industries	L	-	P	P	-	-	P	P	-	P	P	-	-	-	P
	Eliminate backward productivity	L	-	P	P	-	-	P	P	-	P	P	-	-	-	P
	Control the expansion of high-polluting industries	L	-	P	P	-	-	P	P	-	P	P	-	-	-	P
7. Adjustment of	Control small coal-fired	P	-	L	P	P	P	-	P	-	P	P	-	-	-	-

HAP Subplan	HAP Activities	DRC	FB	EPB	IIB	PSB	LSB	SAA	HB	AB	CB	QCB	TB	TrB	FrB	SB
the energy structure and increase the clean energy supply	boilers															
	Implement coal consumption cap	L	-	P	P	-	-	P	P	-	P	P	-	-	-	P
	Prohibit building coal-fired power facilities for self-supply in new projects	L	-	P	P	-	-	P	P	-	P	P	-	-	-	P
	Advance clean use of coal	L	-	P	P	-	-	P	P	-	P	P	-	-	-	P
	Improve energy efficiency	L	-	P	P	-	-	P	P	-	P	P	-	-	-	P
	Increase the supply of natural gas, LPG, substitute natural gas, hydropower, and other clean fuels	L	-	P	P	-	-	P	P	-	P	P	-	-	-	P

Note: IIB = Industry and Information Bureau; SAA = State Asset Administration; CB = Commerce Bureau; QCB = Quality Control Bureau; TB = Technology Bureau; TrB = Transport Bureau; SB = Statistics Bureau; L represents Leading Agency; P represents Participating Agencies.

Annex 2: Results Framework Matrix

Results Areas Supported under PforR	PDO/Outcome Indicators (Key indicators to measure the achievement of each aspect of the PDO statement)	Intermediate Results Indicators (Critical processes, outputs or intermediate outcomes indicators needed to achieve each aspect of the PDO)	DLI #	Unit of Measurement	Baseline (Year)	End Target (2018)
Results Area 1 Comprehensive control of industrial enterprises and reduced emission of multi-pollutants emissions (SO_2, NO_x, and primary PM2.5) from key industrial sectors	PDO Indicator 1: Reduction of SO_2 emissions from enterprises included in the CEM	–	–	Tons	0 (2014)	150,000
	PDO Indicator 2: Reduction of NO_x emissions from enterprises included in the CEM	–	–	Tons	0 (2014)	160,000
	–	1.1 (DLI 1): Number of EPBs at the provincial and prefecture level implementing Standard Protocols on CEM Systems for emissions of air pollutants	1	Number	0 (2015)	12
	–	1.2 (DLI 2): Percentage of enterprises in State-controlled Lists and Municipal-controlled Lists integrated in the Improved CEM and Enforcement Systems for Air Pollutants	2	%	0 (2015)	100
Results Area 2 Area pollution control and dust control	PDO Indicator 3: Reduction of PM2.5 emissions from the 800,000 clean stoves deployed	–	–	Tons	–	1,300
	–	2.1 (DLI 3): Number of clean stoves installed	3	Number	0 (2015)	800,000
Results Area 3 Prevention and control of emissions from mobile sources	PDO Indicator 4: Reduction of NO_x emissions from the transport sector	–	–	Tons	0 (2014)	40,000
	–	3.1 (DLI 5): Number of Clean Energy Buses replacing diesel buses, which are disposed of, in accordance with the National Regulations	5	%	4,000 (2015)	4,500

Indicator Description

Indicator Name (#)	Description	Frequency	Data Source	Methodology for	Responsibility	DLIs

	(Clear definition and so on)			data collection	for Data Collection	Responsibility for Data Verification	Scalability of Disbursement (Yes/No)
Reduction of SO_2 emissions from enterprises included in the CEM	–	Annual	CEM	Estimated method used by the EPB to report to the MEP	EPB	n.a.	n.a
Reduction of NO_x emissions from enterprises included in the CEM	–	Annual	CEM	Estimated method used by the EPB to report to the MEP	EPB	n.a	n.a
Number of EPBs at the provincial and prefecture level implementing Standard Protocols on CEM Systems for emissions of air pollutants	–	Semiannual	11 municipal offices and 1 provincial office	The EPB collects information from all required offices, using an agreed list of parameters.	EPB	Third-party entity	Yes
Percentage of enterprises in State-controlled Lists and Municipal-controlled Lists integrated in the Improved CEM and Enforcement Systems for Air Pollutants	–	Semiannual	CEM	Data generated by the CEM	EPB	Third-party entity	Yes
Reduction of PM2.5 emissions from the 800,000 clean stoves deployed	–	Annual	DRC and Agriculture Bureau	Estimated based on number of stoves deployed and the PM2.5 emissions verified by the testing agency	DRC and Agriculture Bureau	n,a	n.a
Number of clean stoves installed	–	Semiannual	DRC and Agriculture Bureau	Verification of evidence provided by counties that stoves were purchased by end users, including model and type of stove	DRC and Agriculture Bureau	Third-party entity	Yes
Reduction of NO_x emissions from the	–	Semiannual	Data log of bus companies	Estimate considering that a	EPB	n.a.	n.a.

Indicator Name (#)	Description (Clear definition and so on)	Frequency	Data Source	Methodology for data collection	Responsibility for Data Collection	DLIs	
						Responsibility for Data Verification	Scalability of Disbursement (Yes/No)
elimination of diesel buses				bus runs an average of 2,500 km/month			
Number of Clean Energy Buses replacing diesel buses, which are disposed of, in accordance with the National Regulations	–	–	Transport Bureau and Commerce Bureau	Verification of evidence provided by counties that clean energy buses were disposed of in accordance with the National Regulations	Transport Bureau and Commerce Bureau	Third-party entity	Yes

Annex 3: Disbursement Linked Indicators, Disbursement Arrangements, and Verification Protocols

Disbursement-Linked Indicator Matrix

	Total Financing Allocated to DLI (US$, millions)	As % of Total Financing Amount	DLI Baseline	Indicative timeline for DLI achievement		
				Year 1	Year 2	Year 3
DLI 1 Number of EPBs at the provincial and prefecture level implementing Standard Protocols on CEM Systems for emissions of air pollutants	–	–	0	3 EPBs at the provincial and prefecture level implementing standard protocols on CEM systems for air emissions	9 EPBs at the provincial and prefecture level implementing standard protocols on CEM systems for air emissions	–
Allocated amount:	60	12%	–	–	–	–
DLI 2 Percentage of enterprises in State-controlled Lists and Municipal-controlled Lists integrated in the Improved CEM and Enforcement Systems for Air Pollutants	–	–	0	Hebei has integrated, in the improved CEM and enforcement systems for air pollutants, 20% of enterprises in state-controlled lists and municipal-controlled lists.	Hebei has integrated, in the improved CEM and enforcement systems for air pollutants, the remaining 70% of enterprises in state-controlled lists and municipal-controlled lists.	Hebei has integrated, in the improved CEM and enforcement systems for air pollutants, the remaining 10% of enterprises in state-controlled lists and municipal-controlled lists.
Allocated amount:	120	24%	–	–	–	–
DLI 3 Number of Clean Stoves installed	–	–	0	Hebei has installed 100,000 clean stoves, which meet technical emissions standards, acceptable to the Bank.	Hebei has installed 600,000 clean stoves, which meet technical emissions standards, acceptable to the Bank.	Hebei has installed 100,000 clean stoves, which meet technical emissions standards, acceptable to the Bank.
Allocated amount:	80	16%	–	–	–	–
DLI 4 Number of hectares with increased NUE of at least 37% due to the application of formula fertilizer based on soil testing	–	–	NUE 32%	NUE has increased to 37% in 1.0 million ha due to the application of formula fertilizer based on soil testing.	NUE has increased to 37% in 2.2 million ha due to the application of formula fertilizer based on soil testing.	NUE has increased to 37% in 3.0 million ha due to the application of formula fertilizer based on soil testing.
Allocated amount:	79.98	16%	–	–	–	–

	Total Financing Allocated to DLI (US$, millions)	As % of Total Financing Amount	DLI Baseline	Indicative timeline for DLI achievement		
				Year 1	Year 2	Year 3
DLI 5 Number of Clean Energy Buses replacing diesel buses, which are disposed of, in accordance with the National Regulations	–	–	4,000	Hebei has 2,000 clean energy buses replacing diesel buses and disposed of all decommissioned diesel buses, in accordance with the National Regulations.	Hebei has 2,500 clean energy buses replacing diesel buses and disposed of all decommissioned diesel buses, in accordance with the National Regulations.	–
Allocated amount:	78.77	16%	–	–	–	–
DLI 6 Implementation of a Comprehensive Official Emissions Inventory System	–	–	n.a.	Hebei has implemented a comprehensive official emissions inventory system, acceptable to the Bank, populated with emissions data of the year before the effectiveness date.	–	–
Allocated amount:	40	8%	–	–	–	–
DLI 7 Approval of a Cost-effective Comprehensive Plan on Air Quality Control for the next 5 years	–	–	n.a.	Hebei EPB has submitted for the Governor's approval a cost-effective comprehensive plan on air quality control for the next 5 years.	Hebei has approved a cost-effective comprehensive plan on air quality control for the next 5 years.	–
Allocated amount:	40	8%	–	–	–	–
Front-end Fee	1.25	–	–	–	–	–
Total Financing Allocated:	**500**	–	–	–	–	–

DLI Verification Protocol Table

#	DLI	Definition/ Description of achievement	Scalability of Disbursements (Yes/No)	Protocol to evaluate achievement of the DLI and data/result verification		
				Data source/ agency	Verification Entity	Procedure
1	Number of EPBs at the provincial and prefecture level implementing Standard Protocols on CEM Systems for emissions of air pollutants	Offices implementing an acceptable standard protocol for the calibration of total suspended particulate (TSP), SO_2, NO_x CEM equipment at production lines for enterprises	Yes	Hebei EPB	Third-party entity	The verification will be done by reviewing the report prepared by EPB, considering for each Office: • Standard operational procedures (SOP) for regular checking of emission reduction equipment operation and performance, including design and actual reduction efficiency (%) for each compound/pollutant; parameters that can be used to verify performance; specifications of maintenance procedures • SOP for CEM operation, calibration, maintenance, data base at the plant, and verification in plants on sampling basis • SOP for EPBs checking/auditing work on the CEMs • Verification of the performance of the various types of CEM used within the Province in terms of their agreement with Standard gases (for gas measurements) and with Standard emission measurement methods (manual methods) regarding the emissions of the various compounds. • Verification on a sampling basis of the application of the different SOPs
2	Percentage of enterprises in State-controlled Lists and Municipal-controlled Lists integrated in the Improved CEM and Enforcement Systems for Air Pollutants	CEM operating according to agreed SOP and used for effective enforcement standards	Yes	Hebei EPB	Third-party entity	The verification will be done by reviewing the report considering the following: • The list of the industrial plants that includes all the plants in the state-controlled list and the municipal-controlled lists • The list of installed CEMs, with specifications regarding plant and emission point/detailed location where it is installed, CEM type/manufacturer, compounds, and other parameters measured • Operational procedures for how data from the CEMs, as they exist in the data register of each of the CEMs, are transferred unaltered to the provincial central CEM database • Operational procedures for all procedures carried out

#	DLI	Definition/ Description of achievement	Scalability of Disbursements (Yes/No)	Protocol to evaluate achievement of the DLI and data/result verification		
				Data source/ agency	Verification Entity	Procedure
						within the CEM system and evaluation of those procedures as to their completeness and guarantee for data quality and integrity • Procedures for compliance checking and enforcement follow-up organized by the provincial CEM center, based upon automatic alarms showing exceedances hour-by-hour
3	Number of clean stoves installed	Stoves with at least 60 percent reduction in PM2.5 emission per unit of heat delivered compared to the baseline	Yes	DRC	Third-party entity	The Program verification will be done on a sampling basis by reviewing the report which would include the following: • The catalog of eligible clean stoves that meet the project technical criteria, which include manufacturer information and stove model information • For each eligible stove model, the stove testing report from an authorized testing agency that confirms technical eligibility • Sales evidence of the number of eligible stoves sold such as purchase order, shipping/installation information, and related receipts • Sales records, which include stove model, stove price, transaction date, and customer information (resident ID number, address, contact phone number).
4	Number of hectares with increased NUE of at least 37% due to the application of formula fertilizer based on soil testing	Nitrogen use efficiency (NUE) increased	Yes	Agriculture Bureau	Third-party entity	The verification will be done, on sampling basis by reviewing the report, considering the following: • Evidence of soil testing • Area planted by main crops • The ratio between the amount of fertilizer N removed with the crop and the amount of fertilizer N applied (NUE)
5	Number of Clean Energy Buses replacing diesel buses, which are disposed of, in accordance with the	Decrease emissions from bus fleet by replacing diesel bases with clean energy ones	Yes	Transport Bureau and Commerce Bureau	Third-party entity	The verification of the DLI will be done on sampling basis in major metropolitan areas, by reviewing the report considering the following: • Evidence of purchase, which includes the model, type, transaction date, and customer information • Vehicle parameters (including driving range, length,

#	DLI	Definition/ Description of achievement	Scalability of Disbursements (Yes/No)	Protocol to evaluate achievement of the DLI and data/result verification		
				Data source/ agency	Verification Entity	Procedure
	National Regulations					weight, and so on) to prove that the vehicles meet the national subsidy standards • The logbooks of the bus companies to identify the operational situation and efficiency of each bus • The statistical data of all bus companies in Hebei to identify the final proportion of the clean energy buses and new energy buses • Records of diesel buses retired and then delivered to vehicle dismantling facilities which are in compliance with National Regulations
6	Implementation of a Comprehensive Official Emissions Inventory System	Comprehensive emission inventory carried out	No	Hebei EPB	Panel of three independent experts	To check whether the inventory was done respecting the air pollutants emissions inventory technical guidelines issued by Ministry of Environmental Protection, and international technical guidelines similar to the European Environment Agency (EEA) Air Pollutant Emission Inventory Guidebook".
7	Approval of a Cost-effective Comprehensive Plan on Air Quality Control for the next 5 years	A cost-effective comprehensive plan to further improve the air quality during the next 5 years, in place	No	Hebei EPB	Panel of three independent experts	• To validate the model used to develop the Plan, having as basis, internationally recognized tools similar to the GAINS or CMAQ. • To verify evidence that the Plan was officially approved

Bank Disbursement Table

#	DLI	Bank Financing Allocated to the DLI (US$, millions)	Deadline for DLI Achievement[1]	Minimum DLI Value to be Achieved to Trigger Disbursements of Bank Financing [2]	Maximum DLI Value(s) Expected to be Achieved for Bank Disbursements Purposes [3]	Determination of Financing Amount to be Disbursed against Achieved and Verified DLI Value(s) [4]
1	Number of EPBs at the provincial and prefecture level implementing Standard Protocols on CEM Systems for emissions of air pollutants	60	June 2017	3 offices	12 offices	US$5 million per EPB
2	Percentage of enterprises in State-controlled Lists and Municipal-controlled Lists integrated in the Improved CEM and Enforcement Systems for Air Pollutants	120	December 2017	20% of the enterprises in the state control and prefecture control lists adequately linked to the CEM for at least 6 months	100%	US$12 million for each 10% of the enterprises in the state-controlled lists and municipal-controlled lists integrated in the improved CEM and enforcement systems for air pollutants
3	Number of clean stoves installed	80	December 2017	100,000 clean stoves installed	800,000	US$1 million per 10,000 clean stoves, which meet technical emissions standards, acceptable to the Bank, installed
4	Number of hectares with increased NUE of at least 37% due to the application of formula fertilizer based on soil testing	79.98	December 2017	1 million ha	6.2 million	US$1.29 million for every 100,000 ha with increased NUE of at least 37% due to the application of formula fertilizer based on soil testing
5	Number of Clean Energy Buses replacing diesel buses, which are disposed of, in accordance with the National Regulations	78.77	December 2017	500 clean energy buses operating and replaced diesel buses disposed of in accordance in accordance with the National Regulations	4,500	US$8.752 million per 500 clean energy buses
	Implementation of a Comprehensive Official	40	December 2016	Inventory completed	Inventory completed	US$40 million

#	DLI	Bank Financing	Deadline for DLI	Minimum DLI Value to be Achieved to	Maximum DLI Value(s) Expected	Determination of Financing Amount to be Disbursed against Achieved and
	Emissions Inventory System					
	Approval of a Cost-effective Comprehensive Plan on Air Quality Control for the next 5 years	40	June 2018	13th 5-year plan in place	13th 5-year plan in place	US$20 million after the submission of the Plan to approval US$20 million after Plan is approved

Note: 1. If the DLI is to be achieved by a certain date before the Bank financing closing date, please insert such date. Otherwise, please insert the Bank financing closing date.
2. If the DLI has to remain at or above a minimum level to trigger Bank disbursements (for example, DLI baseline), please indicate such level.
3. Please insert the DLI value(s) above which no additional Bank financing will be disbursed.
4. Specify the formula determining the level of Bank financing to be disbursed on the basis of level of progress in achieving the DLI, once the level of DLI achievement has been verified by the Bank. Such formula may be of various types, including pass/fail, linear, or other types as may be agreed between the Bank and the borrower.

Indicative DLIs targets identified for advance

DLI	Target of the advance	Value (US$ Millions)
DLI 1: Number of EPBs at the provincial and prefecture level implementing Standard Protocols on CEM Systems for emissions of air pollutants.	2 EPBs at the provincial and prefecture level implementing Standard Protocols on CEM Systems for Air Emissions	10
DLI 2: Percentage of enterprises in State-controlled Lists and Municipal-controlled Lists integrated in the Improved CEM and Enforcement Systems for Air Pollutants.	Hebei has integrated in the Improved CEM and Enforcement Systems for Air Pollutants 20% of enterprises in State-controlled Lists and Municipal-controlled Lists.	24
DLI 3: Number of clean stoves installed	Hebei has installed 100,000 clean stoves, which meet technical emissions standards, acceptable to the Bank.	10
DLI 5 Number of Clean Energy Buses replacing diesel buses, which are disposed of, in accordance with the National Regulations	1,000 clean energy buses operating and replaced diesel buses disposed of in accordance in accordance with the National Regulations	17.5
DLI 6: Implementation of a Comprehensive Official Emissions Inventory System	Inventory completed	40
DLI 7: Approval of a Cost-effective Comprehensive Plan on Air Quality Control for the next 5 years	Hebei EPB has submitted for the Governor's approval a cost-effective comprehensive plan on air quality control for the next 5 years.	20
	Total	121.5

Annex 4: Summary Technical Assessment

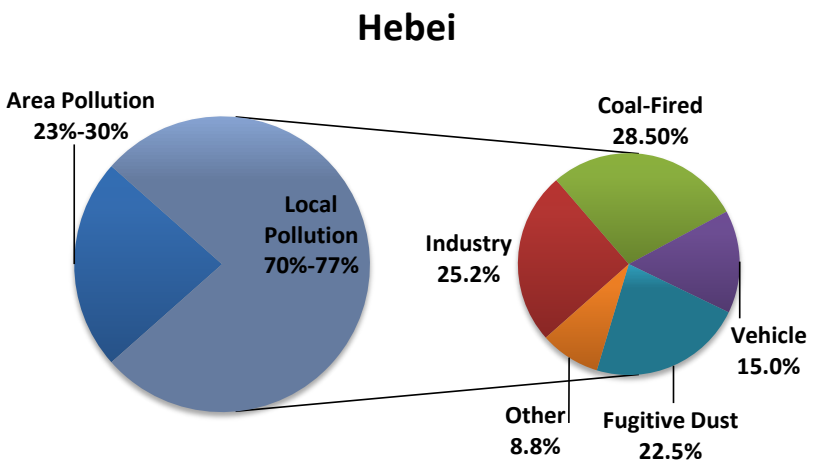
1. In-depth assessments have been conducted specifically on each of the four results areas included in the Program, to identify the areas that would benefit from further technical improvements.

Results Area 1. Comprehensive control of industrial enterprises and reduce emission of multi-pollutants emissions (SO_2, NO_x and primary PM2.5) from key industrial sectors

2. **Strategic relevance.** The industrial sector is a main contributor to air pollution emissions and ground-level air pollutant concentrations in Hebei Province. The four main industrial sectors in the province, iron and steel, electric power, cement and glass, contributed, in 2012, to more than 60 percent of the total of each of the emissions of SO_2, NO_x, and PM in the province. The coal consumption in these industrial sectors accounted for about 53 percent of the total provincial coal consumption (2012).

3. Figure 4.1 presents the emissions sources, which contribute to urban PM2.5 concentrations. The estimated contributions from sources outside the province are between 23 percent and 30 percent, with sources inside the province being responsible for about 70–77 percent of emissions in urban areas. The industry and power sector contributes about 54 percent of the PM2.5 concentrations in some urban locations, most of this coming from sources inside the province.

Figure 4. 1. Contributions from Various Source Categories to Ground-level PM2.5 Concentrations in Hebei in 2013



4. Thus, to meet the ambient PM2.5 concentration target, it is paramount to reduce the contribution to the ground-level PM2.5 concentrations in the province,[23] particularly the

[23] To reduce this contribution involves not only reducing primary PM2.5 emissions from the processes but also reducing the emissions of SO_2 and NO_x from the same sources, to reducing the formation of secondary PM2.5 (particles formed in the atmosphere by chemical reactions between SO_2, NO_x, and NH_3).

emissions from the industrial sources in the province, such as the iron and steel, electric power, cement, and glass sectors.

5. **Technical soundness**. The HAP includes a rather detailed plan on how to reduce the emissions from the four main sectors, iron and steel, electric power, cement, and glass, as well as to implement a system for monitoring the emissions as a basis for checking the compliance of the various sources to meet the emissions standards.[24]

6. The assessment concluded that such a plan and system, when including all heavy emission industrial plants, operated according to quality principles and including an enforcement part for follow up of noncompliance situations, is a proper and necessary part of an action plan to meet the air quality targets.

7. There are presently three different online CEM monitoring platforms in Hebei Province:

- The Hebei Environmental Information Centre platform, involving the provincial level and 9 cities.
- Shijiazhuang and Tangshan have their independent platforms.
- Chengde City is also establishing its own platform

8. Thus, there is presently no single platform where all the monitored data are collected, treated, and followed up, with regard to compliance checking and enforcement.

9. Maintenance of the CEM platforms at the various industries and plants are carried out following different modes:

- Establishing a platform and video surveillance system using government's earmarked subsidies and entrusting a third-party with its operation and maintenance
- Delegating most of the government subsidies to the operation and maintenance companies and some to the enterprises
- Directing enterprises to directly pay the third party for operation and maintenance

10. Thus, there is no standardization of the platform establishment, operation, and management, with a risk for less than needed data completeness and quality, as well as economic efficiency of the system.

11. Several problems are associated with the CEM platform, monitoring, and data acquisition and application that make the system presently less effective than it should have been, such as the following:

[24] Reference: Report on air pollution emission and control in key industries of Hebei Province.

- Monitoring platforms are sometimes not installed or fail to meet standards with regard to station installation quality and integrity.

- Sampling points are sometimes in wrong positions, so data are not representative of the real emissions.

- There are a multitude of brands of monitoring equipment and operators of the equipment, leading to difficulties in standardizing operations and quality.

- Lack of staff to carry out daily operations (less than 50 staff in the entire system), leads to incomplete data records and data quality, incomplete operating procedures and management systems in some stations, and insufficient use of the online data in environmental management.

12. To overcome these problems the recommendations include:

- Strengthening of institution building, and improving management system, such as

    - establishing provincial, municipal, and county level automatic monitoring and management agencies;

    - developing better installation specifications for monitoring facilities and improve operation and management models;

    - improving the operation and maintenance of the pollution source monitoring center and the video surveillance system;

    - homogenizing the installation, operation, and management of the monitoring platform at the plants; and

    - strengthening the professional training of employees.

- Strengthening the data management and the application of the monitoring data from the CEMs, including

    - to improve the reviewing and auditing of the data (this translates to improved data quality assurance and quality control procedures-QAQC);

    - to offer guidance on installation of monitoring platforms and sampling points; and

    - to improve representativeness and accuracy of the data.

13. The establishment of CEM platforms and systems in China enabling online follow-up of emissions monitoring in an area, such as a whole province, should build on the practices followed in Europe and the United States. Hebei will go beyond the practices used in Europe and the United States as it uses these systems for enforcement. This is a natural consequence of the presently much more severe air pollution situation in China than in Europe and the United States.

Exceedances of air quality standards are limited in extent in Europe and the United States, so CEM systems are applied to safeguard against poor plant management, in addition to the need to assess actual amounts of emissions for reducing air pollution effectively to even lower levels.

14. As described above, the quality and consistency of the data transmitted online from the CEMs in China is sometimes questionable. This was also stated in a review article in Energy Policy in 2011,[25] which describes a situation that is still relevant. Some of the concluding remarks on problems, from the study of CEM monitoring practices in China, were (quote):

- Inconsistent certification of CEM installations;
- Lack of systematic on-site inspection by the local EPBs;
- Incomplete plant-level monitoring and maintenance plans; and
- Limited QAQC procedures for CEM systems and data.

15. This situation was considered to be partly due to lack of comprehensive national or provincial standards or insufficient capacity at the MEP and the local EPBs to supervise CEM operations.

16. To correct this situation, the authors suggest that the MEP/EPBs could establish standardized procedures and operating rules covering all aspects of monitoring and QAQC activities and inspection. Also, the MEP could establish a program for accreditation and certification of operators, testers, and inspectors, as well as provide software suitable for auditing of operations to improve consistency and quality of the data.

17. The severe air pollution situation in China makes it necessary to control emissions more rigorously. Online monitoring and enforcement will help avert serious episodic very high concentrations resulting from a combination of difficult meteorological conditions and sometimes very high emissions and also reduce average emissions over time.

18. The establishment of the extensive CEM platforms in Hebei Province is an impressive endeavor, where data from monitors from over 800 stacks are quality checked and transmitted to one (or a few) central data platform(s). Here data can be displayed and followed up, in principle, on an hourly basis. However, as described above, improvement in this CEM is needed to meet more stringent air quality emission standards and ultimately higher ambient air quality standards.

19. Based on these, recommendations are as follows:

[25] Zhang, X., and J. Schreifels. "Continuous Emission Monitoring Systems at Power Plants in China: Improving SO_2 Emission Measurement," *Energy Policy* 39 (2011): 7432–7438.

- The provincial CEM center should receive online data from all the plants/stacks in the province with CEM installed. There may well be different platforms in different cities/localities, but the provincial center should have all data transferred to it online.

- The system should be extended, using government incentives, to other industrial sectors with large emitting plants, where the emission conditions are suitable for monitoring SO_2, NO_x, and PM emissions with CEMs.

- A procedure for compliance checking and enforcement follow-up should be organized by the provincial CEM center, based upon automatic alarms showing exceedances hour-by-hour. Responsibilities for actual enforcement (visits to exceeding plants, enforcement activities to ensure corrective actions) could be distributed between the cities and local agencies, according to a plan devised by the CEM center.

- Common procedures for ensuring the quality of the monitor data should be secured, including SOPs for

    - all monitors covering (a) installation of plant platforms and monitoring points, (b) verification of accuracy of monitors, (c) operational procedures, (d) calibration, and (e) maintenance;

    - covering data integrity and transfer to central databases; and

    - transferring the information about possible noncompliance to the enforcement units.

20. Success in meeting ambient air quality standards is dependent on meeting emission standards that is in turn dependent on a system that delivers trustworthy emission data, has capacity for online compliance follow-up, and has sufficient enforcement capacity.

21. **Institutional arrangement.** Environmental monitoring and regulation compliance is led by the provincial EPB. The provincial CEM center is responsible for daily data collection and maintenance of the provincial CEM system. It is staffed with 42 engineers, 79 monitoring technicians, and 12 engineering assistants. In addition to air pollutants, the center also carries out monitoring functions of wastewater, solid wastes, vehicular emissions, and noise. Regulation compliance is led by the environmental compliance division, a separate division within the provincial EPB. The scope of supervision of provincial-level agencies only covers the large emitters (241 enterprises for air emissions), and the municipal- and county-level EPBs are responsible for the rest of the enterprises within their jurisdiction. However, the municipal- and county-level EPBs are responsible for on-site verification of all the monitoring equipment. Calibration and maintenance of the monitoring equipment is outsourced to qualified third parties.

22. **Budget.** The HAP earmarked fund supports the establishment of the CEM network through purchasing environmental monitoring equipment, including (a) the equipment to be used for establishing a smart platform for CEM covering all the counties in the province for

continuously monitoring the pollutants in industries; (b) the equipment to be used for monitoring the ambient air at different environmental monitoring stations; and (c) IT equipment for data collection, transmission, and analysis for some systems, such as the CEM system and early warning systems managed by the information centers/pollutants control centers under the EPBs at different levels. The estimated cost of one set of the monitoring equipment installed at one station for CEM is over RMB 1 million and that for monitoring the ambient air with 6 pollutants is about RMB 1.5 million.

23. The HAP earmarked fund also supports enterprises through provision of subsidies for investment in pollutant removal equipment. Enterprises submit proposals of end-of-pipe solutions project proposals to the municipal EPBs. With the EPB's endorsement, an enterprise proceeds to contract a technology supplier for the equipment installation advancing with its own investment. On project completion, the enterprise submits a request to the EPB for on-site inspection of completion during the trial operation period in the first month. Once the project completion is confirmed by the EPB's verification expert team, 10 to 20 percent of the total project investment is awarded to the enterprise. The local EPB is responsible for regular on-site supervision of the end-of-pipe devices operation and the monitoring equipment.

Results Area 2. Area pollution control and dust control

Clean Stoves

24. **Strategic relevance.** Promoting clean and efficient stoves and associated fuels are the best ways to decrease emissions at household level. Hebei Province has a population of 72 million, with approximately 56 million (or 15.5 million households) in rural areas. The province relies heavily on coal for energy consumption. The annual coal consumption is about 300 million tons, of which 28 million tons of raw coal (about 10 percent) were burned directly without any environmental treatment, including an estimated 20 million tons of coal used for households heating and cooking, mostly in rural areas. The unprocessed raw coal (usually soft coal), when burned in traditional stoves, emits significantly more pollutants than other types of coal. As a result, it is a significant contributor to air pollution. It is estimated that 15 percent of PM2.5 emissions in Hebei air pollution is from household burning of coal for heating and cooking. While data for Hebei is not available, according to the WHO,[26] an estimated 3.3 million people died from either chronic or the acute effects of inhaling indoor atmospheric pollutants in the South-East Asia and Western Pacific Regions.

25. **Technical soundness.** International experience shows that to promote clean heating and cooking in households, it is important to understand local conditions of the needs of the end users and find appropriate technical solutions that can be accepted and adopted by them. In the current Hebei context, promoting clean stoves that can burn raw coal in a much cleaner form can make significant contribution to air pollution control. The Bank's Ulaanbaatar Clean Air Project showed that promoting the appropriate stove technologies alone resulted in more than 90 percent

[26] WHO (World Health Organization). 2014. *News Release dated 25 March, 2014*. Available at: http://www.who.int/mediacentre/news/releases/2014/air-pollution/en/.

emission reductions and significant improvement of the city's air quality despite an increase in the total number of households (Figure 4.2). In addition, Mongolia's national standard is also based on PM2.5 mg/MJ_{NET} metric, set at 200 mg/MJ_{NET}, a 70 percent reduction from the baseline. The Bank and ADB-supported projects have adopted a more stringent standard of 90 percent reduction from the baseline or 70 mg/MJ_{NET}.

26. In Hebei, clean stoves are currently defined as meeting the provincial stove standards, including thermal efficiency, TSP, SO_2, and NO_x emissions (Table 4.1). In 2015, the Hebei New Energy Office published a catalog of clean stoves that meet the provincial standards with detailed information of manufacturers and stove price. The catalog lists a total of 114 stove manufacturers, who can produce a total of up to 1.6 million stoves annually. This catalog is used as a reference for selection of qualified stoves eligible for government subsidies. Some local governments set even higher standards than the provincial requirements, such as requiring thermal efficiency higher than 75 percent. The Hebei DRC has also selected two manufacturers whose stoves burning briquettes are eligible for government subsidies.

27. Stove testing conducted at a manufacturer by the Bank team indicates that compared to the baseline, switching to coal-burning clean stoves could potentially save as much as 35 percent of total energy. However, there were high losses of energy from unburned carbon monoxide and unburned hydrocarbons that occurs immediately after refueling, suggesting great potential for further emission reduction by changing stove design and refueling practices.

Figure 4.2. Ulaanbaatar PM2.5 Emissions have Been Reduced by the Distribution of Clean Coal Stoves

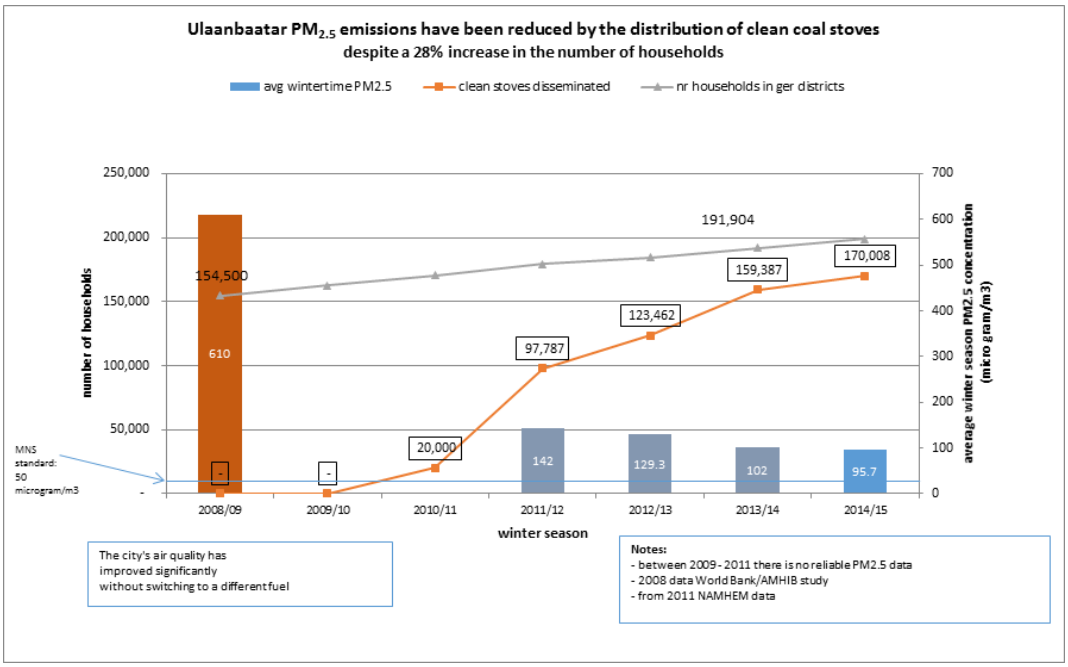


Table 4.1. Key Selection Criteria for Clean Stoves Currently Used in Hebei Province

	Hebei Province	National	Unit
Thermal efficiency	70	60	%
TSP	30	50	mg/m^3
SO_2	200	300	mg/m^3

NO_x	200	300	mg/m^3

28. **One of the main findings of the assessment concerns the quality of the clean stoves.** While the current provincial clean stove standard has an impressive requirement of 70 percent thermal efficiency,[27] it falls short in measuring emission reductions because of the following:

- It lacks testing data and analysis on emission levels of currently eligible clean stoves compared to the baseline stoves. Thus, it is not clear whether and by how much those stoves reduce PM2.5 emissions compared to the baseline stoves.

- TSP is an antiquated metric for measuring PM. Fine particles or their precursors such as NO_x or SO_2 have been proven to have a long life in the atmosphere and be most detrimental to public health and environment. The international practice uses PM2.5 instead of TSP to represent fine particles.

- Even though the Hebei stove emission standards appear to be stricter than the national standards, using mass concentration (mg/m^3) of emitted pollutants (TSP, SO_2, and NO_x) as selection criteria for the provincial stove catalog is inappropriate. 'Mass concentration' measures how much PM there was in 1 m^3 of gases when they emerged from the stove. Such a metric is only useful for determining the total amount of pollutants emitted by the stove over a period if one also knows the total volume of flue gas emitted for a given mass concentration of the pollutant. As the concentration and flue gas volume change continuously over the combustion period, it is impossible to estimate the total emissions using the mass concentration metric.

- Testing protocols for mass concentration are prone to human-induced variations. For example, it can easily be reduced by opening the top door of the stoves slightly and letting in more air, which dilutes the sample and therefore the rating is 'better'.

- Emissions vary at different stages of the combustion cycle and are the worst during the ignition and refueling based on lab testing and experience in other countries. A mass concentration metric fails to capture such variations.

29. To overcome these problems, the following actions are recommended:

- Additional testing report is required to show the performance indicator of PM2.5 emissions: PM2.5 mass emitted for each unit of heat delivered (mg/MJ_{NET}). Based on the experience from other countries and the newness of such an indicator to the initiative, the proposed target for the Program is that stoves need to reach at least a 60 percent reduction in PM2.5 emission per unit of heat delivered compared to the baseline.

[27] Heat gained by the water heating unit attached to the stove immediately behind the combustion chamber, divided by the heat energy available in the fuel loaded during the test.

- Update the catalog of eligible products based on updated technical performance criteria and testing results.

- Conduct education and informational campaigns targeting existing and potential users on which stoves to buy and how to use them properly.

- Strengthen the lab testing capacity of key authorized institutions.

30. **The other key findings concern the efforts to promote processed fuels.** The efforts have enjoyed only modest success and the actual adoption of coal or biomass briquettes was relatively low. According to the plan, 2 million tons of coal briquettes should have replaced raw coal in 2014; however, merely 0.6 million tons was achieved. The target to deploy 200,000 stoves burning coal briquette in 2015 was not met but saw some success in peri-urban areas near Shijiazhuang. Several contributing factors were identified, including the following:

- **Raw coal is easily available in Hebei Province.** Hebei Province is a major transportation route for coal, thus, raw coal is easily available in rural areas despite the government's efforts to limit and replace raw coal with processed/clean coal by 90 percent by 2017.[28]

- **Biomass briquette making has not been established as a profitable business.** Due to local government's efforts, the burning of most crop residues in the fields is banned. This has led the government to promote biomass briquette making as an alternative. The biomass briquette-making business involves collection of crop residues, transport, drying and storing, and then processing the same into briquettes. Unfortunately, with the current low price for raw coal, this entire processing cycle for biomass briquette making does not appear to be a profitable business even after the current government subsidies.

31. To overcome these problems, the following actions are recommended:

- Conduct informational campaigns targeting existing and potential users on the overall economic and environmental benefits of using processed fuel: biomass briquettes or coal briquettes.

- Support technical and business innovation on fuel processing to reduce costs.

- Enforce the regulation to nearly ban[28] the use of raw coal and replaced it with processed/clean coal.

32. Based on the findings of the assessment, it is unlikely that the government would achieve its target of deploying 2 million stoves, which would effectively reduce PM2.5. While the changes that might need to be made in the current stoves to effectively decrease PM2.5

[28] DRC Regulation 455, 2015.

emissions, defined as at least 60 percent reduction per unit of heat delivered compared to the baseline, are simple and may not require major investment from the manufacturers, it will take some time to conduct PM2.5 emission eligibility test to update the clean and efficient stove catalog, adjust stove design and production, and deploy eligible clean stoves. Thus, a target of 800,000 of those clean and efficient stoves deployed by 2017 appears to be more realistic.

33. **Institutional arrangement.** Implementation of the clean stove initiatives are led by the New Energy Office under the Department of Agriculture and the Operations Bureau under the DRC. The former is in charge of rural areas, including both stoves and most recently fuels; the latter is in charge of peri-urban areas (so called villages in urban zones in Chinese terms), promoting coal briquettes and stoves designed for using coal briquettes. Each implementing agency is assigned an annual clean stove target and associated budget allocations from the provincial FB.

34. **Budget**. The HAP earmarked fund of RMB 450 million and RMB 490 million for 2014 and 2015, respectively, is for supporting the clean stove initiative. Expenditure occurs when the participating manufactures/dealers make sales of eligible stove products on the government catalog to the household users. The subsidies of RMB 700 on average for each biomass/coal-burning stove and RMB 500 for coal-burning stoves accounted for up to 50 percent of the market price, making them attractive to the potential buyers.

Agriculture

35. **Strategic relevance.** Hebei is a large emitter of NH_3 (an important contributor to secondary PM2.5 through its reactions with SO_2 and NO_x) from agricultural activity, mainly owing to volatilization losses from excessive use of nitrogen fertilizer and inadequate livestock waste treatment and disposal. This is a critical issue as NH_3 emissions in China[29] have increased by 16 percent from 2006 to 2015. At this pace, further increases of NH_3 emissions will offset the benefit to air quality from the reduction of SO_2 emissions achieved so far.

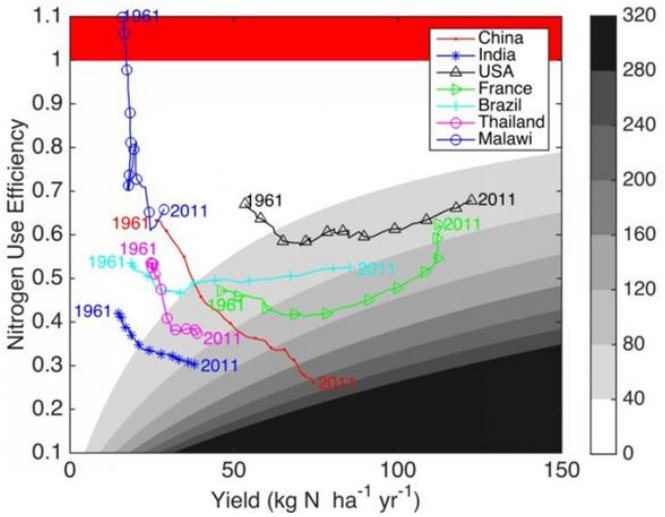
36. Hebei is one of the major producers of wheat in China. In 2013, there were 23,777 km^2 planted with wheat, which represented 9.9 percent of the wheat-planted area in China and 11.4 percent of the national wheat production. The rate of nitrogen fertilizer application was 5.6 percent higher than the average rate in China, which is already about 30 percent higher than the world average. Nitrogen was the most important fertilizer (301 kg/ha) representing more than 70 percent of all chemical fertilizers (434 kg/ha) applied in wheat fields.

37. The NUE in China is significantly lower when compared to other large producing countries such as the United States and Brazil (Figure 4.3)[30] or the international average NUE of 51 percent. In Hebei, NUE of wheat, corn, and rice fields is around 32 percent. This low efficiency coupled with excessive fertilizer use has resulted in food safety and environmental

[29] Wang, Y., et al. 2013. "Sulfate-nitrate-ammonium Aerosols over China: Response to 2000–2015 Emission Changes of Sulfur Dioxide, NO_x, and NH_3." *Atmospheric Chemistry and Physics* 13: 2635–2652.
[30] Zhang, X., et al. 2013. "Managing Nitrogen for Sustainable Development." *Nature* 258, 7580: 51–59.

problems, such as large nitrogen losses through NH_3 volatilization and nitrates leaching into ground water, rivers, and lakes. Studies in 2015 by Chinese and the U.S. scientists, who tracked the fate of fertilizer nitrogen, showed that between 20 percent and 50 percent of it leaked into air and groundwater— although the main pathway through which it was lost varied from crop to crop. For example, wheat and maize in the North China Plain lose 19 percent and 25 percent of applied nitrogen, respectively, as a result of NH_3 evaporation or volatilization.

Figure 4.3. Comparison of NUE and Yields in Different Countries[30]



38. Hebei is also the largest livestock producer in JingJinJi, responsible for 83 percent of the production of pigs, 86 percent of dairy, 68 percent of broiler farms, and 93 percent of layer farms. This production generates an estimate of 308 million tons of NH_3 in manure. Most of the production in Hebei comes from medium-size farms except for pigs, which are mainly produced in large farms (over 10,000 heads). Practices of manure management in farms vary between the species: (a) the majority of pig farmers dry their manure for seven days and then either sell or use the manure themselves; (b) the majority of small dairy farms, layer farms, and broiler farms collect and sell wet manure; and (c) the majority of large pig and poultry farms use anaerobic and aerobic ponds. More recently, the larger farms are investing in technology such as biogas plants to use the manure, with about 2,500 producing 14 million tons of manure each year for biogas.

39. **Technical soundness.** The increased use of formula fertilizer based on soil testing and analysis is a good initiative to increase NUE and decrease NH3 emissions. It is well known that balanced fertilizer application with new mechanical fertilizer application methods can greatly increase NUE. For example, Integrated Plant Nutrient Management is widely recommended by the Food and Agriculture Organization.

40. The efforts in Hebei to promote FFAbased on soil-testing include free soil sampling and testing for farmers, provision of subsided formula fertilizer designed based on soil tests, production of formula fertilizer, application of formula fertilizer through new mechanized methods, farmer training, and field experiments for calculating plant nutrient demand and fertilizer use efficiency. According to field experiments in 2014, the FFA technique could

increase wheat and corn yields by 398 kg/ha and 477 kg/ha, respectively and reduce chemical fertilizer application by 59 kg/ha for wheat and 48 kg/ha for corn.

41. In 2014, the cropping area using FFA was 36,207 km^2, that is, 41 percent of Hebei's total cropping area. About 68,599 soil samples were taken, and 778,000 indexes of soil nutrients were determined. In 2015, over 8 million farmers began to use the free FFA technique. Three hundred soil samples were tested for each project county, in 151 counties.

42. Nevertheless, the intensity of soil sampling is currently low (1 soil sample per 300 Mu or 20 ha) and is only repeated at the same site after 5 years. This means that it is possible that some soil analyses may not be representative of the sample area. Furthermore, the initiative does not systematically assess whether there is an increase of fertilizer use efficiency as a result of the soil testing. This is a key step that should be taken to assess whether the initiative is achieving the expected results.

43. The type of nitrogen used in the fertilizers could also be improved. Currently, the bulk of the subsidized nitrogen fertilizer used in China is urea (46 percent nitrogen) which has a low NUE of approximately 30 percent, resulting in large losses of NH_3 to the atmosphere. China produces slow release fertilizers but these are more expensive and only minimally subsidized. An intermediate option is for China to start producing and using nitrate based fertilizers (for example, ammonium nitrate), which are not as expensive as slow release fertilizers and have a higher NUE than urea requiring about 15 percent less nitrogen for the same yield and have about 50 percent lower environmental index footprint relative to urea.

44. The collection and conversion of animal manure to organic fertilizer is a good practice that could also be promoted in Hebei. This practice returns carbon to the farm soils, thus enhancing the carbon sink in farm soils. Also, soils with higher levels of soil carbon hold water and macronutrients such as calcium, magnesium, and potassium better than soils with low carbon thus requiring lower amounts of formula fertilizers. Enhanced use of organic fertilizers would create a greater demand for animal manure and thereby reduce the significant pollution caused by NH_3 loss from unmanaged manure and the pollution of local surface and ground water from manure disposal into local streams. Currently, Hebei does not provide subsidies for organic fertilizers so farmers do not use them because they have lower nutrient levels relative to formula fertilizers and farmers are unaware of the medium- to long-term benefits of conserving soil carbon. Other provinces do subsidize organic fertilizers, so 80 percent of Hebei's organic fertilizer production is exported to other provinces.

45. Based on the above, the measures to enhance the formula fertilizer initiative and improve the province's NUE should include the following:

- **Developing more comprehensive field experiments and a standardized NUE calculation.** The FFA initiative has been implemented successfully, and the cropping area with formula fertilizer use has increased greatly in Hebei. However, more field experiments in typical sites for specific crops are needed to better estimate potential increase of NUE.

- **Improving field monitoring of impacts of FFA on NH_3 emissions.** Most of the field monitoring experiments were conducted to compare crop yields and nutrient use efficiency, not emissions. Field experiments with different fertilizers and application methods, should add the determination of gaseous nitrogen emissions into the experiment protocol.

- **Continuously improve formula design.** The existing fertilizer formulas are designed without considering micronutrient demand, which is very important to improve crop growth with high NUE. Furthermore, the existing formulas are designed for a large scale (at county level) and might be not useful for a specific area. Fertilizer formulas need to be improved according to the cooperative, or even the specific farmer household.

- **Soil sampling density.** A more efficient soil sampling strategy should be designed to provide adequate coverage of the farming area so that fertilizer recommendations can be further refined. For example, newer soil testing methods are now available that require only a scan at the soil surface using a handheld scanner to provide soil test results in minutes.

- **Organic fertilizers.** Design initiatives, which would promote the use of organic fertilizers as part of the FFA technique.

46. The government targets its livestock waste management initiative to medium and large-scale livestock and poultry farms. The farmers interested in this initiative must submit a plan to the Agriculture Bureau. Once it is approved, the farmer will receive a concessional loan to be disbursed upon verification of progress on the implementation of the plan. The supported activities vary according to the conditions and requirements of each farm and may include one or more of the following: (a) improved livestock sheds with cemented floors, drains for liquid waste, and separation yards to improve animal management and waste capture; (b) wet-dry separation; (c) improved feed quality management; (d) liquid waste treatment; (v) covered manure sheds; and (e) biogas production. These are well-established practices used in China and elsewhere and also supported by Bank projects in China.[31] Currently, this initiative does not systematically monitor NH_3 emissions from livestock farms in Hebei.

47. The government launched a campaign to eliminate opening burning and promote reuse of crop straw in the field throughout the rural area in Hebei. The total collectable straw from field crops is about 59.6 million tons, and vegetable straw is about 19.6 million tons in Hebei. The reuse rate was about 86.8 percent of field crop straw in 2013, though almost all vegetable straw is not reused in any pattern.

48. **Institutional arrangements.** Soil and fertilizer stations of the Agricultural Bureau at the provincial level are responsible for designing the fertilizer formula for each application zone at

[31] Henan Ecological Livestock Project- P100455- Report No: 50281-CN.
Guangdong Agricultural Pollution Control - P127815- Report No: PAD416.

county scale and providing recommendations to the formula fertilizer production factory/company. The provincial Agricultural Bureau also allocates funding for each county and verifies the results based on the assessment report from the county agricultural department (soil and fertilizer station).

49. The county-level Soil and Fertilizer Centre is responsible for the implementations of specific activities in each county, including soil and plant sampling and testing, conducting field experiments, training farmers/cooperatives, guiding FFAs for farmers and formula fertilizer production in fertilizer-making stations at village scale, disseminating new fertilizing methods, and collecting data and reporting the results.

50. **Budget.** Hebei Province received RMB 41 million per year in earmarked funds in 2014 and 2015. This initiative supports more than 8 million farmers in 151 counties. The fertilizer factories produce the formula fertilizer according to the guidelines from the provincial bureau or the Ministry of Agriculture. The farmers buy formula fertilizer from the market or dealer. The subsidies are deducted from the sales price and reimbursed to the manufacturer upon verification of the sales.

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

51. **Strategic relevance.** Reducing air pollution from the road transport sector is one of the main strategies in the Hebei provincial government action plan for air pollution prevention and control. Hebei Province had about 15 million registered vehicles in 2014 of which 1 million were yellow sticker vehicles. Official 2014 data for key Hebei municipalities estimates that vehicular emissions contribute between 10 and 15 percent of the ambient PM2.5 in each municipality. Therefore, yellow sticker vehicles alone are responsible for between 3 to 4 percent of total emissions.

52. Car ownership in Hebei has been increasing by an average of 19 percent per year as a result of the increase of income level in the province and the population increase of 2 percent per year. As such, the continuous upgrading of the State Grade vehicle emission standards, early adoption of stricter fuel standards for gasoline and diesel fuel, and the promotion of green vehicles are necessary to decrease the average emissions per vehicle to offset the expected increase of the fleet over the next few years.

53. While the transport sector in the JingJinJi region only accounts for 4.5 percent of primary PM2.5 emissions, it is a major contributor to precursors of secondary PM2.5. Transport is estimated to be responsible for 26 percent of NO_x emissions, 2 percent of SO_2 emissions, and 9 percent of VOCs. More specifically in urban areas of Hebei, the transport sector is responsible for 15 percent of PM2.5 emissions.

54. **Technical soundness.** This results area covers several initiatives. Therefore, the description and analysis are presented by main initiatives.

55. **Promote NEVs and clean energy vehicles.** NEVs include BEVs and plug-in electric vehicles; there were 2,700 NEV vehicles in service in Hebei Province by 2015, of which 1,700 were acquired in 2015. Almost all of these NEVs were promoted in the public transport sector (primarily buses). There are three reasons why the initial focus is on public vehicles. First, there

are still many constraints that will limit the early market introduction of EVs, for instance, battery performance, safety and maintenance, and the supporting infrastructure. Therefore, it is difficult for private consumers to accept EVs immediately and the promotion of EVs needs to proceed gradually. However, public service fleets have a unified operational management system and this is considered to be easier to monitor and maintain than private vehicles. Second, public service fleets such as buses and taxis are the major transportation modes and they can account for a significant proportion of the total vehicle in the medium- and large-size cities in China. Third, diesel is a major source of NO_x, with emissions 20 times higher than gasoline.

56. The assessment of the operation of electric buses indicates that electric buses are widely accepted and praised by passengers for good environmental performance. In addition, the operation cost of the BEV buses has become competitive with CNG buses due to operating subsidies provided by the government.

57. In addition to EVs, natural gas vehicles have been widely adopted in the public transport sector as clean energy vehicles. In Hebei Province, more than 7,000 of the total 20,000 buses run on CNG. In the taxi sector, there were a total of 68,792 taxis in Hebei at the end of 2014, of which 26,926 (39 percent) were powered by gasoline and 41,886 (61 percent) were powered by CNG. It should be noted that there are no pure natural gas taxis operating in Hebei, but instead all CNG taxis are duel fuel (gasoline-CNG) vehicles.

58. The main shortcomings observed in this initiative are the following:

- **Lack of charging infrastructure.** According to reports from the Shijiazhuang City Public Transport Company, the major reason restricting the promotion of electric buses is the lack of electric charging stations, In Shijiazhuang, the City Public Transport Company signed a procurement contract for 900 electric buses in 2015; however, due to the limitation of the charging stations, only 100 electric buses have been put into operation. There was only one charging station for these buses at first, which increased to four stations after May 2015. However, these four charging stations can only meet the charging requirements of 200 buses, which is still far below the total demand of electric buses. The charging stations in Shijiazhuang are all built by the electric bus manufacturer. Lack of land and high costs are cited as the two major factors limiting the construction of charging infrastructure. In addition to subsidizing the acquisition of new buses, the government needs to adopt supplementary policies to attract and support the private sector to develop efficient charging infrastructure. Based on the experience from other pilot cities, such incentives could include land use approval and construction and operating subsidies. In addition, alternative modes of operation and charging should be considered, such as battery leasing, vehicle leasing, and battery swap stations.

- In the United States, the Department of Energy announced in 2009 that they would invest US$100 million to upgrade the current electricity grid to satisfy the increasing charging demand of plug-in electric vehicles and BEVs, and they also provided subsidies (30 percent of the total cost) to consumers and companies who invested in charging stations (up to US$1,000 for private consumers and US$30,000 for companies). Some EV manufacturers such as Tesla Motors also build many

charging facilities in the United States. By May 2014, a total of 9,857 charging stations and 22,935 charging spots had been built in the United States. In the United Kingdom, the Office for Low Emission Vehicles also announced that it would provide subsidies for constructing charging stations. The subsidies are provided not only to local governments and companies who build the charging facilities but also to private consumers who purchase and install them. The subsidies can cover up to 75 percent of the cost of the charging stations.

- **Life cycle analysis of the CO_2 emissions of EVs.** Even when vehicle electrification is used to reduce energy consumption and CO_2 emissions in China, there is still a substantial carbon content as China's energy mix is predominantly coal based, and coal-fired thermal power has accounted for 80–83 percent of the total electricity generating capacity since 1990. Hebei is representative of Chinese provinces with high coal consumption. It is necessary to consider the full life cycle of the EVs' fuel pathway to understand the real contribution of EVs development to reducing energy consumption and CO_2 emissions.

- Although the life cycle emissions of China's current EV-based energy mix may be higher than a country with a cleaner energy mix (such as Norway), EVs are still considered as having a large potential to reduce energy consumption and emissions as a result of the improvements in the power generation mix. In addition, compared to the pollution emitted by the conventional petrol and diesel vehicles during the operation period, the emissions from the EVs are mainly concentrated in the power generation period, which from a technical perspective is easier to control and maintain, specially through a robust CEM, than a large fleet of vehicles. The promotion of EVs can significantly reduce air pollution in urban areas because power plants are almost always located outside the city, thus benefitting human health.

59. **Accelerate elimination of yellow sticker vehicles.** Hebei is implementing the yellow sticker vehicle elimination initiative according to plan. More than 90 percent of the yellow sticker vehicles were eliminated between 2013 and 2014, and the remaining vehicles should be eliminated by mid-2016.

60. **Improve transport fuel quality.** The continuous upgrade of the State Grade vehicle emission standards, early adoption of stricter fuel standards for gasoline and diesel fuel, and the promotion of green vehicles are necessary to decrease average emissions per vehicle to offset the expected increase of the fleet over the next few years.

61. Hebei has recently implemented the Phase V fuel standards since January 1, 2016, according to the fuel standards promotion plan by the central government. This is a good measure. In the 1990s, facing severe air pollution, Mexico City began requiring the use of higher quality gasoline and diesel that went beyond national fuel quality standards. Moving to alternative fuels, such as natural gas (CNG, LPG, LNG), is another way to reduce vehicle emissions while still using conventional internal combustion engines with minor modifications. Where infrastructure investments are needed (such as with natural gas refueling stations or EV

recharging stations), fleet vehicles such as government vehicles, taxis, or delivery vans are an obvious target for introducing clean fuel vehicles.

62. **Strengthen environmental management of vehicles.** Hebei Province implemented the National Phase IV emission standard for vehicles since 2014. However, the emission standard for vehicles in Hebei lags behind some other developed provinces and cities. Other regions with air quality concerns, including Beijing, Shanghai, and the Pearl River Delta Region, implemented the National Phase V emission standard in 2013 and 2014. Given that Hebei is a heavily polluted province, it should accelerate the implementation of the latest emission standard for vehicles.

63. A new notice has been announced by the central government on January14 2016, which required the eastern 11 provinces (including Hebei Province) to start the National Phase V vehicle emission standards beginning April 1, 2016. The plan requires all light-duty petrol and diesel vehicles, heavy-duty diesel vehicles (only including buses and sanitation and postal vehicles) to meet the national Phase V emission standards. Other heavy petrol and diesel vehicles are not included.

64. Beijing has recently passed legislation that will give it one of the world's cleanest vehicle fleets when the new standards take effect in December 2017. For light-duty vehicles, the new national Phase VI emission standard will reduce emissions by 40 percent compared to current standards. As a heavily polluted province close to Beijing, Hebei should consider implementing a stricter vehicle emission standard such as that adopted by Beijing. California was a pioneer in promoting cleaner vehicle technologies by phasing in some of the most stringent vehicle emissions standards in the world. Because it is such a large car market, California was able to push the development and manufacturing of advanced low-emission vehicles in the 1990s and 2000s, such as the hybrid electric, battery electric, and hydrogen fuel-cell technologies.

65. **Control the vehicle population in urban areas.** The vehicle population is increasing very fast in Hebei, especially in urban areas where traffic congestion is common at peak times and which results in a major contribution to air pollution. Based on information available, there are no regulations or plans to control the vehicle population in the urban areas in Hebei.

66. Other Chinese cities with subordinate districts and with cities and counties under the direct administration of provincial authorities have strict limits on the number of vehicles. However, compared to the vehicle limitations in other cities (such as Beijing, Shanghai, Hangzhou, and Shenzhen), cities in Hebei Province have not implemented vehicle limitations such as vehicle license quotas for private vehicles.

67. The goal is not necessarily to restrict the vehicle population but to reduce the impacts that excessive vehicle use causes on traffic and emissions. A long list of measures has been successfully used internationally to control the unwanted impacts of vehicles. Measures to control the number of vehicles operating in a given locale include license fees, license quotas, parking fees, parking restrictions and enforcement, pedestrian areas, and fuel taxes. If the goal is to reduce the number of vehicles at a given time and place, congestion pricing systems like those in Singapore are the most efficient way to reduce congestion and its pollution effects.

68. **Institutional arrangement.** The Provincial EPB and the Department of Transportation are the primary institutions responsible for transportation-related energy use and emissions reduction efforts in Hebei.

69. The EPB, comprising eight internal units and eight subordinate institutions, is in charge of the 11 prefecture-level environmental protection bureaus in the province. In 2013, a new Vehicle Pollution Office was established, which is responsible for the supervision and management of emissions from motor vehicles, gas stations, oil tankers, oil storage facilities, and other transport-related operations.

70. The Department of Transportation comprises 16 administrative offices and 19 subordinate institutions and is in charge of the 11 prefecture-level transportation administration bureaus. It oversees all transportation activities in the province. The offices directly related to energy savings and emissions reduction include the comprehensive planning office, the road transportation administration, and the passenger transport authority.

71. As the provincial authority in charge of transport-related energy savings and emissions reduction, the primary functions of the Comprehensive Planning Office include the formulation of provincial transportation development plans and programs; the development of special plans and budget distribution schemes; the development of provincial logistics plans and related policies; the preparation and evaluation of new construction and renovation projects; the design and planning of provincial ports; the review of coastline usage; and the collection of information regarding environmental protection, transport statistics, and sector forecasts.

72. The road transportation administration is responsible for the transport by road of passengers, freight, and other related services in the province. The passenger transport authority oversees urban passenger transportation (including public buses and trams, rail, taxis, rental cars) and the training of managers and staff in the province.

73. **Budget.** Battery electric bus manufacturers can receive up to RMB 500,000 per bus from the central government, while public bus companies (purchaser) can receive an equal amount (from the provincial government. In addition to subsidies for bus acquisition, the central government also provides subsidies to cover bus operation costs, which in 2015 amounted to RMB 80,000 per bus per year.

Results Area 4: Establishment of monitoring and warning systems and planning tools

74. **Strategic relevance.** Systematic air quality management planning is applied on a routine basis in many industrialized countries throughout the world, especially by the EU and in the United States.

75. **The European Union.** In principle, member states of the EU face similar challenges for air quality management as provinces and cities in China. There is a substantial regional background component to all air quality problems in Europe, which is beyond the control of competent local authorities. Thus, a member state's emission is not just seen as its own problem but also affects its neighbors. To decide how far one member state must reduce pollution so as to protect another, common environmental objectives are agreed at the European Union (EU) level and translated into emission reduction obligations per member state.

76. In this situation, the EU, which ties countries closer together through a comprehensive set of treaties, has developed a specific air policy framework since the 1980s. The present EU air quality policy focuses mainly on the transboundary aspect of air pollution and related controls that facilitate member states' actions to meet commonly agreed health and environment standards related to air quality. It also provides the basis for local action, for example, by EU-wide emission standards for vehicles, nonroad mobile machinery, product standards, and by offering co-funding programs for local/regional authorities. It incorporates the subsidiarity principle, which demands that decisions are taken as closely as possible to the citizen and that constant checks are made to verify that action at the EU level is justified in light of the possibilities available at national, regional, or local level. Specifically, it is the principle whereby the EU does not take action (except in the areas that fall within its exclusive competence), unless it is more effective than action taken at national, regional or local level.

77. In 2013, the European Commission proposed a comprehensive 'Clean Air Policy Package', which includes quantitative ceilings for all member states for PM2.5, SO_2, NO_x, NH_3, and VOC. These national emission ceilings have been derived from a series of cost-effectiveness analyses with the GAINS model of the International Institute for Applied Systems Analysis.[32] The analysis examined interim environmental targets as milestones toward the long-term objective of the EU Environment Action Program. It was found that in a most conservative perspective, considering monetized benefits only for human health and using the low valuation of the value of a lost life year, net benefits are maximized at a 76 percent 'gap closure' between the current legislation baseline and the maximum feasible emission reductions. At this level, emission reduction costs (on top of current legislation) amount to €4.5 billion per year, while benefits from these measures are estimated at €44 billion per year. The final policy scenario underpinning the proposal will reduce the loss in statistical life expectancy in the EU from 8.5 months in 2005 to 4.1 months in 2030 that is, by 52 percent, and gain about 180 million life years. The number of premature deaths attributable to exposure to ground-level ozone will decline by 34 percent. At costs of 0.02 percent of GDP, emissions would be cut for SO_2 by 77 percent, NO_x by 65 percent, PM2.5 by 50 percent, NH_3 by 27 percent, and VOC by 54 percent relative to 2005.

78. **The United States.** As the pace of industrialization in the United States accelerated during the 20th century, air pollution levels increased significantly. As governments and industry took initial, basic steps to reduce air pollution (often by changing operations or installing emission controls on individual sources to reduce directly-emitted pollutants causing localized problems), it became evident that addressing air quality challenges over the longer term would be much more complex. Ongoing research showed that health and environmental problems such as ground-level ozone, acidic deposition, visibility impairment, and particle pollution were caused (at least in part) by emissions from a diverse set of sources located across broad, multistate regions and that the complex interaction of pollutant emissions in the atmosphere and

[32] Amann, M., J. Borken-Kleefeld, J. Cofala, et al. 2013. *Policy Scenarios for the Revision of the Thematic Strategy on Air Pollution*. TSAP Report 10. International Institute for Applied Systems Analysis, Laxenburg, Austria. Amann, M., J. Borken-Kleefeld, J. Cofala, et al. 2014. *The Final Policy Scenarios of the EU Clean Air Policy Package*. TSAP Report 11. International Institute for Applied Systems Analysis, Laxenburg, Austria.

long-range transport of these pollutants were significant factors contributing to local air quality problems. Based on important advances in the scientific and technical understanding of air pollution sources, emissions measurement and control, pollutant transport, and health and environmental effects during the 1970s, 1980s, and 1990s, the U.S. Clean Air Act was revised (1977 and 1990) to include several provisions for addressing regional, interstate air pollution problems, and the EPA and state governments developed a series of regulatory programs and policy instruments to reduce emissions.

79. **Technical soundness.** The Hebei Province on the APPCAP[33] and the 2015 circular 35[34] from the Hebei Provincial Leading Group Office of Air Pollution Prevention and Control provide specifications for measures that shall be taken before 2017 to reduce the concentration of fine particular matters in the Hebei Province by 25 percent compared to 2012. More stringent reductions for the most polluted cities are also defined (for example, -33 percent in Shijiazhuang, Tangshan, Baoding, Langfang, Dingzhou, and Xinji).

80. This updated plan promotes a more systematic air quality management in cities, requesting authorities to develop targeted governance programs based on emission gap analysis, considering the specific features of industrial structure and pollutant emissions in each city, as well as referring to the results of PM2.5 source analytical studies. Importantly, the circular also makes explicit reference to optimal benefits from enhanced pollution prevention and control, opening the door for air quality management aiming at cost-effectiveness, and includes tasks related to prevention and control of agricultural and rural pollution.

81. There is a need to enhance scientific and technological support to improve the knowledge base for air quality management. In particular, authorities shall 'establish an elaborate list of air pollution emitters and a dynamic update mechanism' and 'conduct a study on the source of atmospheric particulates in a comprehensive way'. Furthermore, the working mechanism of the Hebei Provincial Air Pollution Prevention Expert Consulting Committee should be improved, and a dynamic Hebei Provincial air pollution prevention policymaking support system should be established and operated.

82. The proposed measures include all major point sources of pollution. It is less clear, however, whether the portfolio of measures is likely to achieve the targets. Economic aspects have not been considered in the choice of measures and not all emission sources that actually contribute to the problem have been taken into account at the necessary scale.

83. One important ingredient to address these issues is the availability of reliable source apportionment studies for PM2.5. While it seems that such analyses were scarce in 2013 when the APPCAP has been designed, multiple studies have emerged for JingJinJi in the subsequent

[33] Circular of Provincial Party Committee of Communist Party of China and Provincial People's Government of Hebei on Printing and Distributing the Implementation Scheme of Hebei Province of the Air Pollution Prevention and Control Action Plan, September 6, 2013.
[34] No. 35: Circular of Hebei Provincial Leading Group Office of Air Pollution Prevention and Control on Issuing Action Program of Hebei Provincial In-depth Governance of Air Pollution for Three Years (2015–2017).

years. It seems that a wealth of studies have been conducted for the authorities, which however were not fully available in English. In addition, quite a number have been conducted by academics and published in the international literature.[35] In general, these studies consistently indicate a considerable exchange of pollution across provincial borders, so that ambient levels of PM2.5 within cities and provinces are significantly influenced by emissions from outside. In the case of Hebei Province this is estimated to be 20–30 percent. Most interestingly, studies indicate that contributions from outside sources are even higher during bad pollution episodes. This clearly indicates the need for effective regional coordination and planning as an absolute prerequisite for any cost-effective emission control strategy.

84. The available source apportionment studies also identify the contributions of different source sectors to ambient PM2.5 concentrations. A recent review of international source apportionment studies clearly demonstrates that, in general, the studies present a lot of variation about the relative contributions from important source categories. Much of these differences can be traced back to different source sector definitions across studies. In particular, only 45 percent of the 529 studies explicitly distinguished emissions from the residential and commercial sector, while the majority lumped these sectors into the residual, unexplained fraction. Furthermore, the available studies differ greatly in how they attribute the sources of secondary inorganic and secondary organic aerosols to the different source categories, again with many of the papers refraining from allocating the precursor emissions to the source categories (for example, agricultural sources emitting NH_3, NO_x emissions from traffic, emissions of VOC and organic carbon from the burning of biomass and coal in household stoves).

85. As a general picture, the studies reveal a wide range of emission sources that make significant contributions to ambient PM2.5, especially if the sources of precursor emissions that generate secondary inorganic and organic PM2.5 in the atmosphere are taken into account. Studies agree that the transport sector, industry, and power generation contribute significant

[35] Zhang R, J. Jing, J. Tao, et al. 2013. "Chemical Characterization and Source Apportionment of PM2.5 in Beijing: Seasonal Perspective." *Atmospheric Chemistry and Physics*. 13:7053–7074. doi: 10.5194/acp-13-7053-2013.
Hu M, S. Guo, J. Peng, Z. Wu 2015. "Insight into Characteristics and Sources of PM2.5 in the Beijing–Tianjin–Hebei Region." China. *National Science Review*. nwv003. doi: 10.1093/nsr/nwv003.
Huang R-J, Y. Zhang, C. Bozzetti, et al. 2014. "High Secondary Aerosol Contribution to Particulate Pollution during Haze Events in China." *Nature* 514:218–222. doi: 10.1038/nature13774.
Wang G, S. Cheng, J. Li, et al. 2015. "Source Apportionment and Seasonal Variation of PM2.5 Carbonaceous Aerosol in the Beijing-Tianjin-Hebei Region of China." *Environmental Monitoring and Assessment.* 187:143. doi: 10.1007/s10661-015-4288-x.
Wang LT, Z .Wei, J. Yang, et al. 2014a. "The 2013 Severe Haze over Southern Hebei, China: Model Evaluation, Source Apportionment, and Policy Implications." *Atmospheric Chemistry and Physics* 14:3151–3173. doi: 10.5194/acp-14-3151-2014.
Wang Y, Q. Ying, J. Hu, H. Zhang. 2014b. "Spatial and Temporal Variations of Six Criteria Air Pollutants in 31 Provincial Capital Cities in China during 2013–2014*." Environment International* 73:413–422. doi: 10.1016/j.envint.2014.08.016.
Zhao PS, F. Dong, D. He, et al.2013. "Characteristics of Concentrations and Chemical Compositions for PM2.5 in the Region of Beijing, Tianjin, and Hebei, China." *Atmospheric Chemistry and Physics* 13:4631–4644. doi: 10.5194/acp-13-4631-2013.

shares to ambient PM2.5 (typically between 10 percent and 30 percent). Source apportionment studies that allocate the precursor emissions of secondary aerosols and consider other sources such as residential combustion, waste burning also reveal important contributions of these sectors to overall ambient PM2.5 in the JingJinJi region.

86. The technical assessment of the source apportionment found limitations and inconsistencies. Prefectures are taking care of their own inventory using diverse and unclear inventories and in different periods. The ones conducted to date focus on urban areas and use different categorization, making any kind of data aggregation impossible. Furthermore, each of the inventories indicates that 25 percent to 30 percent of the emissions are from outside the prefecture boundaries. However, these emissions can originate from the prefectures within Hebei or other provinces. Therefore, the mere aggregation of the inventory of all 11 prefectures will not provide a complete inventory of Hebei Province. These shortcomings are clear when comparing, for example, the source apportionment done in Shijiazhuang (Figure 4.4) and Tangshan (Figure 4.5).

Figure 4.4. Source Apportionment Results Based on Receptor Model in Shijiazhuang

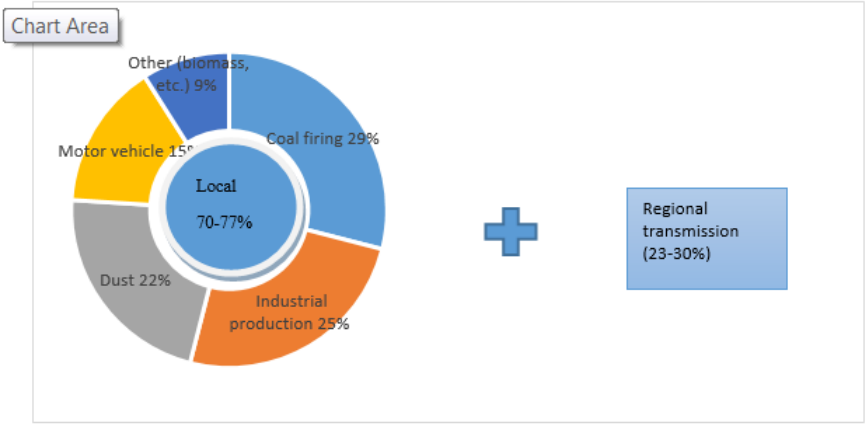
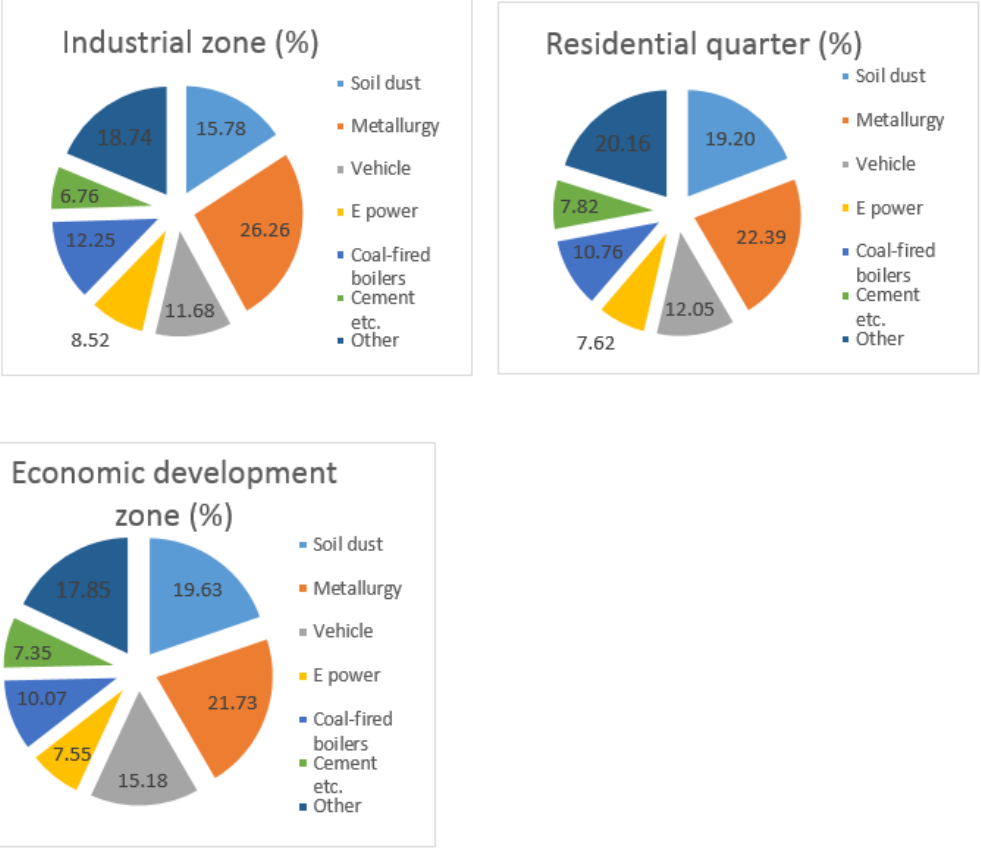


Figure 4.5. Source Apportionment Results for Different Function Zones in Tangshan Municipality



87. The Hebei 2015 Circular No. 35 adds lines of work that are important for a systematic air quality management approach in the future but which have not been pursued in the 2013 Circular. Visits of the team to the Hebei EPB and Tsinghua University in October 2015 confirmed the ongoing activities directed toward the development of a 'decision-making platform' for the Hebei provincial government. The platform, for which a first version is expected for mid-2016, will include a detailed inventory of all important point sources in Hebei, as well as estimates of area source emissions from residential and commercial combustion and agricultural activities. It is unclear, however, to what extent and at which quality emission estimates for these dispersed areas are available. Furthermore, the platform should include the feature of simulating the impacts of specific emission control measures for all these sources on ambient levels of PM2.5 although no methodological details have been provided. Furthermore, the inclusion of cost estimates for the available emission controls is envisaged in principle. It is planned that, after the decision-making tool is completed, it will be installed at the EPB in Hebei, and the local EPB staff will be trained to conduct their own analyses.

88. Any cost-effective approach toward reducing health impacts from the exposure to PM2.5 must consider the mitigation potentials (and costs) from various sources. A narrow focus on the more traditional sectors, such as transport, industry, and power generation can only provide a flawed assessment. Judging from the portfolio of measures listed in Circular No. 35 of the Hebei government that focuses primarily on these few sectors, it seems unlikely that the current action

program has been based on a complete cost-effectiveness analysis. Currently, the Hebei plan has the following main shortcomings:

- A comprehensive source apportionment to inform the modelling and planning is not available.
- The action plans do not build upon robust AQM principles, including a needed understanding of the increased complexity of air pollution sources.
- The action plans do not include a needed understanding of negative impacts from high air pollution concentrations particularly on human health.
- The action plans have not developed an investment portfolio that is prioritized based upon estimating cost effectiveness of the abatement options.

89. **Institutional arrangement.** The EPB is responsible for leading the preparation of the air quality plans under the guidance of the High-level Provincial Working Group (details in Annex 1),

90. **Budget.** The EPB receives about RMB 260 million per year from the earmarked funds to cover the costs of monitoring the air quality (the network of 207 ambient air monitoring stations across Hebei), coordinating the implementation of the existing plan, and preparing the new plan. Funds are used for covering the operation costs of the monitoring stations, travel to cities and counties, and studies and analysis.

Expenditure Framework

91. The authorities currently define and track the HAP on the basis of about 17 line items. The main national and provincial earmarked financing for the HAP totaling RMB 4.8 billion. The same amount was allocated for 2016. About 60 percent of budgeted expenditures are Program-related expenditure lines. Just under 60 percent of the national earmarked funds and over 75 percent of the provincial earmarked funds are associated with the Program.

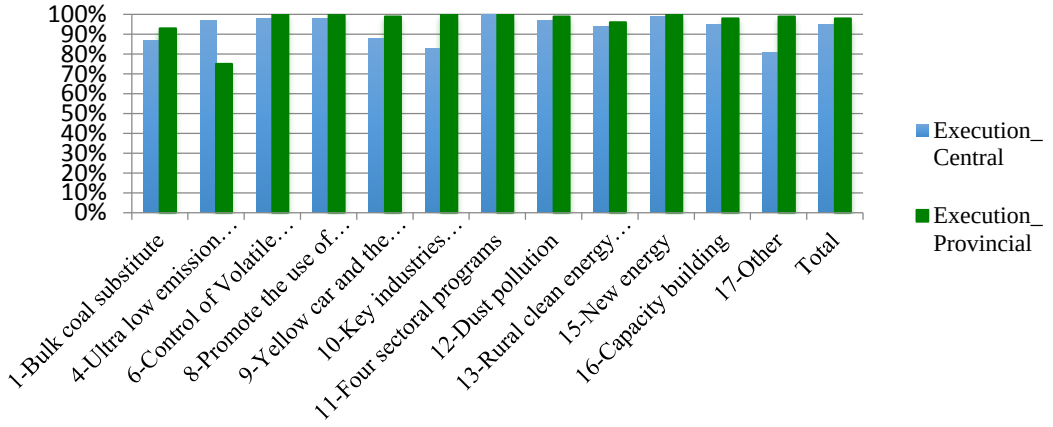
92. For 2015, RMB 2.82 billion is associated with the areas supported under the Program. These earmarked funds were matched by an additional 69 percent of expenditures, or RMB 1.95 billion, from other sources. Assuming the same level of earmarking is sustained in 2016 and 2017, since this is a multiyear nationally funded program mandated by the State Council and considering the carryover from 2015, total Program funds from national and provincial earmarked funds will be around RMB 6 .2 billion. The national and provincial earmarked financing are augmented by further spending by local governments and enterprises in the focus line items of the Program by about RMB 4.3 billion.

93. The HAP does not pose a major risk to subnational fiscal sustainability in Hebei. HAP expenditures represent only a small share of overall subnational expenditures in Hebei. Total HAP expenditures were estimated at RMB 29.4 billion, compared to aggregate consolidated revenues of RMB 533 billion in 2014. The HAP is subject to a diverse set of funding sources. The 2014 Budget Law imposes a hard budget constraint on subnational governments in China. Expenditure adjustments to maintain aggregate fiscal sustainability are likely to come from a

tapering of public infrastructure investments, which have been exceptionally high by international standards across China at the subnational level. Conversely, the prominence of air pollution abatement and control priorities, coupled with the relatively small fiscal costs of an effectively targeted HAP, means that aggregate fiscal considerations do not pose the primary risk for crowding out of HAP expenditures in Hebei over the short to medium term.

94. Medium-term Program predictability will depend on the continuity and effective prioritization of central and provincial level earmarked funding. For 2015, the core central and provincial earmarks accounted for 60.7 and 60.0 percent of the total and focus expenditures, respectively. These levels of higher-level earmarking were sustained in 2016 and by all accounts will be continued in 2017. An initial concern in these earmarked allocations was the low levels of execution even in 2015 for 2014 allocations. Reasons for these delays were that higher-level transfers were only confirmed later in the year, when the People's Congress met.[36] Other causes for under-execution were initial unfamiliarity with planning and preparation and excessive rigidity in expenditure earmarks. Figure 4.6 suggests that this issue has been largely resolved.[37] Beyond ensuring execution for 2016 and 2017, Program expenditures can be considered as mainly investments (leading to permanent reduction in emissions) or have a significant recurrent element (for example, monitoring staff or on-going subsidies). The bulk of the Program appears to be related to abatement investments.

Figure 4.6. 2015 Budget execution performance of line items to be supported under Program



[36] Subprovincial levels of government noted that higher-level earmarks were often only confirmed by mid-year. This in turn led to some delays in budget execution. These delays appeared to explain some of the lagging budget execution numbers reported against 2014 allocations. These funds however, could be carried over into subsequent years.

[37] One mitigating measure to possible budget execution delays is to allow for six extra months through mid-2018 of the 2017 Program. The structural timing issues with inter-governmental budget preparation across levels of government appear to supersede the operation, and will therefore need to be managed during its life. As the Program consolidates, subnational governments could be provided with an indicative medium-term forecast of likely budget allocations, contingent on execution process of the previous allocations.

95. More granular, timely, and systematic Program monitoring will be needed through 2016 to ensure targets are met in the 2017 budget preparation and implementation. The existing expenditure monitoring table is consolidated manually, based on the upward consolidation of up to 182 subprovincial inputs. These reports do not provide information on specific outputs (for example, number of stoves) delivered in a particular category. Beyond ensuring that the reporting granularity of the existing line items conforms to key output/outcome indicators, a companion dashboard could be established to monitor selected output commitments. This would then flag if the Program is behind on key target indicators. This would also yield an early shift to a more integrated Program budgeting approach, with an emphasis on outputs rather than line item inputs. A related point would be to validate the standards associated with particular outputs (for example, stoves), in line with Program indicators.

96. The tracking of Program budget allocations and execution can be improved through greater use of automation. Budgeting and budget execution systems were found to be relatively robust and automated as part of the fiduciary assessment. Existing functional and administrative coding classifications provide for generally systematic and comparative accounting of budget and budget execution across the large number of local governments implicated in Program expenditures. The existing overall summary, however, is subject to a manual compilation process. Economic officers at each level of government in effect manually tag particular expenditure items from the integrated financial management system. This is likely to introduce some ad hoc tracking across local governments and/or time. The fiduciary assessment makes specific suggestions on how this tracking can be mainstreamed and automated better for greater consistency. Despite its limitations, the existence of the tracking process does provide a useful foundation and budget baseline for the Program to build on.

97. While annual line item budget execution measures have improved, payment backlogs could delay the achievement of future Program outputs. Deliveries of such investments as stoves are subject to ex post payments once verification of sale and installation has been made. Some companies seem to be having issues with payment delays, potentially causing delays in further installations.

98. Progressive improvements in Program expenditure tracking should focus on key inputs for priority results outcomes and outputs. The current existing reporting process provides general overall of HAP expenditures.[38] The design of the Program suggests the need to focus on expenditure risks based on materiality to particular priorities. Expenditure materiality will not necessarily only be defined by the magnitude of resource inputs, but the extent to which these inputs are vital to the integrity of the Program. For example, monitoring equipment may not entail large expenditures compared to capital investments such as upgraded bus fleets. However, failure to budget and execute for these former expenditures can put the Program objectives at risk. Rather than create a parallel expenditures monitoring framework for the Program,

[38] This section refers to overall program expenditures as reported by the Hebei coordinating/oversight committee, whether PforR specific expenditures are those ultimately identified as the more narrow Program inputs for particular results areas. Expenditure data disaggregation allowing we also seek to distinguish between budget inputs through higher level earmarks for results areas versus subprovincial co-financing.

materiality should be addressed by agreeing on a priority 'watch list' for particular expenditure items as part of the established Program. These subcategories can then be monitored more closely for budgeting and/or execution bottlenecks hampering key Program results.

99. To be effective, the HAP medium-term budgeting framework needs to closely monitor execution challenges across results areas and local governments. The different subplans inherent to the HAP, as well as the large number of local governments in principle associated with HAP delivery, introduce some complexity to the Program. The medium-term higher-level budget projections for the Program will help anchor the annual budget reviews. The proposed further prioritization of a watch list of the Program could be further augmented by identifying the 20 percent of local governments that would appear to account for the bulk of respective budget resources. The proposed step of automating the present Micosoft Excel-based summary reporting should contribute to a more systematic emphasis on priority budget execution performance.

100. Subnational governments conduct annual performance evaluations of selected initiatives. Under the prevailing budget practices, all local governments maintain a performance evaluation unit. This conducts typically 10–20 evaluations of priority initiatives per year. Initiatives are scored on a scale of 100. Performance evaluations consider outputs and outcomes, but also draw in internal audit findings. The evaluations were identified in some cases to have reoriented initiatives, or notably cut resources. The performance evaluation framework does however suggest an emphasis on the service delivery performance and value for money of the different initiatives. Counterparts identified a number of air pollution abatement and control initiatives that have been subject to evaluation. These summaries suggested that the subplans were found to have performed adequately.

Table 4. 2. Expenditure Framework: Key Findings and Issues

Risk	Assessment and Mitigation Measure
Fiscal sustainability concerns crowd out HAP expenditures	Program expenditures are not dominant in overall national or subnational expenditure initiatives. The policy objective of addressing air pollution meanwhile figures prominently. This is therefore not identified as a primary risk.
Budget prioritization fails to allocate financing inputs to Program results areas	The Program seems to enjoy a fairly high degree of higher-level emphasis, as well as local buy-in. National and provincial earmarks are playing a significant role in financing the Program but also catalyzing subprovincial budgeting contributions.
Higher-level earmarks are diverted to non-Program priorities	All levels of local government maintain an integrated financial management system. Rules on virements and internal controls are in place. However, a strong focus on output tracking required
Lags and/or gaps in budget execution undermine the medium-term impact of the HAP	Execution has improved markedly. Beyond continued monitoring, close attention to key output tracking will be required
Medium-term results are undermined by poor operational efficiency of initiatives	The existing framework of annual HAP performance evaluations across all local governments provides a useful entry point for addressing frontline efficacy and value for money. The analysis should assess whether the prevailing assessments adequately capture results performance, rather than procedural compliance. Performance evaluations for 2015 and 2016 should be focused on key line items of the Program.
Medium-term results are undermined by limited allocative efficiency of the Program	Use performance evaluations and mid-term budget review process to promote allocative efficiency from both a budgeting as well as implementation perspective

Program Economic Evaluation

101. **Introduction.** A study was carried out to provide estimates of the health damage (in physical and monetary terms) of PM2.5 pollution in the base year of the HAP (2012), the impact of the current HAP, and the impact of an extended HAP. The study assumes that the original HAP will lead to a general 15 percent reduction in PM2.5 concentrations over the entire province during 2013–2017 and that an extended HAP will contribute to reaching 25 percent reduction within the same period. A sensitivity analysis was carried out assuming that concentration levels are primarily reduced for urban populations. In addition, a separate analysis of potential health benefits of targeting traditional household fuels is carried as well as a brief estimate of potential climate co-benefits of targeting this source of PM2.5.

102. **Population in Hebei.** The study used population data from the China Census 2010 in Geographic Information System format provided by the China Data Center at the University of Michigan.[39] Hebei consists of 11 prefecture cities, with a total of 172 counties. The total population in Hebei in 2010 was 71.9 million, of which 44 percent was urban (that is, 44 percent lived in urban areas, without necessarily possessing an urban *hukou*). The population density varies considerably throughout the province.

103. The calculations, took into account population growth but not any intra-provincial migration that may change the geographical distribution of people over the scenario period. The average annual population growth from 2010 to 2014 was 0.68 percent,[40] and the study assumed an approximate 5 percent growth over 2010–2017. Estimates of premature deaths in the base year are given for an estimated 2012 population (using the annual growth rate), while corresponding estimates for the scenarios are given for an estimated 2017 population. Monetized estimates are given for the full lifetime of the program beyond 2017.

104. **Population exposure to ambient PM2.5.** The annual average ambient PM2.5 concentration per county for the baseline and the two reduction scenarios used estimates of geographically resolved PM2.5 concentration in Hebei from the Oslo Chemical Tracer and Transport Model, with 2010 meteorology.[41] Emission data for primary PM and PM precursors in 2010 are from the European ECLIPSE project (ECLIPSE version 5 emission data).[42] County-level PM2.5 concentrations are derived from the gridded output of the Oslo-CTM by using Inverse Distance Weighting interpolation in a Geographic Information System tool (ArcMap 10.3.1).[43] As the resolution of the Oslo-CTM is too coarse to model the enhanced pollution levels in cities, the study used urban monitoring data for 2013 (when an extensive monitoring network

[39] China Data Center, University of Michigan, Web: http://chinadataonline.org.

[40] https://en.wikipedia.org/wiki/List_of_Chinese_administrative_divisions_by_GDP_per_capita.

[41] Skeie, R. B., et al. 2011. "Anthropogenic Radiative Forcing Time Series from Pre-industrial Times until 2010." *Atmospheric Chemistry and Physics* 11: 11827–11857.
Søvde, O. A., et al. 2012. "The Chemical Transport Model Oslo CTM3." *Geosci. Model Dev.* 5: 1441–1469.

[42] Stohl, A., et al. 2015. "Evaluating the Climate and Air Quality Impacts of Short-lived Pollutants." *Atmospheric Chemistry and Physics* 15 (18): 10529–10566.

[43] We suggest estimates for administrative units are more useful for policymakers than gridded data, as policies typically are targeting and/or implemented in administrative units.

had been established) from the 11 prefecture cities in Hebei to estimate an 'urban PM2.5 booster' factor. This factor is calculated as the ratio between the average monitored PM2.5 in a prefecture city and the average PM2.5 modelled in the CTM. Within each prefecture city, the adjustment factor is applied to boost the PM concentration in counties where the population density is above 500 people per km^2, which was used as an indicator for urbanized counties. The reason behind this is that air pollution monitoring is carried out only in urban areas, and the study assumed that rural areas are better represented by the CTM regional estimates. The average value of the booster factor is 1.39 in Hebei. The resulting figures reasonably represent the baseline 2012 situation in the province.

105. The PWE to ambient PM2.5 in the baseline and the scenarios for a population group P, is calculated as:

$$PWE_P = \frac{1}{P}\sum_i (P_i \bullet C_i) \qquad \textit{(Equation 1)}$$

where *P* is the population, *C* is the PM2.5 concentration, and *i* refers to any given geographical unit.

106. Note that using the method described here, the study arrived at a PWE for all China of 56 $\mu g/m^3$. For 2005 and 2010, respectively, Brauer et al. (2012)[44] arrived at 55 $\mu g/m^3$, while Apte et al. (2015)[45] arrived at 59 $\mu g/m^3$. Another study estimated a PWE of 61 $\mu g/m^3$ for 2014–2015.[46]

107. **Calculating premature mortality.** Particulate air pollution, PM2.5, is associated with premature death for a number of diseases. Health benefit from ambient air pollution reductions in Hebei was calculated using the methodology applied by the Global Burden of Disease Study.[47] The study calculated the number of premature deaths due to ambient PM2.5 pollution in the baseline situation (before implementation of the HAP) and in scenarios where the PM2.5 concentration has been reduced by 15 percent and 25 percent, respectively.

108. The annual excess cases of deaths that are attributable to PM2.5 exposure in Hebei under alternative scenarios, that is, the attributable cases, are calculated as:

$$AC_{i,j,k}=[(RR_{i,j}-1)/RR_{i,j}] \cdot p_{i,j,k} \cdot P_{i,k} \qquad \textit{(Equation 2)}$$

[44] Brauer, M., et al. 2012. "Exposure Assessment for Estimation of the Global Burden of Disease Attributable to Outdoor Air Pollution." *Environ Sci Technol*. 46 (2): 652–60.
[45] Apte, J. S., et al. 2015. "Addressing Global Mortality from Ambient PM." *Environ Sci Technol*.
[46] See http://www.ecns.cn/2015/10-22/185307.shtml.
[47] Lim, S. S., et al. 2012. "A Comparative Risk Assessment of Burden of Disease and Injury Attributable to 67 Risk Factors and Risk Factor Clusters in 21 Regions 1990–2010: A Systematic Analysis for the Global Burden of Disease Study." *Lancet* 380 (9859): 2224–60.

where *RR* is the relative risk of premature deaths associated with a given level of PM pollution, *p* is the baseline mortality rate, and *P* is the population in a given geographical unit, while *i* refers to age group, *j* refers to the specific cause of death, and *k* refers to gender.

109. Regarding the *RR* estimates for the five deaths causes, the study used the lookup table provided by Apte et al. (2015),[48] which are derived from exposure-response functions for the relationship between exposure to PM2.5 and the five health end-points from Burnett et al (2013).[49] The five health end-points included are chronic obstructive pulmonary disease, lower respiratory infections (LRI), tracheal, bronchus and lung cancer (LC), ischemic heart disease (IHD), and ischemic stroke.

110. **Calculating monetized health benefits.** The PV formula was used to monetize the avoided premature deaths, attributable cases (AC), in the period 2012–2017 and beyond:

$$\text{Benefit} = \sum_{t=0}^{N} \frac{AC\ VSL\ (1+g^t)}{(1+r)^t} \qquad \textit{(Equation 3)}$$

where *VSL* is the value of statistical life, a metric of the willingness to pay for lower mortality risk, g is the growth in the VSL over time, *r* is the discount rate, and *N* is the lifetime of the measures, here assumed to be 10 years.

111. **Premature deaths.** The study estimated that there were 69,448 premature deaths attributable to ambient PM2.5 pollution in the base year (2012). In the baseline scenario, with no changes in PM2.5 concentrations, this corresponds to 71,758 in 2017 given the assumed population growth.

112. Considering the additional exposure from household air pollution, the number of premature deaths is 86,406 in the base year. Note that the relatively modest increase in excess deaths estimated for integrated population weighted exposure compared to ambient air pollution exposure is due to the curvilinear exposure-response functions.

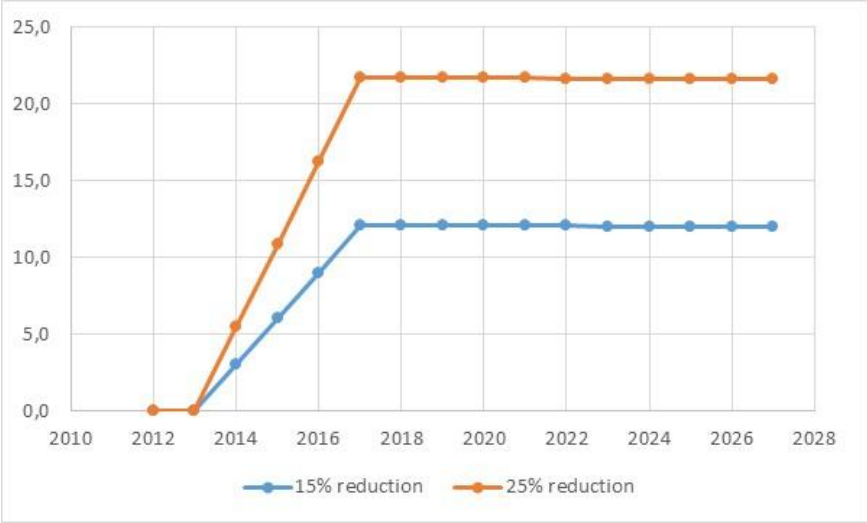
113. A general 15 percent reduction in PM2.5 concentration in Hebei results in an estimated 3,424 avoided deaths annually according to our model. A 25 percent reduction would result in an estimated 6,159 avoided deaths annually. The impact of strengthening the HAP with the support of the Program may thus contribute to an additional 2,735 avoided deaths per year. The largest number of avoided deaths are found for IHD deaths, the top cause of death associated with air pollution exposure. As the exposure-response function is more linear for acute lower espiratory infection, lung cancer, and chronic obstructive pulmonary disease as compared to IHD and ischemic stroke, the benefit of enhanced pollution reduction increases more rapidly for the three first end-points compared to the latter two. In the sensitivity calculations where we assume the PM reductions are mainly obtained in urban areas, we arrive at an estimated 932 avoided deaths for the 15 percent scenario and 1677 at the 25 percent scenario.

[48] Apte, J. S., et al. 2015. "Addressing Global Mortality from Ambient PM." *Environ Sci Technol*.
[49] Burnett, R. T., et al. 2014. "An Integrated Risk Function for Estimating the Global Burden of Disease Attributable to Ambient Fine PM Exposure." *Environ Health Perspect*. 122 (4): 397–403.

Thus, in this scenario, the impact of increasing the reduction rate from 15 percent to 25 percent is an estimated 744 extra avoided deaths.

114. Monetized health benefits of PM reductions. We find that the cost of premature deaths attributable to PM2.5 exposure in Hebei in the base year 2012 is RMB 254 (127–381) billion, which corresponds to 9.6 percent (4.8–14.3 percent) of the province GDP.[50] The PV in the base year of the 15 percent reduction program is estimated at RMB 150 (61–263) billion, whereas the PV of a 25 percent reduction program is estimated at RMB 271 (110–474) billion. The PV of the benefit of expanding the current program to a program that reduces the PM pollution with 25 percent within 2017 is thus estimated at RMB 120 (49–210) billion corresponding to US$19 (8–34) billion. Assuming a 5-year lifetime of the Program (instead of 10 years), the PV will be RMB 72 (31–121) billion. As seen in figure 4.7, the central parameters applied in the evaluation imply that the discounted annual health benefits is nearly constant over the lifetime of the alternative programs.

Figure 4.7. Annual Discounted Health Benefit of the Two Scenarios (RMB billions)



[50] GDP in Hebei in 2012 was RMB 2,657 million in 2012. https://en.wikipedia.org/wiki/List_of_Chinese_administrative_divisions_by_GDP_per_capita

Annex 5: Summary Fiduciary Systems Assessment

1. An integrated fiduciary assessment was carried out in accordance with the Interim Guidance Note (June 18, 2012) to assess whether the Program's systems provide reasonable assurance that financing proceeds will be used for intended purposes, with due attention to the principles of economy, efficiency, effectiveness, transparency, and accountability. Based on the assessment and agreed actions to strengthen the system, which are reflected in the PAP and other mitigation measures, the Program's fiduciary systems are considered adequate to meet the requirements in Bank Policy: Program-for-Results[51] and Bank Directive: Program-for-Results.[52] This annex is a summary of the full Fiduciary Systems Assessment.

2. There are no large contracts for procurement of goods with an expected value at or above the current Operational Procurement Review Committee (OPRC) thresholds under the Program. The procurement profile of the Program primarily focusses on the following:

(a) Purchasing environmental monitoring equipment, including the equipment to be used for establishing a smart platform for CEM covering all the counties in the province for continuously monitoring the pollutants in industries and to be used for monitoring the ambient air at different environmental monitoring stations) and IT equipment for data collection, transmission and analysis for some systems, such as the CEM system and early warning systems managed by the information centers/pollutants control centers under the EPB at different levels. The estimated cost of one set of the monitoring equipment installed at one station for CEM is over RMB 1 million (equivalent to US$ 160,000) and that for monitoring the ambient air with 6 pollutants is about RMB 1.5 million (equivalent to US$250,000).

(b) Purchasing new energy buses. In Sanhe County 150 new energy buses have been procured with the total amount of RMB 23.90 million (equivalent to US$ 3.8 million). Shijiazhuang Bus Company has recently procured 100 new energy buses. All these buses were procured by following the government procurement law.

(c) Leasing new energy buses. The Shijiazhuang Bus Company has through a competitive process - signed in October 2015 a 10 years financial leasing contract for 800 new energy buses. The unit cost of each bus is market based and the total number of buses will be delivered in April 2016. Under the two years duration of this Program, the Shijiazhuang Bus Company will pay a total of US$ 40,000,000. This financial leasing contract meant to overcome the cash flow deficiencies of the Shijiazhuang Bus Company for increasing its bus fleet.

3. The annual earmarked funds for the Hebei Air Pollution Prevention and Control Action Plan (HAP) are approximately RMB 4 billion from the central government and RMB 800 million from the GoH. These transfers are considered as 'financial capital' and included in the budgetary

[51] OPCS5.04-POL.01.
[52] OPCS5.04-DIR.01.

management of the Hebei Provincial Finance Department ("HPFD"). In China, there are two laws governing procurement. One is the Tendering and Bidding Law of China, which governs the procurement under the projects financed by the state-owned funds in controlling or leading roles, and the other, is the GPL. The law and regulations applicable for the Program include the GPL effective on January 1, 2003, the IRGPL effective on March 1, 2015 and the HGPAM effective on July 1, 2012, which guide procurement of goods and services throughout the province under the Program with sources of funds considered as 'financial capital'.

4. The GPL, the IRGPL, and the HGPAM are applicable for all the government procurement in Hebei Province, including the proposed Program.

5. Assessment of the existing procurement management system and arrangements for government procurement has identified some gaps or weakness with potential risks: (a) prevalent rejection of bids due to bid prices exceeding pre-bid cost estimates disclosed in the bidding document and minor, non-substantive deviations; (c) subjective application of technical scoring criteria in bid evaluation; (d) non-application of Bank debarment/temporary suspension lists which may result in unacceptable contract awards to firms and/or individuals under temporary suspension or cross debarment by the Bank or other multilateral development banks; and (e) anonymous complaints are not accepted and handled.

6. **Governance and accountability systems.** As part of the fiduciary assessment, the degree to which the HAP systems relevant to the Program handle the risk of fraud and corruption, including complaint mechanisms, has been analyzed. Systematic countrywide issues from the Bank's portfolio of projects include misrepresentation by providers on experience and past performance and technical and financial resources; use of fraudulent documents such as bid and performance securities, financial and bank statements, qualification and test certificates; over invoicing; collusion; conflict of interest; and coercion in handling complaints. Furthermore, reluctance by officials to confirm breaches by other parties in writing presents a particular challenge in conducting integrity due diligence. According to the GPL, IRGPL, and the HGPAM, the financial departments or bureaus at the county level and above are the designated government authorities to be responsible for oversight and management of government procurement of goods and services, including handling the suppliers' complaints, investigating, and sanctioning firms and individuals for violations of the government procurement and financial management laws, regulations and code of ethics. The Hebei Public Resources Trading Center with the official website of http://www.hebggzy.cn has been in operation since October 28, 2014 and has merged all the individual entity procurement transaction centers and websites in Hebei. The center and the website provide a venue, facilities, and services for all the public resources transactions, including the goods and services under government procurement. The protest and complaint mechanism is well established in the province. The suppliers may send their complaints, including any allegations of fraud and corruption issues through the website or directly to the purchaser, the procurement agent, the center, or to the concerned government procurement administration offices under the financial departments/bureaus at each level. The GPL and IRGPL have specific provisions on due process and sanctions for violations. No fees will be charged to the complaint for the government to handle the complaints.

7. **Control and oversights.** The procurement carried out by the entities in Hebei is subject to audit or inspection/supervision by various government authorities such as audit offices, the

government procurement administration offices, and the law and regulations divisions under the financial department/bureaus at each level. The GPAO has a supervision role for procurement activities to be carried out at the county, municipal, and provincial levels.

8. **Complaints.** Complaints are handled at two levels. The complaints in the form of questions in relation to procurement of any contract package are handled by the implementing entity or the purchaser and the procurement agents. Other complaints including those related to fraud and corruption are handled by the GPAO in consultation with the law and regulations division. Anonymous complaints are not considered. Anyone is allowed to complain for any matter and no fee is required. During the meeting with the GPAO, the Bank team was informed that they received an average of 10 complaints each year for government procurement carried out at the provincial level entities. In 2015, there were a total of 14 complaints received for the provincial level government procurement contracts in the province, which were related to a total contract amount of RMB 345 million (equivalent to US$55 million), accounting for 4.44 percent of the total amount of RMB 7.763 billion (equivalent to US$1.2 billion) for the provincial-level government procurement. During the visit to Shijiazhuang EPB and the Zhao County EPB, the Bank team was informed that they did not receive complaints in recent years. The GPAOs handle complaints with due diligence because the complainants may appeal their decision to the law and regulations division under the EPBs through a process of administrative reconsideration and also to court, if needed. Hebei will provide the Bank a summary of the complaints every six months under the Program.

9. **Applicability of Anticorruption Guidelines of the Bank for the Program.** The GoH is fully committed to ensuring that the Program's results are not impacted by fraud or corruption. Through the Program's legal documents, China (as the recipient of the Bank) and Hebei are formally committed to the obligations under the Anticorruption Guidelines for PforR operations. In particular, in the context of this Program, Hebei has agreed to promptly inform the Bank of any credible and material allegations of fraud/and/or corruption regarding the Program as part of the overall Program reporting requirements. The Bank will inform the recipient and Hebei about any allegation that it receives. Hebei has also agreed to issue specific guidelines instructing all the relevant agencies to comply with the requirements of the ACGs, including all the procuring entities, procurement agents, and FBs at all levels under the Program when the loan for the Program is effective, which will include (a) any person or entity debarred or suspended by the Bank is not awarded a contract under or otherwise allowed to participate in the Program during the period of such debarment or suspension; (b) a provision related to (a) will be also included in the bidding document with the list of debarred and suspended firms and individuals available on the Bank's external website: http://www.worldbank.org/debarr; the Bank's hotline or email address that takes in anonymous complaints will be also included in the bidding document, that is, investigations_hotline@worldbank.org or toll free +1-800-831-0463, collect calls +1-704-556-7046 (interpreters are available, anonymous calls accepted); and (c) the government procurement administration offices at each level will reserve the right to reject the proposed award when it is submitted to them for approval before contract signing. The guidelines will be issued in the joint names of the relevant provincial government agencies responsible for oversight of government procurement and the Program as well as provincial-level sector line agencies which will have procurement under the Program. The provincial-level sector line agencies with procurement activities under the Program include the Hebei Provincial Department of Environmental Protection, Hebei Provincial Department of Transportation, and may be

updated in the subsequent years within the Program period. The above protocol can ensure that persons or entities debarred or suspended by the Bank are not awarded a contract by verifying the same prior to award under the program during the debarment or suspension period. In the Auditor's TOR one of the Auditor's tasks will include sample checking of the Bank's suspension and debarment list for completed procurement under the Program.

10. The Bank's right to conduct an inquiry into such allegations or other indications, independently of or in collaboration with the Borrower regarding activities and expenditures supported by the Program and the related access to require persons, information, and documents will be observed in accordance with the standard arrangements for this purpose between the GoC and the Integrity Vice Presidency of the Bank.

11. **Financial management system.** The Program funds are earmarked government funds and will flow through the public financial management system. Although the Program implementation is carried out by various sector agencies, financial management, including payments associated with the earmarked funds, are centralized in Finance Bureaus at each government level. More specifically, the Treasury Division of Finance Bureaus (FB) process payment upon request and the FB's Resource and Environment Division (RED) at the provincial level and some prefectures, and the Economic Division in the remaining prefectures, all districts, and counties play a central role in managing the earmarked funds. This includes Program budgeting, payment review, and expenditure monitoring and tracking against budget. As the key finance agency, the REDs and Economic Divisions proactively coordinate with all other concerned agencies to conduct periodic reconciliations and monitor overall Program funding and implementation status by producing the Program's financial report on a monthly basis.

12. **Legislation.** To ensure proper usage of the national earmarked funds, the MOF and Ministry of Environment Protection jointly issued Management Rules of National Air Pollution Control Funds (Caijian [2013] 897 and [2015] 733) to regulate principles in funds allocation, budget execution, funds appropriation, reporting, inspection, and M&E. Based on that, the Provincial FB and the Provincial EPB also jointly issued the Earmarked Funds Management rules (Jicaijian [2014] 258) to nail down the implementation procedures. Regarding specific activities to be supported under the Program, sectoral governments also issued instructions to define eligible activities, responsible agencies, payment schemes, verifications.

13. **Planning and budget.** The HAP budget, including national and provincial earmarked funds, is prepared with due regard to national strategy, provincial action plans, and local government policy. Earmarked funds are appropriated in an orderly and predictable manner, but generally in the middle of the year, and thus the implementation may be carried forward to the next year. For instance, the allocation to specific projects for year 2015 was not yet completed by the end of September. By the end of 2015, actual expenditures with 2015 earmarked funds were approximately 97 percent. The remaining funds will be rolled over and implemented in 2016. To improve the situation of delayed budget implementation, the Hebei Provincial FB preallocated RMB 190 million from the 2016 budget to 11 prefectures and 2 province-managed counties in October 2015 and subsequently, in November 2015, the Hebei Provincial FB allocated another RMB 1.74 billion earmarked funds from the MOF.

14. **Accounting and financial reporting.** Adequate documentation and financial records are systematically maintained. A monthly HAP financial report is prepared that shows expenditures by activity financed by national and provincial earmarked funds, as well as local government contributed resources. However, since the MOF-issued Chart of Accounts does not include HAP coding, the consolidated financial reports are prepared manually by identifying expenditures in the governments' budget execution reports at each level of government (provincial, municipal, and county) and consolidating these reports. The Program's financial report will reflect the annual budget and actual expenditures paid with national and provincial earmarked funds. The detailed reporting format has been agreed with MOF, Hebei FB and auditor. The Program report and preparation procedures will be documented as Financial Statements Preparation Instruction and officially issued by Hebei FB. Additionally, the Bank will work with Hebei FB to try pilots of automated report in province, selected municipality and county to enable the government's FMIS to capture the Program's budget and spending information and produce Program financial reports much more efficiently and with the ability to satisfy the information needs of different users. .

15. **Treasury management and funds flow.** The Treasury system maintained by Hebei is advanced, as all processing including payment request, review, payment processing, recording, and settlement with agent banks are automated and efficient. Sufficient and timely funds are also available to finance Program implementation.

16. **Internal controls.** Program implementation is governed by HAP general regulations. Specific regulations are issued by sector governments to standardize practices. There are inspection and performance evaluation functions at each FB level to exercise control and validate results for government funds. Though the internal audit staff is limited, as is the case throughout much of China, other internal reviews conducted by FBs, sectoral agencies and annual special inspections jointly conducted by the member agencies of the leading groups compensate and strengthen internal controls.

115. **Program audit.** Program funds are included, but not separately identified, in the government budget execution report, which is audited on an annual basis. This audit is largely a compliance audit but includes elements of financial audit testing. There is currently no financial audit of the government budget execution report, the primary financial report of the government. To gain reasonable assurance on proper usage of Program funds, the CNAO and the HPAO will agree on an audit TOR with the Bank and conduct an annual Program financial statement audit that will be publicly disclosed. The audit report will be submitted to the Bank within nine months after calendar year-end. The HPAO Foreign Funds Application/International Division will lead the audit and issue the audit opinion. It is expected to closely coordinate with the HPAO Budget Execution/Environment Audit Division and lower-level government Budget Execution Audit Divisions to conduct the audit, thereby using, to the extent possible, the audit work of these divisions. CNAO management is actively participating in planning and coordination of the audit and will provide audit quality assurance, at least during the first year of the audit. The scope of the audit will be the Program financial report. The audit sampling will be determined by the auditors as part of their annual audit planning. CNAO will ensure that coordination and audit technique and work are adequate. The auditors will conduct the financial audit upon the statements in accordance with the audit TOR to meet the Bank's audit requirement. The audit TOR will

require the auditors to audit the overall final reconciliation of program expenditures paid with loan proceeds.

17. The table below provides the key fiduciary risks identified during the assessment and proposed mitigation measures.

Risk	Mitigation Measure
Prevalent rejection of bids due to bid prices exceeding pre-bid cost estimates disclosed in the bidding document and minor, non-substantive deviations.	Since the budget of the contract will be disclosed in the bidding document and any bid which offers a price higher than the budget shall be rejected, the budget shall be reliable. When the procurement plan is prepared, the Purchaser shall carry out the market analysis, check the historic records for the equipment, and work out a reliable and accurate budget for the contract. Before issuing the bidding document, the purchaser may also update the budget based on the latest market information. If any bid is rejected because its price exceeds the budget or other deviations, justifications shall be provided in the procurement files. The documentation of the justifications in this regard will be subject to inspection by the auditors.
Frequent complaints as a result of restrictions in technical requirements and qualifications in bus procurement	For procurement of buses, the purchaser should carry out with due diligence the market analysis and at least provide a comparison table of key technical parameters and qualifications for at least three products which can meet the bidding document, and keep the table in the procurement files. If the client is suspicious of the license for production of the bus, the purchaser should seek written clarification from the relevant ministry or government authority to verify whether the product has got the official license or verify whether the license provided is authentic or not.
Subjective application of technical scoring criteria in bid evaluation	Although the lowest evaluated bid price is one of the bid evaluation methods, scoring system is more often applied. The purchaser should try to adopt a reasonable weighting for the technical scoring, which should not exceed more than 50%. This is to achieve value for money, with a better combination of cost and quality in the decision making process.
Non-application of Bank debarment/temporary suspension lists, which may result in unacceptable contract awards to firms and/or individuals under temporary suspension or cross debarment by the Bank or other multilateral development banks	Reporting to the Bank any credible and material allegations of fraud/and/or corruption regarding the Program as part of the overall Program reporting requirements and ensuring that persons or entities debarred or suspended by the Bank are not awarded a contract by verifying the same before award under the Program during the debarment or suspension period.
The current Chart of Accounts in the Government Fiscal Management Integrated Platform (GFMIS) does not include Program coding to tag program transactions. The GFMIS therefore is not able to produce Program financial reports.	The current manual process to prepare the program report has been in use for more than two years and is well known to report preparers. However, to standardize the financial report preparation work and ensure consistency across the Province, the Bank will assist Hebei to develop program report preparation instructions and guidance which Hebei FB will issue before the end of 2016. Moreover, Hebei FB has agreed to implement an innovative pilot to generate program reports from its FMIS in selected municipality and county in 2016.
Currently the program financial reports are not subject to financial audit.	Hebei Provincial Audit Office (HPAO) has conducted financial audit on Bank- financed operations for years and is deemed acceptable to the Bank. CNAO and HPAO will agree an audit TOR such that HPAO will be able to submit an audit report on the Program's financial reports in a timely manner. The financial audit TOR will also be finalized by the end of 2016, and has to receive a no-objection from the bank as defined in the PAP.

Annex 6: Summary Environmental and Social Systems Assessment

Potential Environmental Benefits and Risks

Potential Environmental Benefits

1. The proposed Program is anticipated to have significant positive environmental and health benefits with regard to reducing air pollution emissions, improvement of environmental quality and public health, and enhancement of environmental monitoring and management capacity in Hebei.

2. The installation of desulfurization, denitrification, and dust removal facilities in key enterprises (hundreds of enterprises) will significantly reduce the emission of SO_2, NOx, and PM, thus contributing to the overall improvement of air quality in Hebei and Jingjinji region as well as reducing acid rain and heavy metal contamination of soil and water. The deployment of a CEM system on emission sources and the establishment of an information and management system will help strengthen the capacity of Hebei to implement the Program and should sustain the long-term pollution control efforts in the province.

3. The activities supported under the Program, which promote the use of formula fertilizer based on soil testing and analysis, decrease NH_3 emissions into the atmosphere. The collection and conversion of animal manure to organic fertilizer by installation of livestock waste management facilities will return carbon to the farm soils thus enhancing the carbon sink in farm soils. Also, soils with higher levels of soil carbon hold water and macronutrients such as calcium, magnesium, and potassium better than soils with low carbon and thus require lower amounts of formula fertilizers. Enhanced use of organic fertilizers would create a greater demand for animal manure and thereby reduce the significant pollution caused by NH_3 loss from unmanaged manure and the pollution of local surface and ground water from manure disposal into local streams.

4. The activities supported under the Program, which promote clean stoves that can burn fuel more efficiently, make a significant contribution to indoor and outdoor air pollution control. Replacing coal with briquettes made of compressed biomass residues to fuel stove will also reduce greenhouse gas emissions.

5. The Hebei Province had about 15 million registered vehicles in 2014 of which 1 million were yellow sticker vehicles. More than 90 percent of the yellow sticker vehicles were eliminated between 2013 and 2014. The rest will be phased out by —mid 2016. Elimination of high-pollution yellow sticker vehicles will reduce vehicular emissions. Increasing the fleet of NEVs (such as natural gas, electricity) will reduce vehicular emissions and contribute to improve air quality in the Hebei.

6. The implementation VOC controls will enhance oil and gas vapor recovery at refueling stations, and VOCs recovery from potentially hundreds of industrial enterprises, thus reducing the VOCs emission into the ambient environment.

Potential Environmental Risks

7. The activities supported under the Program are not expected to take place in environmentally sensitive areas (for example, natural habitat, protected area, and forest) or to have adverse impacts on physical cultural resources. Those activities will not involve pest management practices nor will it involve the production, storage, transport, use, or disposal of hazardous pesticides. However, certain limited environmental risks are expected as part of the implementation of activities supported under the Program. The potential environmental risks identified during the assessment are detailed in the below paragraphs.

8. **Disposal of wastes from end-of-pipe treatment facilities.** Operation of end-of-pipe treatment facilities will generate waste, which needs to be reused or disposed properly. For example, dust removal facilities in coal-fired power plants, sintering machines and pellet production equipment of iron-steel enterprises, and catalytic cracking units in oil refineries will have solid waste of fly ash. Such fly ash is a nonhazardous waste and is normally reused as construction material or disposed in landfill as general industrial solid waste. Operation of desulfurization facilities at the enterprises is primarily associated with the disposal of gypsum byproduct ($CaSO_4.2H_2O$, nonhazardous material) which is the chief component of the spent sorbent. Generally, this material could be used by construction industries. The denitrification facility commonly uses selective noncatalytic reduction, or selective catalytic reduction technology and will not have solid or liquid byproducts. NO_x emissions in the flue gas are converted into elemental nitrogen and water by injecting a nitrogen-based chemical reagent, most commonly urea or low concentrated NH_3 water in Hebei Province.

9. A review of approved environmental assessment (EA) document samples for the end-of-pipe treatment projects in China and the consultation with enterprises during the field visit have been conducted indicating that the installation of the end-of-pipe treatment facilities under the Program does not entail major retrofitting, or expansion of the existing production facilities at the enterprises.

- **Occupational health and safety.** Installation and operation of end-of-pipe treatment facilities, such as desulfurization, denitrification, and PM removal facilities in enterprises in power generation, iron and steel, petroleum and cement industries, will involve some concerns of occupational health and safety, including exposure to emission pollution, and working environment hazards. There is a risk concerning the use of liquid NH_3 or highly concentrated ammonia water as a reducing agent for denitrification facilities. According to the EPB, Hebei government has limited the use of liquid NH_3 or highly concentrated ammonia water as the reducing agent for denitrification facilities due to the potential issues of safety and fugitive NH_3 emission. Instead, Hebei EPB encourages the use of urea (a safe chemical) as the reducing agent. As the emission control facilities themselves are environmental pollution control equipment, there are no significant environmental or health risks expected to workers and general public. The safety and health issues are most likely generic issues of industrial enterprises where China's general health and safety-related regulations will be sufficient to address them.

- **Disposal of old yellow sticker vehicles.** The elimination of yellow sticker vehicles requires environmentally safe disposal. Improper dismantlement, reuse, recycling, and disposal of vehicle parts/wastes may result in adverse environmental impacts of soil, air and water pollution, as well as health impacts on dismantling plant workers. At present, there are 32 vehicle dismantling enterprises licensed by the government in Hebei Province, about half of them are not in compliance with the latest Chinese EA standards/technical specification because these enterprises were built before the effectiveness date of the latest standards/specifications. Therefore, it is possible that the disposal of yellow sticker vehicles or diesel buses under the Program would take place at the vehicle dismantling enterprises, which do not comply with applicable Chinese standards/technical specifications. To mitigate this risk, the DLI related to replacing diesel buses requires evidence that the buses were disposed in dismantling enterprises compliant with the latest Chinese EA standards/technical specification. The activities supported under the Program do not include any construction/upgrading of dismantling enterprises.

- **Livestock waste management.** The installation and operation of livestock waste management facilities will have limited negative short-term construction and long-term operational impacts and risks. During the operation phase of the facilities, long-term impacts will exist, including the disposal of livestock waste, the need for wastewater treatment, odor control, and other impacts associated with the operation and maintenance of biogas facilities and distribution pipelines. The potential risks associated with the biogas facilities have been identified as fire and explosion. These adverse environmental impacts and risks can be adequately avoided, minimized, and mitigated, with good management practice and mitigation measures in accordance with Chinese EA regulations.

- **Formulation/revision of a number of environmental laws, policies, and regulations**. The formulation/revision of environmental policies that promote environmental improvement or pollution control in some domains may have unintended negative environmental and social consequences in other domains. Therefore, environmental concerns shall be mainstreamed into the revision and formulation of laws, policies, and regulations. The policy aspects under the Program is likely to include (a) promotion of the use of high quality fuel and clean energy vehicles, and the restriction of less efficient vehicle and vehicle population; (b) strengthened enforcement of existing environmental policies; and (c) revision of existing policies or formulation of new policies. Hebei has formulated the Regulation on Public Participation in Environmental Protection in Hebei Province (HPC, 2014), which explicitly requires that, when drafting local environmental protection regulations, policies, plans, standards or development plans, economic and technical policies that may have potential environmental impacts, the drafting department and reviewing department must solicit public opinion though public comments, public hearing, and expert consultation. These opinions from experts and public must be carefully considered by the drafting and reviewing departments which must provide feedback on whether to accept these opinions or not and the reasons involved. This is a strong regulation but it has not been implemented

effectively. Measures to strengthen the application of this regulation are included in the PAP.

Potential Social Benefits and Risks

Social Benefits

10. **Overall improvements of air quality and people's living standards.** Implementation of the activities to be supported under the Program will contribute to reduce ambient PM2.5 concentration by 25 percent over its 2012 level, thereby enabling residents to breathe fresher and cleaner air, mitigating risks of diseases due to environmental deterioration, reducing disease-related expenditures, and improving people's quality of life. It is expected that mortality of air pollution-related diseases would decline significantly by 2020.

11. **Control of rural non-point-source pollution and improvement of quality of life of rural residents.** Implementation of the Program will promote integrated management of rural non-point-source pollution from fertilizer use and animal waste disposal and strengthen the ban on stalk burning and integrated use of stalk. It will reduce emissions of various pollutants from non-point-sources in rural areas of Hebei. Improvement of rural energy mix and application of various alternative materials would contribute to increasing the efficiency of new energy use, decrease indoor pollution, and improve the living conditions in rural areas.

Social Risks

12. The assessment of social risks of the activities to be supported under the Program concluded that there will not be significant social conflicts caused by those activities. However, the Program will have some social risks with regard to social sustainability, land acquisition, and ethnic minority development.

Social Risks Related to Social Sustainability and Informed Decision Making

13. In the short term, eliminating yellow sticker vehicles used for private business (12 percent of all yellow sticker vehicles) may result in the loss of original job opportunities for owners and renters of these vehicles and reduce their income to some extent. Therefore, this elimination may have negative impacts on the income of vehicle owners and renters, especially those without other skills who are unable to find new job opportunities within the short term.

14. Use of new types of fertilizers in rural areas will play a big role in increasing market competitiveness of farm produce and increasing farmers' income. However, the lack of training of farmers on how to adequately apply fertilizers will constrain its sustainable use. In addition, farmers lack understanding of rural clean energy development and utilization projects, such as biogas projects. They consider that biogas digesters do not supply sufficient gas, have difficulties in cleaning the sludge, cannot ensure safe use and involve high installation costs. These could impede, to some extent, the promotion and use of new energy and make it hard for activities supported by the Program to be sustainable.

Formulation of Policies and Regulations could Trigger Downstream Social Risks

15. Hebei Province will update its Environmental Protection Regulations and Air Pollution Control Regulations in accordance with the amended Environmental Protection Law and the Law on the Prevention and Control of Atmospheric Pollution. It will enact the Hebei Vehicle Exhaust Pollution Control Measures, Hebei Provincial Supervision and Inspection of Environmental Governance and Accountability Measures, Hebei Provincial Measures for Implementation of Grid Management in Environmental Supervision, Hebei Environmental Monitoring Measures, and other laws and regulations. It will also accelerate the introduction of emission standards for key industries, technical policies for pollution prevention and control, clean production assessment indicator system and other economic policies that are conducive to improving the air environment.

16. Formulation and revision of these policies will involve ethnic minority regions and therefore may cause job transfer or unemployment to the current workforce, as well as land acquisition to a small extent. As a result, it could have negative impacts on some people. Furthermore, social assessment, public participation, and education must be incorporated into the policymaking process, and in particular, policymakers shall pay special attention to the needs of ethnic minorities, the poor, and women.

Land Acquisition

17. The social risk assessment concluded that the activities to be supported under the Program will not lead to large-scale land acquisition and relocation. However, development and usage of clean energy in rural areas, improvement at farm level, management of pilot cities, and the implementation of air pollution prevention and control policies may involve small-scale land acquisition or occupation, which may cause a small number of affected persons to permanently or temporarily lose their land, thereby reducing their agricultural income.

Ethnic Minorities

18. The activities to be supported under the Program cover the entire Hebei Province and are likely to also take place in areas mainly occupied by ethnic minorities. Therefore, their views must be taken into account to ensure ethnic minority groups can enjoy the benefits with minimum impacts on their cultures. Such measures also apply to activities such as the elimination of yellow sticker vehicles, usage of new energy in rural areas, and land acquisition and occupation for livestock farms.

Stakeholder Consultations

19. Several consultations were carried out during the preparation of the operation. The most comprehensive one was held on March 6, 2016. The objective was for the Bank and the Hebei government to receive feedback to draft the ESSA (in Chinese and English), which was distributed beforehand to potential participants.

20. Two consultation workshops were organized, one at the provincial level and the other relates to nongovernmental organizations and individuals. The purpose of the consultation workshops was to (a) introduce the ESSA approach under the proposed PforR operation; (b) seek

opinions and feedback on the key findings and recommendations of the ESSA; and (c) identify possible recommendations for the proposed action plan. The results of the workshops were used to update the ESSA.

21. The consultation involved provincial authorities, nongovernmental organizations and individuals, especially focusing on PforR instrument, the ESSA and recommendations.

22. **Presentation and discussion.** Each consultation meeting was divided into two parts, presentation and discussion. There were two presentations, PforR instrument and the ESSA, made by the Bank team in Chinese. The DRC also provided overall information about the proposed Program. After the presentations, the Bank's team took the opportunity to receive feedback from the participants at all levels.

23. **Conclusions from the consultation.** The participants concurred with the findings of the draft ESSA and voiced their strong support in implementing the proposed Program in the province. Some of the provincial authority participants updated some data/information on the ESSA, and asked some questions on implementation of the Program. All the individuals expressed much appreciation of having the opportunity to join in the consultation process and raised questions on the Program implementation benefits. Some data and information was updated based on the feedback.

Overall Assessment

24. 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, several recommendations are made to address these shortcomings and are included in the PAP or DLIs. The summary of the assessments of relevant for the activities to be supported under the Program is presented in table 6.1.

Table 6.1. Assessment of Environmental and Social System based on the Bank PforR Policy and Directive

Policy (a). To promote environmental and social sustainability in the Program design; avoid, minimize, or mitigate adverse impacts; and promote informed decision making relating to the Program's environmental and social impacts		
Directive	**National and Provincial Systems**	**Key Findings**
Operate within an adequate legal and regulatory framework to guide environmental and social impact assessments at the Program level.	China has developed an adequate legal framework for environmental and social impact assessment, backed by a set of comprehensive laws, regulations, technical guidelines and standards, which apply nationwide. Over the decades, it has gradually evolved into a comprehensive system that is generally consistent with PforRs. The Hebei provincial and municipal EPBs have well-established institutional arrangements with qualified staff and technical expertise for managing the environmental and social impact assessment of projects.	**Consistent** The implementation of policy-level Environment Impact Assessment (EIA) is yet to be formally institutionalized.
Incorporate recognized elements of environmental and social assessment good practice, including (a) early screening of potential impacts; (b) consideration of strategic, technical, and site alternatives (including the 'no action' alternative); (c) explicit assessment of potential induced, cumulative, and transboundary impacts; (d) identification of measures to mitigate adverse environmental or social impacts that cannot be otherwise avoided or minimized; (e) clear articulation of institutional responsibilities and resources to support implementation of plans; and (f) responsiveness and accountability through stakeholder consultation, timely dissemination of the Program information, and responsive grievance redress measures.	The Chinese EIA system has well-defined guidelines covering screening, alternative analysis, impact assessment, mitigation measures, management plan, and consultation.	**Consistent** The implementation of local environmental management system may not be adequate in certain aspects, especially the enforcement of environmental compliance in rural areas, for example, on-site supervision of environmental enforcement team to livestock farms in rural areas can be as less as twice a year. Therefore, a strong capacity building for the environmental enforcement team in rural areas is needed.
Policy (b). To avoid, minimize, or mitigate adverse impacts on natural habitats and physical cultural resources resulting from the Program		
Directive	**National and Provincial Systems**	**Key Findings**
Includes appropriate measures for the early identification and screening of potentially important biodiversity and cultural resource areas	The EIA guidelines provide detailed guidance on identification and screening of sensitive environmental and cultural resources, including survey of baseline environmental situation such as geology, surface water, wild life, forest, wetland, fishery, rare and endangered species, and nature reserves. Key sensitive areas such as rivers, reservoirs, nature reserves, wetland parks, forest parks, scenic areas are identified for detailed survey	**Consistent** Important biodiversity and cultural resource areas will not be involved in this Program.

	and special assessment. Cultural resources are screened through consultation/approval of relevant authority and field investigation.	
Support and promote the protection, conservation, maintenance, and rehabilitation of natural habitats; avoid the significant conversion or degradation of critical natural habitats; and if avoiding the significant conversion of natural habitats is not technically feasible, include measures to mitigate or offset the adverse impacts of the Program activities.	The Chinese environmental protection system emphasizes the protection, maintenance, and rehabilitation of natural habitats. Avoiding such sensitive areas is the top priority of the EIA, and where inevitable, special assessment is mandatory and necessary mitigation or offset measures are to be developed in the environmental management plan.	**Consistent** The activities supported under the Program do not take place on sensitive environmental sites/areas.
To consider potential adverse effects on physical cultural property and provide adequate measures to avoid, minimize, or mitigate such effects	The Cultural Property Protection Law provides adequate legal framework and procedures for protecting cultural property during the EA process. If any physical cultural resource is affected, impacts must be assessed, consultation and approval must be secured with cultural property authority, and protection measures must be included in the environmental management plan.	**Consistent** The activities supported under the Program do not take place in areas with existing physical cultural resources.
Policy (c). Protect public and worker safety against the potential risks associated with (i) construction and/or operations of facilities or other operational practices under the Program; (ii) exposure to toxic chemicals, hazardous wastes, and other dangerous materials under the Program; and (iii) reconstruction or rehabilitation of infrastructure located in areas prone to natural hazards.		
Directive	**National and Provincial Systems**	**Key Findings**
Promote adequate community, individual, and worker safety through the safe design, construction, operation, and maintenance of physical infrastructure; or in carrying out activities that may be dependent on such infrastructure, incorporate safety measures, inspections, or remedial works as appropriate.	China has established a comprehensive management and supervision system for work safety. This system ensures the screening of safety issues and occupation hazards, assessment of work safety, and assessment of occupational disease hazard during project preparation, design and construction completion acceptance of work safety and health facilities, and supervision during operation. Hebei has a comprehensive five-level governmental organizational setup for occupational health and work safety management and supervision, with well-established laws, regulations, procedures and enforcement arrangement.	**Consistent** While compared with the large number of industrial enterprises (about 10,000 enterprises in Hebei), the resources and capacity of administration of work safety at various levels (especially at district/county level) are inadequate, and need to be strengthened.
Promote the use of recognized good practice in the production, management, storage, transport, and disposal of hazardous materials generated under the Program; promote the use of integrated pest management practices to manage or reduce pests or disease vectors; and provide training for workers involved in the production, procurement, storage, transport, use, and disposal of hazardous	The legal system in China provides a comprehensive framework in managing hazardous materials, which requires special permit systems for production, storage and sale of dangerous chemicals with requirements of adoption of good and compliance management practices. It also enforces the training of workers involved in handling dangerous chemicals by requiring a mandatory certificate before engaging them in the job.	**Consistent** The activities supported under the Program do not involve any relevant storage and sale of dangerous chemicals including pesticide

chemicals in accordance with the relevant international guidelines and conventions.		
To include adequate measures to avoid, minimize, or mitigate community, individual, and worker risks when the Program activities are located in areas prone to natural hazards such as floods, hurricanes, earthquakes, or other severe weather or climate events.	The EIA and work safety systems cover the environmental and work-related risk assessment and require necessary measures to be incorporated into the project design and implementation. In addition, China has established other risk assessment systems for projects that are prone to flood and natural hazards (for example geo-hazards, earthquakes) as part of project approval procedures.	**Consistent**
Policy (d). manage land acquisition and loss of access to natural resources in a way that avoids or minimizes displacement, and assist the affected people in improving, or at the minimum restoring, their livelihoods and living standards;		
Directive	**National and Provincial Systems**	**Key Findings**
To avoid or minimize land acquisition and related adverse impacts; identify and address economic and social impacts caused by land acquisition or loss of access to natural resources, including those affecting people lacking full legal rights to resources they use or occupy	The effort of avoiding or minimizing land acquisition is achieved through both technical design of any project including project feasibility study and preliminary design and relevant land department review process, including preliminary verification. The main focus of preliminary verification is to ensure compliance with regional and local land use planning, and safeguard the primary farmland.	**Consistent**
	Where it is not feasible to avoid resettlement, ensure that the original living standards of the affected people are not lowered and their long-term livelihoods are guaranteed. It sets up a strict procedure for approving land acquisition for investment projects. Failing to pass the preliminary verification, the party concerned shall not be approved to convert the land for agricultural use into that for construction use or to have the land requisitioned nor shall it be permitted or to go through the land supply procedures.	**Consistent**
	Under the existing land acquisition procedures, the potential social and economic impacts caused by land acquisition is addressed by engaging affected villages in the process of land impact survey, confirming surveyed outcome, conducting public hearing, establishing unified compensation rates by provincial government, and providing employment opportunities and social security coverage for land loss farmers.	The current legal framework on land acquisition in China is well established to ensure affected people are assisted in improving or at least restoring their livelihood and living standards.
	For those affected people who may lack full legal rights to assets or resources they use or occupy, although the existing laws or regulations do not provide clear entitlements, in the actual implementation, depending on actual condition, certain level of compensation is often provided following negotiation with affected parties. Information related to land acquisition disclosed and disseminated on time and effectively through public media.	The economic and social impacts caused by land acquisition or loss of access to natural resources are fully investigated and compensated.
Provide compensation sufficient to purchase replacement assets of equivalent value and to meet any necessary transitional expenses, paid	Land compensation is provided based on prices of land blocks or unified annual output value of land and is adjusted every 2–3 years.	**Consistent** Land compensation is adequate for livelihood restoration, of

before taking land or restricting access.	Engage qualified evaluation agencies to evaluate attachments to the affected land, develop compensation plan and sign final compensation agreements with the affected households. Specified types of temporarily occupied land and duration of occupation (up to 2 years) and give compensation to the affected people. Clearly specified that buildings can be acquired through cash compensation and property rights swap. Market prices are used for cash compensation.	appfected people; replacement price are used for housing cash compensation.
Provide supplemental livelihood improvement or restoration measures if taking of land causes loss of income-generating opportunity (for example, loss of crop production or employment).	Land policies system requests to use of multiple resettlement channels, including (a) agriculture-based resettlement; (b) employment-based resettlement; (c) shareholding-based resettlement; and (d) relocation-based resettlement. In addition, policies have specified provision of endowment insurance and employment training to affected farmers. Hebei's existing endowment insurance policies targeting at land-taken farmers no longer applicable due to low insurance benefits. New policies are under development. The Land Contract Law specifies that women enjoy equal rights as men to contracting rural land; no special regulations governing provision of assistance to vulnerable groups affected by land acquisition.	**Consistent** Used multiple compensation and livelihood approaches during implementation.
Restore or replace public infrastructure and community services that may be adversely affected by the Program.	There are requirements for titling, registration, and announcement of land to be acquired and organizing hearings for the land.	**Consistent** Developed relevant regulations on disclosing information related to land acquisition
Policy (e). Give due consideration to the cultural appropriateness of, and equitable access to Program benefits, giving special attention to the rights and interests of the indigenous peoples and to the needs or concerns of vulnerable groups.		
Directive	**National and Provincial Systems**	**Key Findings**
Undertake free, prior, and informed consultations if the indigenous peoples are potentially affected (positively or negatively), to determine whether there is broad community support for the Program activities.	The current legal framework supports the lawful rights and interests of the minority nationalities and upholds and develops a relationship of equality, unity and mutual assistance among all of China's nationalities, Disclosed relevant information through radio, TV and the Internet (considering account languages of ethnic minorities) ; Posted relevant information at ethnic minority villages and on community bulletin boards; disseminated relevant information through community and village committees; communities and village collectives organized villagers' meetings to discuss project-related issues.	**Consistent** A series of measures have been taken to conduct public consultation and participation activities, but there no specific policy requirement for any development intervention to carry out prior, free, and informed consultation with minority communities, and to obtain broad community

		support. The activities to be supported under the Program, which may involve ethnic minorities, are voluntary. The issue to be addressed under the Program is of adequate communication and coverage to ensure that those communities have equal opportunity to participate in those activities
Ensure that the indigenous peoples can participate in devising opportunities to benefit from exploitation of customary resources or indigenous knowledge, the latter (indigenous knowledge) to include the consent of the indigenous peoples.	Policies formulated to guarantee freedom of religious belief of all ethnic groups; develop unique languages; increase financial inputs in cultural undertakings, strengthen construction of cultural facilities and accelerate development of various cultural undertakings; strengthen protection and rescue of physical cultural resources; inherit and develop traditional cultures of ethnic minorities. Ethnic minority development and project management are responsibilities of Hebei Provincial Department of Ethnic and Religious Affairs and bureaus of ethnic and religious affairs of all counties in the province. During daily work, an organizational structure has taken shape, which comprises ethnic and religious affairs, finance, environmental protection and other relevant authorities, whose roles and responsibilities are clearly defined and who collaborate with each other, hold joint meetings every year, supervise and inspect implementation of relevant activities and address relevant issues.	**Consistent** There is an efficient organization structure; the Hebei government Leading Group does not include the department and county bureaus of ethnic and religious affairs. This should be considered during the implementation of the Program in case of new activities are identified to take place in areas occupied mainly by ethnic minorities
Give attention to groups vulnerable to hardship or disadvantage, including as relevant the poor, the disabled, women and children, the elderly, or marginalized ethnic groups and, if necessary, take special measures to promote equitable access to the Program benefits	Financial and project support focused on autonomous counties; relocation of people living in areas lacking basic existence conditions, areas prone to natural disasters and ecological protection zones; local counterpart funds allocated by higher-level authorities in proportion to national subsides. There is an established system in China for local government to provide support to urban and rural low-income households, including various vulnerable groups. Such support includes cash income to meet the minimum living allowance for the group and in-kind support on different aspects of daily expenses, such as reduction or waive of electricity tariff and heating cost.	**Consistent**

Annex 7: Systematic Operations Risk Rating (SORT)

China: Hebei Air pollution Prevention and Control Program (P154672)

1. The overall risk rating is substantial.

2. **Technical design of the Program.** The assessment found that the activities to be supported by the Program are technically sound. While areas for improvements have been identified, technical assistance will be provided to enhance its implementation and improve capacity. To ensure adequate mitigation of this risk measures to improve technical performance have been included in the DLIs.

3. **Institutional capacity for implementation and sustainability**. The GoC is committed to air quality management from the top-level leadership. Adequate public funding has been earmarked to support the air quality agenda. The assessments identified few areas that require capacity building. However, this the first PforR in China using government systems and while mitigation measures have been proposed, Hebei might find some difficulty on implementing them.

4. **Fiduciary.** This risk is rated as Substantial. This is due to the following: (a) the current preparation of the Program's financial reports is not standardized which affects its accuracy and reliability, (b) the Program financial report is not subject to financial audit; and (c) while Hebei agreed to comply with the requirement of the Bank's debarment/temporary suspension lists, there is a risk that this requirement may not be followed consistently at all levels of government. To mitigate these risks, measures have been included in the PAP. More details about the risks identified in the fiduciary assessment and the recommendation to address them are presented in annex 5.

5. **Environment and social.** The ESSA (summary presented in annex 6) concluded that, in general, the rules and regulations are consistent with the Bank's PforR policy and the Bank's PforR Directive, but the capacity of few agencies to effectively enforce certain regulations could be improved. To mitigate these risks measures have been included in the PAP or DLIs.

6. **Stakeholders.** Participants on the consultations on the draft ESSA concurred with the findings of the draft ESSA and voiced their strong support in implementing the proposed Program in the province.

Systematic Operations Risk-Rating Tool (SORT)	
Risk Category	**Rating (H, S, M, L)**
Political and Governance	L
Macroeconomic	M
Sector Strategies and Policies	L
Technical Design of Program	M
Institutional Capacity for Implementation and Sustainability	S
Fiduciary	S

Environment and Social	S
Stakeholders	L
OVERALL	**S**

Annex 8: Program Action Plan

Action Description	DLI*	Covenant*	Due Date	Responsible Party	Completion Measurement*
Training is provided to no less than 480 monitoring and enforcement staff at the EPB at all levels.	☐	☒	June 30, 2017	Hebei EPB	Training records to be submitted to the Bank
Training is provided to no less than 60 work safety supervision staff.	☐	☒	December 31, 2017	Administration of Work Safety offices	Training records to be submitted to the Bank.
A GRM is established at the provincial level with staff appointed at the HAP leading group office. The operation structure and protocols and a complaint hotline, is made available to public.	☐	☒	December 31, 2016	Hebei EPB	Telephone hotline established, and the number is made available on a publicly accessible website. Records of operation log of at least one month and one case example is submitted to the Bank.
Report to the Bank of any credible and material allegations of fraud/and/or corruption regarding the Program; and no persons or entities debarred or suspended by the Bank are awarded a contract under the Program.	☐	☒	September 30, 2016 (for the official notification) Semi-annually (for the Program reports)	Hebei FB	Official notification is sent to all agencies responsible for the ear-marked fund with the requirement of following the Bank's Anti-Corruption Guidelines, a list of debarred firms by the Bank and restriction of procurement involving the firms on the list. Program reports including all credible and material allegations of fraud/and/or corruption received regarding the Program.
The CNAO to develop audit TOR and enable required Program financial statement audit report timely issued, acceptable to the Bank	☐	☒	December 31, 2016	CNAO	Audit TOR acceptable to the Bank to be submitted to the Bank

Action Description	DLI*	Covenant*	Due Date	Responsible Party	Completion Measurement*
Program's implementation status should be disclosed publicly on annual basis.	☐	☒	March 15, 2017	Hebei EPB	Plan and Implementation report of 2016 to be published on publicly accessible website

Note: This is an indicative template; task teams may adapt this template to meet the specific requirements of their operation.

* This column should indicate the reference, if any, to either one of the Program DLIs or legal covenants (or both) as appropriate.

** This column should indicate the agreed basis to determine if the action has been satisfactorily completed.

Annex 9: Implementation Support Plan

Strategy and Approach for Implementation Support

1. Implementation of this operation will require considerable focused support from the Bank team. This is the first multisectoral Program and the first PforR to a subnational entity in China. It is expected that there will be a learning curve for the government agencies involved in the implementation of the Program. This annex lays out the key activities to address risks defined in the integrated risk assessment and provide the technical assistance needed to improve the quality of Program implantation.

2. Bank implementation support will include (a) reviewing implementation progress (including that of the PAP) and achievement of Program results and DLIs; (b) monitoring the adequacy of system performance and compliance with fiduciary and environmental and social requirements; and (c) providing ongoing technical support.

3. **Technical support.** The Bank team including staff from across the practices has provided extensive technical expertise during preparation. The Bank team will continue to provide technical support during implementation to ensure that the agreed improved practices and protocols will be implemented accordingly. This support will done in collaboration with the PMEH and the Energy Sector Management Assistance Program.

4. In addition, Bank plans to mobilize US$4.5 million as part of the US$18 million GEF project Developing Market-Based Energy Efficiency Program in China under preparation. This potential parallel grant funding would support local capacity building, proactive outreach, and independent third-party verification of the results to complement this PforR.

5. **Fiduciary support.** The implementation support from procurement and the financial management team will focus on reviewing and monitoring the compliance with the government own systems and the actions defined in the PAP. The implementation support will also provide technical assistance to address the few shortcomings identified during the assessment, especially about the audits, and reporting expenditures.

6. **Environmental and social aspects.** The Bank team will provide guidance to the agencies to ensure the completion of the actions agreed in the PAP.

Implementation Support Plan

7. Most Bank team members will be based in the China Country Office, located in Beijing. This will ensure rapid and effective response to borrower's needs for implementation support. In addition, a few Washington-based staff and international consultants would also be part of the task team to bring global technical experience to the operation. Formal implementation support missions and field visits covering all aspects of implementation will be carried out periodically during implementation. Estimated inputs from different specialists at different stages of implementation are outlined in table 9.1.

Table 9.1. Implementation Support Input Requirements

Time	Focus	Skills Needed	Resource Estimate	Partner Role
First twelve months	• Team and program leadership • Technical implementation support • Financial management and procurement • Environmental and social aspects implementation support • Results M&E and verification of DLIs • Capacity building	• Technical • Financial management • Procurement • Environmental and social aspects	6–8 staff, 3 trips per staff	n.a.
12–30 months	• Technical implementation support • Financial management and procurement • Environmental and social aspects implementation support • Results M&E and verification of DLIs	• Technical • Financial management • Procurement • Environmental and social aspects	6–8 staff, 1–2 trips per staff per year	n.a.

Table 9.2. Task Team Skills Mix Requirements for Implementation Support

Skills Needed	Number of Staff Weeks	Number of Trips	Comments
General technical support on air quality management, coordination and general project management	20	5–8	The focus will be technical and team leadership, conducting focal liaison and communications with the client, and tracking of the overall program results delivery. Country-based staff may travel more frequently for short visits/meetings to provide the client rapid support.
Air emissions and control management	16	5	Focus will be on assisting the client on establishing the standards for CEM and technical connection of the unified system. Country-based staff may travel more frequently for short visits/meetings to provide the client rapid support.
Air planning and modeling	16	5	Focus will be on bringing international expertise in cost-benefit analysis and source apportionment methodologies. Workshops may be organized. Country-based staff may travel more frequently for short visits/meetings to provide the client rapid support.
Agriculture and fertilizer	4–6	5	Initial focus will be on assisting the responsible authorities to developing the NUE testing and sampling protocols and plans. Country-based staff may travel more frequently for short visits/meetings to provide the client rapid support.
Household stove	4–6	5	Initial focus will be on assisting the client to complete testing of the currently eligible stoves, and eventually move onto revision of the standards and protocols followed by dissemination and training efforts within the province. Country-based staff may travel more frequently for short visits/meetings to provide the client rapid support.
Vehicle emissions control	4	4	Focus will be on supporting the client on the technical assistance studies of transport-sector measures for emissions control. Country-based staff may travel more frequently for short visits/meetings to provide the client rapid support.
Financial management and budget	4–6	3–5	Focus will be on assisting the client to address all the measures agreed in the PAP and M&E of the outcome of such measures.

Skills Needed	Number of Staff Weeks	Number of Trips	Comments
Procurement	4–6	3–5	Focus will be on assisting the client to address all the measures agreed in the PAP and M&E of the outcome of such measures.
Environmental safeguards	2–4	3–5	Focus will be on assisting the client to address all the measures agreed in the PAP and M&E of the outcome of such measures.
Social safeguards	2–4	3–5	Focus will be on assisting the client to address all the measures agreed in the PAP and M&E of the outcome of such measures.

Role of Partners in Program Implementation There are no areas for technical cooperation with partners identified for this operation in Hebei.