ADB

Technical Assistance Report

Project Number: 49388-001
Policy and Advisory Technical Assistance (PATA)
December 2015

People's Republic of China: Developing Cost-Effective Policies and Investments to Achieve Climate and Air Quality Goals in the Beijing–Tianjin–Hebei Region

Asian Development Bank

CURRENCY EQUIVALENTS
(as of 30 November 2015)

Currency unit	–	yuan (CNY)
CNY1.00	=	$0.1563
$1.00	=	CNY6.3964

ABBREVIATIONS

ADB	–	Asian Development Bank
BTH	–	Beijing–Tianjin–Hebei
CO_2	–	carbon dioxide
C-REM	–	China Regional Energy Model
ETS	–	emissions trading system
MIIT	–	Ministry of Industry and Information Technology
PRC	–	People's Republic of China
REACH	–	Regional Energy Air Quality Climate and Health
TA	–	technical assistance

NOTE
In this report, "$" refers to US dollars.

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CONTENTS

POLICY AND ADVISORY TECHNICAL ASSISTANCE AT A GLANCE

1. Basic Data — **Project Number:** 49388-001

Project Name	Developing Cost-Effective Policies and Investments to Achieve Climate and Air Quality Goals in the Beijing–Tianjin–Hebei Region	**Department /Division**	EARD/EAEN
Country	China, People's Republic of	**Executing Agency**	Department of Energy Conservation and Resources Utilization Ministry of Industry and Information Technology

2. Sector	**Subsector(s)**	**ADB Financing ($ million)**
✓ Energy	Conventional energy generation	0.10
	Energy efficiency and conservation	0.50
Industry and trade	Large and medium industries	0.15
	Total	**0.75**

3. Strategic Agenda	**Subcomponents**	**Climate Change Information**	
Inclusive economic growth (IEG)	Pillar 1: Economic opportunities, including jobs, created and expanded	Mitigation ($ million)	0.75
Environmentally sustainable growth (ESG)	Environmental policy and legislation	CO_2 reduction (tons per annum)	15,000,000
	Global and regional transboundary environmental concerns	Climate Change impact on the Project	Low
	Natural resources conservation		
	Urban environmental improvement		

4. Drivers of Change	**Components**	**Gender Equity and Mainstreaming**	
Knowledge solutions (KNS)	Application and use of new knowledge solutions in key operational areas	No gender elements (NGE)	✓
	Knowledge sharing activities		

5. Poverty Targeting		**Location Impact**	
Project directly targets poverty	No	Rural	Medium
		Urban	High

6. TA Category: B

7. Safeguard Categorization Not Applicable

8. Financing

Modality and Sources	**Amount ($ million)**
ADB	**0.75**
Policy and advisory technical assistance: Technical Assistance Special Fund	0.75
Cofinancing	**0.00**
None	0.00
Counterpart	**0.00**
None	0.00
Total	**0.75**

9. Effective Development Cooperation

Use of country procurement systems	No
Use of country public financial management systems	No

I. INTRODUCTION

1. One of the core regions in the People's Republic of China (PRC) for coordinated climate, clean energy, and environmental policy making is the Beijing–Tianjin–Hebei (BTH) region.[1] In 2013, the Government of the PRC promulgated its Action Plan for Air Pollution Prevention and Control, 2013–2017, and committed vast amounts of public funds to improve air quality in the region.[2] While measures under the action plan have reaped remarkable results to date, sustainable and inclusive growth will require long-term engagement. Policies and investments need to be coordinated more effectively to achieve climate and air quality goals without prohibitive costs that may damage economic growth.

2. The proposed policy advisory technical assistance (TA) for Developing Cost-Effective Policies and Investments to Achieve Climate and Air Quality Goals in the Beijing–Tianjin–Hebei Region was conceptualized in October 2015 with strong support from the Ministry of Industry and Information Technology (MIIT). The TA concept paper was approved on 4 December 2015. During the fact-finding mission in November 2015, the Asian Development Bank (ADB) reached an understanding with the Government of the PRC regarding the impact, outcome, outputs, implementation arrangements, cost, financing arrangements, and outline terms of reference for the TA. The design and monitoring framework is in Appendix 1.[3]

II. ISSUES

3. The BTH region is home to 109.2 million people and accounted for 10% of the PRC's gross domestic product in 2014.[4] Since the 1990s, accelerated economic growth in the region has been accompanied by a disproportionately high increase in primary air pollutant emissions and degradation in air quality. In many respects, this region is a microcosm of the broader national economy and associated challenges. Poor air quality dominates the region. The rapid deterioration of air quality since 2005 has drawn global attention, prompting the government to adopt the action plan.

4. The action plan aims to cut the level of fine particulate matter in the BTH region by 25% from the 2012 level (with the provincial implementation plan aiming reductions of up to 33% in some Hebei cities), targeting annual concentration of fine particulate matter in Beijing of 60 micrograms per cubic meter by 2017. The action plan recognizes that to achieve sustainable, long-term air quality improvements in the BTH region, industrial transformation of heavy industries and the power sector, as well as productivity enhancing measures, are essential.[5]

5. Climate policy in the PRC is equally focused on heavy, carbon-intensive industries and the power sector, which, combined, account for more than 80% of the country's total carbon dioxide (CO_2) emissions. Prominent among these climate policies are a national industrial

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[1] The BTH region refers to Beijing and Tianjin municipalities and Hebei province. However, Shandong and Shanxi provinces and the Inner Mongolia autonomous region are often associated with the BTH region because of their proximity to this region.

[2] State Council of the PRC. 2013. *Action Plan on Prevention and Control of Air Pollution, 2013–2017*. Beijing.

[3] The TA first appeared in the business opportunities section of ADB's website on 26 November 2015.

[4] The extended BTH region covering surrounding provinces (footnote 1) is home to 267.8 million people and accounts for 25.7% of gross domestic product, which amounted to CNY14.63 trillion in 2014.

[5] The action plan comprises 10 measures with 30 actions, including (i) enhancing the overall treatment and reducing the discharges of multiple pollutants in the power and industrial sectors; (ii) adjusting and optimizing the industrial structure and promoting the upgrade of economic transition toward a clean production process; (iii) speeding up the technological reform of enterprises and improving the capability of scientific innovation; and (iv) accelerating the adjustment of the existing energy structure and increasing the supply by clean energy technologies.

energy conservation program, inefficient capacity phase-out initiatives, and an emissions trading system (ETS) for CO_2. Energy conservation programs include the Top 1,000 (11th Five-Year Plan) and Top 10,000 (12th Five-Year Plan) Programs, which have supported the achievement of national energy and CO_2 intensity targets. These programs have been complemented by efforts to phase out inefficient, backward capacity, including some of the most heavily polluting installations. Multiple ETS designs have been pilot-tested in seven cities and provinces, including Beijing and Tianjin, during 2013–2015. To support the PRC's goal to peak national CO_2 emissions by 2030 or earlier, a national ETS for CO_2 has been announced to begin in 2017, focusing on large enterprises in several of the country's most energy-intensive sectors.

6. To date, measures under the action plan and climate and clean energy policies have achieved notable successes, but a lack of coordination among them has raised questions regarding their cost-effectiveness. These issues are even more challenging in the BTH region, where individual municipalities and provinces are at different development stages and thus have varying capacities to manage policy implementation. The weakest among them in terms of capacity, Hebei Province has a daunting task of managing a multitude of policy actions and large investments. Assessments of interplays among low-carbon and clean air policies in different sectors—such as energy, transport, agriculture, urban construction, and waste management—on a common analytical platform have become essential to fully capture co-impacts and identify proper sequencing of interventions. Otherwise, planned interventions could produce suboptimal outcomes. The absence of this critical analytical work is likely to pose further risks, especially as the ETS rollout seems imminent.

7. For cost-effective policy coordination and formulation of investment programs for the next phase of the government's action plan, policy makers need to assess (i) how well companies in the BTH region are responding to existing directives under the action plan and climate and clean energy policies, (ii) how these policies are interacting with each other in the region, (iii) what constraints and barriers companies in the BTH region face in implementing these policies, (iv) to what extent the policies' effectiveness may be improved in spurring low-carbon innovations in technology and behavior at the company level, (v) what complementary policies or measures are required to incentivize management and behavioral changes, and (vi) the implications for future coordinated policy design to enable system wide low-carbon energy transformation. In particular, policy makers need to understand how newly pilot-tested market-based measures, in particular the ETS, will interact with existing policies and institutions, and how their potential as a tool for enabling energy system transformation and related co-benefits can be maximized.

8. The proposed TA will use, expand, and tailor an existing model to the BTH region to support the government in (i) assessing the interaction of climate and clean air policies; (ii) capturing co-benefits and identifying synergies between policies across sectors; (iii) taking measures that are cost-effective and well-coordinated within the BTH region; (iv) identifying policy and management approaches that strengthen incentives for plant-level compliance with energy transformation and environmental objectives; (v) projecting the impact of incentives created by market-based instruments to be established, such as the national ETS; and (vi) studying the health impacts of policies.

9. The study is timely, as the action plan is well advanced and will approach completion of its initial phase in 2017, while the preparation of its second phase (2018–2022) is expected to commence in 2016. The TA will help the government to formulate cost-effective policies and high-impact interventions for the subsequent phase of the action plan.

10. Cost-effective policies and investments to achieve climate and air quality goals in the BTH region are of high importance for the government. During the country programming meeting in August 2015 in Beijing, the government and ADB agreed to provide long-term and scaled-up support to address air quality issues in the BTH region. Immediate support includes three TA projects and one sovereign loan on air pollution, balanced economic and social development, and low-carbon transport. [6]

III. THE PROPOSED POLICY AND ADVISORY TECHNICAL ASSISTANCE

A. Impact and Outcome

11. The impact will be carbon intensity reduction and air quality improvement in the BTH region accelerated in accordance with the action plan.[7] The outcome will be more cost-effective policies and investments to improve air quality and reduce CO_2 emissions in the BTH region.

B. Methodology and Key Activities

12. The key outputs of the TA include (i) adequacy of model framework assessed and improved; (ii) constraints for effective policy implementation analyzed and synthesized; (iii) interplays of climate and air quality co-benefits in the BTH region and their sequencing assessed; and (iv) a set of policy recommendations and investment choices for the BTH region prepared.

13. Key activities under the TA include the following:

(i) adapt the integrated assessment framework of the China Regional Energy Model (C-REM) and the Regional Emission Air Quality Climate and Health (REACH) model for the BTH region to quantify in detail the expected benefits of existing policies; [8]
(ii) prepare case studies of industry responses to climate and clean energy initiatives across the BTH region to understand the financial and economic costs of existing policies and barriers that delay or suboptimize responses to climate, clean energy, and/or clean air policies at industry level;
(iii) synthesize case study results and adapt model parameters accordingly;
(iv) derive a stronger climate, clean energy, and air pollution policy coordination strategy that integrates plant-level feedback to improve and enhance policy formulation and specific investments; and

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[6] The three TA projects are (i) ADB. 2015. *Technical Assistance to the People's Republic of China for Beijing–Tianjin–Hebei Air Pollution Control.* Manila; (ii) ADB. 2015. *Technical Assistance to the People's Republic of China for the Policy Study on the Development of Intercity Railway in the Beijing–Tianjin–Hebei Region*. Manila; and (iii) ADB. Forthcoming. *Technical Assistance to the People's Republic of China for the Study on the Coordinated Development of Beijing–Tianjin–Hebei*. Manila. The sovereign loan is ADB. 2015. *Report and Recommendation of the President to the Board of Directors: Proposed Policy-Based Loan to the People's Republic of China for the Beijing–Tianjin–Hebei Air Quality Improvement–Hebei Policy Reforms Program.* Manila.

[7] State Council of the PRC. 2013. *Action Plan on Prevention and Control of Air Pollution, 2013-2017*. Beijing.

[8] C-REM is a multiregion, multisector, recursive-dynamic, computable general equilibrium model that includes national or subnational detail in the PRC. The primary goal of the model is to simulate existing and proposed energy and climate policies in the PRC to analyze their impact on technology, interfuel competition, the environment, and the economy within a global context. The REACH model enables the evaluation and projection of the cumulative effects of efforts to improve air quality on energy use, human health, and economic productivity. Both models were co-developed by Tsinghua University and the Massachusetts Institute of Technology. This model suite will be adjusted to the BTH region. Initial focus of the analysis will be the energy and transport sectors.

(v) identify cost-effective policy actions and investment flows that provide optimized and climate change mitigation and air quality impacts.

14. ADB's Midterm Review of Strategy 2020 emphasizes support for achieving environmentally sustainable growth.[9] Strengthening developing member countries' climate change mitigation and low-carbon growth measures has been identified as one of the key means of addressing climate change issues. ADB's country partnership strategy, 2011–2015 for the PRC identified environmentally sustainable growth as one of the three pillars of ADB assistance to the PRC.[10] The TA will promote cost-effective policy measures addressing CO_2 emissions and air pollution reduction.

15. Major risks are (i) delay in the policy implementation of cost-effective policies in the BTH region, (ii) local industry resistance to adopting the proposed policies, and (iii) difficulty in obtaining an accurate air pollution inventory for the region. To mitigate these risks, all policy-making agencies beyond the current executing and implementing agencies will be well informed and consulted when developing cost-effective policies, local industries will be included in capacity development training and workshops, and ADB and all executing and implementing agencies for various TA projects in support of clean air development in the BTH region will maintain close coordination at all stages.

C. Cost and Financing

16. The TA is estimated to cost $850,000, of which $750,000 will be financed on a grant basis by ADB's Technical Assistance Special Fund (TASF-other sources). The government will provide counterpart support in the form of remuneration and per diems for counterpart staff, including counterpart staff's time, remuneration and travel expenses; logistics support in arranging workshops and conferences; a fully functional office; and other in-kind contributions.

D. Implementation Arrangements

17. The executing agency will be the MIIT's, Department for Energy Conservation and Resources Utilization. The implementing agencies will be the provincial and municipal arms of MIIT entities in the BTH region. The collaboration with MIIT is important as the ministry will (i) facilitate access to industries and industrial managers for TA consultants, a key barrier for successful TA implementation; and (ii) be instrumental for adopting and implementing coordinated industrial transformation policies in the region.

18. Selection of a suitable model is the key to successful TA implementation. Selection of any model has to be through single-source selection because each model is proprietary and can best be operated by its developers and owners. The proposed TA will use the C-REM–REACH integrated assessment framework (footnote 8), which proved valuable in formulating two recent ADB studies on climate change in the PRC and is considered to be the most appropriate to capture all key sectors and major contributors for air pollution and CO_2 emissions.[11] Single-

[9] ADB. 2014. *Midterm Review of Strategy 2020: Meeting the Challenges of a Transforming Asia and the Pacific, 2008–2020*. Manila.

[10] ADB. 2012. *Country Partnership Strategy: People's Republic of China, 2011–2015*. Manila.

[11] ADB. 2012. *Technical Assistance to the People's Republic of China for the Road Map for Carbon Capture and Storage Demonstration and Deployment*. Manila; and ADB. 2014. *Technical Assistance to the People's Republic of China for Strategic Analysis and Recommendations for Achieving the 2020 Low-Carbon Goal*. Manila. Tsinghua experts were engaged as individual consultants and through sub-contract, respectively, for conducting necessary modelling and analysis.

source selection of Tsinghua University, representing the Tsinghua–Massachusetts Institute of Technology China Energy and Climate Project, is therefore appropriate and presents a clear advantage over competition in accordance with ADB's Guidelines on the Use of Consultants (2013, as amended from time to time). To improve efficiency and value for money, consulting services under the TA will be engaged on an output-based contract. Disbursements will be made in accordance with the *Technical Assistance Disbursement Handbook* (2010, as amended from time to time). Procurement under this TA will be done in accordance with ADB's Procurement Guidelines (2015, as amended from time to time).

19. The Tsinghua–Massachusetts Institute of Technology team will provide 51 person-months of consulting services, which will involve three international consultants (15 person-months) and six national consultants (36 person-months). The international consultants comprise a clean energy–clean air nexus expert, an econometrician with experience in quantitative economic research and modeling, as well as an energy and environmental policy expert. The national consultants comprise (i) a clean energy–clean air nexus expert, (ii) a project coordinator, (iii) an environmental policy and management expert, (iv) an expert in air quality modeling and health impact, (v) a low-carbon energy and climate policy expert, and (vi) an econometrician. In addition, one reputable international expert in quantitative energy economic research (4 person-months) shall be engaged through individual consultant selection to assess the model framework and review TA results from time to time, and act as a resource person for TA workshops. The outline of the consultant terms of reference is in Appendix 3.

20. A cross-divisional TA team of ADB specialists will work with the consultants. The ADB team will ensure a dialogue and an exchange of information between ADB and the consultants for various TA projects in the BTH region to maximize information sharing, discussion of interim results, and coordination of policy recommendations with ADB.

21. To ensure that relevant agencies benefit widely from TA outputs in their preparation of the action plan's subsequent phase, an effective coordination mechanism will be established through which key ministries and government agencies with low-carbon and clean air policy-making responsibilities for the BTH region will be consulted on TA outputs.[12] High-level roundtables, workshops, and seminars will be organized, to which representatives of relevant agencies will be invited to share information on and discuss interim TA results. ADB and the executing agency will cooperate closely in organizing and managing these gatherings.

22. The TA will be implemented from 11 January 2016 to 11 March 2018. The consultants will be required to submit TA deliverables and progress reports on time. Detailed requirements for deliverables and reports are included in the outline terms of reference for consultants in Appendix 3.

IV. THE PRESIDENT'S DECISION

23. The President, acting under the authority delegated by the Board, has approved the provision of technical assistance not exceeding the equivalent of $750,000 on a grant basis to the Government of the People's Republic of China for Developing Cost-Effective Policies and Investments to Achieve Climate and Air Quality Goals in the Beijing–Tianjin–Hebei Region, and hereby reports this action to the Board.

[12] The key agencies involved will include the BTH coordination committee, the Ministry of Environmental Protection, the Ministry of Finance, and the National Development and Reform Commission.

DESIGN AND MONITORING FRAMEWORK

Impact the Project is Aligned with Carbon intensity reduction and air quality improvement in the BTH region accelerated[a] (State Council of the People's Republic of China. 2013. Action Plan on Prevention and Control of Air Pollution, 2013–2017. Beijing.)			
Results Chain	**Performance Indicators with Targets and Baselines**	**Data Sources and Reporting Mechanisms**	**Risks**
Outcome More cost-effective policies and investments to improve air quality and reduce CO_2 emissions in the BTH region made	By 2019 (2015 baseline: 0) a. Government Plan for Air Pollution Prevention and Control, 2018–2022 includes at least five policy and investment recommendations b. Overachieve by at least 10% the designated carbon intensity and air quality improvement indicators compared with the target set out by the government c. The index of air quality outcome per unit of investment improved by at least 10% in the BTH region compared with the 2015 level	a. Consultant's report and policy announcements by NDRC; Government Plan for Air Pollution Prevention and Control, 2018–2022 b. Industry statistical yearbook c. Government budget	Delay in policy implementation of cost-effective policies in the BTH region Local industry resistance to adopting proposed policies
Outputs 1. Adequacy of model framework assessed and improved	1. Inception report with detailed recommendations on necessary model adjustments and work approach submitted by Q2 2016 (2015 baseline: 0)	1. Consultant's report	1–4. Difficulty in obtaining an accurate air pollution inventory for BTH
2. Constraints for effective policy implementation analyzed and synthesized	2a. Interim report on constraints for effective policy implementation submitted by Q1 2017 (2015 baseline: NA) 2b. Interim report with analysis and results of at least 50 case studies and synthesis of institutional barriers to policy implementation submitted by Q3 2017 (2015 baseline: NA)	2a-b. Consultant's report	
3. Interplays of climate and air quality co-benefits in the	3. Interim report with analytical outputs and results submitted by	3. Consultant's report	

Results Chain	Performance Indicators with Targets and Baselines	Data Sources and Reporting Mechanisms	Risks
BTH region and their sequencing assessed	Q4 2017 (2015 baseline: 0)		
4. Set of policy recommendations and investment choices for the BTH region prepared	4a. Draft final report with policy recommendations submitted by Q1 2018 (2015 baseline: NA)	4a. Consultant's report	
	4b. Workshop with key local stakeholders and policy makers from the BTH region conducted by Q1 2018 (2015 baseline: NA)	4b. Workshop course evaluation; survey reports; back-to-office reports	
	4c. ADB flagship knowledge product with unique and innovative policy recommendations during high-level workshop or conference presented by Q2 2018 (2015 baseline: NA)	4c. Report publication; TA completion report; back-to-office reports	

Key Activities with Milestones (after consultants' engagement)

1. Mobilize team of consultants and develop study framework by month 1.
2. Prepare draft inception report with detailed work plan and conduct inception workshop by month 2.
3. Prepare interim report and conduct interim workshop by month 9.
4. Prepare draft final report and conduct final workshop by month 20.
5. Submit final report 1 month after receiving comments from ADB and stakeholders.
6. Prepare knowledge product by month 24.

Output 1: Adequacy of the model framework assessed and improved

1.1 Conduct in detail model framework assessment in coordination with the executing and implementing agencies, other high-level stakeholder organizations, and ADB by month 2.
1.2 Define model adjustments with cross-divisional team to fulfill TA objectives by month 2.
1.3 Formulate work plan by month 2.
1.4 Draft interim report by month 9.

Output 2: Constraints for effective policy implementation at company level analyzed and synthesized

2.1 Identify suitable companies to be studied by month 3.
2.2 Conduct workshops and interviews with selected firms by month 4.
2.3 Implement tests with companies by month 5.
2.4 Monitor adaptation of measures by companies by month 10.
2.5 Analyze results and draft interim report by month 11.
2.6 Abstract case study results into stylized facts for institutional barriers to policy implementation by month 12.

Output 3: Interplays of climate and air quality co-benefits in the Beijing–Tianjin–Hebei region and their sequencing assessed

3.1 Use the interim results of the case studies to model the dynamics of company responses to clean air and climate change policies by month 15.

3.2 Feed micro-based dynamics into REACH and adjust the model framework to the BTH region by month 16.
3.3 Quantify in detail the expected benefits of the policy, including the impact of incomplete policy implementation (based on patterns observed in case studies), by month 17.
3.4 Formulate draft final report, including model description, detailed analysis of model results, and policy recommendations, by month 18.

Output 4: Set of policy recommendations and investment choices for the Beijing–Tianjin–Hebei region prepared

4.1 Formulate strategic policy recommendations on cost-effective climate, clean energy, and clean air policy coordination in the extended BTH region by month 19.
4.2 Organize final workshop by month 20.
4.3 Strengthen the capacity of the executing and implementing agencies and other line ministries in formulating and coordinating climate, clean energy, and clean air policies by month 20.
4.4 Present study findings and discuss recommendations with key stakeholders and policy makers by month 20.
4.5 Prepare workshop report and incorporate comments of workshop participants into final report by month 21.
4.6 Prepare and publish a knowledge product by month 24.

Inputs

ADB (TASF-other sources): $750,000

Note: The government will provide counterpart support in the form of remuneration and per diems for counterpart staff, including counterpart staff's time, remuneration and travel expenses; logistic support in arranging workshops and conferences; and a fully functional office space for consultants with free utility supply, free access to the internet, and a photocopying machine.

ADB = Asian Development Bank, BTH = Beijing–Tianjin–Hebei, CO_2 = carbon dioxide, NA = not applicable, NDRC = National Development and Reform Commission, Q = quarter, REACH = Regional Energy Air Quality Climate and Health, TA = technical assistance.

[a] State Council of the People's Republic of China. 2013. *Action Plan on Prevention and Control of Air Pollution, 2013–2017*. Beijing.

Source: Asian Development Bank.

COST ESTIMATES AND FINANCING PLAN

($'000)

Item	Amount
A. Asian Development Bank[a]	
1. Consultants	
a. Remuneration and per diem	
i. International consultants (19 person-months)	325.0
ii. National consultants (36 person-months)	325.0
b. International and local travel[b]	35.0
c. Reports and communications[c]	5.0
2. Workshop, training, seminars, and conferences[d]	25.0
3. Case study[e]	10.0
4. Contingencies	25.0
Total	**750.0**

Note: The technical assistance (TA) is estimated to cost $850,000, of which contributions from the Asian Development Bank (ADB) are presented in the table above. The government will provide counterpart support in the form of counterpart staff, office accommodation, office supplies, secretariat services, and other in-kind contributions. The value of government contribution is estimated to account for 11.8% of the total TA cost.

[a] Financed by ADB's Technical Assistance Special Fund (TASF-other sources).

[b] This includes both international and local travel for consultation and data collection. International consultants will be expected to fly with airlines of ADB member countries.

[c] To include translation costs.

[d] An advance payment facility, if appropriate, will be provided to the executing agency for the administration of such workshops, translation and interpretation services, and printing of documents and reports. This need-based advance payment facility will be established only after capacity assessment of the executing agency. To include travel costs for participation in workshops and relevant international high-level low-carbon development or climate change-related conferences in ADB member countries by ADB staff as well as key consultants acting as facilitators and/or resource persons.

[e] To include costs for surveys, interviews, printing of questionnaires, and other costs for conducting the case studies.

Source: Asian Development Bank estimates.

OUTLINE TERMS OF REFERENCE FOR CONSULTANTS

A. Introduction

1. The consultants will be engaged by the Asian Development Bank (ADB) through a university following ADB's Guidelines on the Use of Consultants (2013, as amended from time to time) using the single-source selection method. It is estimated that the technical assistance (TA) will require a team of consultants consisting of three international consultants (15 person-months) and six national consultants (36 person-months) for TA implementation. The international consultants comprise a clean energy–clean air nexus expert, an econometrician with experience in quantitative economic research and modeling, and an energy and environmental policy expert. The national consultants comprise (i) a clean energy–clean air nexus expert, (ii) a project coordinator, (iii) an environmental policy and management expert, (iv) an expert in air quality modeling and health impact, (v) a low-carbon energy and climate policy expert, and (vi) an econometrician. In addition, the TA will require one eminent international consultant (4 person-months), to be recruited individually to assess the model framework and review TA results from time to time.

2. The following terms of reference are indicative and meant to provide guidance on achieving the objectives of the proposed TA.

B. Terms of Reference for the Consultant Team

3. **Clean energy–clean air nexus expert and team leader** (national, 6 person-months). The consultant and team leader should have a postgraduate degree in energy economics or a related field, and at least 15 years of postdoctorate work experience in policy research and advice on clean energy and environmental management. The consultant will have worked with major policy-making institutions in the People's Republic of China (PRC) to deliver policy advice. As team leader, the consultant will be responsible for the final outputs of the TA, as well as for the coordination and supervision of the team. Specifically, the consultant will:

(i) develop a detailed study concept, methodology, and approach in collaboration with the international co-team leader;
(ii) define detailed tasks for the team of consultants in consultation with the deputy team leader, the executing agency, key stakeholders, and consultants; and establish a work plan subject to ADB approval;
(iii) develop a questionnaire for industries;
(iv) coordinate with the executing and implementing agencies in preparing the case studies;
(v) develop outlines of the inception, interim, and final reports;
(vi) conduct the interim and final workshops and organize case studies;
(vii) with the international co-team leader's assistance, steer the (a) conceptualization and implementation of the case studies, (b) analysis of case study results, (c) modeling of stylized facts derived from case studies, (d) adjustment of the China Regional Energy Model (C-REM) and Regional Emissions Air Quality Consumption and Health (REACH) model frameworks for the Beijing–Tianjin–Hebei (BTH) region, and (e) derivation of cost-effective policies to be prioritized for the BTH region;
(viii) assist ADB in establishing an effective mechanism ensuring in-depth dialogue on the preparation of coordinated policies and investments with all relevant agencies charged with determining climate, clean energy, and air pollution control and prevention in the BTH region;

(ix) maintain a regular exchange with the executing agency and provide explanations for coordinated policy making;
(x) maintain intense dialogue and share information with other consultants in other relevant agencies;
(xi) manage and ensure the timely implementation of TA activities, including the overall coordination of inputs from the team member, and conduct interim and final workshops;
(xii) manage the dialogue with consultants from other ADB TA projects in support of clean air development in the BTH region; and
(xiii) be responsible for drafting the TA reports and their revised versions.

4. **Clean energy–clean air nexus expert and deputy team leader** (international, 4 person-months). The international clean energy–clean air nexus expert should have a postgraduate degree in energy economics or a related field, and at least 15 years of postdoctorate work experience in policy research and advice on clean energy and environmental management. The consultant will have extensive experience with international research and advisory projects, and have worked with major policy-making institutions to deliver policy advice. As deputy team leader, the consultant will guide the tasks of the international consultants in close coordination with the team leader and will:

(i) assist the team leader in developing a detailed work plan and tasks for the consultant team in consultation with the executing agency, key stakeholders, and other consultants;
(ii) support the national team leader in conducting necessary analysis;
(iii) conduct interim and final workshops with the team leader;
(iv) provide guidance and international expertise on (a) the conceptualization and implementation of the case studies, (b) analysis of case study results, (c) modeling of stylized facts derived from case studies, (d) adjustment of the C-REM and REACH model frameworks for the BTH region, and (e) derivation of cost-effective policies to be prioritized for the BTH region;
(v) review governance issues in policy implementation;
(vi) derive cost optimized policies and investments with maximum co-benefits for air quality improvement;
(vii) finalize ;
(viii) ensure regular dialogue with national and international stakeholders; and
(ix) assist the team leader in drafting the TA reports and their revised versions.

5. **Project coordinator** (national, 5 person-months). The consultant should have at least a bachelor's degree in project management or a relevant field, 5 or more years of experience in managing research studies in an academic environment with domestic and international partners, substantial experience with statistical analysis techniques, and proficiency in the English language. The project coordinator will:

(i) closely support the team leader and co-team leader for effective coordination;
(ii) prepare all documentation relevant to obtaining necessary research permissions to conduct company interviews;
(iii) ensure effective information and datasharing among consultants working on ADB TAs supporting clean air development in the BTH region;
(iv) establish effective coordination among key policy making institutions for low-carbon and clean air development in the BTH region to ensure broad sharing of TA results and dialogue on cost-effective policies and investments;
(v) develop public communication materials for the project; and

(vi) coordinate between national and international consultants to ensure timely submission of TA reports.

6. **Environmental policy and management expert** (national, 4 person-months). The consultant should have a postgraduate degree in environmental policy or a related field, and at least 15 years of work experience in environmental policy and management research. The consultant will have worked with major policy-making institutions in the PRC to deliver environmental policy advice. The consultant will support the team leader in sourcing relevant environmental data and assessing the effectiveness of environmental policies and the costs of these policies for enterprises to produce the final TA outputs. The consultant will support the team leader in coordination with the Ministry of Environmental Protection. The consultant will:

(i) collect data and establish inventory of the latest air quality information;
(ii) review and assess relevant air quality policies in the BTH region for industries, and assess the economic and financial costs of their implementation;
(iii) support the team leader in preparing the implementation of the interim and final workshops, and organize case studies;
(iv) support the team leader in (a) the conceptualization and implementation of the case studies, (b) analysis of case study results, (c) modeling of stylized facts derived from case studies, (d) adjustment of the C-REM and REACH model frameworks for the BTH region, and (e) derivation of cost-effective policies to be prioritized for the BTH region;
(v) support the team leader in the regular dialogue with the stakeholder organizations, in particular the Ministry of Environmental Protection; and
(vi) assist in drafting the TA reports and their revised versions, as instructed by the team leader.

7. **Air quality modeling and health impact expert** (national, 5 person-months). The consultant should have a postgraduate degree in environmental economics or a related field, 8 years of experience in environmental modeling, deep knowledge of REACH as well as C-REM models, and proficiency in the English language. The consultant will:

(i) provide substantial inputs on statistical analysis techniques;
(ii) conduct the air quality and health impacts modeling for the BTH region;
(iii) conceptualize and implement the case studies;
(iv) analyze case study results;
(v) adjust the C-REM and REACH model frameworks for the BTH region;
(vi) suggest cost-effective policies to be prioritized for the BTH region;
(vii) provide substantial inputs to the TA reports;
(viii) participate in TA workshops to present and discuss study findings; and
(ix) conduct other related tasks assigned by the team leader or the deputy team leader.

8. **Low-carbon energy and climate policy expert** (national, 6 person-months). The consultant should have a postgraduate degree in energy, energy and/or environmental policy, or a related field; at least 5 years of experience in relevant policy work; and deep understanding of quantitative methods as well as familiarity with the REACH as well as C-REM models and their policy implications. The consultant will:

(i) conduct a comprehensive review of existing policies and institutions relevant for the company-level case study in Hebei Province;
(ii) work closely with national consultants to design and conduct company-level surveys and case studies; and analyze company-level responses to energy, climate, and air pollution policies;

(iii) support other consultants in quantifying in detail the expected benefits of the policies, including the impact of incomplete policy implementation;
(iv) in collaboration with the deputy team leader, provide policy recommendations that offer co-benefits for air pollution and climate change measures, and help to identify cost-effective policy approaches;
(v) provide substantial inputs to the TA reports;
(vi) participate in TA workshops to present and discuss study findings; and
(vii) conduct other related tasks assigned by the team leader or the deputy team leader.

9. **Econometrician** (national, 10 person-months). The consultant should have a postgraduate degree in econometrics or a relevant field, a minimum of 5 years of experience in quantitative economic research and modeling, and familiarity with the Tsinghua–Massachusetts Institute of Technology developed models, specifically REACH and C-REM. The consultant will:

(i) conduct data collection and assessment to model the dynamics of company responses to clean air and climate change policies in close coordination with the national consultants;
(ii) work closely with the international consultants on quality modeling to feed micro-based dynamics into REACH, and generate a BTH version of the REACH framework that can be applied to examine the energy, emissions, air quality, and health benefits of proposed policy interventions;
(iii) identify gaps in the outcome and the structure of the model, and propose solutions to close these gaps;
(iv) participate in TA workshops to present and discuss study findings; and
(v) conduct other related tasks assigned by the team leader or the deputy team leader.

10. **Energy and environmental policy expert** (international, 5 person-months). The consultant should have a postgraduate degree in energy and environmental policy or a related field, at least 5 years of experience in relevant policy work, and deep understanding of quantitative methods as well as familiarity with the REACH as well as C-REM models and their policy implications. The consultant will:

(i) conduct a comprehensive review of existing policies and institutions relevant for the company-level case study in Hebei Province;
(ii) work closely with national consultants to design and conduct company-level surveys and case studies; and analyze company-level responses to energy, climate, and air pollution policies;
(iii) support other consultants in quantifying in detail the expected benefits of the policies, including the impact of incomplete policy implementation;
(iv) in collaboration with the deputy team leader, provide policy recommendations that offer co-benefits for air pollution and climate change measures, and help to identify cost-effective policy approaches;
(v) provide substantial inputs to the TA reports;
(vi) participate in TA workshops to present and discuss study findings; and
(vii) conduct other related tasks assigned by the team leader or the deputy team leader.

11. **Econometrician** (international, 6 person-months). The consultant should have a postgraduate degree in econometrics or a relevant field, a minimum of 5 years of experience in quantitative economic research and modeling, and familiarity with the Tsinghua–Massachusetts Institute of Technology developed models, specifically REACH and C-REM. The consultant will:

(i) support the national consultant in assessing collected data to model the dynamics of company responses to clean air and climate change policies in close coordination with the national consultants;
(ii) work closely with the national consultants on air quality modeling to feed micro-based dynamics into REACH and generate a BTH version of the REACH framework that can be applied to examine the energy, emissions, air quality, and health benefits of proposed policy interventions;
(iii) identify gaps in the outcome and the structure of the model, and propose solutions to close these gaps;
(iv) participate in TA workshops to present and discuss study findings; and
(v) conduct other related tasks assigned by the team leader or the deputy team leader.

C. Terms of Reference for the Individual Consultant

12. **Energy and environment expert** (international, 4 person-months). The consultant should have a postgraduate degree in energy and/or environmental economics, and a solid record in policy research and advice on clean energy and environmental management. The consultant will have worked with major policy-making institutions in the PRC to deliver policy advice. The consultant is expected to provide independent and third-party opinion on the assessment of the integrated model framework and on the TA results.

D. Reporting Requirements

13. The consultants will submit (i) an inception report within 2 months after mobilization, (ii) a revised inception report within 2 weeks after receiving comments from the executing and implementing agencies and ADB, (iii) an interim report within 9 months after mobilization, (iv) a revised interim report within 2 weeks after the interim workshop, (v) a draft final report within 20 months after mobilization, and (vi) a final report 1 month after the final workshop and receiving comments from ADB.

14. All TA deliverables and progress reports will be written in English. National consultants will be responsible for translating documents into Chinese. Three copies of the deliverables will be submitted to ADB in English, and 10 copies will be submitted to the MIIT (three in English and seven in Chinese). The deliverables and progress reports should address the terms of reference, with details appropriate to that stage of the TA. The consultants will present key findings to relevant government agencies for low-carbon and clean air development in the BTH region invited to participate in the workshops and seminars.

15. ADB will conduct inception, interim, and final review missions in addition to regular monitoring of TA implementation. During the missions, meetings with all three parties will be held. Therein, ADB, together with the executing and implementing agencies and the consultants, will review consultant performance, implementation progress, and completion of deliverables based on the design and monitoring framework and the consultants' work plan. The reports submitted by the consultants will be reviewed by the executing and implementing agencies, ADB's cross-divisional team, other relevant government agencies, and external peer reviewers. The final outputs will be disseminated to key policy makers and stakeholders through the executing agency. The proceeds of the TA will be disbursed in accordance with ADB's *Technical Assistance Disbursement Handbook* (2010, as amended from time to time).