Document of

The World Bank

FOR OFFICIAL USE ONLY

Report No: ICR00006434

IMPLEMENTATION COMPLETION AND RESULTS REPORT

TF0A4256

ON A

GRANT

FROM THE GLOBAL ENVIRONMENT FACILITY

IN THE AMOUNT OF US$ 17.8 MILLION

TO THE

People's Republic of China

FOR THE

Developing Market-based Energy Efficiency Program in China

06/27/2024

Energy & Extractives Global Practice
East Asia And Pacific Region

CURRENCY EQUIVALENTS

(Exchange Rate Effective May 31, 2024)

Currency Unit =	CHINESE RENMINBI (CNY)
CNY 7.24 =	US$1

FISCAL YEAR
January 1 – December 31

Regional Vice President:	Manuela V. Ferro
Country Director:	Mara K. Warwick
Regional Director:	Sudeshna Ghosh Banerjee
Practice Manager:	Jie Tang
Task Team Leader(s):	Joonkyung Seong
ICR Main Contributor(s):	Hua Du; Qingyuan Wang; Ximing Huang

ABBREVIATIONS AND ACRONYMS

APPCAP	Air Pollution Prevention and Control Action Plan
APS	Announced Pledges Scenario
CPF	Country Partnership Framework
CPS	Country Partnership Strategy
DLI	Disbursement-Linked Indicator
EE	Energy Efficiency
ESCO	Energy Service Company
ESMAP	Energy Sector Management Assistance Program
ETS	Emission Trading System
FYP	Five-Year Plan
FY	Fiscal Year
GDP	Gross Domestic Product
GEF	Global Environment Facility
GHG	Greenhouse Gas
GoC	Government of China
GFC	Green Finance Center
HBPMO	Hebei Project Management Office
HXB	Hua Xia Bank
IAF	Independent Audit Firm
IBRD	International Bank for Reconstruction and Development
ICR	Implementation Completion and Results Report
IEA	International Energy Agency
IPF	Investment Project Financing
IRI	Intermediate Results Indicator
ISR	Implementation Status and Results Report
IVA	Independent Verification Agency
JJJ	Jing-Jin-Ji
M&E	Monitoring and Evaluation
MoF	Ministry of Finance
M&V	Monitoring and Verification
MEP	Ministry of Environmental Protection
NECC	National Energy Conservation Center
NDRC	National Development and Reform Commission
NOx	Nitrogen oxides
OM	Operation Manual
PAD	Program Appraisal Document
PDO	Program Development Objective
PDRC	Provincial Development and Reform Commission
$PM_{2.5}$	Particulate Matter with diameter smaller than 2.5 micron
PMO	Project Management Office
PforR	Program-for-Results
PV	Photovoltaic
RE	Renewable Energy
RF	Results Framework

RMB	Renminbi
SMEs	Small and Medium Enterprises
SO_2	Sulfur Dioxide
TA	Technical Assistance
tce	Tonne of coal equivalent
VOC	Volatile Organic Compound
WHO	World Health Organization

TABLE OF CONTENTS

DATA SHEET 1

I. PROJECT CONTEXT AND DEVELOPMENT OBJECTIVES 5

A. CONTEXT AT APPRAISAL 5

B. SIGNIFICANT CHANGES DURING IMPLEMENTATION (IF APPLICABLE) 11

II. OUTCOME 12

A. RELEVANCE OF PDOs 12

B. ACHIEVEMENT OF PDOs (EFFICACY) 13

C. EFFICIENCY 19

D. JUSTIFICATION OF OVERALL OUTCOME RATING 20

E. OTHER OUTCOMES AND IMPACTS (IF ANY) 20

III. KEY FACTORS THAT AFFECTED IMPLEMENTATION AND OUTCOME 21

A. KEY FACTORS DURING PREPARATION 21

B. KEY FACTORS DURING IMPLEMENTATION 23

IV. BANK PERFORMANCE, COMPLIANCE ISSUES, AND RISK TO DEVELOPMENT OUTCOME .. 24

A. QUALITY OF MONITORING AND EVALUATION (M&E) 24

B. ENVIRONMENTAL, SOCIAL, AND FIDUCIARY COMPLIANCE 25

C. BANK PERFORMANCE 25

D. RISK TO DEVELOPMENT OUTCOME 27

V. LESSONS AND RECOMMENDATIONS 28

ANNEX 1. RESULTS FRAMEWORK AND KEY OUTPUTS 30

ANNEX 2. BANK LENDING AND IMPLEMENTATION SUPPORT/SUPERVISION 38

ANNEX 3. PROJECT COST BY COMPONENT 41

ANNEX 4. BORROWER, CO-FINANCIER AND OTHER PARTNER/STAKEHOLDER COMMENTS ... 42

DATA SHEET

BASIC INFORMATION

Product Information

Project ID	Project Name
P132748	Developing Market-based Energy Efficiency Program in China
Country	**Financing Instrument**
China	Investment Project Financing
Original EA Category	**Revised EA Category**
Partial Assessment (B)	Partial Assessment (B)

Organizations

Borrower	Implementing Agency
People's Republic of China	China National Energy Conservation Center, Hebei PMO, Huaxia Bank

Project Development Objective (PDO)

Original PDO

The objective of the project is to support development and implementation of China'??s priority energy efficiency and environment programs, with a focus on improving the results measurement and verification system and developing market-based mechanisms.

FINANCING

	Original Amount (US$)	Revised Amount (US$)	Actual Disbursed (US$)
World Bank Financing			
TF-A4256	17,800,000	17,075,790	17,075,790
Total	**17,800,000**	**17,075,790**	**17,075,790**
Non-World Bank Financing			
Total	**0**	**0**	**0**
Total Project Cost	**17,800,000**	**17,075,790**	**17,075,790**

KEY DATES

Approval	Effectiveness	MTR Review	Original Closing	Actual Closing
16-Mar-2017	05-Sep-2017	07-Jun-2021	30-Apr-2022	31-Oct-2023

RESTRUCTURING AND/OR ADDITIONAL FINANCING

Date(s)	Amount Disbursed (US$M)	Key Revisions
26-Apr-2022	9.13	Change in Results Framework Change in Loan Closing Date(s) Change in Implementation Schedule

KEY RATINGS

Outcome	Bank Performance	M&E Quality
Highly Satisfactory	Satisfactory	High

RATINGS OF PROJECT PERFORMANCE IN ISRs

No.	Date ISR Archived	DO Rating	IP Rating	Actual Disbursements (US$M)
01	01-Jun-2017	Satisfactory	Satisfactory	.17
02	15-Dec-2017	Satisfactory	Satisfactory	.17

03	29-Jun-2018	Satisfactory	Satisfactory	1.67
04	27-Dec-2018	Satisfactory	Satisfactory	2.24
05	18-Jun-2019	Satisfactory	Satisfactory	2.49
06	19-Dec-2019	Satisfactory	Moderately Satisfactory	3.86
07	19-Jun-2020	Satisfactory	Moderately Satisfactory	4.41
08	07-Jan-2021	Moderately Satisfactory	Moderately Satisfactory	6.26
09	30-Jun-2021	Moderately Satisfactory	Moderately Satisfactory	7.00
10	19-Feb-2022	Moderately Satisfactory	Moderately Unsatisfactory	8.69
11	22-Dec-2022	Moderately Satisfactory	Moderately Unsatisfactory	10.67
12	31-Mar-2023	Moderately Satisfactory	Moderately Satisfactory	11.26
13	31-Oct-2023	Satisfactory	Satisfactory	15.77

SECTORS AND THEMES

Sectors

Major Sector/Sector	(%)
Public Administration	**25**
Other Public Administration	25
Energy and Extractives	**75**
Public Administration - Energy and Extractives	75

Themes

Major Theme/ Theme (Level 2)/ Theme (Level 3)	(%)
Economic Policy	**25**
Economic Growth and Planning	25
Green Growth	25

Environment and Natural Resource Management	**88**
Climate change	88
Mitigation	88
Environmental Health and Pollution Management	51
Air quality management	51
Environmental policies and institutions	25
Energy	75
Energy Policies & Reform	75

ADM STAFF

Role	At Approval	At ICR
Vice President:	Victoria Kwakwa	Manuela V. Ferro
Country Director:	Bert Hofman	Mara K. Warwick
Director:	Riccardo Puliti	Sudeshna Ghosh Banerjee
Practice Manager/Manager:	Jie Tang	Jie Tang
Project Team Leader:	Todd M. Johnson	Joonkyung Seong
ICR Co Author:		Hua Du

I. PROJECT CONTEXT AND DEVELOPMENT OBJECTIVES

A. CONTEXT AT APPRAISAL

Context

1. **At appraisal, China was facing twin challenges of environmental sustainability and energy security.** Both challenges arose from exponential growth in its energy consumption. From 1980 to 2015, China's energy consumption increased by over 6-fold[1] in order to fuel its economy which grew by 21-fold. Such rapid economic growth has taken a high toll on its environment. China became the largest emitter of greenhouse gases in the World, and many Chinese cities were among the world's most polluted cities. In parallel, concerns over energy security began to loom due to China's increasing reliance on energy imports. The twin challenges were expected to become more pressing as China's energy consumption was expected to double from 2015 to 2035.

2. **In its efforts to tackle the twin challenges simultaneously, Government of China (GoC) has been committed to energy efficiency (EE) improvement due to its high cost-effectiveness.** In China, EE not only has the largest potential to contribute to carbon reduction target, but also address concerns of energy security, resource scarcity and affordability. Energy conservation was thus made a national priority[2]: in its 12th Five-Year Plan (FYP, 2011-2015), GoC set a mandatory target of cut energy intensity[3] by 16 percent. More aggressively, in its 13th FYP (2016-2020), the GoC planned to implement a mandatory total energy consumption cap from 4.3 billion tons of coal equivalent (tce) in 2015 to 5 billion tce by 2020, in addition to a 15 percent reduction in energy intensity, which collectively are known as dual control of energy consumption[4]. Therefore, the 13th FYP period (2016-2020) marked a critical transition period during which the country's ambitious energy consumption and intensity reduction targets needed to be met. To ensure long-term and sustainable progress in EE improvement, A robust measurement and verification (M&V) system and a market-based trading instrument need to be in place for the national authorities to monitor the progress of achieving the national targets and provincial goals on EE reduction. The M&V system is much needed to accurately measure energy savings amount while the market-based trading instrument is necessary to ensure the overall energy savings can be realized in an economic manner for the country. Under this context, the GoC requested assistance from the Global Environment Facility (GEF) to help develop and implement the EE goals of the 13th FYP.

3. **Energy consumption rights trading, a market-based instrument for curbing total energy consumption, was contemplated by GoC as its effort to accomplish the total energy consumption cap.** Under this scheme, an energy consumption cap would be imposed in China, enterprises and/or regions with limited potential to meet their respective energy consumption cap are allowed to purchase surplus rights certificate from other enterprises/regions that can realize greater energy savings. At appraisal, the energy consumption rights trading was new in China and faced significant challenges in design and implementation. The major ones included (a) the lack of energy savings measurement and

[1] Energy consumption was 0.6 billion tce in 1980 and climbed to 4.3 billion tce in 2015.
[2] EE improvement has multiple benefits, including energy savings, conservation of scarce natural resources, improvement of local air quality and enhancement of energy security.
[3] Energy intensity is defined as energy consumption per unit of gross domestic product.
[4] China's dual control of energy consumption scheme refers to the policy of controlling total energy consumption and controlling the energy intensity of regions, industries, and companies.

verification (M&V) protocols and associated implementation capacity; (b) the absence of penalties for non-compliance; and (c) reconciliation between this instrument and China's carbon emission trading scheme (ETS)[5].

4. **A credible and standardized energy savings M&V system plays an important role in measuring progress associated with EE and is a prerequisite to safeguard a successful energy consumption rights trading piloting.** At appraisal, China's energy saving M&V was still at nascent stage: only 26 accredited third-party verifiers were in operation, a limited number of energy saving M&V guidelines and methodologies were issued, and a pilot scale online M&V system for energy consumption[6] was developed in selected sectors and provinces.

5. **Despite some progress, China's energy saving M&V system was facing several major barriers:** first, there was a lack of standardized operational guidelines and methodologies for energy saving M&V at both the project and enterprise levels. At appraisal, although national protocols for energy saving calculation and guidelines were issued for the most used EE technologies, they were not practically enough to provide operational guidance to the third-party verifiers to conduct energy saving M&V for EE investments. In addition, there was demand for standardized methodology for energy saving M&V at the enterprise level to determine whether its mandated energy saving targets were met and to pave the way for future Energy consumption trading among enterprises. Secondly, there was a lack of a transparent and credible accreditation process and institutional framework and limited capacity of third-party verifiers. China's massive EE activities from the 13th FYP and onward would create a huge demand for qualified third-party verifiers. To ensure credibility in energy savings M&V, transparent qualification criteria, accreditation process and a credible institutional framework became essential. Capacity building targeted for those verification agencies were also pressing at appraisal as their technical skills in China were still low compared to international standards.

6. **At appraisal, China was also experiencing severe air pollution due to its rapid economic development (aligning with rapid urbanization[7]) over the past three decades.** Many Chinese cities were among the world's most polluted ones. This issue was particularly acute in the Jing-Jin-Ji (JJJ) region.[8] Its annual average fine particulate matter ($PM_{2.5}$) concentration reached 93 micrograms per cubic meter ($\mu g/m^3$), nearly 1.7 times higher than the national $PM_{2.5}$ standard (35 $\mu g/m^3$) and 8.3 times more than the World Health Organization standard (10 $\mu g/m^3$). Several cities in the JJJ region had heavy pollution over half of the year. Emissions of air pollutants—$PM_{2.5}$, sulfur dioxide (SO_2), and nitrogen oxides (NO_x)—had far exceeded the cities' environmental absorptive capacity by 80 percent, 50 percent, and 70 percent, respectively.[9]

7. **To alleviate severe air pollution, the Government of China (GoC) issued a suite of policies and mitigation actions.** Among them, the Air Pollution Prevention and Control Action Plan (APPCAP)[10] was the most noteworthy at appraisal. The APPCAP had a national coverage with a specific mandate for the Jing-Jin-Ji (JJJ) region for ambient $PM_{2.5}$ concentration reduction by 25 percent between 2012 and 2017, followed by a further decline by around 40 percent from the 2013 level by 2020. It also set a mandatory target to reduce coal consumption by 83 million tons from 2012 to 2020.

[5] At appraisal, the pilot of ETS started in five cities and two provinces with a plan to be rolled out nationwide during 2017.
[6] It was developed under the World-Bank financed China Energy Efficiency Financing (CHEFF) Project
[7] In 1990, China's urban population was 26 percent of the total population, reached 56 percent in 2015 at appraisal, and further rose to 63 percent in 2021. Source: https://data.worldbank.org/indicator/SP.URB.TOTL.IN.ZS?locations=CN.
[8] Includes Beijing, Tianjin, Hebei, Shandong, Shanxi, Inner Mongolia, and Henan Provinces.
[9] According to estimates from the Ministry of Environmental Protection (MEP).
[10] It was enacted by the State Council of China in 2013 to lower the particulate matter level in China. Between 2013 and 2017, each administrative division established its own environmental preservation strategy in accordance with the APPCAP.

8. **Two World Bank-financed Program-for-Results (PforR) operations were under preparation to support the GoC's APPCAP when this project was under appraisal in 2016**. The first one is the Innovative Financing for Air Pollution Control in Jing-Jin-Ji Program (the JJJ PforR)[11]. The objective of the JJJ PforR was to reduce air pollutants and carbon emissions through EE and clean energy, with a focus on the JJJ and neighboring regions. It was achieved through (a) undertaking eligible EE and renewable energy investments for coal reduction; (b) applications of pollution abatement measures for reduced air pollution emissions; and (c) strengthening institutional capacity of implementing entity Hua Xia Bank (HXB). The second one is the Hebei Pollution Prevention and Control Program (the Hebei PforR)[12]. The objective of the Hebei PforR was to reduce the emissions of air pollutants from key sectors in Hebei Province. It was accomplished by (a) comprehensive control of industrial enterprises and the reduction of air pollutants emission from key industrial sectors; (b) area source air pollution controls; (c) prevention and control of transport emission sources; and (d) establishment of monitoring and warning systems and the use of advanced planning tools.

9. **At appraisal, the World Bank had established a long-term engagement with China on EE over the past two decades, moving from pilots to mainstreaming actions.** The engagement has resulted in transformational impacts which helped China move towards more market-based approaches for energy conservation. These include i) introduction of energy service companies (ESCOs) to China under the Energy Conservation Project (P003606) in 1998; ii) partial risk guarantee to ESCOs for access to financing under the Energy Conservation Phase II Project (P067337) in 2003; iii) mainstreaming EE within China's banking sector by establishing EE credit lines under the China Energy Efficiency Financing (CHEEF) Project (P084874) in 2008; and iv) supported market-based EE programs, including EE leasing model, at the provincial level via the Provincial Energy Efficiency Scale-up Project (P114182) in 2011.

10. **Under this context, this Project was conceived.** Its overarching objective is to support GoC's priority energy efficiency and environment programs and policy development during the 13th FYP. The project design includes provision of analytical studies and technical assistance (TA) to the design and pilot of the energy consumption certificate trading and to the improvement of energy savings monitoring, reporting and verification (MRV) system, as well as provision of support to the development and implementation of the two fore-mentioned PfoR programs in accordance with China's APPCAP. The Project would contribute to the China's transition to a sustainable energy pathway and support government's goals to improve EE and address air pollution and climate change. The Project was prepared under China's 13th FYP with implementation spanning over the 13th and 14th FYPs. During the 13th FYP, improving EE was at the top of GoC's agenda, as evidenced by its mandatory dual targets on total energy consumption cap and energy intensity.

11. **At outset of the 14th FYP, the GoC's policy agenda shifted as China began to strengthen its climate commitment to achieving carbon emission peaking by 2030 and carbon neutrality by 2060, so called 'Dual Carbon Goals'**. Its updated National Determined Contribution (NDC) targets for 2030 include increasing the target reduction of carbon intensity per unit of gross domestic product from the 60-to-65 percent range to more than 65 percent of the 2005 level, increasing the target share of non-fossil fuel in primary energy mix from about 20 percent to about 25 percent, and setting a target of installed capacity of solar photovoltaic (PV) and wind power to be more than 1,200 gigawatts (GW) by 2030. Subsequent commitments have been announced, including that China will strictly control building new coal-fired power generation projects and limit the increase in coal consumption over the 14th Five-Year Plan (FYP) period (2021-2025) and phase down coal consumption during the 15th FYP period (2026-30), and China will not build new coal power projects outside China.

[11] It is first operation in China using the PforR lending instrument and approved by the World Bank Board in March 2016 (Report No. 102272-CN). The total investment was around US$1.0 billion, half of which came from IBRD loans and the other half from Hua Xia Bank Loans.
[12] Hebei PforR was approved by the Board of Executive Directors on June 2016 (Report No. 105757-CN). The total investment was around US$650 million, of which US$500 million came from IBRD loans and the remaining from the Hebei Government.

As the energy sector represents the largest carbon emission, energy transition through scaling up renewable energy and EE is central to China's climate commitment.

Theory of Change (Results Chain)

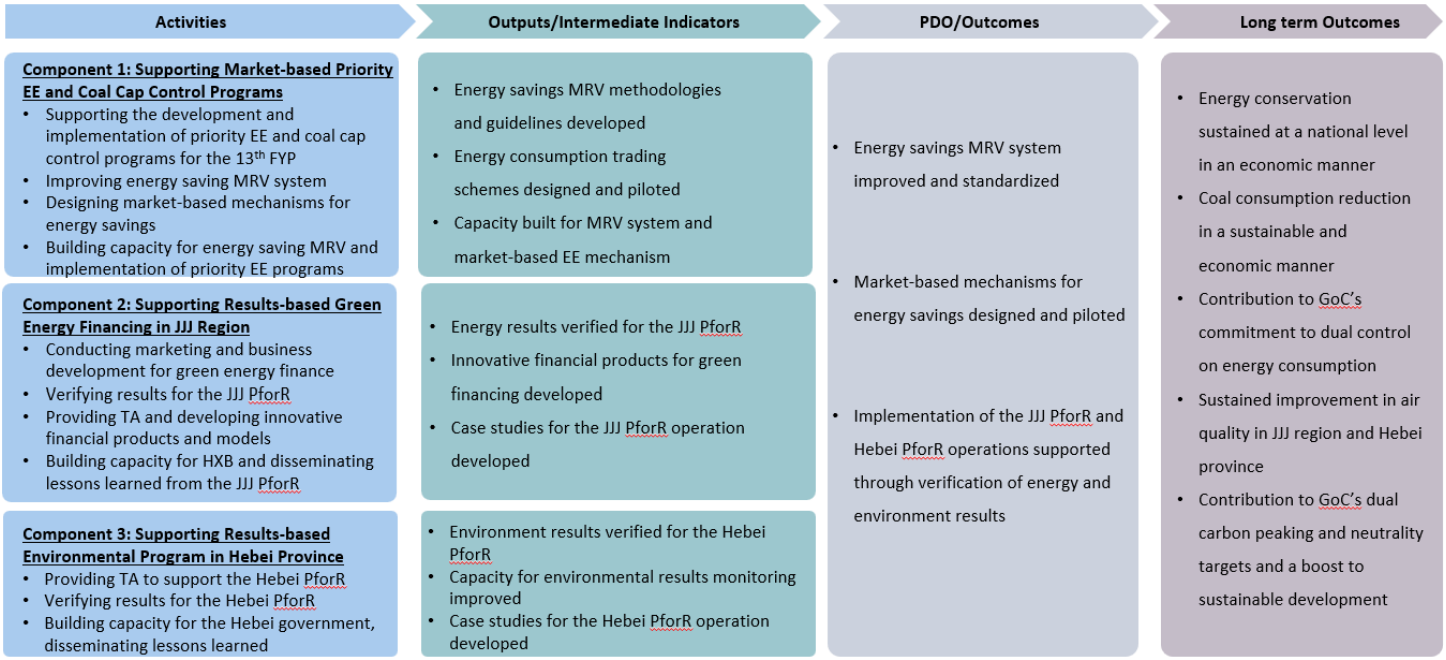
12. A results chain summarizing the relevant activities, corresponding outputs, associated intermediate indicators, and resulting outcomes to achieve the Project Development Objective (PDO) is presented in Figure 1. In general, a direct causal link can be drawn between the project activities, outputs, intermediate outcomes, and the longer-term outcomes. Overall, the PDOs are addressed by a clear results chain through interventions grouped into two aspects:

- **The first aspect of the PDO was focused on EE, including improvement of the energy savings MRV system and development of the market-based mechanism on energy consumption rights trading**. It was achieved through supporting the market-based priority EE and coal cap control programs in China (component 1). The implementation of the component 1 would lead to improved China's energy saving MRV system. The improvement is measured mainly by energy savings MRV methodologies developed (a PDO level indicator), and to a lesser extent by studies completed on good global practices on policies, MRV protocols, accreditation and regulation systems for third-party verifiers, and on-line monitoring network. In addition, the component 1 would result in the design and pilot of a market-based EE trading mechanism (a PDO level indicator) to rein in energy consumption using the market mechanism to maximize economic efficiency. The component 1 aims to address main challenges associated with energy consumption rights trading in China by designing a robust MRV system, strengthening institutional capacity through training provisions to a variety of stakeholders and designing a reconciliation mechanism between energy consumptions rights trading and ETS trading.

- **The second aspect of the PDO was focused on implementation support to China's priority EE and environment programs.** It was achieved through supporting implementation of two IBRD-financed PforR operations – i) Innovative green energy financing In JJJ region (component 2); and ii) Hebei Environmental Program (component 3). In both PforR operations, correspondingly disbursement linked indicators (DLIs) were verified by the 3rd-party verifiers funded through the GEF grant. The successful verification of both energy and environment results led to timely disbursement of the IBRD fund which safeguarded the implementation of both PforR operations.

13. All those activities under component 1-3, when implemented together, would eventually lead to achieving the PDO, that is to support development and implementation of China's priority EE and environment programs, improving the energy savings MRV system and developing market-based mechanisms for energy savings. In the longer term, the GEF grant would not only contribute to GoC's targets of dual control on energy consumption but also catalyze the accomplishment of GoC's Dual Carbon Goals.

Figure 1. Theory of Change for the Developing Market-based Energy Efficiency Program in China



Project Development Objectives (PDOs)

14. The objective of the project is to support development and implementation of China's priority energy efficiency and environment programs, with a focus on improving the results measurement and verification system and developing market-based mechanisms[13].

Key Expected Outcomes and Outcome Indicators

15. The key expected outcomes are i) implementation of the two PforR operations supported; ii) energy savings measurement and verification system improved and iii) EE market-based mechanisms developed.

16. The outcome indicators to be used to assess the outcomes are the following:

- energy savings measurement and verification system improved and standardized.
- market-based mechanisms for energy savings designed and piloted.
- energy and environment results verified for the Jing-Jin-Ji Region and Hebei Province.

Components

[13] The PDO in PAD is the same as that in the GEF Grant Agreement (TF0A4256)

17. **Component 1: Supporting Market-based Priority Energy Efficiency and Coal Cap Control Programs (at appraisal: US$8.8 million GEF grant; at completion: US$8.28 million GEF grant).** This component, consisting of four subcomponents, was designed to support the NDRC in the development and implementation of market-based priority EE policies and programs during the 13th and 14th FYP.

(a) **Subcomponent 1.1: Supporting the development and implementation of priority EE and coal cap control programs for the 13th FYP.** This subcomponent provided analytical and technical support to the NDRC to help achieve its energy intensity reduction target and the total energy and coal consumption caps for the 13th FYP.

(b) **Subcomponent 1.2: Improving the energy savings measurement, report, and verification system.** This subcomponent supported analytical and technical assistance activities to stock take international experience on energy MRV and develop MRV principles and operational methodologies and guidelines at enterprise and project levels as well as institutional systems for operationalizing MRV, including third-party verification.

(c) **Subcomponent 1.3: Designing market-based mechanisms for energy savings.** This subcomponent provided analytical and technical support to design and pilot the energy consumption trading scheme.

(d) **Subcomponent 1.4: Building the capacity of selected stakeholders in energy saving MRV and implementation of priority EE programs.** This subcomponent provided technical assistance to strengthen capacity in energy saving MRV, energy consumption trading scheme, and relevant EE policy measures.

18. **Component 2: Supporting Results-based Green Energy Financing in the JJJ Region (at appraisal: US$4.5 million GEF grant; at completion: US$4.32 million GEF grant).** This component provided support to implement the JJJ PforR operation. It complemented at least US$1.0 billion of investments[14] in EE, RE, and emission reduction in the JJJ region.

(a) **Subcomponent 2.1: Undertaking marketing and business development for green energy finance.** This subcomponent supported HXB in generating bankable pipeline for green energy financing through analyses of relevant policies and market segments and workshops and consultations with financial institutions, enterprises, government agencies, industrial associations and ESCO associations.

(b) **Subcomponent 2.2: Verifying results for the JJJ PforR operation.** This subcomponent supported HXB in verifying six agreed-upon DLIs[15] over lifetime of the JJJ PforR program. Independent verification agencies (IVAs) were hired from the 26 accredited verification agencies to verity the results achieved against DLI-2 and DLI-3. An independent audit firm was contracted to verify the results achieved against DLI-1, DLI-5 and DLI-6.

(c) **Subcomponent 2.3: Providing technical assistance for developing innovative financial products and models.** This subcomponent aided HXB in developing innovative financial products and models for green energy financing, as required under DLI-5 of the JJJ PforR Program.

[14] Of total, US$500 million came from IBRD loans and another US$500 million from HXB loans.

[15] In the JJJ PforR program, DLI-1: sub-loans for eligible EE, RE, and pollution abatement subprojects disbursed to sub-borrowers; DLI-2: the coal reduction from eligible EE and RE subprojects; DLI-3a and DLI-3b: the reduction in SO_2 and NOx emissions from desulfurization and denitrification subprojects, respectively; DLI-5: the number of different eligible innovative financial products for green financing piloted; DLI-6: the number of ESCOs receiving sub-loans for eligible EE, RE, and pollution abatement subprojects.

(d) **Subcomponent 2.4: Building capacity for HXB and disseminating lessons learned from the JJJ PforR.** This subcomponent strengthened capacity of HXB and supported the knowledge sharing from the JJJ PforR program via training, enhancing HXB's green financing infrastructure and case study development/knowledge dissemination.

19. **Component 3: Supporting the Results-based Environmental Program in Hebei Province (at appraisal: US$4.5 million GEF grant; at completion: US$4.48 million GEF grant).** This component provided support to implement the Hebei PforR. It complemented US$650 million[16] of investments in air pollution control in Hebei Province.

(a) **Subcomponent 3.1: Providing analytical studies and technical assistance to support the implementation of Hebei Air Pollution Prevention and Control Program.** This subcomponent carried out analytical studies and provided technical assistance to support the Hebei Government in developing and implementing air pollution emissions monitoring and control measures and assessing the pathways for provincial energy transition and industrial decarbonization.

(b) **Subcomponent 3.2: Verifying results for Hebei Air Pollution Prevention and Control Program.** This subcomponent was designed to verify seven DLIs[17] listed under the Hebei PforR program through independent and credible third parties.

(c) **Subcomponent 3.3: Building capacity for the Hebei Government and disseminating lessons learned from the Hebei PforR**. This subcomponent provided training on emission control policies and enforcement and results monitoring and supported the dissemination of knowledge and lessons from the Hebei PforR Program.

B. SIGNIFICANT CHANGES DURING IMPLEMENTATION (IF APPLICABLE)

Revised PDOs and Outcome Targets

20. No change on PDOs and outcome targets has been made during implementation.

Revised PDO Indicators

21. No change on PDO indicators has been made during implementation.

Revised Components

22. No change on components has been made during implementation.

Other Changes

[16] Of total, US$500 million came from IBRD loans and US$150 million from the Hebei province.

[17] Under the Hebei PforR program, DLI-1: number of EPBs at the provincial and prefecture level implementing standard protocols on continuous environmental monitoring (CEM) systems for air emissions; DLI-2: the percentage of enterprises in state-controlled lists and municipal-controlled lists integrated in the improved CEM and environmental enforcement systems for air pollutants; DLI-3: number of clean stoves installed that meet technical emissions standards, acceptable to the World Bank; DLI-4: number of hectares with increased nitrogen utilization efficiency of at least 37 percent due to the application of formula fertilizer based on soil testing; DLI-5: number of clean energy buses replacing diesel buses, which are disposed of in accordance with National Regulations; DLI-6: implementation of a comprehensive official emissions inventory system, acceptable to the World Bank, populated with emissions data for the year before the effective data, and DLI-7: approval of a cost-effective comprehensive plan on air quality control for the next five years, acceptable to the World Bank.

23. **Extension of Project Closing Date** was undertaken in a project restructuring[18] in 2022 to extend the Project closing date for 18 months from April 30, 2022, to October 31, 2023, to enable the Borrower to enhance the development effectiveness of the operation for the Project. The need for project extension was initially identified during the Mid-Term Review in 2021, citing that "*because of COVID related delays, a series of activities that are critical to achieve the GDO indicators targets cannot be completed before the current closure date of the project*", and thus recommended an extension as it "*would also allow to adjust on-going and future activities to take into account the new commitments of peaking GHG emissions before 2030 and achieving carbon neutrality by 2060, thus substantially enhancing the outcome and the impact of the Project*".

24. **Changes in Results Framework** were carried out in line with the above-mentioned extension of the Project closing date, the end target date of all PDO and Intermediate Results indicators, except an intermediate results indicator under Component 2 "Innovative financial products for green financing developed and piloted", which already has achieved its end target, were extended to October 31, 2023.

25. **Changes in Disbursement Estimates** were made to reflect the actual disbursements during FY17-22 and projected disbursements in the rest of FY22, FY23 and FY24.

Rationale for Changes and Their Implication on the Original Theory of Change

26. The outbreak of COVID-19 in early 2020 in China has had adverse impact on project implementation. During the midterm review carried out in May 2021, the Bank team and the three Project Management Offices (PMOs) agreed with the need of closing date extension for 18 months to lead to successful completion of implementation and close of the Project. Based on the agreement, the Ministry of Finance (MoF) issued a request letter dated December 7, 2021, for closing date extension from April 30, 2022, to October 31, 2023. The extension allowed time to complete the ongoing and planned activities which are critical for achieving PDO indicators and help achieve the targets of the three intermediate results indicators. Thus, the extension of the project closing date does not have any impact on the original theory of change.

II. OUTCOME

A. RELEVANCE OF PDOs

Assessment of Relevance of PDOs and Rating

27. The relevance of the PDO is rated as **High**. The Project at completion remains highly relevant and consistent with the World Bank Group Country Partnership Framework (CPF) for China (Report 117875-CN) (FY2020-2025) engagement area 2: Promoting greener growth by facilitating the transition to a lower-carbon energy path and by reducing air pollution. It is also highly relevant in the current context in China for the following reasons.

28. First, EE still constitutes an important policy measure during the 14th FYP. The 14th FYP work plan called for "improving the dual control of total energy consumption and intensity, focusing on controlling fossil fuel consumption". Several key changes, made to China's dual-control scheme on energy consumption implemented in 13th FYP period, is summarized as follows:

[18] Only one restructuring was carried out throughout the Project lifetime.

- The 14th FYP work plan set no predetermined national cap on total energy consumption but gives provinces more room to set and adjust their own targets to better suit local development needs. In addition, a national energy intensity target of 13.5 percent reduction is set but can be flexibly adjusted across the five years. The target achievement will be assessed only once at end of the five-year period, instead of annually.

- Incremental renewable power consumption will be exempted from the provincial accounting of total energy consumption during the 14th FYP period. The exemption will incentivize provinces to prioritize the use of renewable power to support economic growth. However, this does not mean that renewable power can be used without limit to develop energy-intensive industries or towards inefficient uses, because all renewable power consumption will still be assessed against energy intensity reduction targets.

29. More recently, on May 29, 2024, the State Council issued an action plan[19] for energy conservation and carbon reduction during 2024-25. The action plan set targets for a cumulative energy savings equivalent of about 100 million tons of standard coal spanning over 2024 and 2025. The Circular emphasized more efforts in strengthening supervision on energy conservation, and adopting statistical accounting of energy consumption, which is in a good alignment with activities supported under the Project.

30. Secondly, environmental programs for air pollution control are still one of the highest policy priorities in China. In November 2023, the State Council issued its third air pollution control plan. It has specific targets to reduce fine particulate matter pollution (PM2.5) levels by 10 percent compared to 2020 and limit the number of heavily polluted days to less than 1 percent of the year by 2025 for cities at the prefecture level and above. The JJJ region and Hebei Province are included in the key areas, and the JJJ region has a more ambitious target to decrease PM2.5 level by 20 percent. EE is highlighted among key measures to achieve the targets for air pollution control.

31. Thirdly, the PDO remains relevant in carbon-based policy environment at completion. In September 2020, China announced its Dual Carbon Goals and subsequently included them in the revised NDC. In response, the 14th FYP work plan also called for “implementing a system that focuses on carbon intensity control and is supplemented by total carbon emission control”. This system is referred to as “dual control scheme on carbon emissions”. While carbon emission management has become a priority policy objective, EE still constitutes one of the important measures to achieve carbon emissions peaking and carbon neutrality. The 14th FYP, therefore, still contains the target for energy intensity reduction.

B. ACHIEVEMENT OF PDOs (EFFICACY)

Assessment of Achievement of Each Objective/Outcome

32. The outcomes of the Project are i) supporting development and implementation of China’s priority energy efficiency and environment programs; ii) improving the results measurement and verification system and iii) developing market-based mechanisms. The achievement of those outcomes is measured by three PDO indicators (Please refer to Table 1). The PDO indicators (i), (ii) and (iii) measure cumulative impacts throughout the six-year project implementation period. The PDO-level indicators were highly relevant to the PDO, their baseline and target values were set realistically. In addition, those indicators sufficiently captured the Project’s scope of supporting development and implementation of China’s priority energy efficiency and environment programs, improving the results measurement and verification system, and developing market-based mechanisms.

[19] https://www.gov.cn/zhengce/content/202405/content_6954322.htm

Table 1. Key PDO Results Indicators Values: Targets and Actual Values as of October 2023

PDO outcomes	PDO/Outcome Indicators	Baseline	Year 6 Target	Year 6 Actual
Supporting development and implementation of China's priority energy efficiency and environment programs	(i) Energy and environment results verified for the Jing-Jin-Ji Region and Hebei Province.	n.a.	Verification systems for green energy financing and environmental programs in JJJ Region and Hebei Province established and completed.	Verification systems for green energy financing and environmental programs in JJJ Region and Hebei Province established and completed. All DLIs for the JJJ and Hebei PforR operations achieved and verified.
Improving the results measurement and verification system	(ii) energy savings measurement and verification system improved and standardized.	n.a.	MRV system for energy savings improved and standardized[20]	MRV system for energy savings improved and standardized
Developing market-based mechanisms	(iii) market-based mechanisms for energy savings designed and piloted.	n.a.	Market-based EE trading mechanisms designed and piloted[21]	Market-based EE trading mechanisms designed and piloted

33. **Achievement of Objective one: Supporting development and implementation of China's priority energy efficiency and environment programs.** The Project supported implementation of two IBRD-funded PforR programs, namely i) Hebei Air Pollution Prevention and Control Program (P154672) and ii) Innovative Financing for Air Pollution Control in JJJ Program (P154669), which were closed with Highly Satisfactory ICR ratings. The achievement of the first objective is measured by the successful achievement and verification of energy and environment results, which are in the form of disbursement-linked indicators (DLIs), for the JJJ PforR (priority energy efficiency) and Hebei PforR (priority environment) operations. The Project financed the hiring of the 3rd party verification agencies, contributed to development of verification protocols, facilitated consensus among key stakeholders and supported the on-site verification activities.

34. The Project provided critical support that enabled to generate the successful outputs and outcome of the two PforR operations and improve enabling environment for sustainable impacts beyond their implementation period. In addition to supporting DLI monitoring and verification, which accounted for a marginal share, about 10 percent, of the GEF grant support to the PforR operations, the majority of the GEF grant provided capacity building and training to the PMOs and stakeholders and technical assistance focusing on institutional policy framework on energy efficiency, environmental protection, and green financing, and business development to generate investment pipeline and mobilize private sector capital.

[20] According to the PAD, the definition of this target is "China's energy savings MRV system to be improved relative to global good practices with respect to policies, MRV protocols, accreditation and regulation systems for third-party verifiers, and on-line monitoring network."
[21] According to the PAD, the definition of this target is "An energy consumption trading scheme to be designed and piloted, including determining the coverage, cap, allocation and compliance mechanisms, implementation guidelines and trading regulations, registry and trading platform, coordination with the ETS, and conducting post-evaluation."

35. The Hebei PforR Program, closed in 2019, had seven DLIs identified to measure the results. The verification of the achievements of the seven DLIs were successfully completed by 3rd party verification agencies based on the agreed verification protocol over the span of program implementation. A comprehensive official emissions inventory system was successfully established for pollution control in Hebei province. The mean annual population weighted PM2.5 reduced from 83 μg/m^3 in 2015 to 54 μg/m^3 in 2019 when the PforR was closed, a reduction of around 35 percent. The reduction in air pollutants is attributed to the implementation of continuous monitoring systems for the industrial sector for enforcement and supervision, electrification of public transportation, reduction of domestic coal use, and agricultural emission reduction through formulated fertilizer usage. The Hebei PforR Program also supported the establishment of an emissions inventory and cost-effectiveness analysis, which informed the development of future air quality action plans. The outcome of the Hebei Program was rated Highly Satisfactory[22]. The cost-effectiveness analysis conducted under Hebei PforR found that the implementation of Hebei's air quality management measures avoids 7 percent of the province's overall CO2 emissions by 2020 compared with a baseline in which no air quality action plan is implemented. This accounts to 64 million tons of carbon dioxide equivalent (tCO2e) avoided cumulatively from 2018 to 2020. The PM2.5 level decreased further and reached 38.6 μg/m^3 in 2023. There are more opportunities to further improve air quality in Hebei province as the $PM_{2.5}$ level was still six times higher than the World Health Organization recommended threshold.

36. The financial support of the Project enabled Hebei province in planning energy transition and improving policy framework to further promote EE. Hebei province explored energy transition pathways under the Dual Carbon Goals as well as industrial decarbonization pathways with a focus on the iron and steel sector. The Project resulted in five new technical standards[23] to help strengthen EE in the iron and steel sector. In addition, the GEF grant supported Hebei to improve GHG emissions MRV systems and enforce them for the eight energy-intensive industrial sub-sectors, including power, steel, chemical, cement, petrochemical, papermaking, aluminum production and glass industry since 2023.

37. The JJJ PforR Program, closed in 2022, had six DLIS identified to measure the results. The achievements of the six DLIs were successfully verified by 3rd-parties based on the agreed verification protocol over the course of program implementation, and the outcome of the JJJ Program was rated Highly Satisfactory[24]. The Project financed 33 sub-projects and resulted in the reduction of GHG emissions by 2.876 million tons of CO2 equivalent, particulate emissions by 4.2 million tons, SO2 emissions by 14,324 tons, NOx emissions by 17 million tons, and coal consumption by 1.2 million tons of standard coal, most of which exceeded the original targets. It also mobilized a total investment of US$1.77 billion, of which US$1.36 billion was commercial capital from Hua Xia Bank and the market. It was the first PforR program in energy efficiency and renewable energy, and the first PforR on-lending project implemented in China.

38. The financial support of the Project also enabled Hua Xia Bank in mainstreaming green finance through the JJJ PforR Program. One of the DLIs was to set up a Green Finance Center in Hua Xia Bank to strengthen institutional capacity and help mainstream green finance. The Project also supported developing business plans in specific sub-sectors, facilitating match making to generate investment pipeline, and training Hua Xia Bank staff to enhance capacity to assess and underwrite green financing transactions. Building on the extensive support, Hua Xia's total green loan portfolio reached seven-fold increase, from US$5.3 billion in 2016 to US$38.5 billion in June 2023. With support of this Project, it

[22] Implementation Completion Report (ICR) Review (Report Number: ICRR0022169) for Hebei Air Pollution Prevention (P154672)
[23] Including 'Technical Requirements for Dry Fine Desulfurization of Blast Furnace Gas', 'Rare earth low-carbon steel hot-rolled disc rod', 'Rare earth plated low-carbon steel wire without coating', 'Rare Earth Carbon Steels and Low Alloy Structural Steels, Hot Rolled Steel Plates and Steel Strips' and 'Requirements for Carbon Metering, Provisioning and Management of Thermal Power Generation Enterprises'
[24] Implementation Completion Report (ICR) Review (Report Number: ICRR0023348) for Innovative Financing for Air Pollution Control in JJJ region (P154669)

has developed several green financing instruments, such as green bonds, green leasing, and emission allowance-backed loans. Hua Xia's total green financing portfolio reached US$50 billion in June 2023. Its green financing portfolio ranked the fifth among 24 major banks in China and the second among joint-stock commercial banks as of June 2022. Green financing supported infrastructure retrofitting with green solutions, clean energy industry, energy conservation, climate and biodiversity and green services. Hua Xia Bank also adopted the result-based approach to appraise green finance investments, with emission reduction as a key criterion.

39. Furthermore, the Project also contributed to the design and roll-out of priority EE policies at national level. At completion, 22 TA activities were completed, which supported development of priority EE and coal cap control policies and their implementation. The outputs of those TA activities have informed the design and formulation of many EE policies during the 13th and 14th FYP. The key policy impacts are summarized as follows:

- ***Supported the preparation and issuance of key policy documents*.** These include i) China's "14th FYP Comprehensive Work Plan for Energy Conservation and Emission Reduction", and ii) "Implementation Plan for Coal Consumption Reduction and Replacement Project" and iii) "Green Technology Promotion Catalogue (2020)". In particular, the 14th FYP Work Plan set an overarching and biding target of reducing the national energy consumption per unit of GDP by 13.5 percent by 2025 compared to the 2020 level. This binding target is expected to be accomplished based on the achievement on energy intensity reduction from 2021-2023. In addition, the 14th FYP Work Plan set several other targets, including completing the ultra-low emission retrofit of 530 million tons of steel production capacity by 2025, and reducing energy consumption per unit industrial value added by 13.5 percent. Those targets are on track to be achieved as well.
- **Guided provincial governments in allocating their allowance to enterprise.** This in turn is instrumental in achieving the dual control targets. It contributed to better achievement of energy intensity reduction target through rewarding enterprises with better energy efficiency.
- **Formulated EE policy recommendations which were adopted by the State Council, including:**
  - Recommendations on China's energy saving and environmental protection service industry, which were adopted to inform the development of the 2019 report "Recommendations to take emergency measures to help green and environmentally friendly enterprises navigate through difficulties".
  - Roadmaps to achieve national energy consumption dual control targets for 14th FYP by sector and by region, which were adopted by "14th FYP Comprehensive Work Plan for Energy Conservation and Emission Reduction".
  - Opinions on establishing and improving an economic system for green, low-carbon and circular development. Such opinions provided technical underpinning for the issuance of "Guiding opinions on accelerating the establishment and improvement of a green, low carbon and circular development economic system" by State Council.
- **Contributed to promotion of green technologies and associated green financing.** The "Green technology promotion catalogue (2020)" covered 116 green technologies in five categories[25]. The catalogue became a guiding policy document for green technology promotion and is updated annually by NDRC. By end of 2023, the green credit balance of 21 major banks reached RMB 27.2 trillion, a year-on-year increase of 31.7 percent, although its attribution to the catalogue is difficult to quantify.

[25] Five categories include i) energy savings and environmental protection industries (63 technologies included), ii) clean production industries (26 technologies), clean energy industry (15 technologies), infrastructure green upgrade (8 technologies) and ecological and environmental industries (4 technologies).

40. **Achievement of the Objective two: improving the results measurement and verification system**. The achievement of the second objective is measured by the PDO level indicator – "MRV system for energy savings improved and standardized". The improvement made by this Project are multi-faceted, including establishing an overarching framework for energy savings MRV based on extensive review of the legal, policy and technical standard frameworks of MRV systems in the European Union (EU) and the United States (US), developing a total of 29 methodologies at project level, enterprise level and city/province (management level), improving accreditation and regulation systems of third-party verifiers so that "reasonable" or "limited" assurance[26] on verification results can be provided, and formulating implementation guideline for MRV data from the energy consumption online monitoring system.

41. Several highlights of the EE MRV system improvements are summarized as follows:

- **Ensure raw data quality** by setting clear measurement and reporting requirements for enterprises to deliver quality energy data reports/statements. The enterprise shall follow *"Energy Data Measurement and Reporting Conceptual Framework (Regulation)"*, *"Guidance for energy data measurement and reporting"* and *"MRV methodologies (enterprise level)"* to deliver quality data for the third-party verification.
- **Providing assurance to verification of energy savings** by improving verification systems for third-party verifiers: The third-party verification entities could follow "*Energy Data Verification Conceptual Framework (regulation)*" and using "*Guidance for MRV evidence analysis*" to obtain "reasonable assurance" for verification results for energy saving. Alternatively, the third-party verifiers could follow "*Energy data statements Review Guidelines*" together with "*Guidelines for energy data review*" to obtain "limited assurance" for the results.
- **Supporting market-based EE trading**: The existing energy MRV systems are not designed for the trading between different enterprises because such trading demands more accurate energy data and relevant information. The energy savings MRV system developed under this Project is designed to support the energy consumption rights trading.
- **Compatibility with ETS MRV**: the energy savings MRV system under this Project is compatible with ETS MRV, which supports co-existence of the energy consumption rights trading and the ETS trading, and their conversions.

42. NDRC is currently exploring opportunities to apply the improved energy savings MRV systems for implementation. The Department of Environmental Protection and Resource Conservation of NDRC is coordinating with other departments under NDRC and other government agencies including the Ministry of Environment and Ecology (MEE) and the National Bureau of Statistics (NBS) for various pilot and use cases, e.g., monitoring energy consumption and savings of high energy-intensive enterprises, improving statistical reporting, or using in the development of carbon emissions MRV systems to be used for the ETS.

43. **Achievement of the Objective three: developing market-based mechanisms.** The achievement of the third objective is measured by the design and pilot of market-based EE trading mechanisms. This Project supported the development of the national energy consumption rights trading scheme. The scheme has been designed to be consistent with China's current EE policies. Three trading modalities were suggested, including i) trading between provincial governments; ii) trading among enterprises; and iii) trading between provincial government and enterprises for greenfield energy intensive projects. The trading scheme was already cleared by NDRC and is now under review by the State Council.

[26] Currently, third party verifiers did not provide any form of assurance on their verification results in China. Source: NDRC ICR 2022

44. This Project also contributed to the four provincial/city-level pilot EE trading schemes in Henan Province, Fujian Province, Shandong Province, Qingdao city (in Shandong Province) and Ningxia Hui Autonomous Region. These four pilot EE trading schemes were authorized by NDRC in 2017 to explore various operational modalities. In addition, five provinces voluntarily introduced market-based trading scheme on energy savings, coal consumption savings, etc. These provincial and regional pilots provided experience and lessons learned to inform the development of the national energy consumption rights trading scheme. How the Project contributed to various regional pilots and associated transaction status of energy consumption rights trading are summarized as below:

(a) In Fujian, the Project contributed to revision of the guidelines for the energy savings MRV in the province's energy use right trading, mainly involving nine industries, including cement manufacturing, thermal power generation, crude oil processing, and steelmaking. Since 2021, 13 transactions took place, with a volume of about 1.24 million tons of standard coal and a total value of about RMB 18.4 million.
(b) In Henan, the Project informed the revision of the "Henan Province Energy Rights Paid Use and Trading Pilot Implementation Plan", particularly on the finalization of transaction scope and trading entities. Since 2021, two transactions in Anyang city and Fu yang city took place with a total volume of about 0.21 million tons of standard coal and a total value of about RMB 0.418 million
(c) In Qingdao, the Project informed formulation of Implementation Rules for Energy Savings Trading in Qingdao (Trial version). The implementation rules stipulates that the energy savings trading in Qingdao is mainly for key enterprises with an annual comprehensive energy consumption of 5,000 tons of standard coal and above in the city, and it clarifies process associated with energy savings quota allocation, quota trading and usage.
(d) In Ningxia Hui Autonomous Region, the Project informed formulation of “Implementation Opinions on Carrying out the Reform of Fully Paid Use and Trading of Energy to Improve the Efficiency of Energy Factor Allocation", and the development of five supporting guidelines. Following the roll-out of the implementation opinion, the Ningxia Hui Autonomous Region Public Resources Trading Platform Energy Use Right Trading System was put into trial operation on November 2, 2023.

Justification of Overall Efficacy Rating

45. The overall efficacy of the Project is rated **High**. All the three objectives of the Project have been fully achieved and are highly attributable to the Project. The results and impacts have been assessed at three different levels as below:

(a) At project output level, the Project has successfully delivered outputs as designed at appraisal. These include successful implementation support to the two parallel IBRD-funded PforR operations that were closed with Highly Satisfactory ICR ratings, improvement of EE MRV system, and the design and pilot of energy consumption rights trading scheme, as described in the previous section.
(b) At policy outcome level, the Project output informed development of and led to adoption of several 13th and 14th FYP policies and regulations on energy efficiency and conservation (see Paragraph 39). The Project also informed key institutional policies of Hebei province and Hua Xia Bank to support energy efficiency, emissions reduction and green financing (see Paragraph 36 and 38). The improved energy savings MRV systems will likely find opportunities for application building on NDRC’s current effort (see Paragraph 42). The national energy consumption rights trading scheme is currently under review by the State Council, and considering China’s policy making process, there is a high likelihood to put it into implementation (see Paragraph 43).
(c) At transformational impact level, the Project has already contributed to the substantial achievement of energy efficiency and conservation under the 13th and 14th FYP through the policies and regulations adopted, ranging from GoC’s EE target design, sectoral EE diagnosis/green technologies/EE benchmarking, to development of

robust MRV for EE measurement and the design and pilot of energy consumption rights trading schemes. Hua Xia Bank has already demonstrated significant green financing scale up as a result of the Project support. Building on the Project output and additional policies, Hebei province is developing its own plan for provincial energy transition, carbon emissions peaking, and industrial decarbonization, all of which are expected to lead to transformational impact on energy efficiency and emissions reduction. The energy savings MRV systems and national energy consumptions rights trading scheme, once adopted and implemented, will generate significant impacts on further exploiting energy efficiency potential on a market-based approach.

C. EFFICIENCY

Assessment of Efficiency and Rating

46. The overall efficiency is rated **Substantial.** There were no major shortcomings that substantially effected key project results as most were successfully achieved. The key indicator of GEF incremental cost is overachieved compared to the Appraisal. In terms of the global environmental benefits, the incremental cost of GEF have exceeded the original outcomes in terms of reducing CO_2 emissions and coal consumption. But due to the implementation delays caused by COVID-19 pandemic and the needs to extend the closing date, the overall Project efficiency is rated Substantial which can be justified by the use of GEF grant funds.

47. Since it is a tehnical assistance (TA) project funded by GEF, thetraditional cost-benefit analysis to evalute the efficiency with which the funding was used is not feasible. Instead, a more appropriate set of measures could be to evaluate the Project's cost efficiency comparing project costs and outcomes at Apprasial; and assess the Project's operational efficiency for smoothly implementing the myriad of activities and maximizing its value-added. A GEF incremental cost anlysis for avoided CO_2 emissions is conducted as below:

48. **Annual & accumulative CO_2 emission reduction:** While strict economic valuation is not appropriate, it can be informative to compare the direct investment benefits from the Project with the GEF grant expenditures, acknowledging that the full value of the Project rests on major policy initiatives it supported that are not easily quantifiable. When the Project was designed to support development and implementation of China's priority energy efficiency and environment programs, it resulted in a commensurate level of avoided CO_2 emissions. While it may not be appropriate to attribute the entire national target to reduce energy intensity sole by the GEF funded project – this Project, it had a more directly role in catalyzing the pilot of market-based EE trading scheme at the provincial level. The Energy efficiency and renewable energy subprojects enabled by the GEF grant have resulted in an annual reduction of 1.179 million tons of coal equivalent (tce) compared to an estimate of 800,000 tce/year at Appraisal. Using the same emission factor for China of 2.44 tons of CO_2 per tce as used during Appraisal, the total estimated incremental emission reduction attributable to the GEF by the end of project implementation is 2.876 million tons of CO_2/year. The cumulative avoided CO_2 emissions is equal to 10 times of the annual CO_2 emission reduction, resulting in a cumulative emission reduction of 28.76 million tons CO_2 which is 46 percent increase of the original estimate of 19.69 million tons of CO_2 at Appraisal.

49. **GEF incremental cost:** At Appraisal, the Project cost was estimated at US$17.8 million. The actual disbursed amount at the end of project completion was US$17.08 million. Based on the Project cost and the cumulative avoided CO_2 emissions enabled by the GEF grant, the undiscounted incremental cost is calculated at US$0.59 per ton of CO_2 which is significant improvement compared to the Appraisal estimate of US$0.7 per ton of CO_2.

50. **Implementation efficiency**. The project was rated modest in terms of implementation. The Component 1 encountered several delays due to either NDRC's prolonged internal review, approval and payment processing procedures or a key personnel change in NDRC. As a result, the contracts of two key activities – "Reviewing MRV International Experience" and "Developing MVR Principles and Guidelines" were signed in May 2020, about three years after the project was approved. Those two activities were also negatively impacted by the subsequent outbreak of COVID-19 in first half of 2020. In addition, the mobility restriction and capacity constraints imposed during COVID-19 also delayed the implementation of Component 3. The PMO of the Component 3 was not able to fully function because the city of Shijiazhuang where it is located experienced nearly two-month locked down in fourth quarter of 2022. To manage potential impacts of any further mobility restriction, for new activities under the Component 3, their scopes of work were designed in a way to minimize travel requirements.

D. JUSTIFICATION OF OVERALL OUTCOME RATING

51. Based on High ratings of two elements of outcome rating – relevance of PDO and efficacy of three PDO outcomes and substantial rating of efficiency, the overall outcome is rated as **Highly Satisfactory**.

E. OTHER OUTCOMES AND IMPACTS (IF ANY)

Gender

52. There was no special focus on gender in this project and no disintegrated targets for men and woman.

Institutional Strengthening

53. The Project has effectively enhanced China's national and local energy conservation management capabilities. Six international study tours on EE policy making, fiscal incentives, and enforcement were carried out. The study tours strengthened capacity of China's national and local energy conservation officials through training and knowledge exchange of EE policy making and energy conservation management. In addition, the GEF grant also enhanced capacity of key stakeholders on energy savings MRV and pilot energy consumption rights trading scheme. It developed standard training curriculum, trained the trainers, and provided online and offline trainings to relevant government departments, third-party verifiers, ESCOs, priority enterprises and provincial EE centers. Cumulatively, a total of 2,715 person-times of online training and 210 person-times of offline training were delivered, significantly exceeding the original target of 1,200 person-times training.

54. In addition, the GEF grant also supported development of Green Finance business within Huaxia Bank (HXB). Specifically, it facilitated establishment of a green finance center, a professional institution specialized in the green finance, and developed marketing incentives and specialized management mechanisms. With the grant support, HXB established mechanisms for institutional setting, resource allocation, assessment and incentives, risk control, and continuously developed an innovative green finance product system, forming a suite of integrated green finance products[27] and service system, covering green loans, green notes, green investment, green leasing, green debt financing

[27] As of September 2023, for **photovoltaic loan**, the number of customers reached 2,375 with a loan balance of RMB 307 million; for **pollution discharge rights mortgage financing business**, the number of customers reached 11, with a total investment of Yuan 555 million and a loan balance

instruments underwriting, green wealth management and green funds. Meanwhile, with the support of the World Bank team, HXB has carried out capacity building in green finance and E&S risk management, conducted industry research on industrial energy efficiency, building energy efficiency and renewable energy, and organized multi-level trainings at the headquarter and branches to enhance professional capabilities for industry, product and talent specialization.

Mobilizing Private Sector Financing

55. The Project helped Hua Xia Bank scale-up its Green Finance, which in turn contributed to private capital mobilization. It contributed to the improved institutional capacity for green financing with the private sector, through technical assistance in developing business plans in specific sub-sectors, facilitating match making to generate investment pipeline, and training Hua Xia Bank staff to enhance capacity to assess and underwrite green financing transactions. On top of its achievement in green finance, Hua Xia Bank is also expanding its loan portfolio with the private sector despite the relatively low creditworthiness of private sector enterprises compared to SOEs. Under JJJ PforR, private sector investment reached US$570 million, accounting for 32 percent of total investment. As of June 2023, 27 percent of Hua Xia Bank's green loan portfolio is provided to the private sector, with the total loan amount of US$10.4 billion.

Poverty Reduction and Shared Prosperity

56. The Project contributed to the promotion of shared prosperity on a livable planet. Reducing air pollution is a top priority for the Government of China, particularly given the severe air pollution in the Jing-Jin-Ji Region and the impact on public health. Hebei Province had the highest annual average ambient PM2.5 concentration in the region with 112.9 μg/m^3 in 2012. Hebei Province was also responsible for about 70 percent of total emissions in the region. At completion, the air quality of Hebei Province has significantly improved. The annual average PM2.5 concentration in the region have been on a downward trend from 44.8 μg/m^3 in 2020 to 36.8 μg/m^3 in 2022[28], a reduction of 52 percent relative to the 2015 level at appraisal. The downward trends were also established for other air pollutants, including the annual average SO_2 concentration from 13 μg/m^3 in 2020 to 8 μg/m^3 in 2022, a decrease of 80 percent relative to the 2015 level, the annual average NOx concentration from 34 μg/m^3 in 2020 to 28 μg/m^3 in 2022, a decrease of 39 percent relative to the 2015 level.

Other Unintended Outcomes and Impacts

57. There were no other unintended outcomes and impacts from the Project.

III. KEY FACTORS THAT AFFECTED IMPLEMENTATION AND OUTCOME

A. KEY FACTORS DURING PREPARATION

58. Key factors during the preparation period included an assessment of government commitment, project objectives, project design, linkage with the PforR Program, and evaluation of risks of project implementation and mitigation measures.

of RMB 467 million; for **green financial bonds**, it supported a total of 167 projects with a total investment of RMB 20 billion; for **green project syndication financing**, it has served 6 corporate customers with a total of approved RMB 452 million in credit lines; for **carbon emissions rights mortgage financing**, HXB closed two deals with a credit line of RMB 281 million and a loan of RMB 151 million.

[28] Data from Hebei PMO.

59. **Strong and sustained government commitment was critical to ensure success of the Project.** The Project was conceived during a period when rising energy consumption and severe air pollution, negatively affected the sustainability of China's economic development. Recognizing the importance of energy consumption control and air pollution prevention for China's sustainable growth, the GoC is committed to energy conservation, coal consumption control, and air pollution prevention at the time of appraisal. The strong government commitment led to the birth of the Project. The commitment has been sustained since the project effectiveness, which provided conducive environment to ensure successful implementation of the Project.

60. **The Project had clear PDOs, and a strong link was established between the PDOs and project activities**. The activities financed by the Project—TAs on priority EE and coal cap control policies/programs, design and pilot of market-based EE trading scheme, improvement of energy savings MRV system, and support to implementation of both JJJ and Hebei PforR programs — directly contributed to provisions of assistance to development and implementation of China's Priority energy efficiency and environment programs, with a focus on improving the MRE system and developing market-based mechanisms.

61. **The selection of three capable and fitting Project implementing entities laid the cornerstone for successful implementation.** Despite the long preparation period of 36.1 months, the task team engaged in extensive and protracted discussion with NEA at the initial phase of the Project preparation. While setting up national policies on EE and designing and piloting EE trading scheme went beyond the scope of NEA, the NDRC was identified as the appropriate ministry to execute this Project with its existing government programs. Two concurrent ongoing IBRD operations provided the implementing entities with ample opportunity to acquaint themselves with the Bank's operational guidelines.

62. **The project design was built upon good international and Chinese experience** related to energy saving M&V, the coordination of EE trading, RE trading and ETS and their relevance to China, which are summarized as follows:

- It is justified for Government of China to set multiple targets for EE, RE and carbon emission as objectives of energy policy are multi-dimensional.
- Multi-faceted nature of the energy policy led to the use of multiple trading schemes, and carbon cap and trade alone is not sufficient to tap the full potential of EE. International experience demonstrates that EE, RE, and carbon trading schemes can coexist and complement each other.
- MRV is essential to both the EE trading scheme and the ETS. A clear definition of the concept of energy savings is important to avoid misinterpretation when protocols and methodologies are implemented; Transparent institutional structures and decision-making processes are critical to the establishment of a credible energy saving M&V system.

63. **Coupling GEF grant with IBRD PforR operation facilitated the program implementation and expanded impacts of the PforR program.** The GEF grant financed a series of TA activities which played an important supporting and catalytic role to support implementation of the PforR program. In case of Hebei PforR, the GEF grant supported analyses to identify and close specific knowledge gaps, for example, stove efficiency tests, and the innovative approach to quantify and verify environmental results for each DLI. In case of JJJ PforR, the GEF grant facilitated development of innovation financial products and verification of DLIs. It also facilitated knowledge sharing and dissemination, as well as green financing related policy study and interaction with concerned government agencies to influence the policy making and regulation in promoting green financing in China.

64. **Adequate risks identification and effective mitigation measures in place to support Project implementation.** The overall risk was adequately assessed as Moderate during preparation, with a special concern on fiduciary risk and the coordination of energy savings trading scheme and carbon emissions trading system. To mitigate these risks, several effective measures were developed during preparation: i) strengthen institutional arrangements for internal control on procurement and financial management, providing adequate fiduciary trainings to project staffs, in particular to Hebei Project Management Office that had no previous experience with implementing bank-financed projects; ii) implementing lessons learned from international experience and from stakeholder consultation conducted during project preparation; iii) included a TA to study coordination between market-based EE trading scheme and carbon emissions trading in China and iv) develop energy savings MRV system that is compatible with Chinese carbon emissions trading.

B. KEY FACTORS DURING IMPLEMENTATION

65. **Institutional capacity for implementation is a key cause of the delay associated with technical assistance under the Component 1.** The implementation challenge was primarily caused by NDRC's prolonged internal review, approval, and payment processing procedures. As a result, completed technical studies were either waiting for final review, or pending internal approval by NDRC or pending payment processing. It not only created backlog in disbursement but also delayed start of new contracts that is contingent upon final output of prior studies. To mitigate such issue, several measures were put in place: i) a regular bi-monthly progress review meeting was held between the Bank and National Energy Conservation Center (NECC) to facilitate internal review and approval process; ii) NDRC appointed a project coordinator within the Department of Environmental Protection and Resource Conservation of NDRC, per Bank team's request. In this way, the NECC PMO can follow up with the project coordinator directly to expedite the internal process within NDRC.

66. **The personnel change in NDRC and the delayed decision on scope and methodologies of the studies partially set back implementation of key activities related to MRV related activities.** As a result, the contracts of two key activities – "Reviewing MRV International Experience" and "Developing MRV Principles and Guidelines" were signed in May 2020, about three years after the project was approved. The timely and successful completion of both activities is important for completion of a subsequent activity - "developing MRV methodologies" that is critical towards the achievement of a PDO level indicator – "MRV system for energy savings improved and standardized". With the interventions from the Bank team and NDRC, the personnel change was resolved, and the scope and methodologies of MRV-related studies finalized, the two critical activities started to progress.

67. **The outbreak of COVID-19 also negatively impacted the project implementation.** The impact was the strongest during the 2020-21 period. Take Component 1 for instance, achievement of two PDO level indicators – "MRV system for energy savings improved and standardized" and "Market-based EE trading mechanisms designed and piloted" were adversely impacted. For both indicators, the contracts of corresponding technical assistance were signed in May 2020. As a result, their implementation was delayed due to mobility restriction and capacity constraints imposed during the COVID-19. In the second half of 2022, the project implementation was affected again by the covid re-surging cases in China. Internal approval within implementing agencies and responses to the procurement process took much longer time, as capacities within implementing agencies and potential contractors were severely constrained by the pandemic. For example, the city of Shijiazhuang, where the implementing agency of Component 3 is located, experienced nearly two-month locked down from mid-October until early December 2022. The PDRC and PMO were required to work from home and were thus not be able to fully function. To manage potential impacts of any further mobility restriction, for new activities, their scopes of work were designed in a way to minimize travel requirements.

IV. BANK PERFORMANCE, COMPLIANCE ISSUES, AND RISK TO DEVELOPMENT OUTCOME

A. QUALITY OF MONITORING AND EVALUATION (M&E)

M&E Design

68. The project's Theory of Change is clear. The Result framework (RF) is robust because there are no changes to the RF from the design till project completion. Adequate results framework indicators were identified to monitor the progress towards and assess the achievement of the PDOs. They were sufficient to assess the attribution to the project. The PDO level indicators were highly relevant to the PDO and sufficiently capture its scope of supporting development and implementation of China's priority EE and environment programs, with a focus on improving the results measurement and verification system and developing market-based mechanisms. Adequate M&E arrangement was in place to ensure all results indicators designed by the Project were collected during implementation.

M&E Implementation

69. **M&E of the Project** consisted of (a) regular monitoring of implementation status in the Results Framework, (b) quarterly implementation progress reports, (c) a midterm review on implementation and outcome progress, and (d) the Project implementation completion report. The three implementing agencies were responsible for daily M&E activities of respective components, including data collection and monitoring, reporting of progress based on the agreed indicators to the World Bank, and coordination with all third-party verification agencies.

70. **M&E was implemented thoroughly as planned and was reported on a regular basis.** PDO-related targets were duly and timely reported. For both PforR operations, verification reports from the IVA and independent Audit Firm (IAF) were made available on time and consistently used as the main basis for authorizing the World Bank's disbursements upon the successful achievement of DLI targets.

M&E Utilization

71. **M&E was utilized** to (a) monitor and manage the Project progress and achievements toward the PDO; (b) identify areas where emerging issues might require attention and make adjustment to implementation plans to help achieve the Project's objectives; and (c) inform important decision-making. Take JJJ PfoR for instance, M&E was used to inform decision-making such as expanding geographic coverage and including VOCs to be one of the eligible air pollutants under the JJJ PforR Program. Lastly, the disbursement-linked indicators for both energy and environment PfoR operations were closely aligned with targets outlined in the government program. Thus, implementing and achieving the targets of the DLIs translated into progression of the government targets as well.

Justification of Overall Rating of Quality of M&E

72. **The overall quality of M&E is rated as High**. The PDO-level indicators are sufficient to capture essence of the PDOs, and the intermediate results indicators were also instrumental in monitoring the progress of the subcomponents. The ME reports were prepared timely to keep track of the status of all subcomponents at any given time. The utilization of the M&E helps ensured successful and timely completion of the Project.

B. ENVIRONMENTAL, SOCIAL, AND FIDUCIARY COMPLIANCE

73. **Environmental and Social Safeguards.** The project activities were all technical assistance activities to support development and implementation of China's priority energy efficiency and environment programs, with a focus on improving the results measurement and verification system and developing market-based mechanisms. The project did not finance any physical investments or activities. The only Safeguard Policy triggered by the project is Environmental Assessment (EA) OP/BP 4.01. The project was classified as Category B considering the potential downstream environmental and social impacts, and no EA instrument was required according to the provisions of OP 4.01. Environmental and social considerations had been included in the terms of reference for consultancies related to studies, assessments, and capacity-building activities under the project. The environmental and social safeguards management was considered satisfactorily undertaken in compliance with domestic regulations and OP 4.01 requirements, with no reported cases on occupational safety and health (OHS) incident or accident during the project implementation.

74. **Procurement.** Procurement performance was Moderately Satisfactory. The procurement has been carried out in compliance with the Bank policies and procedures. The major procurement under the project was small consultancy assignments. Three PMOs had designated staff responsible for procurement. The PMO and PIUs made efforts to build their staff's capacity to mitigate the risk of inexperience in Bank financed project. The overall progressing for procurement was slower than the plan and unbalanced among the different PMOs. The slow progressing was mainly resulted from the following reasons: i) the adverse impact of outbreak of coronavirus pandemic, which delayed the assignments involving substantial site visit and consultation; ii) the delay in organizing review/assessment for the output when the deliverables were furnished by the consultant; and iii) the frequent staffing substitutions, which weakened the effect of training and caused additional time spent for handover. Procurement plans were realistic and detailed and were updated regularly.

75. **Financial Management (FM).** The project had adequate project financial management system that provided, with reasonable assurance, accurate and timely information that the grant was being used for the intended purposes. The project accounting and financial reporting were in line with the regulations issued by MOF and the requirements specified in grant agreement. No significant FM issues were noted throughout the project implementation and the FM related issues or weaknesses raised during FM implementation could be resolved on timely basis. The project audit reports were all with unqualified audit opinions. In addition, the withdrawal procedure and funds flow arrangement were appropriate. The grant proceeds were disbursed in a timely manner.

C. BANK PERFORMANCE

Quality at Entry

76. **The development of the project concept benefitted from the World Bank's understanding of the country context and priorities as well as the World Bank's prior experience in EE, clean energy, and environment sectors of China.** The project development objectives were highly relevant with China's mandatory total energy consumption cap and energy intensity reduction target during the 13th FYP, and well aligned with the GoC's program on air pollution prevention. It also incorporated the lessons learned from two Energy Sector Management Assistance Program (ESMAP) studies that reviewed international experiences regarding energy saving M&V and coordination of EE, RE, and ETS and their relevance to China. Key lessons incorporated in the design of activities under the component 1 included i) multiples targets for EE, RE and carbon emissions is justified for the energy policy, which led to the use of multiple trading schemes. Carbon cap and trade alone will not tap the full potential of EE because carbon pricing alone cannot remove all the market barriers and failure for EE; ii) EE and carbon trading schemes can co-exist and complement each other. Co-existence

ensures that if one policy fails to meet the carbon reduction target, the other complementary policies may compensate; iii) MRV is essential to the EE trading scheme and the ETS; and iv) China's energy saving M&V system should build on good international experience.

77. **Parallel technical assistance (TA) financed by the Project proved to be a salient feature of both PforR operations.** This Project is critical to successful implementation of both PforR Programs and had a high payoff. In case of the JJJ PforR, HXB made full use of the GEF grant to support (a) business development, deal origination, and pipeline development; (b) support the development of innovation financial products under the Program[29]; (c) due diligence of investment sub-projects; (d) verification of the results and DLIs which is critical to funds disbursement; (e) capacity building to strengthen implementation capability of HXB; and (f) knowledge sharing and dissemination. In case of the Heibei PforR, the Project was used to identify and close specific knowledge gaps, for instance, stove efficiency tests, as well as to support the development of innovate approach to quantify and verify environment results for each DLI.

78. In hindsight, the World Bank team's judgement on the GoC's commitment to energy conservation and shifting toward the use of market-based mechanisms was on track. It's also worth noting that the World Bank team considered the coordination between the EE trading system and carbon ETS at appraisal and incorporated it as one of key activities under the Component 1. Both the judgement and careful design of project activities ensured sustainability and impact of the project deliverables. This is particularly evident as the Project progressed into the 14th FYP period during which the targets for carbon peaking and neutrality were announced.

Quality of Supervision

79. The World Bank team worked closely with three implementing agencies to ensure smooth implementation of the Project. Twelve supervision missions were carried out over the seven-year Project implementation period, implying on average two supervision mission a year. The Aide Memoires and Implementation Status and Results Reports (ISRs) were prepared on time. The Results Framework was used as an effective tool for proactive management of issues encountered during project execution. The World Bank's team, comprising Task Team Leaders and most the team members, were stationed in the field (Beijing office), thus ensuring intensive and on time communication and implementation support. The World Bank team played a critical coordinating and proactive role in advising and promoting solutions to implementation challenges. For instance, the Component 1 experienced a slow disbursement during the 2021-22. At the request of the World Bank team, NDRC appointed the project coordinator within Department of Environmental Protection and Resource Conservation to facilitate the internal review, approval, and payment processing procedures of all deliverables under the component 1. The World Bank team also established regular bi-monthly progress review meetings with the implementing agency to closely monitor progress of ongoing technical assistance activities and take proactive actions if needed. Subsequently, the funds disbursement accelerated.

80. The World Bank provided a number of trainings to project implementing agencies on fiduciary and environmental and social safeguards during implementation, guidance and advice on specific project issues during implementation support missions. This is particularly important for HBPMO as it had no previous experience with implementing the World Bank-financed projects prior to the Hebei PforR. The World Bank promptly reacted to all procurement inquiries and closely followed up with concerned implementing agencies to address and solve them.

[29] For example, HXB used the GEF grant to undertake a green bond study which would help HXB design and facilitate issuance of the green bond product under the Program. HXB also used the GEF grant to finance a study to use carbon emission reduction credit as collateral.

Justification of Overall Rating of Bank Performance

81. Bank performance is rated **Satisfactory**, based on the discussion above on quality at entry and project implementation support. The World Bank team's good understanding of local policies and careful design of project activities, as well as active engagement with implementing agencies in resolution of any rising issues are critical to implementation of the project and eventually to the successful delivery of the project on time.

D. RISK TO DEVELOPMENT OUTCOME

82. **The overall risk to development outcome is Moderate.** The project design integrated policy support, institutional strengthening, technical studies, and capacity building. All interventions under the project would contribute to the sustainable growth of EE development in China. The project faces the following main risks to development outcome.

(a) **Sustainability of energy savings MRV system.** The GoC's commitment to energy conservation is high. This necessitates the establishment of energy savings MRV system because it is fundamental for the implementation and evaluation of all EE measures and play a critical role in bringing credibility and transparency to the market-based energy consumption rights trading schemes. NDRC has been working with selected provinces/cities to put MRV methodologies into application (see Table 3 for details). It also contributes to ETS MRV system development for expansion.

(b) **Sustainability of the market-based approach in curbing energy consumption. The GoC set twin goals of total energy consumption curbing and carbon emission peak in its 14th FYP.** To meet the GoC's energy consumption obligation, the energy consumption rights trading scheme is cost-effective approach to sustain the GoC's energy conservation commitment and efforts by providing a market-based option for the obligated parties. Carbon ETS alone will not tap the full potential of EE as carbon pricing alone cannot remove all the market barriers and failures for EE. In addition, energy consumption rights trading would also contribute to carbon peaking. This is corroborated by the recent International Energy Agency (IEA) findings[30] that "reaching a peak in China's CO_2 emissions before 2030 relies on progress in three priority areas: energy efficiency, reducing coal use and renewables". Close coordination between the energy consumption rights trading system and the carbon ETS will ensure that the two trading schemes complement each other and jointly achieve the GoC's energy consumption curb and carbon peaking targets.

(c) **Sustainability of the government's air pollution policy.** Given its adverse impacts on public health and costly environmental damage, air pollution control will likely remain a top priority in the government's agenda in the long term. The strong government commitment to fight against air pollution was the foundation on which these PforR Programs were built, while the sustained commitment will likely be a prerequisite for continued improvement of air quality in China in the long run. These PforR Programs were conceived during the first phase of the government program, the implementation of the Program coexisted with the second phase, while the third phase of the government program goes beyond the Program lifetime. Such continuation of the government programs serves as a good indicator of sustainability of the GoC's commitment to air pollution control in the long run.

[30] International Energy Agency, An energy sector roadmap to carbon neutrality in China, Sep 2021

V. LESSONS AND RECOMMENDATIONS

83. **Technical assistance projects can generate large-scale catalytic impacts with relatively small resources.** Small grants can play a strategic and transformational role by complementing large lending programs, leveraging private sector financing, providing technical assistance and knowledge sharing opportunities to the local institutions, and enhancing capacity building and empowerment. Building on the experience of the China Renewable Energy Scale-up Program (CRESP) Phase I and II, this Project was also designed to primarily support technical assistance activities to underpin the national priority agenda and address key bottleneck. As elaborated in paragraph 31-36, the Project informed a number of key policies at the national and provincial levels to promote energy efficiency and air pollution reduction and directly supported the scale up of green financing at a commercial bank beyond the scope of the Project or the parallel PforR program. As highlighted by CRESP I and II, it was important to keep flexibility in the project design. Since the announcement of China's climate commitment to the Dual Carbon Goals, the policy priority has been expanded beyond energy efficiency to carbon emissions reduction. The Project could respond to the evolving policy environment and support the implementing agencies to develop policy measures and programs to pursue carbon emissions reduction with a focus on energy efficiency and air pollution management.

84. **Aligning local development needs on air pollution management with global public goods on coal consumption and carbon emissions reduction was crucial to seek strong buy-in from the counterparts.** Air pollution was one of the most substantial development challenges for China and the priority policy objective of all levels of governments at the time of appraisal. Developing a set of projects and programs to tackle the local challenge was well received and owned by the counterparts, while it was more challenging to take forward a project for global public goods. The World Bank helped align the local development needs with the global public goods and positioned the Project as a contribution to climate change mitigation for the GEF support from its climate change window. The Project delivered substantial GHG emissions reduction impact as a result. Going forward, as the World Bank is seeking to address global public goods agenda across the world, it will be critical to find a common ground where tackling local development needs produces benefits beyond the borderline of the borrowing countries.

85. **Coordination of MRV systems for energy and carbon among various de-facto carbon pricing measures will be important for China.** The MRV systems play a critical role in providing the trust needed for a well-functioning market-based mechanism, as all participants in a carbon market value chain require assurance that the reporting of GHG emissions is credible, transparent, and trustworthy. Strong coordination among various players is crucial for the successful implementation of carbon pricing instruments and the effective functioning of carbon markets. The Project supported China in improving energy consumption MRV and developing market-based energy consumption right trading scheme. They help price energy saving and monetize it through the market once implemented. In parallel, China has launched the national ETS to price carbon on a market basis, starting from fossil fuel-based power plants in the power sector, and expanded the market of China Certified Emission Reduction (CCER), a voluntary carbon pricing and trading platform. Furthermore, China has also developed the Green Electricity Certificate (GEC) market to issue and trade the certificate on a market basis and launched the green power trading pilot where consumers can directly buy renewable energy-based electricity from producers. These programs are directly or indirectly pricing carbon on a market basis, but with different market participants. To generate a consistent price signal, strengthen integrity and avoid any double counting, it will be critical to ensure close coordination of MRV systems for energy and carbon among the multiple markets in China.

86. **Fragmented procurement packages of a large number of TA contracts posed challenges in implementation support.** To achieve the overall outcomes, the Project supported many activities, totaling over 60 different contracts among three PMOs. Despite the task team's effort to streamline and consolidate TA activities to focus on selected key

areas, the procurement plans ended up having a large number of contracts. It was primarily driven by the procurement policies of the counterparts, under which PMOs had incentives to limit the total value of a contract below a certain threshold to avoid seeking approval at higher level of the implementing agency. Furthermore, under some sub-components where the scope of TA support was relatively broad, the counterparts brought up with several focus areas and found it difficult to narrow down to a few, as they were from different internal departments of the implementing agencies and difficult to turn down for some of them. For similar operations focusing on TA, it would be important to agree upfront on procurement strategy and procurement plan at the early stage of implementation to preempt PMO's drive towards smaller contracts, while the task team would define narrowly with a few focus areas the scope of TA activities in the project design. Nevertheless, it should be recognized that the PMO did successfully bring the project to closure with most activities complete with the cancellation of a few contracts that are not progressing.

87. **The Project took long time in preparation to build and reach consensus with counterparts, which was essential in delivering highly satisfactory results and impacts.** It was prepared over five FYs, more precisely for 4.5 years from AIS to Board Approval or 4 years from Concept Review to Board Approval. During the period, the project went through substantial changes in project design several times, including changes in implementing agencies. While it costed a long time and substantial resource, the final design of the project was closely aligned with the immediate needs of the counterparts, i.e., design and implementation of the 13th and 14th FYP for NDRC and implementation of the first-ever P4R operations for Hua Xia Bank and Hebei province. Despite the complexity of implementation arrangement involving three different implementation agencies, the Project was efficiently implemented (on time considering the lost period during the pandemic) and successfully delivered the planned results. The Project was not able to meet the current corporate guidance to keep the average preparation time to 12 months, but demonstrated that in changing circumstances patience may help navigate the complexity on the ground and earn stronger buy-in from the counterparts, which is critical for the quality and impact of projects.

88. **Combining TA with the PforR Program plays a pivotal role to expand the impacts of the Program.** The parallel TA activities financed by this Project and additional resource[31] that the World Bank team mobilized to support the Program implementation played an important role.

- **JJJ PforR Program:** The TA under this Project were used to cover the incremental costs associated with development of innovation financial products, verification of DLIs, knowledge sharing and dissemination etc., green financing related policy study as well as interaction with concerned government agencies to influence the policy making and regulation in promoting green financing in China. It fits timely into the critical implementation stages to guide business development, support due diligence of investment subprojects to ensure that the requirements in the OM are followed, conduct third-party verification for the results and DLIs, and support knowledge sharing. The implementation of the TA activities accelerated the Program implementation and helped share the Program experience widely with more audience in China and globally.
- **Heibei PforR Program**: the GEF grant provided critical support to build research capabilities needed to implement the PforR Program. And the provision of continuous capacity building has been essential to success. The GEF grant supported analyses to identify and close specific knowledge gaps, for example, stove efficiency tests, as well as the innovative approach to quantify and verify environmental results for each DLI. GEF project supported training and study tours to ensure capacity was built on the ground for Hebei, particularly to take on the research for DLIs6 and 7. This support was also critical to the implementation of DLIs1 and 2 on strengthening standards and policy enforcement.

[31] The Hebei PforR Program also secured financing from the Pollution Management and Environmental Health Trust Fund to support analytical studies.

ANNEX 1. RESULTS FRAMEWORK AND KEY OUTPUTS

A. RESULTS INDICATORS

A.1 PDO Indicators

Objective/Outcome: To support development and implementation of China's priority EE and environment program

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Energy savings measurement, reporting and verification system improved and standardized	Text	n.a. 16-Mar-2017	MRV system for energy savings improved and standardized 30-Apr-2022	MRV system for energy savings improved and standardized 31-Oct-2023	MRV system for energy savings improved and standardized 31-Oct-2023

Comments (achievements against targets):
Energy savings measurement, reporting and verification (MRV) framework and guidance has been developed. 29 MRV methodologies for enterprises and verifiers are developed. The overall energy savings MRV system has been improved and standardized with the new framework, guidance and methodologies.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Market-based mechanisms for energy savings designed	Text	No Market-based mechanism for energy	Market-based EE trading mechanisms	Market-based EE trading mechanisms	Market-based EE trading mechanisms

and piloted		savings designed or piloted 16-Mar-2017	designed and piloted 30-Apr-2022	designed and piloted 31-Oct-2023	designed and piloted 31-Oct-2023

Comments (achievements against targets):
Provincial energy consumption rights trading scheme has been piloted in several provinces, with contribution of the project. A national energy consumption rights trading scheme has been designed, building on the pilot experience.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Energy and environment results verified for the Jing-Jin-Ji Region and Hebei Province	Text	No results to be verified 16-Mar-2017	Verification systems for green energy financing and environmental programs in JJJ Region and Hebei Province established and completed 30-Apr-2022	Verification systems for green energy financing and environmental programs in JJJ Region and Hebei Province established and completed 31-Oct-2023	Verification systems for green energy financing and environmental programs in JJJ Region and Hebei Province established and completed. All DLIs for the JJJ and Hebei PforR operations achieved and verified. 31-Oct-2023

Comments (achievements against targets):

Verification systems have been established and have been operational for both PforRs, with independent verifiers contracted. DLIs for the Innovative Financing for Air Pollution Control in JJJ PforR and the Hebei Air Pollution Prevention and Control PforR Operations were verified. Verification has been fully completed for both PforR as the Hebei PforR was closed on December 31, 2019, and the JJJ PforR was closed on June 30, 2022.

A.2 Intermediate Results Indicators

Component: Component 1. Supporting market-based priority energy efficiency and coal cap control programs

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Capacity built for M&V system and market-based EE mechanism (Number of people trained)	Number	0.00 16-Mar-2017	1,200.00 30-Apr-2022	1,200.00 31-Oct-2023	2,925.00 31-Oct-2023

Comments (achievements against targets):
A total of 2,715 person-times of online training and 210 person-times of offline training has been delivered, significantly exceeding the original target of 1,200 person-times.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Energy savings M&V methodologies and guidelines developed	Number	0.00 16-Mar-2017	25.00 30-Apr-2022	25.00 31-Oct-2023	29.00 31-Oct-2023

Comments (achievements against targets):
29 MRV methodologies have been developed, exceeding the original target.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Energy consumption trading schemes designed and piloted	Yes/No	No 16-Mar-2017	Yes 30-Apr-2022	Yes 31-Oct-2023	Yes 31-Oct-2023

Comments (achievements against targets):
Energy consumption trading scheme has been designed and piloted.

Component: Component 2. Supporting result-based green energy financing in Jing-Jin-Ji Region

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Innovative financial products for green financing developed and piloted	Number	0.00 16-Mar-2017	3.00 31-Oct-2022	3.00 31-Oct-2023	4.00 31-Oct-2023

Comments (achievements against targets):

HXB developed and deployed four innovative financial products for green financing, including emissions right mortgage loan, small green projects aggregation loan, green bond, and solar PV loan, exceeding the original target of 3.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Case studies for the JJJ and Hebei PforR operations developed	Number	0.00 16-Mar-2017	2.00 30-Apr-2022	2.00 31-Oct-2023	2.00 31-Oct-2023

Comments (achievements against targets):
Huaxia Bank has completed the case study of the operation of JJJ PforR Programs. Hebei PMO has also completed the case study of the operation of Hebei PforR Program.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
CO2 emissions avoided (thousand tons)	Number	0.00 16-Mar-2017	1,969.00 30-Apr-2022	1,969.00 31-Oct-2023	2,876.00 31-Oct-2023

Comments (achievements against targets):
The JJJ PforR operation was completed in June 2022 and its results verified in December 2022.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Annual energy savings(Thousand tce)	Number	0.00 16-Mar-2017	800.00 30-Apr-2022	800.00 31-Oct-2023	1,178.69 31-Oct-2023

Comments (achievements against targets):
The JJJ PforR operation was completed in June 2022 and its results verified in December 2022.

Component: Component 3. Supporting result-based environmental program in Hebei Province

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Capacity for environmental results monitoring improved (Number of people trained)	Number	0.00 16-Mar-2017	480.00 30-Apr-2022	480.00 31-Oct-2023	720.00 31-Oct-2023

Comments (achievements against targets):
The target number 480 is over delivered.

B. KEY OUTPUTS BY COMPONENT

Objective/Outcome 1: Supporting development and implementation of China's priority energy efficiency and environment programs	
Outcome Indicators	1. Energy and environment results verified for JJJ Region and Hebei Province
Intermediate Results Indicators	1. Innovative financial products for green financing developed and piloted 2. Capacity for environmental results monitoring improved (number of people trained) 3. Case studies for the JJJ and Hebei PforR operations developed
Key Outputs by Component (linked to the achievement of the Objective/Outcome 1)	1. DLIs for the JJJ and Hebei PforR operations verified 2. Innovative financial products developed and piloted for green financing 3. Capacity strengthened for environmental results monitoring 4. Case studies developed for the JJJ and Hebei PforR operations
Objective/Outcome 2: Improving the results measurement and verification system	
Outcome Indicators	1. Energy savings measurement and verification system improved and standardized
Intermediate Results Indicators	1. Capacity built for MRV system (number of people trained) 2. Energy savings M&V methodologies and guidelines developed
Key Outputs by Component (linked to the achievement of the Objective/Outcome 2)	1. Improved energy savings measurement and verification system 2. Strengthened capacity for MRV system 3. Energy savings M&V methodologies and guidelines
Objective/Outcome 3: Developing market-based mechanisms for energy savings	
Outcome Indicators	1. Market-based EE trading mechanisms designed and piloted

Intermediate Results Indicators	1. Capacity built for market-based EE mechanism (Number of people trained) 2. Energy consumption trading schemes designed and piloted
Key Outputs by Component (linked to the achievement of the Objective/Outcome 3)	1. Newly designed market-based EE trading mechanism 2. Enhanced Capacity built for market-based EE mechanism

ANNEX 2. BANK LENDING AND IMPLEMENTATION SUPPORT/SUPERVISION

A. TASK TEAM MEMBERS

Name	Role
Preparation	
Todd M. Johnson	Task Team Leader(s)
Xiaowei Guo	Procurement Specialist(s)
Fang Zhang	Financial Management Specialist
Dafei Huang	Team Member
Shanshan Ye	Team Member
Aristeidis Panou	Team Member
Kun Cao	Team Member
Yabei Zhang	Team Member
Zhuo Yu	Team Member
Pei Shen Wang	Social Specialist
Tianxiu Kang	Team Member
Chau-Ching Shen	Team Member
Cristina Hernandez	Team Member
Xiaodong Wang	Team Member
Garo J. Batmanian	Team Member
Youxuan Zhu	Social Specialist
Supervision/ICR	
Joonkyung Seong	Task Team Leader(s)
Zheng Liu	Procurement Specialist(s)
Fang Zhang	Financial Management Specialist

Yan Zhang	Procurement Team
Yanqin Song	Team Member
Hua Du	Team Member
Aristeidis Panou	Counsel
Ross James Butler	Social Specialist
Na Han	Team Member
Qingyuan Wang	Team Member
Bin Xu	Environmental Specialist
Dongqi Qian	Team Member
Minghe Zheng	Team Member
Ximing Huang	Team Member

B. STAFF TIME AND COST

Stage of Project Cycle	Staff Time and Cost	
	No. of staff weeks	US$ (including travel and consultant costs)
Preparation		
FY13	8.223	44,767.77
FY14	15.762	94,619.48
FY15	8.637	70,266.64
FY16	3.650	21,553.13
FY17	6.500	62,166.38
Total	**42.77**	**293,373.40**
Supervision/ICR		
FY15	.250	17,315.22
FY18	2.225	26,796.28
FY19	1.762	16,973.97
FY20	5.350	56,789.75
FY21	0	4,411.04

FY22	8.965	57,499.78
FY23	10.210	87,226.92
FY24	2.390	65,504.90
Total	**31.15**	**332,517.86**

ANNEX 3. PROJECT COST BY COMPONENT

Components	Amount at Approval (US$M)	Actual at Project Closing (US$M)	Percentage of Approval (%)
Component 1. Supporting market-based priority energy efficiency and coal cap control programs	8.80	8.28	94.1
Component 2. Supporting result-based green energy financing in Jing-Jin-Ji Region	4.50	4.32	95.9
Component 3. Supporting result-based environmental program in Hebei Province	4.50	4.48	99.6
Total	**17.80**	**17.08**	**95.9**

ANNEX 4. BORROWER, CO-FINANCIER AND OTHER PARTNER/STAKEHOLDER COMMENTS

National Energy Conservation Center (NECC), PMO of Component 1

Since its launch in 2017, the Project has achieved good results and fruitful research results under the joint guidance of the Environmental and Resources Department of the National Development and Reform Commission and the World Bank, and the joint efforts of all parties involved. The total budget of Component 1 was US$8.8 million, supporting 42 TA projects, 38 contractors participating in TA implementation, nearly 207 experts participating in the review process, more than 200 TA outputs, 29 MRV methodologies developed, and a total of 2,925 people trained online and offline, exceeding the targets of the Project. The Project directly supported the release of major policy documents such as China's " 14th FYP Comprehensive Work Plan for Energy Conservation and Emission Reduction" and " “Green Technology Promotion Catalogue", and the implementation of " Pilot Program on the Compensated Use and Trading of Energy Rights System", all of which promote China's energy conservation and energy efficiency work to a higher level and produce a "green leverage" effect of synergistically promoting pollution reduction and carbon reduction. The ICR report makes a comprehensive and in-depth summary of this, and we have no objection.

During the implementation of the Project, due to external factors such as the COVID-19 pandemic, the Project implementation progress lagged behind and the closing date was extended for 18 months. Since Mr. Joonkyung Seong served as the Task Team Leader of the Project, he has actively coordinated all parties in project management, regularly scheduled project progress review, and promoted the completion of this project in accordance with the expected timeline with quality and quantity. Here, on behalf of the Project Management Office, I would like to express my gratitude to Mr. Joonkyung Seong for his contribution to this Project and look forward to working with you again in the future!

Hua Xia Bank, Implementing Agency of Component 2

The actual disbursement of Huaxia component is USD 4,317,109.15, rounding up to USD 4,320,000 (rather than USD 4,150,000), and the corresponding disbursement percentage is 431.71/450=95.9%.