Report and Recommendation of the President to the Board of Directors

Project Number: 47052-002
November 2014

Proposed Loan
People's Republic of China: Low-Carbon District Heating Project in Hohhot in Inner Mongolia Autonomous Region

This is the version of the document approved by ADB's Board of Directors that excludes information that is subject to exceptions to disclosure set forth in ADB's Public Communications Policy 2011.

Asian Development Bank

CURRENCY EQUIVALENTS
(as of 6 November 2014)

Currency unit	–	yuan (CNY)
CNY1.00	=	$0.1636
$1.00	=	CNY6.1140

ABBREVIATIONS

ADB	–	Asian Development Bank
EIA	–	environmental impact assessment
EIRR	–	economic internal rate of return
FIRR	–	financial internal rate of return
GIMAR	-	Government of Inner Mongolia Autonomous Region
GJ	–	gigajoule
HCDIO	–	Hohhot City Development, Investment, and Operation Company
HCHC	–	Hohhot Chengfa Heating Company
HMG	–	Hohhot municipal government
IMAR	–	Inner Mongolia Autonomous Region
LIBOR	–	London interbank offered rate
m^2	–	square meter
NO_X	–	nitrogen oxides
O&M	–	operation and maintenance
PMO	–	project management office
PRC	–	People's Republic of China

NOTE

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

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PROJECT AT A GLANCE

1. Basic Data — **Project Number:** 47052-002

Project Name	Low-Carbon District Heating Project in Hohhot in Inner Mongolia Autonomous Region	**Department /Division**	EARD/EAEN
Country	China, People's Republic of	**Executing Agency**	Government of Inner Mongolia Autonomous Region
Borrower	People's Republic of China		

2. Sector	**Subsector(s)**	**ADB Financing ($ million)**
✓ **Energy**	Energy utility services	150.00
	Total	**150.00**

3. Strategic Agenda	**Subcomponents**	**Climate Change Information**	
Inclusive economic growth (IEG)	Pillar 1: Economic opportunities, including jobs, created and expanded	Mitigation ($ million)	43.88
Environmentally sustainable growth (ESG)	Eco-efficiency	CO_2 reduction (tons per annum)	1,299,000
	Global and regional transboundary environmental concerns	Climate Change impact on the Project	Low

4. Drivers of Change	**Components**	**Gender Equity and Mainstreaming**	
Knowledge solutions (KNS)	Pilot-testing innovation and learning	No gender elements (NGE)	✓
Partnerships (PAR)	Official cofinancing		
	Private Sector		

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

6. Risk Categorization: Complex

7. Safeguard Categorization **Environment:** A **Involuntary Resettlement:** C **Indigenous Peoples:** C

8. Financing

Modality and Sources	Amount ($ million)
ADB	**150.00**
Sovereign Project loan: Ordinary capital resources	150.00
Cofinancing	**162.38**
Shanghai Pudong Development Bank	162.38
Counterpart	**90.76**
Government	90.76
Total	**403.14**

9. Effective Development Cooperation

Use of country procurement systems	Yes
Use of country public financial management systems	Yes

Source: Asian Development Bank

I. THE PROPOSAL

1. I submit for your approval the following report and recommendation on a proposed loan to the People's Republic of China for the Low-Carbon District Heating Project in Hohhot in Inner Mongolia Autonomous Region.[1]

2. The proposed project will introduce a first-of-its-kind low-carbon, low-emissions, and highly energy-efficient district heating system in the eastern part of Hohhot, the capital of the Inner Mongolia Autonomous Region (IMAR). The project will demonstrate the efficiency and viability of large-scale natural gas and wind-based district heating in IMAR. Combining these two energy sources will improve the poor air quality in urban areas of IMAR during the winter and help reduce carbon dioxide emissions.[2]

II. THE PROJECT

A. Rationale

3. IMAR is located in a severe cold climate zone of the People's Republic of China (PRC), where winter temperatures can drop to as low as –40°C and subzero temperatures typically last for 6 months of the year. Thus, adequate heating is a basic human need and essential for socioeconomic activities. Coal has been the predominant fuel for heating in IMAR, contributing to indoor and outdoor air pollution and undermining human health. A district heating system with a centralized plant and a network of distribution pipes to provide space heating and hot water is one of the most energy-efficient and least-polluting heating modes in urban areas. Such a system allows heat sources to be located away from densely populated areas and has the flexibility to use a wide range of energy sources. As rapid urbanization increases the demand for heating, heavy use of coal-based district heating will worsen air quality, especially in large urban areas such as Hohhot. Switching to a low-emission fossil fuel, such as natural gas, and emission-free renewable energy is urgently needed.

4. Hohhot has the highest concentration of urban residents in IMAR. About 10% of IMAR's total population resides in the city. As urbanization and population growth increase heating demand, Hohhot faces critical gaps in its heating infrastructure. As of 2013, district heating covered only 86.8 million square meters (m^2) of floor area; existing isolated, decrepit, and inefficient heating systems for an additional 42.0 million m^2 of floor area need to be replaced. The hazy skies above Hohhot already have a high concentration of inhalable particulate matter during winter.[3] Through a decree issued in 2013, the Hohhot municipal government (HMG) promoted the use of natural gas to meet the growing energy demand and address associated environmental and health concerns. The decree includes (i) a natural gas subsidy for residential heating, and (ii) financial support to heating operators that replace small coal-fired neighborhood boilers with natural gas boilers in central business districts. Compared with coal, natural gas emits half as much carbon dioxide, a fraction of particulate matter and nitrogen oxides (NO_X), and negligible sulfur oxides. Since the decree was issued, HMG has provided CNY230 million in subsidies for natural gas use and switching from coal to gas boilers. The

[1] The design and monitoring framework is in Appendix 1.

[2] The Asian Development Bank (ADB) provided project preparatory technical assistance. ADB. 2013. *Technical Assistance to the People's Republic of China for Preparing Low Carbon District Heating in Hohhot in Inner Mongolia Autonomous Region Project*. Manila.

[3] Inhalable particulate matter refers to particulate matter less than 2.5 micrometers in diameter ($PM_{2.5}$). In January 2014, Hohhot recorded 81–95 micrograms per cubic meter (m^3) of daily $PM_{2.5}$, more than three times higher than the 25 micrograms per m^3 recommended by the World Health Organization.

HMG policy to promote natural gas in district heating is aligned with the central government's 2013 Air Pollution Prevention Act, which requires all prefecture-level cities like Hohhot to reduce inhalable particulate matter by 10% in 2017 compared with 2012 levels.

5. IMAR is a resource-rich province. In addition to being the PRC's top coal-producing province,[4] IMAR has large reserves of natural gas[5] and excellent solar and wind energy resources. In 2013, IMAR reached 18 gigawatts of installed wind power capacity, equivalent to 25% of the total installed wind power capacity in the PRC. The Government of IMAR (GIMAR) plans to increase installed wind capacity up to 50 gigawatts by 2020. IMAR prioritizes combined heat and power plants to meet the electricity and heat demand, rather than electricity-only wind power plants. As a result, many wind farms are forced to disconnect from the grid, particularly at night during the winter when power demand is low but wind power generation is high. In 2013, about 11.3 terawatt-hours of wind power generation was curtailed in IMAR.

6. The National Energy Administration in the PRC issued a policy notice in 2013 strongly encouraging the use of curtailed wind power for district heating, which requires high energy use at night during the winter. Both the GIMAR and HMG are keen to pilot the use of curtailed wind power for district heating, taking into consideration that the current curtailed wind power in IMAR could meet the heating demand up to about 100 million m^2 of floor area and contribute to better air quality in the winter by eliminating hazardous emissions from coal-based heating systems. Yet, IMAR currently does not have a business model for using the curtailed wind energy for district heating and needs to gain more insights into the technical and economic challenges before wider deployment. The proposed project will demonstrate a large-scale low-emission and low-carbon district heating system using wind power and natural gas. Because of its easy access to sufficient natural gas and excess wind power, Hohhot is an appropriate choice to demonstrate such heating system. If successful, it can be replicated in IMAR and elsewhere in the PRC's northern provinces.

7. The Asian Development Bank (ADB) has supported two other projects in IMAR to provide energy-efficient district heating.[6] The Hohhot project is a logical next step to improve energy efficiency and reduce emissions from such projects through advanced natural gas boiler technology. The project will also pilot a new business model [This information has been removed as it falls within exceptions to disclosure specified in paragraph 97, (v) of ADB's Public Communications Policy (2011)]. The project is closely aligned with the Midterm Review of Strategy 2020, which identifies environmentally sustainable growth as a priority for helping developing member countries move onto a low-carbon growth path by improving energy efficiency and expanding renewable energy.[7] The project also supports the goal of ADB's Energy Policy, which prioritizes energy efficiency and access to energy for all, including district

[4] IMAR is the top coal-producing province, followed by Shanxi and Shaanxi. IMAR produced 1,062 million tons in 2012, accounting for 30% of the PRC's total coal production (3,549 million tons).

[5] IMAR has about 834.4 billion m^3 of natural gas, equivalent to 19% of the total natural gas reserves in the PRC. According to the Statistics Bureau of the PRC, the proven natural gas reserves in the PRC total 4.4 trillion m^3.

[6] ADB. 2006. *Report and Recommendation of the President to the Board of Directors: Proposed Loan to the People's Republic of China for the Inner Mongolia Autonomous Region Environment Improvement Project*. Manila; and ADB. 2010. *Report and Recommendation of the President to the Board of Directors: Proposed Loan to the People's Republic of China for the Inner Mongolia Autonomous Region Environment Improvement Project (Phase 2)*. Manila.

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

heating.[8] It is aligned with ADB's country partnership strategy, 2011–2015 for the PRC, which identifies environmental sustainability as one of the three pillars of ADB assistance.[9]

B. Impact, Outcome, and Outputs

8. The impact will be improved energy efficiency and a cleaner environment in IMAR. The outcome will be improved air quality and reduced greenhouse gas emissions in Hohhot. The outputs will be (i) district heating coverage expanded, (ii) low-carbon and highly efficient heat-generation system installed, and (iii) a new business model for wind-based district heating piloted.

9. The project will install (i) low-emission natural gas boilers, (ii) wind-powered electric boilers with zero emissions, (iii) energy-efficient heat exchange stations, (iv) insulated heating pipelines, and (v) a distribution control and data management system to optimize system operation. The project covers three heating zones (Jinqiao, Xinjiaying, and Haoqingying) in Saihan and Xincheng districts in the eastern part of Hohhot. About 61,000 households in these areas are currently connected to 50 small and inefficient coal-fired boilers (equivalent to 158 megawatts thermal), and more than 210,500 households are using coal-fired heating stoves without any emission control. After completion, the project will avoid 848,500 tons of standard coal, and will emit 60% less carbon dioxide, 82% less NO_X, negligible particulate matters, and 98% less sulfur dioxide compared with the existing heating supply. The project will achieve energy efficiency of 0.5 gigajoule/m^2, which is 17% more efficient than the average IMAR district heating system.[10] Table 1 summarizes the project's key features in the three heating zones.

Table 1: Key Features and Heating Zones of the Project

	Heating Zone	Jinqiao	Xinjiaying	Haoqingying		
Item	Unit	Natural Gas	Natural Gas	Natural Gas	Wind Power[a]	Total
Heating areas	million m^2	9.5	8.8	10.4	1.0	29.7
Heat source capacity	MWt	490	490	580	50	1,610
Heating pipe network	km	17.1	26.0	30.7		73.8
Heat exchange stations	set	45	48	87[b]		180

m^2 = square meter, MWt = megawatt thermal, km = kilometer.

[a] Wind-powered electric boilers are piloted only in the Haoqingying heating zone because the availability of a suitable power transmission line for electric boilers makes incremental costs lower.

[b] Eleven out of 87 are building-level heat exchange stations, which are more energy efficient.

Sources: Domestic feasibility study reports commissioned by from Hohhot City Development, Investment, and Operation Company (2012).

10. The new business model for district heating benefits three key stakeholders—wind farms, the district heating company, and the grid company.[11] [This information has been removed as it falls within exceptions to disclosure specified in paragraph 97, (v) of ADB's Public Communications Policy (2011)], the new business model will enable (i) wind farms to sell surplus wind energy for district heating, (ii) the heating company to buy wind energy at an

[8] ADB. 2009. *Energy Policy.* Manila.

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

[10] The energy intensity of district heating in IMAR is 0.60 gigajoule/m^2 (GJ/m^2), which is higher than the PRC average of 0.57 GJ/m^2 because of the longer heating days and colder outdoor temperature.

[11] New Business Model under the Project (accessible from the list of linked documents in Appendix 2). The business model enables the heating company to purchase wind energy at an affordable cost of [This information has been removed as it falls within exceptions to disclosure specified in paragraph 97, (v) of ADB's Public Communications Policy (2011)].

affordable cost, and (iii) the grid company to cover wheeling charges for transmitting the additional wind power. This business model will benefit IMAR environmentally, socially, and economically by improving air quality, reducing health risks, and using surplus wind power that would otherwise have been wasted. The successful demonstration of this business model in Hohhot will provide lessons and guidance to other major cities in IMAR and other northern provinces that might want to replicate this approach because of similar conditions. The successful demonstration is also expected to lead to a new policy promoting wind power utilization for heating in northern PRC, thereby reducing curtailment of abundant wind power.

C. Investment and Financing Plans

11. The project is estimated to cost $403.1 million (Table 2), of which 27.4% of the base cost will finance civil works, 54.4% for equipment and 0.2% for consulting services.

Table 2: Project Investment Plan

Item			Amount ($ million)[a]
A.	**Base Cost**[b]		
	1.	Jinqiao heating zone	106.0
	2.	Xinjiaying heating zone	111.7
	3.	Haoqingying heating zone	114.1
	4.	Consulting services	0.5
		Subtotal (A)	**332.3**
B.	**Contingencies**[c]		**44.8**
C.	**Financing Charges During Implementation**[d]		**26.1**
		Total (A+B+C)	**403.1**

[a] Includes taxes and duties of $28.2 million to be financed by the government and the Asian Development Bank (ADB) loan. The following principles were followed in determining the amount of taxes and duties to be financed by ADB: (i) the amount is within reasonable country thresholds, (ii) the amount is not an excessive share of the project investment plan, (iii) the taxes and duties apply only to ADB-financed expenditures, and (iv) the financing of the taxes and duties is relevant to the success of the project.

[b] In June 2014 prices.

[c] Physical contingencies ($16.6 million) are estimated at 5.0% of base cost. Price contingencies ($28.2 million) are estimated based on projected domestic and international inflation rates.

[d] Includes interest and commitment charges. Interest during construction for ADB loan has been computed at the 5-year US dollar fixed swap rate plus a spread of 0.50% and a maturity premium of 0.10%. Commitment charges for the ADB loan are 0.15% per year to be charged on the undisbursed loan account. Interest during construction for the domestic bank loan has been computed at the domestic rate of 6.55%.

Note: Numbers may not sum precisely because of rounding.

Source: Asian Development Bank estimates.

12. The government has requested a loan of $150.0 million (37.2% of the total project cost) from ADB's ordinary capital resources to help finance the project. The Hohhot City Development, Investment, and Operation Company (HCDIO), better known as Chengfa Company, will finance $90.8 million (22.5%) through an equity contribution. The Shanghai Pudong Development Bank will cofinance $162.4 million (40.3%) with a domestic loan that qualifies as collaborative direct value-added cofinancing.[12] The ADB loan will have a 25-year term, including (i) a grace period of 5 years, (ii) a straight-line repayment option, (iii) an annual interest rate determined in accordance with ADB's London interbank offered rate (LIBOR)-based lending facility, (iv) a commitment charge of 0.15% per year, and (v) such other terms and conditions set forth in the draft loan and project agreements. Based on these, the average

[12] ADB received a commitment letter from Shanghai Pudong Development Bank indicating that it will follow ADB's Safeguard Policy Statement (2009) and Anticorruption Policy (1998, as amended to date). The loan from the bank will have a 5-year term and a" 3- to 5-year" reference lending rate published by the People's Bank of China plus 30% of the rate.

loan maturity is 15.25 years and the maturity premium payable to ADB is 0.10% per year. The Government of the PRC has provided ADB with (i) the reasons for its decision to borrow under ADB's LIBOR-based lending facility based on these terms and conditions, and (ii) an undertaking that these choices were its own independent decision and not made in reliance on any communication or advice from ADB. The financing plan is in Table 3.

Table 3: Financing Plan

Source	**Amount** ($ million)	**Share** (%)
Asian Development Bank		
Ordinary capital resources (loan)	150.0	37.2
Shanghai Pudong Development Bank	162.4	40.3
Government		
Hohhot City Development, Investment, and Operation Company	90.8	22.5
Total	**403.1**	**100.0**

Note: Numbers may not sum precisely because of rounding.
Source: Asian Development Bank estimates.

D. Implementation Arrangements

13. The GIMAR is the executing agency responsible for project implementation. The government oversight body, consisting of the IMAR Finance Bureau, IMAR Development and Reform Commission, IMAR Construction Bureau, and IMAR Environment Protection Bureau, will support implementation. The HMG will sign onlending agreements with the GIMAR and HCDIO. HCDIO will (i) provide management oversight to the Hohhot Chengfa Heating Company (HCHC); (ii) liaise with the GIMAR and HMG; (iii) sign onlending agreements with the HMG, and then onlend to HCHC; (iv) be directly responsible for making equity contributions totaling 22.5% of the total project cost; (v) provide project procurement services on behalf of HCHC; and (vi) provide managerial and technical support to HCHC to ensure timely project implementation, as well as good governance.[13] The implementing agency is HCHC, which is responsible for day-to-day project management, including contractor management, operation and maintenance (O&M), and social and environment safeguard monitoring and compliance.[14]

14. Previous loan projects on district heating in IMAR (footnote 6) experienced significant start-up delays. To avoid project delays, HCDIO and HCHC already established a project management office (PMO), which will be supported by loan implementation consultants.[15] The implementation arrangements are summarized in Table 4 and described in detail in the project administration manual.[16]

Table 4: Implementation Arrangements

Aspects	**Arrangements**
Implementation period	December 2014–April 2020
Estimated completion date	30 April 2020 (estimated loan closing date: 31 October 2020)
Management	

[13] HCDIO, which is 100% owned by the HMG, is in the business of urban district heating, waste management, low-income housing, and intelligent transport monitoring system. HCDIO owns 98.17% of HCHC.

[14] Since 2000, HCHC has provided highly efficient district heating services in Hohhot, achieving the energy intensity of 0.55 GJ/m^2 per year (the average district heating energy intensity in IMAR is 0.60 GJ/m^2 per year). Its current coverage is 32 million m^2 and is expected to expand the heating coverage to 74 million m^2 by 2016.

[15] Terms of reference for loan implementation consultants are provided in the Project Administration Manual (accessible from the list of linked documents in Appendix 2).

[16] Project Administration Manual (accessible from the list of linked documents in Appendix 2).

Aspects	Arrangements		
(i) Oversight body	IMAR Development and Reform Commission, IMAR Region Finance Bureau, IMAR Construction Bureau, and IMAR Environmental Protection Bureau		
(ii) Executing agency	GIMAR		
(iii) Implementing agency	Hohhot Chengfa Heating Company		
(iv) Implementation unit	Project management office at the Hohhot Chengfa Heating Company, 11 staff (including four staff from Hohhot City Development, Investment, and Operation Company)		
Procurement	National competitive bidding	3 contracts	$18.6 million
	International competitive bidding	13 contracts	$130.9 million
Consulting services	Individual	26.5 person-months	$0.5 million
Retroactive financing and/or advance contracting	The GIMAR has requested advance contracting and retroactive financing. This will include the procurement of goods and consulting service. The amount to be retroactively financed will not exceed $30 million (equivalent to 20% of ADB loan) and may finance costs incurred before loan effectiveness but not earlier than 12 months before the signing date of the loan agreement.		
Disbursement	The loan proceeds will be disbursed in accordance with ADB's *Loan Disbursement Handbook* (2012, as amended from time to time) and detailed arrangements agreed upon between the government and ADB.		

ADB = Asian Development Bank, GIMAR = Government of Inner Mongolia Autonomous Region, IMAR = Inner Mongolia Autonomous Region.
Source: Asian Development Bank estimates.

III. DUE DILIGENCE

A. Technical

15. **Heat source assessment.** The resource availability, cost implications, and environmental impacts of different heat sources were assessed. While coal is widely available at a low cost, it was not considered because of its environmental and health impacts. Geothermal and biomass resources are not adequate in the project area. Despite good solar radiation, solar photovoltaic utilization is low in Hohhot because of its high cost.[17] Excess wind power can be utilized for heating without much additional investment. To gain experience, HCDIO and HCHC decided to heat an area of 1.0 million m^2 on a pilot basis using curtailed wind power. Natural gas was assessed as the most suitable option for district heating in the project area because of its superior environmental performance (para. 4) compared with coal and its availability in IMAR. China Gas (Hohhot) Company, the major gas supplier in Hohhot, has confirmed its commitment to supply adequate natural gas to the project.[18]

16. **Energy-efficient and low-emission design.** The project design uses the most cost-effective, technically advanced, energy-efficient, and low-emission technologies and features. Different boiler options for natural gas and electric boilers were assessed to improve energy efficiency and reduce emissions. Key features of the project design are (i) low NO_X natural gas boilers, (ii) high-voltage and large 25-megawatt electric boilers, and (iii) building-level heat exchange units. Compared with conventional natural gas boilers, low NO_X boilers—a mature technology that is widely used in the PRC—can reduce about 85% of NO_X emissions without affecting boiler efficiency. Electric boilers are also a proven technology with 99% boiler efficiency, quick response time to operate, and low maintenance cost. A high-voltage, large-scale electrode boiler has a competitive advantage, as it requires a cheaper transformer and less space than a small, low-voltage electric boiler. A high-voltage large electrode boiler that

[17] Despite significant cost reductions, solar power is the most expensive renewable energy technology. The current solar photovoltaic tariff is more than double the wind power tariff.
[18] Such commitments are often treated as firm long-term gas supply arrangements in the PRC.

requires less space to install is more suitable for urban district heating. A building-level heat exchange unit eliminates secondary pipelines and reduces pipe size.

B. Economic and Financial

17. **Economic analysis**. The economic benefits of district heating include heating efficiency and environmental improvements. The calculations reflect all project-related costs and net environmental benefits. Additional health benefits from cleaner air were excluded. The economic analysis of the project indicates an economic internal rate of return (EIRR) of 18.52%, which is more than the 12% economic cost of capital. Therefore, the project is economically viable. Sensitivity analysis indicates that the EIRR will decrease to (i) 11.72% when economic benefits decrease by 10%, (ii) 17.00% when capital costs increase by 10%, (iii) 13.70% when O&M costs increase by 10%, and (iv) 18.49% if project implementation is delayed by 1 year. The project's economic viability is sensitive to changes in benefits, but remains robust under all scenarios. If the substantial health benefits were included, the EIRR would improve further under all sensitivity scenarios.

18. **Financial analysis**. The financial internal rate of return (FIRR) is calculated under the assumption that both (i) the natural gas subsidy from the HMG and (ii) adequate wind power at reduced tariff (footnote 11) will continue for the life of the project. Financial analysis of the project indicates that the FIRR is 8.93%, substantially higher than the corresponding weighted average cost of capital (2.48%). Sensitivity analysis shows that the FIRR would be (i) 7.96% when project capital costs increase by 10%, (ii) 2.53% when O&M costs increase by 10%, (iii) 3.60% if revenues from heat sales decrease by 10%, and (iv) 7.65% if project implementation is delayed by 1 year. If all the above adverse cases occur at the same time, the project would not be financially viable.

C. Governance

19. The financial management assessment shows that the GIMAR has (i) sufficient experience with a number of ADB-financed loan projects, (ii) adequate capacity to manage an imprest account, and (iii) a good track record of delivering ADB-financed projects. HCDIO and HCHC have solid financial management systems and procedures in place to guarantee proper financial management and reporting. The accounting systems of HCDIO and HCHC are also adequate for implementing an ADB loan. HCDIO and HCHC have experience with projects financed by other international financial institutions.[19] Additional assessments of governance risks indicate low associated risks regarding (i) accounting policies and procedures, (ii) staffing, (iii) reporting and monitoring, (iv) information systems, (v) internal auditing, and (vi) external auditing. HCHC and HCDIO also have extensive project implementation experience for multiple district heating projects at a scale and scope similar to this project. Both have consistently demonstrated timely and high-quality delivery within agreed cost frameworks. However, as HCDIO and HCHC have no experience with ADB-financed projects, the overall control risks before mitigation have been conservatively estimated as *medium*.

20. To mitigate these risks, HCDIO and HCHC will strengthen the financial management capacity by undertaking capacity development training on ADB policies and procedures, and by seeking external financial management assistance as needed. During the project processing,

[19] They completed two projects funded by the Japan Bank for International Cooperation in 1998 and 2006. The third project funded by the Japan Bank for International Cooperation was signed in March 2012 and is being implemented. HCDIO and HCHC recently signed a project loan with German development cooperation through KfW.

ADB provided training on disbursement and procurement to PMO that is responsible for project management, including procurement, disbursement, consultant management, construction supervision, and all other tasks relevant to successful project implementation. Core PMO staff have benefited from training and will continue to be trained on disbursement, procurement, reporting, and other ADB rules and regulations important for project implementation.

21. ADB's Anticorruption Policy (1998, as amended to date) was explained to and discussed with the GIMAR, the HDCIO, and the HCHC. The specific policy requirements and supplementary measures are described in the project administration manual (footnote 16).

D. Poverty and Social

22. **Social benefits.** The project will generate substantial direct and indirect social gains. It will directly benefit 294,500 households (30% of Hohhot's total population), of which 271,500 households are currently connected to either coal-based, small, and inefficient neighborhood boilers or coal-fired household stoves. By income level, 4.9% of the households are poor (14,570 households) and 24.8% are in the low-income group. In addition, the project will benefit 18 schools with about 12,000 students, 35 kindergartens with about 4,000 children, and 12 hospitals. The project will (i) reduce the number of cases involving people suffering from respiratory diseases by improving indoor and outdoor air quality; (ii) reduce indoor carbon monoxide poisoning by providing safer district heating services; (iii) reduce heating expenditure by switching from household stoves to centralized energy-efficient heating system; (iv) support a better medical environment by providing cleaner and reliable heating services to hospitals; (v) improve living conditions through adequate, reliable, and affordable heating services; and (vi) support a better school environment during winter by providing cleaner and reliable heating services.

23. **Labor retrenchment.** The HMG will close down 50 small, inefficient boilers in 29 neighborhood boiler houses and 132 seasonal workers will lose their seasonal jobs working at neighborhood boiler houses. The prepared labor retrenchment and reemployment plan will safeguard the livelihoods of the affected workers. Skills training will be provided to affected workers, and HCHC is committed to retain them as long as they acquire the required skills.

24. **Gender impact.** The project will give about 441,750 women, including 8,000 female students, access to cleaner, safer, and more affordable heating services. It will also ensure that half the 280 permanent positions created by the project will be filled by women. In addition, the project will conduct energy conservation awareness campaigns targeting women and students in collaboration with the local women's federation at least twice during the project implementation period.

E. Safeguards

25. **Environment.** The project is classified category A for environment. A draft project environmental impact assessment (EIA) was disclosed on ADB's website on 12 May 2014. The EIA complies with ADB's policies and requirements, including ADB's Safeguard Policy Statement (2009), and identifies potential adverse impacts. During construction, such risks would include (i) noise, vibration, and dust; (ii) solid waste; (iii) community disturbance and public safety; and (iv) occupational health and safety. During operation, potential adverse impacts would be (i) emissions, (ii) noise, (iii) wastewater from the heat source plants, and (iv) occupational health and safety risks. The EIA concludes that those impacts can be mitigated through the implementation of the environmental management plan, which specifies mitigation

measures, monitoring requirements, and institutional responsibilities for ensuring proper environmental management throughout the project's construction and operation.

26. **Involuntary resettlement and indigenous peoples.** The project is classified category C for involuntary resettlement and indigenous peoples. The project does not entail permanent land acquisition. Installing the underground heating pipelines will temporarily occupy the publicly owned land (road and sidewalks) for a maximum of 6 months, which will not cause involuntary resettlement of people. The project will not entail demolition of any structure. The project beneficiaries include ethnic minorities. Thus, the project does not have any adverse impact on ethnic minority people.

F. Project Readiness

27. The GIMAR has approved the feasibility study report and the EIA of the project. There is no pending safeguard issue. The PMO was set up to manage the project since May 2014 (para 14). The GIMAR and HCHC requested advance contracting and retroactive financing to proceed with project-related procurement. The GIMAR and HCHC engaged a tendering agency in October 2014 to assist in procurement management.[20] The HCDIO and HCHC will engage loan implementation consultants (para 14) using advance contracting to further strengthen project management.

G. Risks and Mitigating Measures

28. There are no major outstanding risks. The identified risks and mitigating measures are summarized in Table 5 and described in detail in the risk assessment and risk management plan.[21] The integrated benefits and impacts are expected to outweigh the costs.

Table 5: Summary of Risks and Mitigating Measures

Risks	Mitigating Measures
Financial management Reduction or removal of subsidies on gas and wind will undermine the financial viability of the project.	The State Council's air pollution reduction and control measures have triggered wider use of natural gas for district heating. Most of the northern provinces and cities have introduced or plan to introduce a subsidy scheme to switch to natural gas. The subsidy scheme of the Hohhot municipal government (para. 4) is assessed to be a well-funded scheme as IMAR gets large revenues from energy resource utilization in the province. For the wind subsidy, the business model described in para. 10 is developed based on an agreement signed by all three parties: Datang (Hohhot) New Energy Company; Inner Mongolia Power Grid Company; and HCDIO, which represents HCHC.
Procurement Project implementation may be delayed because of limited experience in ADB procurement procedures.	HCDIO and HCHC have experience with projects funded by the Japan Bank for International Cooperation and German development cooperation through KfW, but no ADB project experience. The staff at HCDIO and HCHC received training on ADB's procurement and disbursement procedures during project preparation. During project implementation, their institutional capacity will be strengthened further. A tendering agency with extensive experience with ADB procurement procedures is engaged to further supplement the capacity of the project management office, which has already been set up.
Other risks Reduction in urban air pollution from the project	The GIMAR has taken additional measures to reduce air pollution, including (i) eliminating small coal-fired boilers in urban areas, (ii) enhancing air pollution control measures in key industries, (iii) introducing more stringent fuel standards

[20] The China Far East International Tendering Company has extensive procurement experience, managing a number of projects financed by multilateral development banks, including ADB.
[21] Risk Assessment and Risk Management Plan (accessible from the list of linked documents in Appendix 2).

Risks	Mitigating Measures
may be negated by the construction of additional polluting industries in urban areas.	for vehicles, (iv) promoting more clean energy, (v) relocating industries and eliminating outdated polluting plants, (vi) introducing more stringent environmental standards for industry approval, and (vii) enhancing environmental monitoring. Thus, associated risks are minimal.

ADB = Asian Development Bank, GIMAR = Government of Inner Mongolia Autonomous Region, HCDIO = Hohhot City Development, Investment, and Operation Company, HCHC = Hohhot Chengfa Heating Company, IMAR = Inner Mongolia Autonomous Region.
Source: Asian Development Bank.

IV. ASSURANCES AND CONDITIONS

29. The Government of the PRC and the GIMAR have assured ADB that implementation of the project shall conform to all applicable ADB policies including those concerning anticorruption measures, safeguards, gender, procurement, consulting services, and disbursement as described in detail in the project administration manual and loan documents. The national government and the GIMAR have agreed with ADB on certain covenants for the project, which are set forth in the loan agreement and project agreement.

30. The disbursement is conditional upon the borrower's certification that an onlending agreement between HCDIO and HCHC will have been duly executed and delivered, and all conditions precedent to their effectiveness will have been fulfilled.

V. RECOMMENDATION

31. I am satisfied that the proposed loan would comply with the Articles of Agreement of the Asian Development Bank (ADB) and recommend that the Board approve the loan of $150,000,000 to the People's Republic of China for the Low-Carbon District Heating Project in Hohhot in Inner Mongolia Autonomous Region, from ADB's ordinary capital resources, with interest to be determined in accordance with ADB's London interbank offered rate (LIBOR)-based lending facility; for a term of 25 years, including a grace period of 5 years; and such other terms and conditions as are substantially in accordance with those set forth in the draft loan and project agreements presented to the Board.

Takehiko Nakao
President

18 November 2014

DESIGN AND MONITORING FRAMEWORK

Design Summary	Performance Targets and Indicators with Baselines	Data Sources and Reporting Mechanisms	Assumptions and Risks
Impact Improved energy efficiency and cleaner environment in IMAR	By 2025, energy intensity in IMAR is reduced by 23%, compared with 2010.[a] (2010 baseline: 1.95 t of standard coal equivalent per CNY10,000 of gross regional products) By 2025, emission of SO_2 is reduced by at least 4.5% and NO_x by 6.5%, compared with 2010. (2010 baseline: 1,397,000 t of SO_2 and 1,314,000 t of NO_x)[b]	Data from IMAR Environment Protection Bureau	**Assumptions** The IMAR government and enterprises make the required investments in energy efficiency and emission reduction. Local environmental protection bureaus enforce air pollution laws and standards. **Risk** Additional polluting industries in urban area worsen air quality in IMAR.
Outcome Improved air quality and reduced greenhouse gas emissions in Hohhot	By 2022, average annual concentration of $PM_{2.5}$ decreases by 12% compared with 2013. (2013 baseline: 59.1 µg/m^3) By 2022, natural gas and wind-power-based district heating project cumulatively avoids annual CO_2 emissions of 1.3 million t[c] (2013 baseline: 0 t of CO_2)[d]	Hohhot Chengfa Heating Company project performance reports Loan review missions and project performance reports Data from the project's environmental monitoring reports Data from Hohhot and/or IMAR Environment Protection Bureau	**Assumption** Successful demonstration of the pilot project leads to large uptake of natural gas and wind energy in heating. **Risk** Reduction or removal of subsidies on gas and wind reduces financial viability of using natural gas and wind energy for heating.
Outputs 1. District heating coverage expanded	By 2020, district heating covers 116.5 million square meters in Hohhot. (2013 baseline: district heating covers 86.8 million square meters)	Data from Hohhot and/or IMAR Construction Bureau Loan review missions and project performance reports	**Assumption** Housing development activities in the new heating areas are completed on time. **Risk** Full occupancy has not been achieved by 2020.
2. Low-carbon and highly efficient heat-generation system installed	By 2020, the project avoids 848,500 t of coal per year; annual emissions of 1.3 million t of CO_2; 11,000 t of SO_2; 26,000 t of PM; and 9,000 t of NO_x[c] (2013 baseline: 665,000 t of standard coal consumption; and emissions of 1.6 million t of CO_2, 9,000 t of SO_2, 65,000 t of PM, and 7,500 t of NO_x)[d] By 2020, the project achieves energy efficiency of 0.5 GJ/m^2. (2013 baseline: average energy efficiency 0.6 GJ/m^2)	Loan review missions and project performance reports Data from the project's environmental monitoring reports Data from Hohhot and/or IMAR Environment Protection Bureau	**Assumption** Sufficient counterpart funds are mobilized on time. **Risks** Changes in subsidy schemes on wind energy and natural gas may impact the financial sustainability of the project. Project implementation may be delayed because HCDIO and HCHC have limited experience with ADB procurement.

Design Summary	Performance Targets and Indicators with Baselines	Data Sources and Reporting Mechanisms	Assumptions and Risks
3. A new business model for wind-based district heating piloted	By 2020, a new business model for wind-based district heating is successfully tested.	Loan review missions and project performance reports	**Assumption** Three parties—heating company, wind farms, and grid company—sign purchasing contracts with agreed financial arrangement before testing and commercial operation. **Risk** Wind energy market is changed and available wind energy for district heating is insufficient for the entire project life time.
Activities with Milestones **1. Output 1. District heating coverage expanded** 1.1. Complete civil works by September 2019. 1.2. Complete construction of pipelines and heat exchange stations by March 2020. 1.3. Complete trial testing by April 2020. **2. Output 2. Low-carbon and highly efficient heat-generation system installed** 2.1. Engage loan implementing consultants and a tendering agency by March 2015. 2.2. Complete detailed engineering design by December 2015. 2.3. Complete installation of boilers, electric, and control equipment by March 2020. 2.4. Complete trial testing by April 2020. 2.5. Conduct a series of capacity development activities for project management, safeguards performance, and district heating advancement by April 2020. **3. Output 3. New business model for wind-based district heating piloted** 3.1. Agree on financial arrangement among three parties—heating company, wind farms, and grid company—and sign the three party agreement by September 2015. 3.2. Sign purchasing contracts among three parties by December 2019. 3.3. Complete the first financial transaction by December 2021.		**Inputs** **Loan** **ADB: $150.0 million** **Shanghai Pudong Development Bank: $162.4 million** **Government (Hohhot City Development, Investment, and Operation Company): $90.8 million**	

ADB = Asian Development Bank, CO_2 = carbon dioxide, GJ/m^2 = gigajoule per square meter, IMAR = Inner Mongolia Autonomous Region, µg/m3 = microgram per cubic meter, NO_x = nitrogen oxides, PM = particulate matter, SO_2 = sulfur dioxide, t = ton.

[a] Energy intensity is calculated as units of energy per unit of gross domestic product. Energy intensity reduction rate from 2005 to 2010 in IMAR was 22.6%.

[b] IMAR Environmental Protection Bureau. 2011. *The Twelfth Five-Year Plan for Environmental Protection in Inner Mongolia Autonomous Region.* IMAR.

[c] Emission avoidance is based on the business-as-usual scenario of coal-fired district heating system, taking into consideration the expected increase of heat demand in the project area by 2020.

[d] Energy consumption and emissions indicated in the 2013 baseline are based on the actual coal consumption of existing households in the project area and associated emissions.

Source: Asian Development Bank.

LIST OF LINKED DOCUMENTS

http://www.adb.org/Documents/RRPs/?id=47052-002-3

1. Loan Agreement
2. Project Agreement
3. Sector Assessment (Summary): Energy
4. Project Administration Manual
5. Contribution to the ADB Results Framework
6. Development Coordination
7. Financial Analysis
8. Economic Analysis
9. Country Economic Indicators
10. Summary Poverty Reduction and Social Strategy
11. Environmental Impact Assessment
12. Risk Assessment and Risk Management Plan

Supplementary Documents

13. Financial Management Assessment
14. Procurement Capacity Assessment Report and Recommendation
15. New Business Model under the Project
16. Three Parties Agreement on Wind Power Utilization in Heating