Project Information Document (PID)

Appraisal Stage | Date Prepared/Updated: 18-Apr-2019 | Report No: PIDA26339

BASIC INFORMATION

A. Basic Project Data

Country	Project ID	Project Name	Parent Project ID (if any)
China	P163679	China Renewable Energy and Battery Storage Promotion Project	
Region	**Estimated Appraisal Date**	**Estimated Board Date**	**Practice Area (Lead)**
EAST ASIA AND PACIFIC	08-Apr-2019	11-Jun-2019	Energy & Extractives
Financing Instrument	**Borrower(s)**	**Implementing Agency**	
Investment Project Financing	China	Huaxia Bank	

Proposed Development Objective(s)

The project development objective is to improve the integration of renewable energy (RE) and increase RE utilization in China through the deployment of battery storage systems and innovative RE technology applications.

Components

Investment Component

PROJECT FINANCING DATA (US$, Millions)

SUMMARY

Total Project Cost	750.00
Total Financing	750.00
of which IBRD/IDA	300.00
Financing Gap	0.00

DETAILS

World Bank Group Financing

International Bank for Reconstruction and Development (IBRD)	300.00

Non-World Bank Group Financing

Counterpart Funding	450.00

Borrower/Recipient	450.00

Environmental and Social Risk Classification

Substantial

Decision

The review did authorize the team to appraise and negotiate

Other Decision (as needed)

B. Introduction and Context

Country Context

1. **China has experienced fast economic growth in the decades to 2019 and this has contributed to a dramatic reduction in extreme poverty.** Since China announced its 'reform and opening' policy in 1978, its GDP per capita has increased 25-fold in the intervening 40 years from about Y 2,548 (equivalent to US$379) in 1978 to Y 64,644 (equivalent to US$9,620) in 2018 (valued at 2018 price).[1] Economic growth has taken 753 million people out of extreme poverty, with the number of poor people declining from 770 million in 1978 to 16.7 million in 2018. The Government of China has now increased its focus on eliminating poverty where it remains, especially in the northern and western provinces.

2. **The steady growth of China's economy has driven a fast rise in energy consumption, leading to severe domestic and global environmental impacts.** Primary energy consumption grew from 571 million tons of coal equivalent (mtce) in 1978 to 4,640 mtce in 2018, an increase of more than 8-fold. In the power sector, total installed capacity in China amounted to 1,900 GW, and total electricity consumption reached 6,994 TWh by the end of 2018. Installed capacity and electricity consumption have grown at annual average rates of 9.2 and 8.6 percent respectively over the past four decades. China faces ongoing challenges to: (a) further reduce the share of coal in the energy mix and address associated serious environmental pollution; (b) further reduce the energy intensity (energy consumption per unit of GDP); and (c) cap and reduce greenhouse gas (GHG) emissions to fulfill its nationally-determined contribution (NDC) to global action on climate change under the Paris Agreement.

(a) ***China is suffering from severe air pollution due to coal-dominated energy consumption.*** Though coal's share in the primary energy mix has gradually declined from about 70-76 percent before 2000 to about 59 percent in 2018, coal remains the dominant energy source in China. High coal consumption has brought serious environmental pollution, making cities in China among the world's most polluted. Particulate matter and other local pollutants from coal combustion take a high toll in terms of deaths, morbidity, and associated economic costs (World Bank & PRC State Council Development Research Center 2013). The Government has placed a high priority on air pollution control and declared a 'war on pollution'. A major

[1] Source: China Statistic Yearbook 2018; and 2018 Statistical Bulletin on National Economic and Social Development. National Bureau of Statistics.

part of this effort is to promote renewable energy (RE) and other clean energy sources to replace coal consumption.

(b) ***Although energy intensity in China has declined beyond Government targets, it is still high by international benchmarks.*** China has made substantial progress in improving energy efficiency (EE), with its energy intensity falling from 1,567 tce/US$ million in 1978 to 346 tce/US$ million in 2018 (valued at 2018 price). However, China's energy intensity is still much higher than the international average and more than double the level in the United States.[2] Along with meeting the growing energy demand, actions are needed to further advance China's EE program and bring down energy intensity.

(c) ***Continuous growth of energy consumption, dominated by coal, adds to the challenge of fulfilling China's NDC commitments for 2030.*** China emits more GHGs per year than any other country, including the United States and Europe combined. In its 2015 NDC under the Paris Agreement on climate change, China committed to reduce the carbon intensity (carbon emission per unit of GDP) by 40-45 percent from 2005 to 2020 and by 60-65 percent from 2005 to 2030. China also committed to peak annual carbon emissions by 2030. Achieving these commitments will largely rely on both the EE program to halt the fast growth of energy consumption, as well as RE development to replace coal.

3. **To meet the energy sector's key challenges and reduce GHG emissions for its NDC targets, China has embarked on an energy transition program to shift away from coal.** An "energy revolution" program, launched by President Xi Jinping, calls for radical changes in energy consumption, energy supply, institutional reform, energy technology innovation, and strengthening international cooperation. An *Energy Supply and Consumption Revolution Strategy for 2016 to 2030*, issued by the Government in December 2016, requires more intensive RE development than in the past. Emerging transformative solutions to improve the integration and use of RE include utility-scale battery storage, distributed RE (DRE), and new RE technology applications such as geothermal and biomass for heating and RE for hydrogen production.

Sectoral and Institutional Context

4. **At the crux of China's energy revolution is the need to elevate clean energy sources to a fundamentally higher share of the energy mix to rival and displace coal.** The Government has determined to reduce its reliance on coal and increase the share of non-fossil fuels in energy supplies. As of 2018, China's energy mix comprised 59 percent coal, 18.9 percent oil, 7.8 percent gas, and 14.3 percent non-fossil fuels. Phased targets in China's long-term energy development strategy include: (a) by 2020, total energy consumption to not exceed 5,000 mtce and the share of non-fossil fuel energy to reach 15 percent; (b) by 2030, total energy consumption to not exceed 6,000 mtce, the share of non-fossil fuel energy to reach about 20 percent, and the share of gas to be about 15 percent; and (c) by 2050, total energy consumption in China to be stabilized, and more than one-half of the country's primary energy consumption to be supplied from non-fossil fuel sources.

5. **Although China has the world's largest installed RE generation capacity, more intensive RE growth is needed to support the ongoing energy transition.** China's installed capacity of wind power and solar photovoltaic (PV) rank number one in the world at 184 GW and 175 GW respectively by the end of 2018. Yet

[2] In 2017, the energy intensity was 372.4 tce/US$ million in China, 163.9 tce/US$ million in the United States and an average of 240.8 tce/US$ million globally, based on the data provided in BP Statistical Review of World Energy 2018 and World Economic Outlook Database (April 2019).

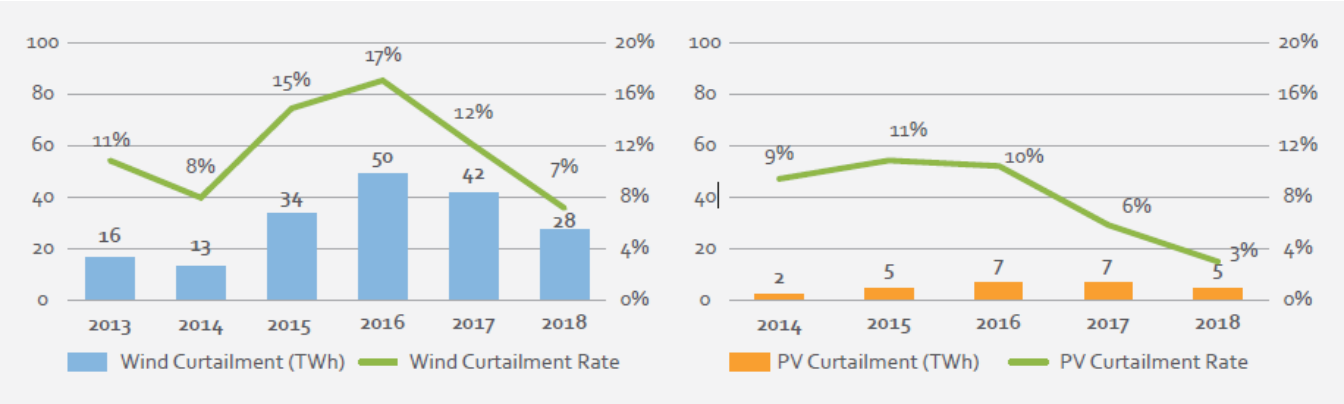
non-fossil fuel sources (including renewables and nuclear) still occupy a small share of the energy mix. Their share has nevertheless increased from 8.6 percent in 2010 to 14.3 percent in 2018, close to the Government's 2020 target of 15 percent. More ambitious RE development is expected in order to increase the share of non-fossil fuel energy to meet the Government's 2030 and 2050 targets. Some estimates[3] indicate that total installed capacity of wind power and solar PV could reach more than 700 GW and 730 GW respectively by 2035 and more than 970 GW and 1,270 GW respectively by 2050. This implies that both wind power and solar PV have the long-term potential to be scaled-up by four to seven times the current levels of installed capacity. However, to unlock this potential, prompt actions are needed to address the causes of extensive curtailment faced by existing RE assets (described below) and to create the enabling environment to develop and integrate new RE capacity.

6. **Current levels of RE asset utilization are extremely low owing to extensive curtailment, which may significantly slow future RE development unless properly solved.** China has experienced serious wind and solar PV energy curtailment since 2010 (Figure 1).[4] This is associated with the development of large-scale centralized RE power stations mostly in northwest China, especially Xinjiang, Gansu and Inner Mongolia. Existing RE asset utilization is extremely low. For comparison, in 2015, China produced the same amount of electricity from wind as the United States, but with twice the installed capacity (Fairley 2016, see Figure 2). Given the current amount of total wind power generated in China, a reduction of curtailment by one percent could increase annual RE generation by about 3,600 gigawatt hours (GWh), equivalent to a reducing annual GHG emissions by 2.9 million tons. The main causes of RE curtailment, and actions taken to address them, are described in Box 1. Given the expected large growth of new RE capacity, the integration of variable RE will become more challenging and requires a more holistic approach including RE policies, planning, investment and energy trade across China, as well as proactive adoption of emerging transformational technologies to enhance the flexibility of power systems. Grid-connected battery storage is one such technology with great potential to improve the flexibility of power systems to integrate RE and reduce curtailment. The Government has included battery storage as an essential element of its strategy to support smart grid development and increase RE penetration.

[3] China Renewable Energy Outlook 2018, China Renewable Center; Report by State Grid Energy Research Institute, 2019.

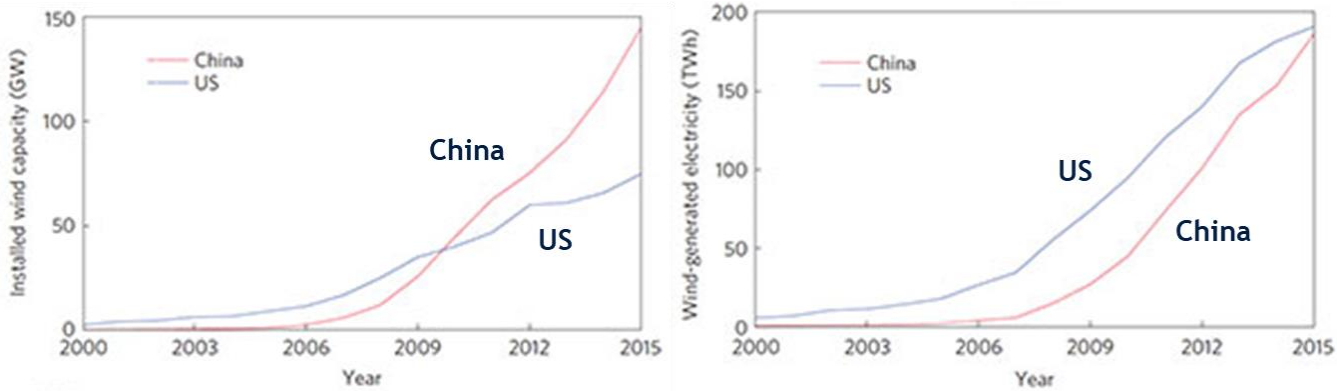
[4] Brookings-Tsinghua Center defines wind curtailment as *the reduction in electricity generation below what a system of well-functioning wind turbines are capable of producing.* This definition can be applied to PV systems as well. For the purposes of this Project, curtailment of RE refers specifically to curtailment of wind and PV as forms of variable RE.

Figure 1: RE Curtailment in China (2013-18)



Source: Energy Transition Trends 2019: China, Europe, USA; Energy Research Institute, China Renewable Energy Center; 2019.

Figure 2. Installed Wind capacity in China and the United States



Source: Tsinghua University/Harvard University.

7. **The Government is diversifying its strategy for RE development beyond large-scale RE bases to promote both DRE and new RE technology applications.** Since the mid-2000s, China has developed large-scale RE bases mainly in the northwest, northeast and northern China, with the objective of producing renewable electricity at scale and transferring that electricity to load centers in the South and East. In absolute terms China experienced the fastest growth of RE capacity in the world until it slowed development in context of high curtailment. Since then, China has diversified its RE strategy to promote both DRE and new RE technology applications as additional ways to help achieve its ambitious RE targets. Plans include to build dispersed wind power and distributed PV close to load centers in central, eastern and southern China, as well as to newly promote renewable energy (e.g. geothermal and biomass) for heating and to use RE for hydrogen production in suitable places, complementary to efforts to address curtailment at large-scale RE bases. Immediate actions are needed to deal with the causes of acute RE curtailment as well as to create the enabling environment to develop new RE capacity. Policy interventions and other reforms by the Government have played a key role, particularly in changing the behaviors of state-owned enterprises including both generation and grid companies. To keep downward pressure on curtailment and allow a further increase of RE capacity and use in China toward long-term development goals, further efforts are needed to address both the institutional and technical barriers. Innovative solutions such as battery storage and use of RE for heating and hydrogen production can be further explored to advance the energy transition in China.

(a) ***Harnessing the potential of DRE can help speed up China's clean energy transition, but it requires further efforts to address policy gaps, market failures, and technical challenges.*** DRE can help meet local demand without requiring new transmission capacity. It also has the potential to provide ancillary services to the power grid to help ensure adequate and reliable supply. Scaling up DRE is constrained by market and policy weaknesses. These include lack of urban planning to integrate DRE and inadequate regulations to enable access to the grid and trade between developers and users. Weaknesses also include the lack of clear pricing mechanisms, viable business models, and access to financing for developers. Whereas the intermittence of DRE poses a major issue for its grid integration, battery storage can play a significant role to handle the intermittence of DRE, and thus promote DRE development.

(b) ***Promoting new RE technology applications, especially to replace coal for heating, could become a new driver of RE development to help achieve China's targets.*** Complementary to the development of grid-connected DRE and centralized RE bases, the Government is promoting new RE technology applications such as geothermal and biomass energy for heating. These new applications can replace the conventional coal-fired boilers and help address severe local air pollution especially in Northern China. In Gansu, Inner Mongolia, and Northeast China, where curtailment rates are high, electric heating supply is piloted to increase power generation from existing wind farms to meet heating demand and replace coal-fired boilers though sustainability issue has been raised for this pilot. Such solutions are being promoted by government authorities at different levels. Other emerging uses of RE such as for hydrogen production have the potential to grow in coming years if technically proven and commercially accepted by the market. Access to financing by small and medium enterprises (SMEs)[5], however, remains one of the key barriers for scaling up such new RE technology applications.

Creating and Expanding Markets for Battery Storage

8. **Battery storage can play a significant role in improving the integration of RE, including to reduce RE curtailment and facilitate new RE capacity.** Among available energy storage technologies, battery storage is becoming a feasible solution to increase power system flexibility, at different levels, to improve grid integration of RE and improve the balancing of DRE and demand at local level. Distinct feature of battery storage for this purpose include its fast response, modularity and easy deployment at different locations. At the generation level, battery storage can help directly mitigate RE variability. At the transmission and distribution (T&D) level, battery storage can increase demand during off-peak hours by charging and increase energy supply during peak demand hours by discharging. This reduces congestion in the network and subsequently can reduce RE curtailment. At the consumer level, battery storage enables higher utilization of DRE such as rooftop PV to meet local demand, reducing network congestion and avoiding costly investments in T&D networks. All these unique features make battery storage essential in low-carbon power systems to address China's RE curtailment and support new RE development. Countries that are leading efforts to capture the value of batteries include the United States (in particular states such as California and New York), the Republic of Korea, the United Kingdom, Germany, Australia, and Japan. These countries are developing innovative policies, regulation and incentives, while also investing in new battery technologies to lower costs, improve efficiency, and enhance safety.

[5] The definitions of different sizes of enterprises in different sectors were updated by the National Statistics Bureau of China in 2017, based on their numbers of employees and annual operation revenue. In power sector, medium-size enterprise has an annual operation revenue of 20-400 million Y and total employee of 300-1000; small-size enterprise has annual operation revenue of 3-20 million Y and total employee of 20-300.

9. **Application of battery storage in China's power system is still immature, and the development of battery storage markets faces substantial institutional and financial barriers.** Despite the huge potential for commercial applications of battery storage in the power sector at utility and consumer levels[6], applications in China are still mostly at the pilot stage and have been mostly financed by sponsors' or owners' equity. The pioneering first movers have typically been a few private enterprises at consumer level, and state-owned enterprises at the utility level. As estimated by the China Industrial Association of Power Sources, the total installed capacity of battery storage for power system applications in China amounted to about 1,038 MW by the end of 2018, of which 34 percent was deployed at generation level, 24 percent at grid level, 25 percent at consumer level, and 17 percent installed with DRE and microgrids[7]. SMEs are very keen on investing in power system battery storage applications but face a series of obstacles. These include: (a) difficulties accessing loans especially from state-owned commercial banks owing to the reluctance of these banks to finance SMEs in general and to finance specific technologies perceived to be risky; (b) lack of effective pricing mechanisms to monetize values of battery storage; and (c) lack of viable business models to cover the high up-front costs of battery storage. Moreover, there is a lack of policy and regulations on issues of access to the grid, environmental impacts and safety management, and battery recycling. Details of these barriers are described below.

(a) ***The policy and regulatory environment in China is yet to enable a commercial market for SMEs' to invest in battery storage.*** Battery storage is a fairly new focus in China's 13th FYP and related policy documents. Responsible authorities need to acquire the knowledge and experience to develop corresponding policies and regulations for battery storage investments to become bankable and sustainable. Key barriers in this respect include: (i) lack of clearly defined market structure with roles and responsibilities of market players; (ii) lack of regulation for grid access by third-party battery storage investors and services providers; (iii) lack of regulation for grid integration of consumer-side battery storage; (iv) lack of pricing mechanisms to capture the values of battery storage; (v) lack of clear technical standards on grid integration, energy storage services, operation and maintenance, technology risk and safety management, particularly explosion risks; and (vi) lack of clear regulations on battery recycling. Given these large gaps in policy and regulations, most battery storage systems deployed today use equity investment from first movers to test the market; grid access is obtained case-by-case with strong local government interventions; and there exist only limited types of battery storage applications[8]. Adequate regulatory and pricing frameworks are needed to enable a market for SMEs and commercial banks to finance bankable investment in battery storage. The large gaps in relevant knowledge extends from policy makers to commercial banks, SMEs, grid companies and consumers.

(b) ***Access to financing is a common challenge for investors in battery storage as commercial banks are reluctant to provide financing to new and high-risk industries.*** The first movers in battery storage are mainly SMEs invested at both consumer and generation levels, and state-owned grid companies have been the only investors of battery storage at grid level so far. Consultations with selected SMEs confirmed

[6] According to BNEF (2018), global battery storage capacity could increase to 942 GW/2,857 GWh by 2040. The total investment requirement would amount to US$620 billion; two-thirds of the market would be located in China, the United States, India, Japan, Germany, France, Australia, Korea and the United Kingdom.

[7] Battery storage capacity in China to date has been led by first movers in the market. Government agencies have not yet developed adequate policies and regulations to spur the deployment of battery storage technologies.

[8] Most battery storage systems deployed today involve only one of three main applications: energy shifting to reduce electricity charges; backup power; or increasing solar PV self-consumption. Some pilot applications provide ancillary services to the grid.

that SMEs have limited access to bank loans to finance investments in battery storage[9]. According to SMEs consulted, the average financial return of the early stage battery storage projects was about 5-7 percent, while the cost of available bank loans for SMEs was in the range of 8-10 percent. Commercial banks' caution to finance battery storage projects stems from the following concerns: (a) inadequate understanding of the battery storage technologies and business; (b) lack of sustainable policy support; (c) low return on battery storage projects; and (d) inadequate communication with battery storage enterprises and investors. The situation is quite similar to the EE market of the early 2000s when commercial banks were reluctant to finance the new emerging EE market while energy service companies (ESCOs) could not access the finance from commercial banks. At that time, the World Bank had worked with the Government on policies and regulations, supported the establishment and operation of China's first three major ESCOs, and identified and supported participating banks to open up new business lines in EE. These efforts eventually helped create the EE market in China, which now has more than 6,400 ESCOs, about $17 billion investment per year, and annual energy conservation of about 39 mtce.[10]

World Bank Group (WBG) Engagement in Creating and Expanding Markets for RE Development

10. **The World Bank has been supporting RE development for well over two decades as a trusted partner of the Government of China**. Bank support has covered policy and reforms, creation of a market of wind power and solar PV and of a full supply chain for solar PV, as well as project financing, capacity building, and knowledge exchange between China and other developing countries. Bank support has been provided thorough: (a) advisory services and technical assistance (TA) mainly with the Global Environment Facility (GEF) and the Energy Sector Management Assistance Program (ESMAP); (b) the Renewable Energy Development Project (REDP - 1999), the China Renewable Energy Scale-up Program Phase 1 (CRESP1 - 2005) and 2 (CRESP2 – ongoing), and the upcoming GEF China DRE Scale-up Project (CDRESP, under preparation); and (c) support for demonstration investments in wind power.

11. **Grant-financed activities are underway to strengthen policy and institutions to create an enabling environment for battery storage with RE in China.** Both the ongoing CRESP 2 (2013-2019) and forthcoming CDRESP (2019-2023), financed by the GEF with China's National Energy Administration (NEA) as the implementing agency, will support development of required policies, regulations and pricing or incentive mechanisms. CRESP 2 focuses on improving efficiency and reducing incremental costs of RE for its sustainable development over the medium and long term. CDRESP supports policies and regulations for development of DRE and pilots of innovative use-cases of DRE including viable business models. Together these two GEF-funded projects will help create the enabling policy and regulatory environment for RE, DRE, and particularly battery storage. Hand-in-hand, the proposed new IBRD loan will create and expand the market to identify and prepare bankable projects, test viable business models, and leverage both equity and commercial debt financing for battery storage applications in power systems and new RE technology applications.[11] The proposed project

[9] Data collected from 14 enterprises in their investment of battery storage in 2017 and 2018 showed that: (a) 10 SMEs invested a total of US$ 361 million, of which bank loans were only US$ 2.1 million; (b) 4 SOEs invested a total of US$ 204 million, of which bank loans were US$ 75 million. On average, the share of bank loans in total investment was only about 1 percent for SMEs and 37 percent for SOEs, much lower than the normal practice of about 70-80 percent for conventional infrastructure projects in China.

[10] Source: ESCO Committee of China Energy Conservation Association, January 2019.

[11] Coordination of these activities across Projects is strengthened by NEA's role at the center of policy making in Government and as the implementing agency of CRESP2 and CDRESP, as well as the involvement of common Bank staff in various task team roles, and joint supervision activities as needed.

complements other Bank support in a holistic approach to the sustainable development of RE and energy transition in China.

12. **The Bank has a successful track record in supporting commercial banks at national, provincial, and municipal levels in China to establish and strengthen green business lines, so applying this experience to the proposed project will help create and expand the market for battery storage.** The design of the proposed project builds upon the successes achieved through Bank support to create the market for EE and emissions reductions in China. The Bank has supported three commercial banks (Huaxia Bank, China Export-Import Bank, and Minsheng Bank) to finance EE at the national level, and two banks (Shanghai Pudong Development Bank and Bank of Shanghai) to finance building energy efficiency at the municipal level. While all these financial intermediaries (FIs) have performed satisfactorily, only Huaxia bank created a specialized Green Finance Center to solely focus on green and emerging environmental technologies financing. Following a market review conducted during project preparation, the FI approach was chosen because it can open the nascent market to a large number of SMEs for the large number of subprojects expected at the level of distribution-grids and customer applications while large SOEs may dominate the market at grid level. Huaxia Bank was selected as it: (a) shows strong commitment to innovative business lines; (b) has a good database of SMEs and first movers in battery storage; (c) is willing to take risks and commit significant counterpart financing of US$450 million to move first in developing China's battery storage market in partnership with the Bank, (d) is an open bank and is willing to share knowledge and experience; (e) has rich experience in international cooperation, particularly successful experience in collaboration with the World Bank. Building on past success in creating enabling environments and markets in China, the World Bank can play an active role to: (a) assist Huaxia bank to fill knowledge gaps and develop a new business line for battery storage investments; (b) support the Government in developing policies and regulations to enable efficient deployment of battery storage; (c) facilitate the creation and expansion of the broader green financing market for commercial banks like Huaxia, applying recognized international environmental standards; (d) mitigate the risk for Huaxia to enter the new battery storage market by providing long-maturity concessional finance; and (e) in doing so help to deliver substantial global public goods in the form of GHG emissions reduction.

13. **The IFC is supporting front-runners of battery storage manufacturers in China, though barriers still limit market expansion.** A recent IFC study concluded that energy storage deployment in emerging markets is expected to grow substantially over coming decades and will open new markets and offer tremendous opportunities for the private sector. To date, IFC has engaged in early-stage venture capital investments in battery manufacture, helping the market to prepare for mainstreaming investments[12]. Current barriers, however, prevent IFC from providing commercial loans to specific types of battery storage investment projects. The IFC considers that the current cost of battery storage is still relatively high and restricts access to affordable financing. Innovative investment mechanisms, in coordination with improved industry standards and stronger government support are needed to unlock the transformative potential of energy storage.

C. Proposed Development Objective(s)

Development Objective(s) (From PAD)

[12] Some of IFC's noteworthy investments include Microvast, a China-based manufacturer of especially fast-charging lithium-ion batteries; Fluidic Energy, a manufacturer of zinc-air batteries used to power telecom towers; and AST from India which deploys PV solar plus batteries to power telecom towers.

14. The PDO is to improve the integration of RE and increase RE utilization in China through the deployment of battery storage systems and innovative RE technology applications.

Key Results

15. The proposed PDO level indicators are:
    - Increase in RE absorption by the grid (GWh/year);
    - Increase in energy production from innovative RE technology applications (GWh/year); and
    - Reduction in GHG emissions (tons CO_2/year).

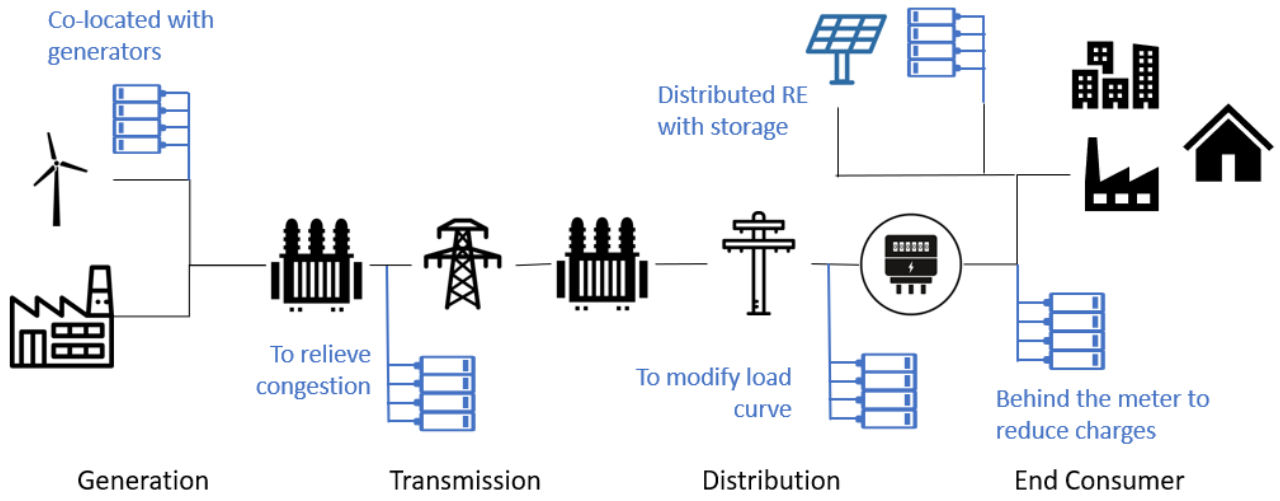
16. Intermediate project indicators are:
    - Installed capacity of battery storage systems (Megawatt hours, MWh);
    - Installed capacity of DRE (MW);
    - Co-financing leverage ratio (multiples of IBRD loan amount);
    - Beneficiaries' satisfaction (scale of 1-5); and
    - Subloans portofolio's non-performing loans level to SMEs.

D. Project Description

17. The proposed project comprises an investment component, with an IBRD loan of US$300 million and co-financing from Huaxia Bank of about US$450 million, to support the expansion of financing for battery storage systems and innovative RE technology applications. The investment component will be implemented by Huaxia Bank. In parallel, technical assistance will be provided to Huaxia Bank, the National Energy Administration (NEA) and other market players through on-going and new GEF-financed projects and through support from the Energy Sector Management Assistance Program (ESMAP) and the UK Government via the UK DFID Prosperity Fund.

18. **Investment Component.** The proposed project will principally support the installation of battery storage systems and innovative RE technology applications. The investments to be financed by sub-loans from Huaxia Bank to enterprises would include: (a) installation of battery storage systems, *at the generation level* in existing wind farm and solar PV plants; *at the grid level* in existing substations; and *at the consumer level* such as in industrial and commercial zones; (b) installation of DRE capacity with battery storage; and (c) scale-up of innovative RE technology applications such as RE for heating (geothermal, biomass, etc.) and for hydrogen production.

Figure 3: Application of Battery Storage in Power System



Source: World Bank staff.

19. The eligibility criteria of investment subprojects will emphasize battery technologies that can be scaled up and sustained in grid applications. The major types of application of battery storage in a power system are illustrated in Figure 3. Battery attributes that are particularly important in grid applications and for expanding the market for these technologies include duration, responsiveness, safety, recyclability, operability, robustness, and low toxicity. Research[13] has confirmed that there is a significant market potential as well as investors seeking to invest in these technologies. Huaxia Bank and the World Bank have carried out a market sounding, consulted with prospective investors, and identified a number of prospective sub-loan activities that could be proposed for financing under the project.

20. The project's Operational Manual (OM) developed jointly by Huaxia Bank and the World Bank defines the technical, financial, environmental and social eligibility criteria for subprojects to be considered. as well as requirements on due diligence, rules and procedures for appraisals of subprojects in line with Bank requirements. These include, but are not limited to, procurement, financial management, safeguard procedures, and monitoring and evaluation (M&E). Sub-borrower selection criteria is also defined in the OM, including creditworthiness, technical competence and a track record in the targeted types of project investments.

21. Two forms of TA are being provided and implemented in parallel with the proposed project. These are: (a) support to build due-diligence and implementation capabilities within Huaxia Bank; and (b) policy, regulations and standards to create the institutional frameworks needed nationally to support market creation and development for battery storage systems.

[13] Both recognized international agencies and local industrial associations have projected the potential market growth of battery storage in China. The China Industrial Association of Power Sources estimates that total installed capacity of battery storage could amount to 24 GW by 2025, with associated investments of over US$ 15 billion.

22. **TA to support building due-diligence and implementation capabilities within Huaxia Bank.** This TA will include: (a) expert advice on subprojects appraisal and evaluation with special focus on technical and safeguards issues; and (b) market survey studies, training and expert advice to strengthen Huaxia's technical capabilities (Table 1). The TA is expected to be financed by about US$ 1-1.5 million from the Energy Sector Management Assistance Program (ESMAP) and addition funds if needed from the UK Government via the UK DFID Prosperity Fund. These funds are expected to be secured in the 2nd half of 2019 and would allow these critical activities to be undertaken in parallel with the proposed project. Alternative solutions has also been discussed during the project preparation, including using Huaxia's own fund, in case above funds may not be secured.

Table 1: TA Activities and Proposed Budget Allocation

Subcomponent	Activities	Cost Estimation (US$ millions)
Due Diligence of Investment Subprojects		
	Support from Institutions on Technical Evaluation, Environmental and Social Management, M&E and Auditing	0.4
	Experts Support (technical, safeguards, and fiduciary)	0.6
Subtotal		**1.0**
Capacity Building for Huaxia Bank		
	Studies and Market Survey	0.15
	Training on Battery Storage	0.25
	Consultation with Potential Sub-borrowers for Business Development	0.05
	Lessons Learned and Dissemination	0.05
Subtotal		**0.5**
Total		**1.5**

23. **Policy and Institutional Strengthening for Battery Storage Applications.** During the preparation of the proposed project, NEA organized workshops together with the Bank to identify gaps in policy, regulations and standards. Based on these consultations, the Bank and NEA discussed and agreed to fund activities required to address these gaps in parallel with the proposed project. These activities (see Table 2) aim to create the required enabling environment for scaling up the deployment of battery storage and DRE through support from the ongoing CRESP2 and GEF CDRESP projects, for which NEA is the implementing agency. The proposed activities are critical not only for RE under the proposed project but also to scale up centralized and distributed RE under the two GEF-financed projects. The CDRESP project focuses on policy and institutions, financing mechanisms, viable business models and informing possible pipeline investment subprojects for DRE, including use of battery storage to harness all benefits of DRE. The CRESP2 project focuses on improving efficiency and reducing incremental costs of RE for its sustainable development over the medium and long term. Building on synergies among CRESP2, CDRESP, and the proposed project, the corresponding activities will be implemented through the NEA's existing project management office (PMO) to coordinate and collaborate with relevant government agencies. These activities include: (a) develop and oversee enforcement of policies and regulations on deployment of battery storage in the power system, including pricing policy, access to grid, and open market to new investors; (b) develop technical and environmental standards on battery safety, reuse, and disposal; (c) develop system operating guidelines with battery storage; and (d) support the pilot of emerging innovative use of battery storage in the power systems. The policy and institutional strengthening activities will be funded with

about US$2.0 million in GEF grants from the ongoing CRESP2 and GEF CDRESP projects. Coordination among the teams involved in the three projects will be closely managed and supervision of the activities will be jointly carried out whenever needed.

Table 2: Policy and Institutional Strengthening Activities and Budget Allocation

Type of Activities	Tasks	Funding Source	Cost Estimation (US$ millions)
Policies and Regulations	Development of policies and regulations to address the grid access, pricing, and planning issues.	CDRESP	0.5
Technical and Environmental Standards	Standards on battery safety, reuse, and disposal.	CDRESP	1.0
System Operation Guidelines with Storage	Modeling system operation with the application of battery storage to serve for efficient dispatch.	CRESP2	0.15
Pilot of Emerging Innovative Use of Storage	Battery storage and other emerging innovative storage technologies.	CRESP2	0.35
Total			**2.0**

Legal Operational Policies

	Triggered?
Projects on International Waterways OP 7.50	No
Projects in Disputed Areas OP 7.60	No

Summary of Assessment of Environmental and Social Risks and Impacts

The proposed energy storage investments are anticipated with overall environmental benefits, including the improvements in energy resilience and efficiency and reduced CO2 emissions through the integration of more clean electricity from renewable sources. At the same time, potential negative environmental impacts and safety risks are also expected depending on the type and efficiency of energy storage technology to be adopted and the effectiveness of implemented environmental & social (E&S) management measures.

To better understand potential safeguards risks associated with proposed investments through financial intermediaries, E&S due diligence has been conducted for the project during preparation. This covers the review of the existing Chinese legal framework, overall E&S performance of existing Battery Energy Storage System (BESS) projects in China and their primary suppliers (battery producers and recyclers), and Huaxia Bank's current Environmental and Social Management System (ESMS) and E&S performance. Based on project characteristics and the key findings of E&S diligence, ESS1 (Assessment and Management of Environmental and Social Risks and Impacts), ESS2 (Labor and Working Conditions), ESS3 (Resource Efficiency and Pollution Prevention and Management), ESS4 (Community Health and Safety), ESS5 (Land Acquisition, Restrictions on Land Use and Involuntary Resettlement), ESS7 (Indigenous Peoples/Sub-Saharan African Historically Underserved Traditional Local Communities), ESS9 (Financial Intermediaries), and ESS10 (Stakeholder Engagement and Information Disclosure) are deemed relevant to the project and the relevance of ESS6 (Biodiversity Conservation and Sustainable Management of Living Natural Resources) and

ESS8 (Cultural Heritage) remains to be determined upon subproject identification during implementation. The assessment of Environmental and Social Standard (ESS) relevance and proposed mitigation measures are summarized below.

The proposed subprojects (mostly BESS to be installed within existing facilities) are not complex and have small footprints. The environmental risks anticipated are mainly fire and explosion risks during operation and environmental hazards related to the disposal of used batteries containing hazardous waste. Although the existing BESSs visited during E&S due diligence have shown appropriate and sufficient safety management in full compliance with applicable national laws and regulations, the environmental risk for the project is still rated as substantial given the need for further development of battery recycling facilities and supportive technical standards to enhance safety and environmental management of the emerging energy storage sector in China, particularly among new and inexperienced SMEs and individuals.

Most installations will be smaller than existing premises and will be implemented within existing footprints or the perimeters of existing facilities (such as power generation facilities, substations, or end-users' buildings/sites). Potential displacement impact, direct adverse impact on ethnic minorities, risks associated with labor and the working conditions of construction workers are considered low risk during the construction period. During operation, community safety risks that are linked to explosion, fire and electric shock will be strictly managed under China's current regulatory framework and applicable ESSs. A multitude of projects located close to vulnerable communities may give rise to a limited degree of social conflict, harm, human security risk associated with perceptions of community endangerment and nonreceipt of benefits. The social impacts and risks are generally site specific with a low probability of serious effects to people and can be mitigated through strict eligibility criteria of subprojects, as well as enforcement of culturally appropriate stakeholder engagement and appropriate standards and regulations.

As the primary suppliers, battery manufacturers and recycling/disposal service providers play an important role in the management of E&S risks and impacts. According to the investigation, major battery producers and recycling enterprises have set and implemented high-level safety and environmental standards for their own long-term sustainable development in the sector, however, it was also found that there were still unsound "backyard" recyclers targeting used lead-acid batteries, and qualified recycling/disposal facilities are still to be developed for lithium batteries before their decommissioning from the first BESSs in China (approximately around 2025).

In this context, the strict exclusion list and screening procedures established for the project under ESMS require that subborrowers are only eligible for a loan if they commit to the use of certified and licensed entities for battery collection, recycling and disposal. In addition, the technical assistance activities in parallel with the project have been proposed to address E&S concerns associated with battery recycling and disposal through policy/standard development. During project implementation, it is also anticipated that more stringent technology-specific environmental and safety standards (some currently being developed) and their enforcement will further eliminate disqualified Small and Medium Enterprises (SMEs) and individuals from the market if they are without appropriate technical expertise and oversight.

Huaxia Bank is the responsible financial intermediary for implementing the project and has acquired extensive experience on E&S risk management through preceding World Bank and AFD (Agence Française de Développement) funded projects. Since 2008, Huaxia Bank has started to develop its ESMS system by adopting the World Bank's safeguards policies and mainstreaming the E&S requirements into the project's OM.

Based on the identified key environmental risks and impacts and current practice, an enhanced ESMS has been

developed for Huaxia Bank to assure the project's alignment with Environmental and Social Framework (ESF) requirements throughout the subproject's life cycle, and the Environmental and Social Commitment Plan (ESCP) has specified all the actions to ensure E&S management capacity and ESMS implementation. In addition, part of the GEF-financed TA activities in parallel with this project is also designed to support Huaxia Bank to further strengthen internal and external expertise and capacity on E&S management.

Following the ESMS procedure, all subprojects will be firstly screened against the exclusion list and assessed for their E&S risks and impacts prior to financing under this project. Any subproject with the potential to have a significant impact on natural habitat and physical cultural resources will be excluded from the project financing following the eligibility criteria. All of the project-supported subprojects will be prepared and implemented according to national regulations and ESMS requirements. Safeguard documents of subprojects, following the ESMS, will be prepared by the subborrowers, disclosed locally, and revised as needed according to the disclosure. The approved documents should be submitted to the Bank for disclosure. Regular clearance of safeguard documents will rest with the Huaxia Bank's in-house safeguards specialists and be subject to spot checks by the Bank as needed. Any subprojects involving potential land acquisition and resettlement; adverse risks or impacts on indigenous peoples; or significant risks or impacts on the environment, community health and safety, labor and working conditions, biodiversity or cultural heritage are to be classified as high risk or substantial risk. High-risk projects will be excluded from the project financing and the sub-projects classified with substantial risk will be subject to the World Bank's prior review and clearance until Huaxia Bank can demonstrate its capacity to manage safeguard issues on its own.

As part of the ESMS, Huaxia Bank has established a Stakeholder Engagement Plan (SEP) for the project, which is deemed consistent with the requirements of ESS9 and ESS10. The first draft of ESMS and SEP were respectively disclosed on Huaxia Bank's website (in Chinese) on January 21, 2019 and at the Bank's external website (in English) on January 22, 2019. Two rounds of consultations on the SEP and ESMS were carried out by Huaxia Bank, respectively in January and February 2019. The revised ESMS (including SEP) and the ESCP were disclosed again locally and by the World Bank in April 2019.

Note: To view the Environmental and Social Risks and Impacts, please refer to the Appraisal Stage ESRS Document.

E. Implementation

Institutional and Implementation Arrangements

24. **Huaxia Bank will be the project implementing agency.** It has established, under its Corporate Business Department, a Green Finance Center (GFC) to be responsible for the daily management of implementation. A Green Finance Steering Committee will be established within Huaxia Bank to plan and guide the development of green financing business of Huaxia Bank and coordinate the business cooperation among relevant departments. The GFC is the line department within Huaxia Bank to organize marketing of green finance business in Huaxia Bank and is the project management office to implement the World Bank projects. Huaxia Bank commits to build and improve its own capacity on both technical aspects and environmental and social management of the investment sub-projects and will expand this practice to its other green finance business lines.

25. **It is expected that Huaxia Bank will on-lend the IBRD loan to eligible final borrowers on commercial terms.** The terms will be determined based on Huaxia's risk assessment of the sub-borrowers and proposed

investment subprojects. Given the risks associated with emerging markets, especially battery storage, TA activities have been agreed and funding sources are expected to be confirmed in the 2nd half of 2019 to support Huaxia Bank in capacity building, business development, and due diligence review of all investment subprojects, following the requirements of the OM.

26. In the OM, details of business development, review process within Huaxia Bank, contracting, fund management, and reporting have been defined, as well as both the technical and financial criteria to select investment subprojects. Subprojects selection criteria cover: (a) technology and technical standards and soundness; (b) cost effectiveness; (c) contribution to RE integration; and (d) environmental and social requirements. Sub-borrower selection criteria is also include in the OM, including creditworthiness, technical competence and track record in the targeted types of project investments. The GFC will be responsible for daily management of the overall project implementation and will coordinate with line departments within Huaxia Bank accordingly. External assistance will be provided as required, especially for technical review and to ensure compliance with safeguards requirements.

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