Project Information Document (PID)

Concept Stage | Date Prepared/Updated: 13-Jan-2019 | Report No: PIDISDSC24013

BASIC INFORMATION

A. Basic Project Data

Country	Project ID	Parent Project ID (if any)	Project Name
China	P163679		China Renewable Energy and Battery Storage Project (P163679)
Region	**Estimated Appraisal Date**	**Estimated Board Date**	**Practice Area (Lead)**
EAST ASIA AND PACIFIC	Mar 20, 2019	May 30, 2019	Energy & Extractives
Financing Instrument	**Borrower(s)**	**Implementing Agency**	
Investment Project Financing	People's Republic of China	Huaxia Bank, National Energy Administration	

Proposed Development Objective(s)

The project development objective is to improve the performance of renewable energy (RE) through reduction of curtailment and deployment of emerging uses of RE in China, focusing on application of battery storage technology.

PROJECT FINANCING DATA (US$, Millions)

SUMMARY

Total Project Cost	639.24
Total Financing	639.24
of which IBRD/IDA	200.00
Financing Gap	0.00

DETAILS

World Bank Group Financing

International Bank for Reconstruction and Development (IBRD)	200.00

Non-World Bank Group Financing

Counterpart Funding	425.00
Borrower/Recipient	425.00
Trust Funds	14.24

Global Environment Facility (GEF)	14.24

Environmental and Social Risk Classification	Concept Review Decision
Substantial	Track II-The review did authorize the preparation to continue

Other Decision (as needed)

B. Introduction and Context

Country Context

1. **China has experienced fast growth of energy consumption tied to sustained economy growth in the past decades.** Since China announced its 'reform and opening' in 1978, China's GDP per capita has increased 24 fold in the past 40 years, from 385 CNY per capita in 1978 to 59,660 CNY per capita in 2017 (valued at current year price). China's efforts in economy growth has taken 740 million people out of extreme poverty – the poverty population reduced from 770 million in 1978 to 30.5 million in 2017, and the government shifted its focus on reducing poverty in northern and western provinces. The fast economy growth is accompanied with fast energy consumption: total energy consumption increased from 571 million tons of coal equivalent (mtce) in 1978 to 4,490 mtce in 2017, of which the share of coal has been kept at about 70-76 percent before 2000, and decreased gradually to 60 percent in 2017. Challenges are emerging in meeting the continuous growth of energy demand and addressing the ensued serious environmental pollution in China.

2. **Ambitious renewable energy (RE) development has been launched in China, and the Government is committed to reduce carbon intensity of the energy sector.** To reduce the serious environmental pollution and greenhouse gas (GHG) emission caused by the coal-dominated energy production, the Government of China has announced ambitious targets of RE development, aiming to reduce the share of coal in the country's energy mix, and achieved the targets set for the 13th Five-Year Plans (FYPs) period (2016-2020). By end of 2017, the installed capacity of wind power and solar PV amounted to 164 GW and 130 GW respectively, ranked the top in the world. The share of non-fossil fuel energy increased from 8.6 percent in 2010 to 14.2 percent in 2017, close to the government's 2020 target (15 percent).

3. In its nationally determined contribution (NDC) for action under the Paris Agreement on climate change, China committed to reduce the GHG emission[1]. The Government's Strategy (labeled as the "Energy Revolution"), issued formally in 2016, sets the long-term goal of having more than half of energy come from non-fossil sources by 2050, compared to current targets of 15 percent by 2020, and 20 percent by 2030. Ambitious RE development

[1] As part of China's NDC submitted in 2015, the Government intends to reduce carbon emissions per unit of GDP by 40–45 percent from 2005 to 2020 and by 60–65 percent from 2005 to 2030, and for carbon emissions to peak by 2030.

is still anticipated in China. Domestic researches[2] indicate that total installed capacity of wind power and solar PV could reach more than 400 GW and 300 GW respectively by 2030.

4. **Along with the sustained economic growth, China's power sector has also experienced fast growth in the past decades.** By the end of 2017, total installed capacity in China amounted to 1,777 GW, and total electricity consumption amounted to 6,363 TWh. The average annual growth rates of installed capacity and electricity consumption in China were 9.2 and 8.6 percent respectively in the past four decades. With the fast growth or RE, especially wind and solar power since 2005, the share of coal-fired power generation has been reduced steadily, from 83 percent in 1978, to 81 percent in 2010, and 65 percent in 2017.

Sectoral and Institutional Context

5. **Though China is already a leading country in RE development, efficiency of RE development has raised concerns due to serious curtailment problems.[3]** Since 2010, China has experienced serious curtailment of wind and solar energy in northern China and hydropower in the southwest. Taking wind power as an example, National Energy Administration (NEA)'s statistics show that total wind curtailment increased from 39 TWh in 2015 to 49.7 TWh in 2016, reaching 17 percent of total available wind power generation in the country, then dropped to 41.9 TWh (or 12 percent of available wind power generation) in 2017. Regional data show that serious curtailment of wind power occurs in northern China, especially Gansu, Xinjiang, Inner Mongolia and Jilin provinces. A comparison of wind power generation in both China and US in 2015 indicated that China produced the same amount of electricity from wind as the US but with twice the installed capacity (See Figure 1)[4]. Considering the current size of the total wind generation in China, a reduction of curtailment by 1 percent point could increase RE generation by about 3,000 GWh, equivalent to GHG emission reduction of 2.4 million tons of CO_2 equivalent [5].

6. The RE curtailment issue has raised concerns among investors and decision makers in China. As a result, China held back the development of RE capacity in several provinces where serious curtailment occurred in 2016, enhanced its monitoring of the performance of existing wind farms and solar PV stations, and adjusted its 13th Renewable Energy Development Five-Year-Plan (2016-2020) to discipline the development of centralized RE in 2017 and 2018. Without addressing the curtailment issue, achievement of the ambitious target of RE development (more than 700GW by 2030 as projected by China Energy Research Society) could be delayed since the current volume of RE is still a small portion of the ambitious target and future RE development could lead to more curtailment.

7. **RE integration is a key challenge in China, and swift actions are needed to overcome both institutional and technical barriers.** The serious RE curtailment in recent years was caused by both institutional and technical barriers. Institutionally, gaps in both RE and grid planning, insufficient incentives to break "provincialism" and promote inter-provincial power exchange, and vested interests prevented RE generation dispatch. Technically,

[2] China Renewable Energy Outlook, 2018, China Renewable Center (CNREC); China Energy Outlook 2030, Chine Energy Research Society (CERS).

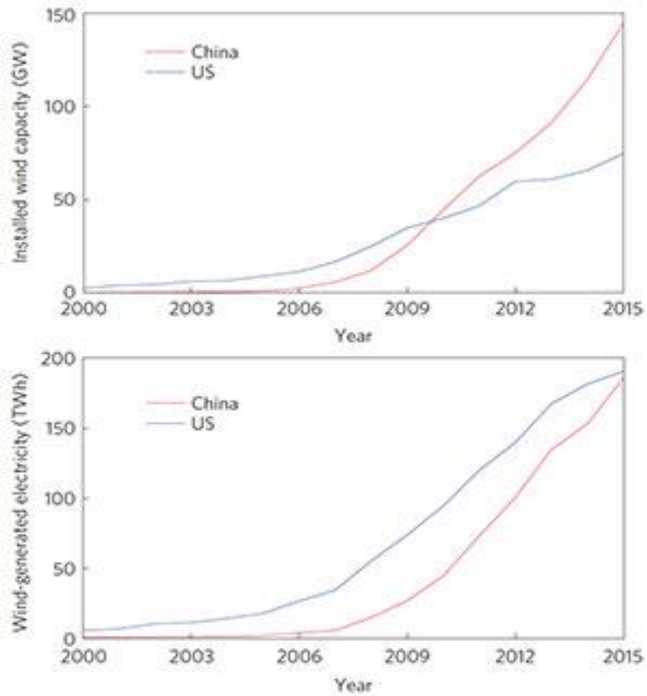
[3] Curtailment is defined as a reduction in the scheduled capacity or energy delivered to the grid, in this case from wind, solar, and hydro energy facilities. Because electricity from variable resources such as wind and solar must be used when it is produced (unless there is associated energy storage), the resource is therefore wasted.

[4] Why China's Wind Energy Underperforms. By Peter Fairley - IEEE Spectrum 23 May 2016.

[5] Total wind generation was 303.4 TWh in 2017 in China. Applying an estimated emission factor of 0.8 tCO2/MWh, an one percent point increase of wind power generation will reduce a total 2.4 million tons of CO2.

coal-dominated generation systems have limited flexibility and storage capacity to integrate the large-scale variable wind and solar power (referred to as VRE in the reminder of the CN). In addition, the transmission bottleneck prevents inter-province power exchange when large amount of RE needs to be transmitted from rich-resource western provinces (with low electricity demand) to high-demand central and eastern provinces. In 2015, the State Council issued Decree No. 9 to deepen power sector reforms. It required to gradually phase out the generation quotas for coal-fired power plants, abolish the single buyer model and change the role of grid companies to provide transmission and distribution services, and establish power markets to introduce competition and increase the efficiency of power sector.

Figure 1. Installed wind capacity in China and US (Image: Tsinghua University/Harvard University)



8. **Achieving the ambitious RE targets also requires rethinking the RE development roadmap, and multi-dimension RE development tracks are needed.** The prevailing RE development in China has been contributed mainly by the development of large scale centralized wind and solar power. Development of distributed RE, connected to the distribution networks directly and consumed locally, has been recognized as a new direction of RE development and has been promoted by both state and provincial authorities, leading to a fast growth since the mid-2010s. New uses of RE have also emerged with some success, including RE for heating, thus opening a third track to promote RE development in China.

a) **<u>Technical solutions particularly battery storage, are envisaged to reduce the curtailment and improve the Integration of Large Scale Centralized VRE:</u>**

√ **Technical solutions for improving the integration of VRE have also been identified but support is required to promote their development.** Improving the operational flexibility of power system, promoting the development of grid-friendly distributed RE, and developing emerging markets to increase consumption of RE generated electricity, are three major types of technical solutions envisaged to address the curtailment issue. Major specific actions of improving system operational flexibility include: (a) easing transmission and distribution constraints to allow power dispatch across larger geographical areas; (b) improving the dispatch flexibility of existing dominated coal-fired thermal power plants, especially the combined heat and power plants in northern China; (c) reshaping the outputs of existing VRE by deploying energy storage and improving VRE forecast; and (d) installing energy storage in power systems to adapt quickly to the changes of both VRE and demand fluctuations, including generation, grid and consumer sides.

√ **Energy storage systems, coupled with advanced information and communication technology (ICT), are emerging as a technology package that is essential to provide flexibility to integrate higher levels of VRE.** Energy storage is emerging as a technical solution to cut RE curtailment and support RE development in the short, medium and long term. Among many types of energy storage technologies, batteries offer a wide range of services and benefits at utility-scale generation, transmission and distribution levels and at end user level. On the generation side, battery storage can help smooth RE outputs to provide more stable supply to the grid. At transmission and distribution levels, it can improve the flexibility of system dispatch by shifting the locations of sources of power supply, increasing demand in the off-peak hours, and transferring energy supply from off-peak to peak hours. This operation will enable more RE integration and reduce congestion of transmission system, and eventually reducing RE curtailment. At the consumer level, it also helps increase demand at off-peak hours and provides localized power supply at peak hours; it enables expansion of distributed VRE to meet local demand, further contributes to easing congestion at the transmission level and avoid costly investments in transmission and distribution networks, and provide additional flexibility to the power system to integrate more centralized VRE through introduction of demand side management. Advances in ICT, including cloud computing, big data, artificial intelligence, and blockchain, are enabling efficient planning, design, operation, monitoring, and safety and life expectancy control over battery systems. Countries that are leading efforts to capture the value of batteries through innovative policies, regulation and incentives include the US (e.g. California, New York), Republic of Korea, UK, Germany, Australia, and Japan, while investing hugely in battery technology innovations to lower down cost, improve efficiency, and enhance safety. The experiences in these countries can provide lessons and complement solutions envisaged by China to resolve the similar issues.

b) <u>Supporting the Development of Distributed RE – energy storage is also an emerging solution to the Integration of DRE</u>

√ **Distributed RE is emerging as a major contributor to China's clean energy development with distinct opportunities.** Distributed RE (DRE) comprises technologies and services at the level of electric power distribution grid and its users, including generation, energy efficiency, demand response, storage, and related ICT systems (Hungerford & others 2017). Potential benefits of DRE from the perspective of the power system include avoiding the need for additional grid capacity, and ancillary services to ensure quality operation of the grid, among others.

√ **Harnessing the potential of DRE for China's clean energy transition requires further efforts to address market and policy challenges, as well as technical barriers.** However, for specific use-cases of DRE, the benefits and costs, and their allocation among actors, depend on a wide range of context-specific technical, economic, and policy factors. Moreover, realizing the full benefits of DRE is likely to require institutions that look very different from those prevalent today and in charge of setting standards, pricing, market design, regulation, and business models. In China, DRE and supporting institutions are at a relatively early stage of development compared with some other countries. Reforms in market design and other aspects of power sector institutions, which China continues to explore, are thus likely to influence and be influenced by demand for DRE. Technical barriers relate mainly with the non-conformity of required technical standards due to quick development of distributed PV in vast areas, as well as the inadequate capacity of the distribution networks. With the fast growth of distributed solar PV in China, quality and performance of these installed capacity not up to standards could downgrade the effectiveness of the investment. Improved maintenance practices, enhanced and more flexible distribution networks, improved dispatch of DRE with installation of energy storage, could be required.

c) **Promoting New Emerging Use of RE, especially RE for Heating, could be a new area to achieve China's RE target.** Complementary to the development of grid connected centralized and distributed RE, new uses of RE such as RE for heating, are emerging in several countries including China. Such applications contribute to addressing the serious environmental problems in winter and improve RE integration in some cases, especially in northern China. In Gansu, Inner Mongolia and Northeast China, where curtailment is significant, business models have been developed between existing wind farms and cities to increase wind power generation to meet heating demand and replace coal-fired heating boilers. Development of heat pumps to supply heat in some areas has also been piloted in many areas. Scaling up of such solutions is being considered by different levels of government authorities. Some other new emerging use of RE (e.g. hydrogen) could also have the potential to grow in the coming years, if technically well tested and accepted by the markets.

9. **In China, the market for battery storage is growing but faces significant barriers.** While some battery segments are already commercial, i.e. car batteries, application of batteries for energy storage in the power sector is yet at its infant stage. However, there is a huge potential of new markets for utility-scale and commercial applications of energy storage in the power sector. According to the 2018 Long-Term Energy Storage Outlook (BNEF, 2018), global battery storage capacity could increase to 942 GW/2857 GWh by 2040, total investment requirement would be around US$ 620 billion; two-thirds of the market would be in China, US, India, Japan, Germany, France, Australia, Korea and UK. However, a series of roadblocks still need to be removed for these new markets to expand. These include high cost, environmental impacts and safety issues. The utility-scale battery storage market is still mainly confined to demonstration although grid companies announced quite large-scale energy storage pilots in 2018. Energy storage demonstration projects installed in existing thermal power plants, have been initiated since 2016 when ancillary services compensation mechanisms were developed in several provinces.

10. **New policies and regulations in China need to be designed and implemented to create the enabling environment for the scale-up of flexibility solutions, such as battery storage, to reduce RE curtailment and enable further development of both centralized and distributed RE.** Energy storage is a fairly new focus in China's 13th Five Year Plan (FYP) and related policy documents. Public institutions in charge of developing policies, pricing and standards need to acquire the corresponding knowledge and experience to develop policies and regulations to allow implementation and sustainable growth of the emerging technical solutions in line with best environmental practice and technical standards. Specific financial or other policy incentives are yet to be developed to address the barrier to scale up energy storage in the power sector, including (i) high cost, (ii) concern on safety management, (iii) environmental risks related to battery recycling and disposal, (iv) lack of regulation for grid access by third-party energy storage investors and for associated energy storage services, and (v) lack of regulation for integration of consumer side battery storage. The business models that are being piloted need to be expanded - most battery storage systems deployed today involve only one of three main applications: demand charge reduction, backup power, or increasing solar self-consumption, though there are some pilot

applications of providing ancillary service with battery storage. Capturing multiple benefits of battery storage and adapting its development to different system characteristics can make investments more attractive but would require adequate regulatory and pricing frameworks. Policies, regulations, standards and institutions to fully address these issues are presently lacking in China. Decision making in the sector is also fragmented among concerned agencies and coordination mechanisms are relatively weak.

11. **The Government and related stakeholders in China are already exploring solutions to varying degrees for reduction of RE curtailment and further development of RE, including with World Bank assistance in certain areas.** For example, pilot market mechanisms to provide ancillary services, and rehabilitation of thermal power plants to increase its peaking capability, have shown promising results in reducing RE curtailment in various provinces, with strong potential for replication. The grid companies are upgrading transmission capacity at key locations to eliminate transmission bottleneck. The Government also intervened and caused provincial governments and grid companies to increase inter-provincial power exchange, with positive results in 2017 and 2018 to reduce VRE curtailment. The Government is also introducing a RE quota system to set minimum renewable power consumption targets for major consumers, distributors, retailers and self-generators in each province. The World Bank has been accompanying and providing support to the development of these policies and regulations for several years, in particular through the "Second Phase of the Renewable Energy Scale-up Program" (P127033) supported by a GEF grant. Other parallel operations are also under preparation, which include support to DRE and enabling policies for energy storage deployment. However, important investments are needed to unlock the potential of each solution individually.

12. **IFC is supporting front runners of battery storage manufactures but barriers still limit market expansion.** IFC's recent study concluded that energy storage deployment in emerging markets is expected to grow substantially over the next decades and considered this will open new markets and offer tremendous opportunities. To date, IFC has engaged by means of early-stage venture capital investments on battery manufactures[6], helping to prepare the market for mainstream investments. However, the current barriers hold IFC from providing its commercial loans to specific battery storage investment projects. IFC considers the current levels of cost for battery storage remain relatively high, restricting access to affordable financing. Innovative investment mechanisms, in coordination with improved industry standards and stronger government support, will be needed to unlock the transformative potential of energy storage.

Relationship to CPF

13. **The proposed Project supports the World Bank Groups' broader strategy of engagement in China.** The project furthers the WBG twin goals of ending extreme poverty and boosting shared prosperity and is fully aligned with the key priorities identified in the Systemic Country Diagnostic (Report No. 113092-CN) and the Country Partnership Strategy for China (Report No. 67566-CN) by strengthening the policy and institutional framework for green growth and clean energy. This context informs the concept of the proposed Project and its relationship to other ongoing and prospective activities in the World Bank portfolio in China. In particular, the proposed Project is consistent with three interlinked dimensions of the clean energy transition in China that harness Bank's global expertise: (a) promote the required enabling environment, supporting sector market reforms, design of new policies and regulations and financing pilots; and (b) support the design and the piloting of innovative

[6] Some of IFC's noteworthy investments included 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 photovoltaic (PV) solar plus batteries to power telecom towers.

financing mechanisms to crowd-in commercial banking and capital markets. In addition, the Bank will further help disseminate the most successful Chinese experience in scaling-up and mainstreaming clean energy.

14. **The Project also contributes to WBG global priorities in climate finance, clean energy and batteries.** In September 2018, the WBG announced the "Accelerating Battery Storage for Development" initiative.[7] This includes a commitment of $1 billion in WBG financing, with an aim to fundraise $1 billion in concessional climate funds, through channels such as the Climate Investment Funds' Clean Technology Fund (CTF), and mobilize at least another $3 billion from the public and private sectors. The goal is to finance 17.5 gigawatt hours (GWh) of battery storage by 2025 (more than triple the 4-5 GWh currently installed in all developing countries). The program intends to help shape policies needed to integrate battery storage and establish procurement practices in favor of environmental friendly technologies and recycling programs. It will also convene a global think tank on battery storage, bringing together national laboratories, research institutions, development agencies and philanthropies to foster international technological cooperation and training to develop and adapt new storage solutions that are tailored to the needs and conditions of developing countries. The proposed Project aligns with this initiative in substance and timing, to potentially contribute up to one-fifth of the global targets for finance and battery capacity. The Project also aligns with the global program emphasis on safeguarding public benefits. The Project would also contribute to the WBG climate targets, announced in December 2018, to provide around $200 billion over 2021-2025 in support for countries to take ambitious climate action.

C. Proposed Development Objective(s)

15. The project development objective is to improve the performance of renewable energy (RE) through reduction of curtailment and deployment of emerging uses of RE in China, focusing on application of battery storage technology. The global environmental outcome associated with this PDO is to reduce greenhouse gas emissions.

Key Results (From PCN)

16. The proposed outcome indicators are:
    - Reduced curtailment of RE (GWh);
    - Total MWh of battery storage installed; and
    - CO_2 emissions reduction (million tons)

17. Intermediate project indicators will be provided in PAD, likely to be:
    - Capacity installed for emerging RE uses
    - Installed capacity for distributed RE
    - Leveraged financing

D. Concept Description

18. **Project activities will promote investments to reduce curtailment and promote emerging use of RE to improve the efficiency of RE development.** Considering the investment comprising many small scale sub-projects covering generation, grid and demand sides, and benefits of leverage financing, financial intermediary, identified as Huaxia

[7] http://www.worldbank.org/en/news/feature/2018/09/26/powering-new-markets-for-battery-storage

Bank, is proposed to on lend the IBRD loan to eligible final borrowers. This practice has been applied successfully in the Bank's previous engagement in energy efficiency, low carbon cities, and air pollution control programs. The proposed implementation period is 2019 to 2024. Project financing will comprise: (a) IBRD loan of US$200 million made to the Ministry of Finance and on-lent to Huaxia Bank as a financial intermediary (FI); (b) commercial debt at around US$300 million from Huaxia Bank; and (c) equity in order of US$125 million from sub-borrowers for target investments. A blended GEF grant (US$ 20.2386 million)[8] will be included to support activities related to the development of battery storage technology and distributed RE, implemented by Huaxia Bank and National Energy Administration (NEA) respectively.

Investment Component (US$ 200 million IBRD loan, and co-financing US$ 425 million)

19. **Investments under the proposed Project may cover a range of technologies and use cases of battery storage in generation, grid and demand sides,** subject to certain eligibility criteria, in line with the objective to improve performance of RE development. As such, project types could include:

- **Generation Side:**
  - *Installation of battery storage systems in existing wind farm and solar power plants*. It would improve the dispatchability of wind and solar power by smoothing the power outputs and reduce curtailments by storing VRE generated in surplus, which would otherwise curtailed, for use when it is needed by the system.
  - *Deployment of advanced wind/solar power forecast systems*. They would improve the accuracy of projection and predictability of VRE generation, to allow optimally dispatch and use of installed VRE capacity
  - *Installation of heat/battery storage in existing non-coal power plants to increase their flexibility in energy supply to the grid,* which provides additional flexibility to power systems to dispatch RE and avoid curtailments.
- **Grid Side:**
  - *Installation of battery storage systems in existing substations.* Such systems would provide additional capability to power systems to better absorb and integrate VRE and reduce RE curtailment. Grid side battery systems in substations, as part of the transmission and distribution networks, can also transfer VRE generation from off-peak to peak periods, provide ancillary services and system backup to help mitigate the impact of the integration of VRE.
  - *Installation of advanced energy management systems to improve dispatch of VRE.* Examples of this type of investment could be joint dispatch of both hydropower and VRE for better use of the intermitted generation of the latter.
  - *Improving existing distribution network or grid connection* to take advantage of DRE generation potential and reduce the congestion of distribution systems.

[8] Total US$ 14.4 million residual GEF grant from the previous CHUEE project could be provided, in addition to US$ 7.2786 GEF grant (original China Distributed RE Scale Up Project, P162299) that endorsed to support development of distributed RE in China. Per discussion with MOF, 90 percent of the residual GEF grant (US$ 12.96 million) can be used to support the development of battery storage development in China, while 10 percent of the grant will be used by the World Bank for project management. Further discussion with MOF will be conducted during project preparation to define the details of project activities and implementation arrangement. The China Distributed Renewable Energy Scale Up Project was approved as a stand-alone project at the PCN stage, but now it is proposed to be blended with the proposed IBRD loan to make it more effective.

- **Demand Side:**
  - *Installation of battery storage systems* in existing industrial zones or commercial consumers to meet the peak demand. This could reduce the peak load to be supplied by the grid and increase off-peak demand, and enable power systems to integrate more RE with the same generation mix and transmission networks.
  - *Development of distributed RE with storage.* Installation of battery storage systems in microgrids and 'behind the meter' at consumer sites (e.g. distribution network in industrial development zones and commercial buildings) to complement distributed VRE generation and other services. The storage systems could enable the distributed VRE more dispatchable and grid-friendly.
  - *Pilot heat storage and scale up of use of RE for heating.* This is an emerging use of RE in China and the world [9]. In China, it would consist of using VRE electricity to displace coal consumption for heating, directly or with heat storage. Additional commercial arrangements or investments will be made to increase VRE generation to meet this additional electricity consumption. Commercial arrangements include direct contracting, purchasing of green certificates, or administrative measures to increase the utilization hours of RE.
  - Other innovative use of VRE that can be proved to reduce RE curtailment or increase RE use efficiently, such as producing hydrogen and powering heat pumps.

20. A Project **Operation Manual** is being developed by Huaxia Bank to define the eligibility criteria of investment sub-projects, as well as the project management and procurement, financial and safeguard procedures for sub-project evaluation and appraisal. Sub-project criteria will cover: technology adopted; cost effectiveness; contribution to renewable energy integration; environmental and social requirements; and related applied technical standards. Sub-borrower criteria will include creditworthiness, technical competence and track record of related investments. A number of preliminary potential sub-loan activities/projects have already been identified from consultation with different companies in China. The pipeline will be further developed during preparation.

<u>Technical Assistance Component (US$ 20.2386 million GEF, and co-financing)</u>

21. A **technical assistance component** will be included to establish enabling environment for battery storage development, to support the development of distributed RE, capacity building for Huaxia Bank and NEA, and project management. Classified by the implementing agencies (both Huaxia Bank and NEA), Huaxia will implement the activities related to market penetration of battery storage, while NEA will implement the activities related to policies, regulations, technical standards and pilot investment projects in both battery storage and distributed RE.

- The residual GEF fund from the previous CHUEE project will be mainly used to (a) buy down cost of battery storage, these could include possible guarantee arrangement, risk sharing mechanism, business models, and

[9] "Bioenergy contributes the highest absolute growth in renewable heat consumption during the outlook period (2018-23), although other renewable sources are anticipated to grow at a faster rate.", "Renewable electricity for heat is expected to have the second-largest absolute growth over the outlook period because: 1) the share of renewables in electricity generation is expanding and 2) the use of electricity in heat production is increasing more quickly than total heat consumption. The total use of electricity for heat is expected to grow 20% in the industry sector and 11% in buildings. Heat pumps, mostly powered by electricity, are being increasingly deployed, especially in buildings". IEA Renewables 2018, analysis and Forecasts to 2023.

creation of communication platform to build consensus for business development thus expand the market of battery storage; (b) due diligence of investment sub-projects regarding their compliance with requirements in the Operation Manual (technical, environmental, social and fiduciary), (c) project monitoring and evaluation, and (d) capacity building for Huaxia Bank on market development, safety risk assessment and mitigation, and environmental and social management, with special focus on issues related to battery storage.

- Policies, regulations and technical standards to promote battery storage and distributed RE will be included, in close consultation with associated government agencies and industrial associations. For battery storage, the focus will be to review and improvement of technical standards of battery storage will be covered. These technical standards could include grid connection, system operation and technical designs of battery storage projects. Suggestions to improve both safety management of battery storage projects and battery disposal will be considered. While for distributed RE, the main activities will focus on: (a) grid access under direct contracting between the generators and other end users; (b) pricing schemes to account for the economic value of DERs to different actors and at given times and locations especially in the context of power sector reform, including tariffs for power supplied to the grid, incentive for DERs to meet peak demand, distribution-level wheeling charges, cost recovery for measures for the grid to accommodate high penetration of distributed resources, and benefits from generation and grid investments avoided due to distributed resources; (c) standards and certification schemes such as for safety, security, technical parameters, and building-integrated PV; (d) urban planning that incorporates DERs at city and township levels; (e) information and communication mechanisms including technology platforms, access, privacy, and cybersecurity risk management.

- Support to pilot innovative applications of both battery storage and distributed RE will be included. [Yanqin, please add]. This will primarily involve acquisition of technical assistance (including for carrying out of studies), and may also support specific subprojects for piloting innovative and scalable use-cases of both battery storage and distributed renewables in select parts of China. Activities under this component will support development and demonstration in generation, transmission, and distribution sides for battery storage and specific locations (e.g. a given city, district or industrial park) of specific use-cases for which the techno-economic potential is otherwise already proven for distributed renewables. That is, pilot support is not intended to demonstrate individual technologies, but rather to prove financial, institutional, and business-model viability for scale-up.

- Project management: fund will be allocated to support NEA in establishing a project management office during the implementation period of the project.

Legal Operational Policies	**Triggered?**
Projects on International Waterways OP 7.50	No
Projects in Disputed Areas OP 7.60	No

Summary of Screening of Environmental and Social Risks and Impacts

Energy storage systems can provide indirect environmental benefits through the improvements of energy resilience and efficiency and the increased use of clean electricity from renewable sources. The proposed subprojects (mostly Battery Energy Storage System) are not complex with small size of footprint. Any subproject with the potential of significant impacts on natural habitat and physical cultural resources can be excluded from the project financing following the eligibility criteria to be developed during project preparation. The environmental risks anticipated are mainly fire and explosion risks and environmental hazards related to the disposal of used batteries containing hazardous waste. Though China has promulgated the regulations on the life cycle management for batteries and electrical apparatus , the risks may increase exposure as new or inexperienced SMEs and individuals deploy distributed user-systems in disparate locations at proximity to people and communities. Any major risk can be addressed by enforcement of appropriate standards and strict eligibility criteria of sub-projects. Necessary actions for risk management will be incorporated into the ESCP to be available prior to appraisal. Most of installations will be minor in dimensions compared to existing premises and will be implemented within existing footprints or within the perimeters of existing facilities (such as power generation facilities, substations or consumers). Potential displacement impact, direct adverse impact on ethnic minorities, risks associated with labor and working conditions of construction related workers is considered low risk during construction period. During operation, community safety risks are linked to explosion, fire and electric shock, which will be strictly managed under China current regulatory framework and ESSs. A multitude of projects located close to vulnerable communities may give rise to limited degree of social conflict, harm, human security risk associated with perceptions of community endangerment and non-receipt of benefits. The social impacts and risks are generally site specific, 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.

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

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