Enabling Zero Carbon Energy in Rural Towns and Villages in China (EZCERTV) Project

Part I: Project Information

GEF ID
10366

Project Type
FSP

Type of Trust Fund
GET

CBIT/NGI
- ☐ CBIT
- ☐ NGI

Project Title
Enabling Zero Carbon Energy in Rural Towns and Villages in China (EZCERTV) Project

Countries
China

Agency(ies)
UNDP

Other Executing Partner(s) **Executing Partner Type**

Other Executing Partner(s)
Ministry of Agriculture and Rural Affairs (MARA)

Executing Partner Type
Government

GEF Focal Area
Climate Change

Taxonomy
Climate Change Mitigation, Climate Change, Focal Areas, Financing, Energy Efficiency, Renewable Energy, Influencing models, Transform policy and regulatory environments, Deploy innovative financial instruments, Convene multi-stakeholder alliances, Strengthen institutional capacity and decision-making, Demonstrate innovative approache, Stakeholders, Type of Engagement, Partnership, Information Dissemination, Consultation, Communications, Education, Awareness Raising, Public Campaigns, Indigenous Peoples, Local Communities, Private Sector, Individuals/Entrepreneurs, SMEs, Gender Equality, Gender Mainstreaming, Beneficiaries, Capacity, Knowledge and Research, Capacity Development, Knowledge Generation

Rio Markers

Climate Change Mitigation
Climate Change Mitigation 1

Climate Change Adaptation
Climate Change Adaptation 0

Duration
60 In Months

Agency Fee($)
848,580

Submission Date
10/10/2019

A. Indicative Focal/Non-Focal Area Elements

Programming Directions	Trust Fund	GEF Amount($)	Co-Fin Amount($)
CCM-1-1	GET	6,932,420	49,350,000
CCM-1-3	GET	2,000,000	37,050,000
	Total Project Cost ($)	**8,932,420**	**86,400,000**

B. Indicative Project description summary

Project Objective

Acceleration of zero-carbon transformation in China's rural area to contribute to global climate change mitigation and the achievement of the United Nations sustainable development goals (SDG)

Project Component	Financing Type	Project Outcomes	Project Outputs	Trust Fund	GEF Amount($)	Co-Fin Amount($)
1. Policy Formulation and Institutional Mechanisms on Zero Carbon Town and Village Development	Technical Assistance	Effective enforcement of policies and institutional frameworks towards the development of zero carbon towns and villages in rural China.	· Formulated and approved policies on the promotion and support of zero carbon town and village development in line with China's circular economy and rural revitalization objectives. · Established institutional framework to promote and support zero-carbon town and village development. · Formulated and approved technical, management and operational standards in rural renewable energy (RE) development and utilization, energy storage, energy conservation and energy efficiency (EC&EE) and comprehensive energy management. Completed assessment of renewable energy resource endowment, economic and social development level, and energy use trends and patterns in rural China; and formulated energy-integrated development plans of pilot towns in selected 6 provinces.	GET	1,150,000	14,000,000

Project Component	Financing Type	Project Outcomes	Project Outputs	Trust Fund	GEF Amount($)	Co-Fin Amount($)
2. Integrated Renewable Energy and Energy Efficiency Technologies Applications for Zero Carbon Town and Village Development	Investment	Low/zero carbon technology applications are widely implemented in rural towns and villages in rural areas of China.	· Completed and operational zero carbon technology demonstration involving the installation of about 182 MW of RE-based power generation capacity in 118 rural villages and 3 towns for energy production and utilization showcasing the cost-effective application of new RE delivery mechanisms decentralized RE-based energy generation and distribution (through mini/micro-grids), energy storage, EC&EE and comprehensive energy management[1]. · Completed and operational demonstrations of the cost-effective applications of EC&EE technologies and comprehensive energy management systems in selected energy end-use sectors in support of rural socio-economic development. Estimated annual energy savings of about 2,314.4 TJ/year in 2 towns and 115 villages - Developed, published and disseminated zero carbon town and village development guidelines that are in line with the "ecological livability" and circular economy strategies for rural revitalization [1] In consideration of the resource endowments of different climate regions of the country, three categories of demonstration of rural zero-carbon/low-carbon energy production and application in typical regions of China, including users, villages, and towns will be carried out. The demos are on the application of new technologies and concepts in rural communities in China such as decentralized renewable energy power generation, energy storage, energy conservation, multi-energy complementarity, and comprehensive energy management; The following are the 3 categories of the planned demonstrations of zero carbon towns and villages: 1) Zero carbon household —This will showcase the application of low carbon energy technologies in a household that will	GET	6,357,067	49,200,000

Project Component	Financing Type	Project Outcomes	Project Outputs	Trust Fund	GEF Amount($)	Co-Fin Amount($)
3. Facilitating Rural Zero Carbon Development and Lifestyle Popularization and Knowledge Dissemination	Technical Assistance	Enhanced and strengthened public awareness and knowledge about low carbon technology energy applications in support of zero carbon town and village development in rural China	Completed training program on zero carbon town and village development for local authorities, service companies, rural energy cooperatives, public institutions, · private entrepreneurs, farmers and other stakeholders. · Completed information, communication and education (ICE) program for the public on zero carbon development in rural towns and villages in China. · Completed promotion and implementation of zero-carbon rural development, circular economy and green transformation in countries along the "Belt and Road", to help achieve these countries' in achieving their nationally goals of the "Paris Agreement". · Established social mechanism for the promotion of zero-carbon town and village development and the sustainability of renewable energy industries. · Established and operational investment and financing mechanisms for supporting the commercial viability and operation of zero-carbon towns and villages and the development of rural renewable energy industries. Established and operational market-oriented mechanism for the enhanced development and utilization of rural RE resources, EC&EE improvement and comprehensive energy management systems for supporting sustainable socio-economic development, and creation of zero carbon towns and villages in rural China.	GET	1,000,000	20,000,000

Project Component	Financing Type	Project Outcomes	Project Outputs	Trust Fund	GEF Amount($)	Co-Fin Amount($)
				Sub Total ($)	**8,507,067**	**83,200,000**
Project Management Cost (PMC)						
				GET	425,353	3,200,000
				Sub Total($)	**425,353**	**3,200,000**
				Total Project Cost($)	**8,932,420**	**86,400,000**

C. Indicative sources of Co-financing for the Project by name and by type

Sources of Co-financing	Name of Co-financier	Type of Co-financing	Investment Mobilized	Amount($)
Government	Ministry of Agriculture and Rural Affairs	Grant	Investment mobilized	13,200,000
Government	Ministry of Agriculture and Rural Affairs	In-kind	Recurrent expenditures	1,000,000
Government	Local people's government at project demonstration and replication area (state specific name of each co-financing local government)	Grant	Investment mobilized	36,100,000
Government	Local people's government at project demonstration and replication area (state specific name of each co-financing local government)	In-kind	Recurrent expenditures	2,600,000
Private Sector	Relevant companies and farmer cooperatives in project sites(state specific name of each co-financing private sector entity)	Grant	Investment mobilized	25,800,000
Private Sector	Relevant companies and farmer cooperatives in project sites(state specific name of each co-financing private sector entity)	In-kind	Recurrent expenditures	7,500,000
GEF Agency	UNDP	Grant	Investment mobilized	200,000
			Total Project Cost($)	**86,400,000**

Describe how any "Investment Mobilized" was identified

MARA is a very important ministry of the GOC and has been developing and implementing projects (including those funded by the GEF) and at the same time also mobilize counterpart funding to such projects. They mobilize project funds from multi-lateral and bilateral donor agencies for funding projects that especially are geared towards the development of the country's agricultural sector. The various local governments that will be working on this proposed project themselves are also doing their own financial mobilization efforts for their respective agricultural sectors. During the stakeholder consultations that were conducted with the project development team in MARA, they committed

to seek expressions of interest and commitments from these local governments to participate and co-finance the envisioned activities of the project. In that regard, the project would leverage some of the ongoing and planned investments and initiatives in their respective agricultural sector and rural development agenda. MARA will explore further commitments as needed during the design and development stage of the project.

D. Indicative Trust Fund Resources Requested by Agency(ies), Country(ies), Focal Area and the Programming of Funds

Agency	Trust Fund	Country	Focal Area	Programming of Funds	Amount($)	Fee($)	Total($)
UNDP	GET	China	Climate Change	CC STAR Allocation	8,932,420	848,580	9,781,000
				Total GEF Resources($)	**8,932,420**	**848,580**	**9,781,000**

E. Project Preparation Grant (PPG)

PPG Amount ($)
200,000

PPG Agency Fee ($)
19,000

Agency	Trust Fund	Country	Focal Area	Programming of Funds	Amount($)	Fee($)	Total($)
UNDP	GET	China	Climate Change	CC STAR Allocation	200,000	19,000	**219,000**
				Total Project Costs($)	**200,000**	**19,000**	**219,000**

Core Indicators

Indicator 6 Greenhouse Gas Emissions Mitigated

Total Target Benefit	(At PIF)	(At CEO Endorsement)	(Achieved at MTR)	(Achieved at TE)
Expected metric tons of CO_2e (direct)	4079416	0	0	0
Expected metric tons of CO_2e (indirect)	0	0	0	0

Indicator 6.1 Carbon Sequestered or Emissions Avoided in the AFOLU (Agriculture, Forestry and Other Land Use) sector

Total Target Benefit	(At PIF)	(At CEO Endorsement)	(Achieved at MTR)	(Achieved at TE)
Expected metric tons of CO_2e (direct)				
Expected metric tons of CO_2e (indirect)				
Anticipated start year of accounting				
Duration of accounting				

Indicator 6.2 Emissions Avoided Outside AFOLU (Agriculture, Forestry and Other Land Use) Sector

Total Target Benefit	(At PIF)	(At CEO Endorsement)	(Achieved at MTR)	(Achieved at TE)
Expected metric tons of CO_2e (direct)	4,079,416			
Expected metric tons of CO_2e (indirect)				
Anticipated start year of accounting				
Duration of accounting				

Indicator 6.3 Energy Saved (Use this sub-indicator in addition to the sub-indicator 6.2 if applicable)

Total Target Benefit	Energy (MJ) (At PIF)	Energy (MJ) (At CEO Endorsement)	Energy (MJ) (Achieved at MTR)	Energy (MJ) (Achieved at TE)
Target Energy Saved (MJ)				

Indicator 6.4 Increase in Installed Renewable Energy Capacity per Technology (Use this sub-indicator in addition to the sub-indicator 6.2 if applicable)

Technology	Capacity (MW) (Expected at PIF)	Capacity (MW) (Expected at CEO Endorsement)	Capacity (MW) (Achieved at MTR)	Capacity (MW) (Achieved at TE)

Technology	Capacity (MW) (Expected at PIF)	Capacity (MW) (Expected at CEO Endorsement)	Capacity (MW) (Achieved at MTR)	Capacity (MW) (Achieved at TE)	
Biomass select	72.60				
Geothermal select	98.30				
Solar Photovoltaic select	20.30				
Solar Thermal select	9.60				
Small Hydropower select	4.30				

Indicator 11 Number of direct beneficiaries disaggregated by gender as co-benefit of GEF investment

	Number (Expected at PIF)	Number (Expected at CEO Endorsement)	Number (Achieved at MTR)	Number (Achieved at TE)
Female	630,000			
Male	538,500			
Total	1168500	0	0	0

Provide additional explanation on targets, other methodologies used, and other focal area specifics (i.e., Aichi targets in BD) including justification where core indicator targets are not provided

According to the National Rural Renewable Energy Statistics, the total energy consumption in China's rural areas in 2017 was 590 million tons of standard coal (tce), of which 320 million tce was consumed in the residential sector and 270 million tce was used in other rural energy end-use sectors. For details on the estimation of the potential GHG emission reductions (by end-of-project) from the implementation of low carbon energy technologies that will help bring about zero carbon development of rural towns and villages are presented in Annex A-2. These demonstrations are planned in 6 provinces of the country representing each of the climate regions of the country, which obviously have implications on the availability of RE resources as well as the quantity of energy demand and consumption of the rural towns and villages.

Part II. Project Justification

1a. Project Description

1a.1: Global environmental and/or adaptation problems, root causes and barriers that need to be addressed

China is the world's most populous country with the most energy consumption and greenhouse gas emissions. At present, China's rural population is nearly 580 million, accounting for 42.65% of the country's total population. Rural energy consumption is nearly 760 million tce/year, accounting for about 17.8% of the country's total energy consumption. Rural energy is an important part of China's energy strategy. With the development of economy and society, the energy consumption in agricultural production and rural life also increases sharply. The contradiction between energy supply and demand and the pressure of low-carbon energy transformation and development are increasingly prominent, which are described as follows:

Firstly, the country’s total energy demand is increasing while the level of conventional energy (e.g., petroleum fuels) consumption is going down. The energy consumption pattern of urban residents in China has changed from "coal-based" in the past to "high-quality clean energy with coal both as main and auxiliary sources". Coal accounts for less than 10% of domestic energy consumption, and the collective proportion of natural gas, heat, electricity and other commercial energy has risen to 60%. In the vast rural areas of China, household energy consumption continues to grow. The per capita energy consumption is nearly 300 kg of standard coal per year, with an annual growth rate of more than 4%, exceeding the average annual growth rate of China's energy consumption, while the consumption of commercial energy such as coal, electricity, oil and natural gas and LPG only accounts for about 52% of the energy used in rural areas. The per capita consumption level of commercial energy is only about 50% of the per capita consumption level of the city. The traditional energy sources such as straw and fuelwood still accounts for a large proportion, accounting for about 43%.

Secondly, the energy allocation is unreasonable, and the cost of energy consumption in rural goods is high. China's energy supply is mainly a centralized development model, which prioritizes the optimal allocation of urban resources and has relatively high energy efficiency. However, China's rural areas are relatively scattered, with high cost of cross-regional transmission and distribution of commercial and energy, and poor stability of energy supply. The transmission efficiency of rural power grid is lower than that of developed countries in Europe and America, and the power grid line loss rate reaches more than 7%. Therefore, the price of energy supply fluctuates greatly. In some remote rural areas, energy infrastructure is not well configured, energy supply is expensive, commercial energy is severely scarce, and "energy poverty" is a serious problem, which restricts China's new rural construction and urbanization process, and poses great challenges to China's energy supply development in the future

Thirdly, the utilization rate of the abundant renewable energy resources in rural areas is low. The development of wind energy resources from above 10 meters of the ground is about 250 million kW, the solar energy technology is about 40.7×10^{14} kWh, and the biomass straw can collect 9.0 billion tons per year. The amount of geothermal energy resources is about 2.78×10^{20} J per year, and the potential for energy conservation and emission reduction is huge. The Chinese government attaches great importance to the development and utilization of rural renewable energy technologies. Rural renewable energy consumption accounts for more than 10% of the total, but it still cannot meet the needs of rural energy transformation and development. The resource-depleted development model has not been fundamentally changed. Most of the facilities feature traditional firewood stoves, fire pits, stoves or hearths. The typical range of thermal efficiency of stoves is about 10-20%, which is far lower than the 50% thermal efficiency standard required by the state. A large amount of biomass resources has not been fully exploited. It is estimated that about 400 million tons per year, and biomass resources such as crop straw and livestock manure, which are worth 200 million tons of standard coal, are disposed of or discarded at will, seriously threatening the regional soil, atmosphere and water environment.

Fourthly, the quality of rural energy resources must be improved as well as the RE technology utilization model. With the improvement of China's social and economic development level, rural residents' demand for clean commercial energy is also growing, and their demand for easy-to-operate and easy-to-obtain commercial energy such as electricity and heat is becoming stronger. The Chinese government has made great efforts to promote renewable energy technology in rural areas, but due to the impact of the economic and educational level of rural residents, their awareness and mastery of renewable energy technology are relatively low, mostly confined to biogas, solar water heaters, biomass fuel and other aspects. Over the years, the development of renewable energy in China's rural areas has been concentrated on household technology, and farmers often become investors, production operators, users and even maintainers of energy. This severely restricts the long-term development of renewable energy, reduces the willingness and enthusiasm of rural residents, and urgently requires the transformation of the development and utilization mode of rural renewable energy.

1a.2. Baseline scenario and any associated baseline projects

Baseline scenario

China stated in its Nationally Determined Contributions that CO_2 emissions of the country is expected to peak by around 2030, but the country will strive to avoid this by reducing the CO_2 per unit of GDP by 60-65% over the 2005 level by that year, and to make non-fossil energy to account for about 20% of primary energy consumption.

Since the implementation of the *Renewable Energy Law* in 2006, China has entered a period of rapid development of renewable energy, and the market scale has continued to grow. The development and utilization of renewable energy has achieved remarkable results, and the cumulative installed capacity of renewable energy-based power generation units such as hydropower plants, wind power plants and photovoltaic power generation units ranks first in the world. The proportion of renewable energy in the country's energy mix is constantly increasing, and the energy mix is transforming towards clean energy utilization, which guarantee the rapid development of China's economy. By the end of 2018, the country's main renewable energy power generation installed capacity was 728.96 million kilowatts, accounting for 38.4% of the total national installed power generation capacity, an increase of 15.1 percentage points from that in 2005, of which non-water renewable energy power generation increased from 0.6% in 2005 to 19.8% by 2018. In 2018, the utilization of commercial renewable energy is equivalent to 580 million tons of standard coal, accounting for 12.5% of the country's primary energy consumption, an increase of about 6 percentage points compared with 2005. Among them, renewable energy generation capacity was 1,867 billion kWh, accounting for 26.7% of total power generation, up 10.6 percentage points from 2005, and non-water renewable energy generation increased from 0.1% in 2005 to 9.1% in 2018.

By the end of 2018, there were 39.076 million biogas household users and 108,000 biogas projects, with an annual total gas production of 11.216 billion cubic meters. Solar water heaters cover an area of 880.543 million square meters, solar houses 2529.76 million square meters, solar stoves 2,135,700 units. There were also promotions and demonstrations on the application of the application of energy efficient cook stoves using biomass, as well as more energy efficient coal-fired stoves. Promotions on the applications of bundled straw direct combustion clean heating, straw biogas centralized gas supply, straw gasification and pelleted/briquetted straw fuels. Through the promotion of these technologies, the energy mix in the rural sector of the country has improved, and the supply and use of clean energy forms in rural areas has increased. At the same time, some fossil energy sources have been replaced, and pollutants and greenhouse gas emissions have been reduced. It is estimated that the development and utilization of rural energy will save more than 83 million tons of standard coal equivalent per year, and it has the potential to reduce CO_2 emissions by more than 200 million tons.

The Chinese government attaches great importance to climate change issues and achieves green and low-carbon sustainable development by optimizing industrial structure, energy structure, improving energy efficiency, reducing carbon emissions, reducing emissions and working to reduce emissions in response to climate change. Through this project, it is envisioned that with the implementation of low to near-zero carbon technology application demonstrations, people in the rural areas of China are shown how to explore options to save energy, utilize low carbon energy technologies that will influence zero-carbon town and village development, and actively respond to climate change as a major strategy to promote economic and social development. China is one of the members to the United Nations Framework Convention on Climate Change (UNFCCC) and the largest CO_2 emitter in the world. The Chinese Government has committed itself to achieving the goal of reducing carbon intensity by 40%-45% by 2020. According to estimates, under the target of controlling the temperature rise to less than 2 degrees, by 2050, China's remaining carbon emissions in the energy sector will be only about 300 billion tons. Carbon emissions need to be reduced by more than 40% at the current level. At that time, China's total energy consumption will be about 1.5 times the current level. China's future

carbon emissions space will become increasingly tight, which will pose a huge challenge to the low-carbon transformation of the energy system. Therefore, China's low carbon emission reduction strategy and development will have a significant and far-reaching impact on the country’s future international negotiations on climate change.

President Xi Jinping reiterated at the 2019 Beijing-Tianjin-Hebei Collaborative Development Symposium that lucid waters and lush mountains are invaluable assets, and therefore the supply of clean energy should be increased, and the structure of energy consumption should be adjusted. To thoroughly implement President Xi Jinping's ecological civilization thoughts and the essence of his important speech during his visit to Beijing, efforts will be made to strengthen the construction of the "four centers", fulfill the sustainability commitment of Beijing 2022 winter Olympics and Paralympics with high standards, significantly improve the development and utilization of renewable energy and promote green development.

The 19th National Congress of the Communist Party of China proposed the overall goal of rural revitalization, “industrial prosperity, ecological livability, rural civilization, effective governance, and prosperous life”. At the 14th meeting of the Central Financial and Economic Leading Group, President Xi Jinping made important instructions to use natural gas and to generate biogas as the main treatment method for agricultural waste, and to use the biogas as a local energy source. The byproducts of the bio-decomposition process to produce also produce biomaterials that can be used as agricultural organic fertilizer This is also meant to solve the problem of manure disposal and resource utilization in large-scale livestock and poultry farms during the 13th Five-Year Plan period. In 2017, China's total natural gas consumption was 237.3 billion cubic meters, with an import volume of 92 billion cubic meters, and its external dependence reached 38.22%. China promises that by 2030, non-fossil energy will account for about 20% of primary energy consumption.

In 2017, China's rural resident population is 576 million, the total number of administrative villages is about 690,000, and the total rural energy consumption is 590 million tce. China has a vast territory and abundant solar energy resources. The potential rural solar photovoltaic-energy generation capacity is about 603 GW; 175 GW of solar photovoltaic power generation have been installed and 380 GW of solar thermal capacity have been utilized. China's crop straw resources are 1 billion tons, the collectable resources 840 million tons, and the utilization amount is 700 million tons accounting for 84% utilization rate. Animal wastes are about 3.8 billion tons per year, more than 30% of which are not effectively utilized.

For a long time, the typical mode of energy production, supply and consumption in rural areas have led to increasing GHG emissions from agricultural and rural areas of the country. Therefore, GHG emission reduction in the agricultural and rural sectors of the country and the transformation process in rural economic development will help in achieving China’s climate change mitigation efforts. Making the rural energy infrastructure is important in ensuring sustainable development of rural society and

economy. Clean and zero carbon development contributes to improving rural productivity and living conditions and protect/conserve the natural environment in rural areas. China's rural areas are also rich in clean energy resources such as biomass, solar energy, wind energy and geothermal energy. The development and utilization of these indigenous RE resources can meet the energy needs of rural society. Therefore, relying on renewable energy technology and energy conservation and energy efficiency (EC&EE) technologies, developing and applying the Internet of Things as applied to energy production, supply and consumption[1][1] can facilitate increased RE-based power generation and utilization as well as applications of smart EE appliances in rural households – all these contributing to zero carbon development, it will fundamentally meet the rapidly growing demand for commercial energy supply in rural areas, solve the waste of rural biomass resources and environmental pollution problems caused by fossil energy utilization, and effectively alleviate the pressure of greenhouse gas emission reduction in China.

The two trends under the profound changes in China's rural areas include: (1) the total energy demand brought by the country's rapid economic development has increased substantially, mainly distributed in the eastern coastal areas and suburbs of large and medium-sized cities; and, (2) the rapid economic development has led to an obvious decrease of rural population, resulting in the formation of "hollow villages", and resulting in a substantial economic loss in supplying power infrastructure in the rural areas. Although China is already 100% electrified, there are in mountainous and pastoral areas, because of the different way of agriculture in these areas there are from time to time some energy access problems in this areas. This part of the population currently accounts for 3-5% of the rural population. Rural energy is an important part of China's energy strategy, with the development of economy and society, energy consumption in agricultural production and rural livelihood has also increased dramatically. The contradictions between energy supply and demand are becoming increasingly prominent, as well as the pressure of low-carbon energy transformation and development. The main manifestations are as follows:

First, the total energy demand is increasing, and the level of commercial energy consumption is low. In the vast rural areas of China, household energy consumption continues to grow. In 2017, the per capita energy consumption is nearly 0.56 kg of standard coal per year, with an annual growth rate of more than 4%, exceeding the average annual growth rate of China's energy consumption. The collective consumption of coal, electricity, oil, natural gas and liquefied petroleum gas accounts for about 52% of the energy used in rural areas. The per capita consumption level of commercial energy is only about 50% of the per capita consumption level of the city, straw, fuelwood, etc. Non-commercial energy still accounts for a large proportion, about 43%. With the rapid development of China's rural economy and rural construction, the increase in rural energy consumption and commercial energy demand is inevitable, and China's future energy supply gap will become more and more obvious.

Second, the rural energy consumption structure is unreasonable. Renewable energy accounts for a relatively low proportion of rural energy consumption. China's energy supply is mainly a centralized development model, which gives priority to the optimal allocation of urban resources, and energy efficiency is relatively high. The rural areas in China are

relatively scattered, the cost of trans-regional transmission and distribution of commercial energy is high, and the energy supply stability is poor. The transmission efficiency of rural power grids is lower than that of developed countries in Europe and America. The grid line loss rate is over 7%, and the energy supply price fluctuates greatly.

In addition, as some rural areas in China are in remote areas, and suffering from serious decline in population growth, it is difficult for rural communities to access to energy sources such as gas and electricity. The imperfect allocation of energy infrastructure, high cost of energy supply, and serious shortage of commercial energy still exist. In some mountainous and pastoral areas, due to changes in the production mode of farmers and herdsmen, occasional electricity inaccessibility has also occurred, leading to "energy poverty" problems. These problems restrict the process of rural revitalization in China and bring great challenges to the future development of China's energy supply.

Third, utilization rate of abundant renewable energy resources is low. About 130 million rural households in China use traditional biomass energy as cooking and heating energy. In the Northwest Plateau and Northeast China, they also use renewable energy resources such as solar energy. However, the overall energy consumption in rural areas is still comprised mainly of fossil energy, the understanding about the use of traditional rural energy resources is inadequate, traditional rural waste and renewable energy resources cannot be locally used to solve the energy supply problem to support rural development. Rural people are still mainly using the traditional energy inefficient firewood stoves or heated brick beds. The average thermal efficiency of these cooking/heating equipment range from about 10% to 20%, which is far below the national standard of 50% thermal efficiency for such equipment. Many biomass resources have not been fully exploited and utilized. It is estimated that, about 400 million tons of biomass resources, such as crop straw and livestock manure, equivalent to about 200 million tons of standard coal, are discarded deliberately and unconsciously, seriously threatening the regional soil, atmosphere and water environment.

Fourth, the comprehensive utilization level of rural energy is low. In general, the awareness about energy conservation of rural people is weak, construction technology is backward, and the traditional rural buildings have high energy consumption. General building energy efficiency is about 40% of the city level. The energy efficiency of the typical equipment used in rural industries, and rural households is low while the pollution emission is high. With the improvement of the national social and economic development, the demand for clean commercial energy by rural residents is also growing, and the desire for easy-to-operate, easy-to-use energy and heat energy is becoming stronger. Currently, rural renewable energy cannot meet the energy demand to support rural energy transformation and development. The resource-depleting development model that has been used in the past has not been fundamentally changed. For a long time, China’s rural renewable energy development has focused on technology application by household while the single renewable energy technology is subject to the geographic, climatic, economic characteristics of the locality and other factors. It is not easy to guarantee the application efficiency and stability. In general, energy technology applications are not done in an integrated manner, considering security, flexibility, economy and efficiency aspects of the systems where the technologies are applied.

For the reasons above, if China plans to increase the rural areas' contribution to the achievement of China's NDC targets, an integrated approach to transformation towards zero carbon town and village development should be removed. There are four (4) major barrier categories that must be addressed and eliminated.

Policy barriers - Rural areas lack clear policies for the application and promotion of low-carbon and low GHG emitting energy technologies. Policies can mobilize investment and financing resources to promote the application of rural renewable energy technology and low-carbon development. The central government has not yet established and improved laws and regulations and long-term mechanism for zero carbon rural development, let alone low-carbon rural development, especially in energy supply and consumption. Currently rural energy policies can be changed to facilitate the increased utilization of available renewable energy resources in these areas. The potentials for distributed energy generation, distribution and utilization, micro-grid distribution system, biomass gasification, biogas power generation, solar and wind hybrid power generation, etc. can make good use of supporting policies that would allow the widespread applications of these technologies that can bring about zero carbon town and village development. The current rural energy policies do not include on decentralized RE-based power generation, distribution and utilization, including energy storage. However, the policies lack detailed implementing rules and regulations making it difficult to adapt to the rapid development of rural areas in China. Although the revised Renewable Energy Law and Cleaner Production Promotion Law have laid the foundation for the development of rural renewable energy, they do not include encouraging economic incentive mechanism and impeccable financing mechanism.

Technical barriers. Currently, the adoption of RE technologies in rural areas often do not have the benefit of proper screening and integration of other key aspects such as local natural, environmental and ecological conditions, including economic conditions. China's rural renewable energy technology is still relatively weak, characterized by inadequate systematic and properly set processes, standards, and normative systems. The development of decentralized RE-based energy generation projects has not yet led to significant rural energy system transformation model that suitable for different regional economic, climatic conditions and resources distribution. For example, there are no major breakthroughs in scientific research and development of energy efficient solid fuel fired stove for many years. Presently, many rural people use straw and corncob as solid fuels, but there are no suitable stoves for the combustion of these biomass energy forms. The straw gasification technology is basically still at the level of the 1980s. The process of building new rural communities is also weak in integrating the planning of each sector and the supply and utilization of energy (especially indigenous RE resources) to implement all sectoral activities. Rural areas have not yet formed a network of energy micro-grid and integrated management services, and the operation of micro-grid still lacks corresponding technology, equipment and standards. Typically, in rural areas any plans to promote and implement RE, technology application promotion cannot be adequately be done because of the lack of baseline data on RE resources present and available in rural areas, and a dearth of data relating to the socio-economic conditions, and the degrees of adaptation between technology route and energy development is not high

Awareness and capacity barriers. The concept of low-carbon development among rural and provincial government personnel is weak, and there is a lack of knowledge in the application of RE-based energy generation in rural areas, especially for electric power generation. At present, the phenomenon of hollow villages in China is widespread. The proportion of women left-behind in villages and towns is increasing, the trend of aging is going rapidly upwards, and the level of cultural awareness of women and the elderly is low. It is impossible to recognize the importance and necessity of rural green development and the application of renewable energy, and it cannot take the initiative to reduce energy consumption in production and living. Due to the low level of education and the entrenched old ideas of rural people, they dare not easily try new ways of life and production methods. Therefore, most of the rural people choose to use old, traditional, high-carbon energy consumption. The farmer's lack of awareness of green development, coupled with the lack of propaganda, guidance and incentives, has made rural environmental pollution worse and worse, creating a vicious circle. As to the rural government's capacity on rural energy issues, they typically have insufficient technical management capabilities, and their knowledge and understanding of the zero carbon, let alone the low carbon development concept needs to be strengthened. Managers have insufficient knowledge of the appropriate policies, regulations and technical standards that will enable them to come up with integrated policies and plans that are supportive of low carbon development. Many of the rural governments have limited information system and management system.

Financial barriers. At present, the promotion and application of low carbon energy technologies in rural areas are still dominated by national fiscal funds, and there is only one source of funds. It is difficult to meet the demand for large-scale technology promotion and application by relying solely on government funds. The income of farmers is generally low, and for rural communities, it is difficult to raise funds for the construction of renewable energy facilities like for decentralized RE-based power generation. The enthusiasm of farmers to collectively finance and build such kind of facilities themselves is not high. This limits development and establishment of low carbon villages and towns. Coupled with the lack of successful demonstration and promotion of relevant technology application models, the effectiveness of the development of low carbon villages and towns is not significant. The concept of the low carbon development of rural towns and villages is not attractive enough to get the relevant stakeholders to participate in such initiative. In that case, it is difficult to fund and implement decentralized RE-based power generation initiatives. It will be difficult to establish effective coordination of sustainable commercialization and large-scale capital operation mechanism among government, farmers, enterprises and social funds to support rural clean energy infrastructure constructions.

China has carried out pilot projects on low-carbon provinces and low-carbon cities and accumulated relevant experience. However, the application of zero carbon, let alone low-carbon, development in the rural areas has not yet been piloted. At present, China is implementing projects based on a rural revitalization strategy to promote the rural energy revolution. The establishment of zero-carbon towns and villages will help promote ecological livability, promote clean energy development and use, and promote zero carbon development in rural areas. China's rural renewable energy resources are abundant, and their further development and sustainable use will be instrumental in the promotion and application of zero carbon town and village development in rural China.

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Baseline Projects

There were several rural renewable energy projects of MARA that were recently completed in China. These were projects that are in line with the country's program to revitalize the rural areas and promote the use of sustainable renewable energy resources in rural towns and villages. While in these projects there was the intention to achieve low carbon development in Chinas' rural areas, none of these have included activities that could lead to zero carbon rural development. Nonetheless, the proposed GEF project will make use of the experiences gained and lessons learned (successes and shortcomings) from the implementation of these projects, as well as pertinent results and outputs. These projects include:

· ADB-China's Rural Energy Ecological Construction II – This is on the development and implementation of large and medium-sized biogas projects.

· China and Germany Optimization of the Utilization of Biomass Energy – This provided guidance in the design and financing of the production and utilization of biomass energy.

· Biomass Renewable Energy Scale Development – This project formulated China's biomass renewable energy development policy, established the biomass renewable energy industry system.

· Market Transformation of Energy Efficient Bricks and Rural Buildings Project – This focused on rural energy conservation, manufacturing of energy efficient bricks and their applications in the construction of rural buildings.

There is also an ongoing Rural Energy Comprehensive Construction Project (2019-2022), on which the proposed GEF project will build on particularly on the researches and work that will be done on agricultural energy multi-energy applications and clean energy use in China's rural areas. The activities of this ongoing project could be supplemented or improved and be considered as baseline activity in the development of RE technology standards and policies that will support enhanced RE technology applications that will contribute to the enabling of zero carbon development of rural towns and villages in China.

While the abovementioned initiatives are intended for improving the socio-economic conditions in the Chinese countryside, these are not enough to ensure the increased applications of RE technologies, particularly for power generation, and EE technologies that will contribute to the revitalization of the rural economy. With just these interventions, China's rural areas will continue using significant amount of coal and use biomass energy resources in an inefficient and polluting manner for a long time. Considering the current huge share of coal in the energy consumption mix in China's rural sector, the increasing demand for improved living standards in these areas, and the

nationwide forecast high energy demand growth, China's LC development strategy will not be cost-effective and the potential reduction of energy-related GHG emissions from the rural areas will not be fully realized.

Therefore, without the intervention of GEF, the relevant government's relevant rural energy and rural environmental protection plans, and activities will not be effectively encouraged and guided to focus on rural distributed renewable energy construction because the relevant obstacles will not be effectively overcome. The development model of system integration will not form a favorable macro environment to accelerate the acceleration of rural renewable energy; related technologies will not be effectively integrated, and its technical and economic benefits and energy conservation and emission reduction effects will not be fully demonstrated. It will be difficult to further deepen the application and demonstration. Rural distributed renewable energy development and knowledge will not be accepted and understood by the public and rural residents; China's rural distributed renewable energy development will not be able to obtain long-term sustainable financial guarantee.

1a.3: The proposed alternative scenario with a brief description of expected outcomes and components of the project

Proposed Alternative Scenario

Through the implementation of the proposed project will bring about an alternative scenario that is characterized by the following:

1) Widespread application of low carbon energy technologies that are adequately supported by effectively enforced policies and regulations, and institutional framework.

2) Increased low carbon energy production (e.g., decentralized RE-based power generation and distribution, with/without energy storage) and utilization (e.g., demand side management) technologies and techniques adopted and implemented by rural towns and villages, leading to an increased share of RE resources in the power generation mix of the country.

3) People in rural communities in China are fully aware of the benefits and supportive of low carbon energy systems as important contributors to rural socio-economic development.

4) Financial/banking institutions are providing access to financing to rural communities that are investing in decentralized RE-based power generation and distribution, as well as to energy end users in rural areas that are implementing energy efficiency projects.

The acceleration of the zero-carbon transformation in China's rural areas and contribute to the global climate change mitigation and the achievement sustainable development goal of the United Nations sustainable development goals (SDG) is the objective of this proposed project. To achieve this, the identified barriers to the effective and extensive application of low carbon energy technology applications in the rural towns and villages in the country must be removed. In this regard, a barrier removal approach will be applied. Taking the cue from the current trend of the advocacy and support for sustainable development in the country, this project, with the assistance of the GEF will facilitate the application of appropriate technological, institutional and policy-oriented options that would make the growth of rural towns and villages in China is a sustainable manner making use of available clean energy resources to promote and support socio-economic growth that contributes to increased climate resilience, productivity and income generation of the town/village citizens, and reducing emissions of greenhouse gases (GHGs). The focus is on the decentralized optimal and efficient utilization of clean energy resources that support zero carbon town and village development, significantly reducing the use of coal and the inefficient use of biomass energy resources. The project will cover the following;

a) Establishing and enforcing supportive policy/regulatory frameworks and institutional mechanisms to facilitate low carbon energy technology applications to achieve zero carbon rural towns and villages;

b) Showcasing of applicable RE-based energy generation (power and non-power applications) in rural towns/villages, including appropriate EE technologies, as well as zero carbon development planning of towns and villages.

c) Enhancement of the information and awareness capacity of government authorities and citizens on zero carbon development and RE and EE technology applications in rural areas; and,

d) Improving the availability/access to financial resources for financing low carbon energy technology applications in rural towns/villages.

The major intervention that will be carried out in this project are the investment-type activities comprising the design, planning and implementation of the low carbon energy technology applications, and piloting of the application of zero carbon town and development planning. Through the proposed project, enhanced application of appropriate renewable energy delivery mechanisms, and energy conservation and energy efficiency technologies will be carried out in pursuit of low carbon rural development and ultimately the establishment of zero carbon towns and villages in rural areas of China. Such applications will result in the transformation of energy production into low/zero carbon emitting decentralized energy generation and distribution systems through the utilization of available indigenous renewable energy resources in rural areas and smart grid systems. The low carbon systems will be in accordance with the characteristics of the available renewable energy resources, the suitable combination of the use of such resources, and the prevailing climate/weather conditions in the various climate regions of the country. These will also be designed to be independent of the existing grid that distribute fossil fuel-generated electricity, through the installation of energy storage systems, and equipping these with smart control systems that will enable comprehensive load and energy management system

that will result in optimal generation cost for a green, clean, renewable energy-generated electricity. The demonstrations of such systems, including zero carbon town and village development will be carried out in select rural towns/villages in Heilongjiang, Hebei, Hubei, Anhui, Gansu, and Yunnan. As part of the "Rural Revitalization" strategy of the government, the MARA will promote the results of these demonstrations and intensify the project publicity and promotion efforts in other provinces like Sichuan or Qinghai.

Specifically, the envisioned alternative scenario will feature zero carbon town and village development becoming the standard in the development of the rural towns and villages in China. This green and sustainable development pattern will feature: (1) widespread application of enhanced and smarter RE-based energy generation for power and non-power application, as well as smart energy (electricity, water, heat) distribution systems; (2) widespread application of EC&EE technologies by the rural energy consumers, as well as comprehensive energy management systems both in energy generation, distribution and consumption, making use of smart technologies, e.g., Internet of Things; (3) Construction and operation of zero carbon houses, villages and towns, that make use of low carbon energy forms and low/zero GHG emitting technologies; and, (4) China leading in the application of zero carbon town and village development as a means of enhancing sustainability and socio-economic development of rural areas, and the experiences in this China can share with other developing countries starting with those involved in the "Belt and Road Initiative".

1a.3: Components of the Proposed Project

Component 1: Policy Formulation and Institutional Mechanisms on Zero Carbon Town and Village Development

This component is intended for the elimination of barriers related to policies and regulations, as well as institutional mechanisms that do not facilitate the promotion and application of low carbon energy technology applications in rural towns and villages in China, that could lead to zero carbon town and village development. The effective enforcement of policies and institutional frameworks towards the development of zero carbon towns and villages and towns in rural China is the expected outcome from the expected outputs under this component, which will be delivered through the implementation of these tentative activities:

a) Conduct of research studies on the concepts and applications of low/zero carbon energy technology applications to support zero carbon town and village development;
b) Conduct of research studies on low/zero carbon development policies and measures in rural areas that were implemented in developed and developing countries and their impacts (social, economic and environmental);

c) Formulation and recommendation for approval and adoption of standards, policies and IRRs on the promotion, application and practice of low/zero carbon development in rural towns and villages development in line with China's circular economy and rural revitalization objectives;

d) Formulation and recommendation for approval and adoption of suitable institutional framework for supporting the implementation of low/zero carbon development policies, standards and IRRs, and LC town and village development planning that are in line with the country's circular economy and rural revitalization objectives;

e) Development, publication and dissemination of guides and reference documents for rural Low/zero carbon development planning;

f) Formulation of zero carbon development plans (inclusive of RE and EE technology application policies, standards and IRRs) in pilot rural towns in selected provinces;

g) Design and piloting of low carbon development planning and policy implementation (RE and EE technology application policies, standards, and IRRs) in selected 6 pilot towns;

h) Evaluation and presentation of the results of the low carbon development planning and policy implementation pilots;

i) Promotion of the application and practice of low carbon development planning and implementation in rural towns and villages; and,

j) Preparation and lobbying for the approval and government funding of a follow-up plan for the replication of the application of the piloted low carbon development planning and policies rural towns and villages in other provinces.

Component 2: Integrated Renewable Energy and Energy Efficiency Technologies Applications for Zero Carbon Town and Village Development

This component is intended to address the barrier regarding the low level of knowledge and capacity of local authorities as well as technical and planning staff of towns/villages in rural areas, about the concepts and technologies associated to low/zero carbon development. Specifically, it is also intended to address the low level of confidence of rural towns and villages in the implementation of low carbon energy application projects as part of the low carbon development of rural town infrastructures and services. The expected outcome from the realization of the expected outputs under this component is low/zero carbon energy technology applications are widely implemented in rural towns and villages in rural areas of China. The tentative activities that are expected to deliver the outputs that will collectively bring about first expected outcomes include:

a) Conduct of studies on applicable low carbon energy technologies that can be feasibly applied to various types of rural towns and villages in China;

b) Evaluation and selection of applicable low carbon energy technologies for demonstration, and selection of representative rural towns that will host the demonstrations[2][2];

c) Design, organization and implementation of a capacity development program for local government authorities, rural development entities, and the technical and planning staff of the pilot towns on the: (a) Application of decentralized RE-based energy generation technologies, and EE technologies, techniques and practices; (b) Low carbon town/village development planning; and, (c) Financing of low carbon energy technology application projects;

d) Design of the selected decentralized RE-based energy generation technologies and EE technologies to be demonstrated in selected demonstration villages[3][3];
e) Design of the implementation plans for replications of completed low carbon energy technology application demonstrations, and conduct of promotional and advocacy work for their approval and funding;
f) Design and approval of the action plan for the sustainability of the low carbon energy technology application demonstrations;
g) Organization, establishment, promotion and operationalization of a China Low Carbon Village Construction and Development Industry Association;
h) Servicing requests for the provision of guidance and monitoring support by rural towns and villages that implement low carbon energy technology application projects;
i) Publication and dissemination of the profiles of rural towns and villages in other provinces that adopt low carbon development planning and low carbon energy technology applications;
j) Preparation of the designs and implementation plans of demonstrations of cost-effective applications of EE and RE technologies that promote and support low carbon development in selected rural towns;
k) Implementation of the installation, commissioning and operation of the low carbon energy technology application demonstrations in the demo towns, including the monitoring/tracking of the operations of each demonstration;
l) Monitoring, evaluation and reporting of the operational, economic and energy performance and impacts of each demonstration;
m) Preparation, publication and dissemination of low carbon rural development models and technical guidance documents based on the results of the demo program, and in line with the "ecological livability" and circular economy strategies for rural revitalization; and,
n) Development of an action plan for sustaining the low carbon energy technology demonstration and working for its approval and government funding.

Component 3: Facilitating Rural Zero Carbon Development and Lifestyle Popularization and Knowledge Dissemination

This component is intended to address the barrier related to the low level of awareness and knowledge of the local authorities and the people in the rural areas about the concepts, principles and technologies and practices associated with low carbon development. The expected outcome from the collective outputs that will be delivered under this component is enhanced and strengthened public awareness about low carbon energy technology applications in support of zero carbon town and village development in rural China. The indicative activities that will deliver the expected outputs under this component include:

a) Conduct of survey and assessment of the current level of knowledge and awareness of local authorities and citizens of, and availability and accessibility of information in, rural towns and villages about low/zero carbon rural development and low carbon energy technology applications;

b) Design of information, communication and education (ICE) materials on low carbon rural development and low carbon energy technology applications for use in information and awareness raising campaigns in rural towns/villages;

c) Conduct of targeted ICE campaigns including international & national discussion fora on low carbon development, in general, and particularly, low carbon energy technology applications in rural towns and villages in target provinces;

d) Evaluation and dissemination of the results and impacts of completed ICE campaigns;

e) Development of a sustainable follow-up plan for a continuing ICE program on low carbon development and low carbon technology applications in the rural areas;

f) Organization, setting up and operationalization of an information sharing network for the promotion and dissemination of knowledge on low/zero carbon rural development, inclusive of technology applications on decentralized RE-based energy generation (power and non-power applications) and energy efficiency in support of rural development;

g) Design, promotion and approval for implementation of energy monitoring and reporting system and energy benchmarking system for rural towns/villages;

h) Establishment and operationalization of an energy monitoring and reporting, and energy benchmarking system for rural towns/villages;

i) Design and construction and operationalization of model zero carbon rural towns and/or villages that showcase the application of technologies on decentralized RE-based energy generation (with and without energy storage) and EE in rural energy end-uses; and,

j) Evaluation of the impacts of the model low carbon rural villages in the widespread promotion and application of low carbon development principles and approaches in rural China.

k) Conduct of research and assessment of existing financing schemes by the government and the local banking sector for rural development in China, as well as in other countries;

l) Design and development of feasible financing models and schemes to facilitate financing of low carbon development initiatives, in general, and particularly, low carbon energy technologies applications of rural towns and villages;

m) Establishment and operationalization of designed financing scheme for LC rural development projects including low carbon energy technologies applications;

n) Evaluation and dissemination of the results and impacts of the low carbon development financing scheme; and,

o) Development of a sustainable follow-up plan for a continuing financial assistance program on low carbon rural development and low carbon energy technology applications in the rural areas.

The project will be implemented by the designated implementing partner, which is the Ministry of Agriculture and Rural Affairs (MARA), under the UNDP's national implementation modality. In this case, the Government of China as represented by the MARA is fully responsible for the effective use of the project resources and the delivery of the agreed tangible outputs of the project and bring about the expected project outcomes. As the GEF Agency for this project, the UNDP will be providing administrative and logistical services, apart from the required GEF Agency project management services, during project implementation if these are specifically requested by the MARA and such request is endorsed by the country's GEF Operational Focal Point.

1a.4: Alignment with GEF focal area and/or Impact Program strategies

The project is in line with GEF-7 climate change mitigation objective of promoting innovation and technology transfer to achieve sustainable energy breakthroughs. The specific entry points under CCM objective this proposed project is in line with are: (1) Decentralized renewable power with energy storage; and, (2) Accelerating energy efficiency adoption. At present, China is implementing a rural revitalization strategy to improve rural production and living conditions. Especially in the construction of beautiful and livable villages, renewable energy technology and energy-saving technology have been promoted and applied in certain areas in rural areas and proved to be an effective way to reduce rural carbon emissions and improve rural environment. Despite these ongoing and planned rural development initiatives of the GOC, and the availability of feasible energy efficiency technologies in rural towns/villages; and although there are proven cost-effective and feasible approaches to low carbon (RE and EE) technologies applications, the adoption and uptake of low/zero carbon (RE & EE) policies, measures, and technologies has not reached full potential in China, particularly in the country's rural sector. The rather limited and not cost-effective applications of clean energy and efficient use of energy to support the socio-economic development of rural towns/villages in China are clear manifestations of the core problem that this proposed project intends to address. This proposed project will address this core problem, particularly its immediate, intermediate and root causes, through various technical assistance and investment-type barrier removal activities. To boost the widespread application of RE-based energy generation, i.e., for power applications (with/without storage); and non-power applications (e.g., thermal) and energy-saving technologies, pertinent feasible policies, regulations, methodologies and standards, the project will collaborate with the Sustainable Energy for All (SE4ALL) in rural energy services provision, as well as end-use energy efficiency applications.

In facilitating the promotion and implementation of the application of EE technologies, policies, measures and IRRs, collaboration with a SE4All-supported energy efficiency accelerator for buildings and industries will be considered. The partner EE accelerator is expected to provide advice on best practices, information resources and knowledge on existing policies and experience from the implementation of previous building and industrial EE improvement projects in other countries.

The implementation of the project will work with the National Women's Federation to mobilize more rural women in the project areas and enable women to play significant roles in the implementation of the project. This is in line with the UN's sustainable development goals for poverty eradication, gender equality, gender equality and empowerment of all women and children, as well as the GEF's focus on women's equality.

1a.5: Incremental/additional cost reasoning and expected contributions from the baseline, the GEFTF, LDCF, SCCF, and co-financing

The proposed project will build on the planned and budgeted rural development projects in China that are funded by relevant GOC ministries, as well as by local government agencies in selected provinces. These are mostly for improving and ensuring the socio-economic development of the rural towns and villages in the country. Some of these projects are on energy since this is essential in the revitalization of the Chinese rural sector. The energy projects are on the application of RE and EE technologies, such as those from the MARA, NDRC and other government agencies working on comprehensive green countryside construction. Nevertheless, these baseline projects/programs are still based on the traditional town and village development planning and management that are non-holistic, i.e., not integrated and do not consider of the energy and environment impacts of whatever plans and programs that will be put into action. With just these, the full potential for energy and energy cost savings, clean and renewable energy applications, particularly RE-based power generation, will not be realized. Moreover, the associated local benefits (e.g., increased income generation activities, improved services, etc.) from the utilization of RE-based energy generation and application of EE technologies, and the resulting GHG emission reductions from the displacement of coal use in rural areas, will not be realized.

The project will be designed to incorporate features associated with the concepts and techniques of low carbon development, in general, and particularly low/zero carbon energy applications in rural areas. The facilitation and enabling of the application of low carbon energy applications in rural towns and villages will be done through the removal of barriers associated with the lack of support policies, regulations and institutional mechanisms, limited capacity and knowledge about the application, design, financing and operation of low carbon energy projects, particularly RE-based power generation and energy efficiency in the rural end-use sectors as part of low carbon rural development. Most of the barrier removal activities make up the incremental activities that the project will implement. Incremental support activities are necessary to facilitate the enabling of the application low carbon rural development activities, in general, and particularly applications of low carbon energy technologies, e.g., commercial RE-based power generation and distribution, EE technology applications in energy end use sectors in rural towns/villages. Without the incremental barrier removal and enabling activities the achievement of the anticipated alternative scenario in the development of the rural towns and villages in China will not be realized. More importantly, incremental activities to establish and enforce policy and regulatory frameworks that are supportive (through effective institutional arrangements, financial/fiscal incentives, information sharing, etc.) will be necessary to sustain the replication of low carbon energy projects in other towns and villages in other provinces in China. The substantial sustainable development benefits that result from the application of such initiatives will not be achieved if the barriers that the GEF can help eliminate will not be forthcoming.

Through the implementation of the project, the construction funding and rural energy development project plans of MARA, NDRC and other relevant government agencies can be utilized as co-financing for the proposed project. In addition, the Chinese government will also support the project's management office in terms of personnel salaries, office space and equipment, and supplies and other sundries. The demo rural towns/villages will invest funds in the design, engineering, planning and construction of demo decentralized RE-based power generation and distribution systems to support the implementation of the project. The overall supporting funds of the project will be no less than seven times that of GEF funds.

1a.6: Global environmental benefits (GEFTF) and/or adaptation benefits (LDCF/SCCF)

The global environmental benefits that are attributable to this project are mainly from the improvement in the utilization level of RE resources for the development of the rural countryside. This will come from GHG emission reductions due to coal consumption displacement in rural households by increased utilization of available feasible renewable energy resources, and the avoidance of CH4 emissions from unused and left-to-rot biomass wastes. The GHG emissions reductions would come from: (1) Direct emission reductions from completed RE and EE technology application demonstrations and replications; and, (2) Consequential emission reductions from follow-up RE and EE technology application projects in towns and villages in other provinces as influenced by this proposed GEF project.

The GHG emissions that will be attributed to the project will come from the low carbon energy technology application demos that will be carried out under the project. Such applications in rural towns and villages are intended to facilitate zero carbon development in these places. Some expected replications of the demos will be facilitated during the project implementation period, and this will be in operation towards the end of the project or just after the end of the project. Based on the preliminary line up of rural-based low carbon technology projects as presented in Annex A-2, the potential overall annual direct and consequential GHG emission reduction after completing the low/zero carbon energy technology application demonstrations in 6 provinces is about 1,359,800 tons of CO2eq. It is estimated that 4.079 million tons of direct GHG emission reduction will be achieved during the five-year implementation period of the EZCERTV Project (see Annex A-2). This translates to a unit abatement cost (UAC) of US$ 2.19/ton CO_2 (i.e., GEF US$/ton CO_2 removed) by end-of-project, which is better that the ongoing CER prices in China[1]. Considering the average lifetime of 15 years for all installed hardware involved in all low/zero carbon technology application demos (RE and EE), this translates to a UAC of US$ 0.44/ton CO_2. These estimates of direct GHG emission reduction are preliminary. As the project application development process is progressing, MARA will organize experts to carry out further detailed analyses to come up with an improved estimation of the GHG emission reduction impact of the project.

[1] CER Price in Hubei Carbon Exchange Market is US$ 4.22/ton CO2. Ref: Climate Daily News: 30 October 2019 (http://www.factorCO2.com)

1a.7: Innovation, sustainability and potential for scaling up

Innovativeness: The proposed project is innovative for at least two reasons. First, this project promotes and demonstrates the application of zero carbon town and village development in Chinese rural areas. Such development is expected to lead to green development as advocated by the country's rural revitalization strategy. This will involve the enhanced use of available renewable and zero GHG emitting energy forms in meeting the energy needs of rural towns and villages. It is also innovative in terms of the model for town and village development that involves the application of appropriate technological, institutional and policy-oriented options that increase the community's climatic resilience, productivity and income of its citizens, while reducing emissions of greenhouse gases (GHGs). Second, another novel feature of the project is the application of decentralized commercial RE-based power generation systems in rural towns/villages. As part of low carbon development of rural areas, model low carbon villages will be established as demos where appropriate low carbon energy technologies applications will be showcased to other rural towns to replicate and emulate. This will also include the demonstration of the application of: (a) energy storage as supplemental component of the decentralized RE-based power generation system; and, (b) smart mini/micro-grid distribution system. In addition, energy-integrated rural development planning, which is part and parcel of the zero-carbon rural development process.

Sustainability: The proposed GEF project will develop and work towards the adoption of supportive policies/regulations and institutional mechanisms focused on low carbon development planning, incentive mechanisms for decentralized commercial RE-based energy generation, technical standards and specifications for EE and RE technologies, that contributes to sustainable rural development in China. The objective for ecological environmental protection and renewable energy development in the countryside is a significant component of the country's sustainable agricultural and rural development and is one of the major drivers for the sustained efforts towards the green town and village development. To ensure avoidance of the recurrence of the barriers and the continuance of the enabling environments that will be created and/or facilitated by the project, appropriate sustainable follow-up actions will be planned as part of the project activities. The establishment of China Rural Distributed Renewable Energy Construction and Development Industry Association will also sustain efforts of the rural towns and villages to replicate the low carbon energy technology application models. Under this project, the development of this association into something like a national EE Accelerator, will also help ensure the sustainability of rural LC development efforts for the promotion and servicing of efforts towards EE rural buildings and industries in China.

Scale-up Potential: The proposed GEF project will lay a solid basis for scaling up with its exploration of the effective models and mechanics for decentralized RE-based energy generation, as well as RE and EE financing models that will support low carbon development of rural towns and villages. These provide the possibility for scaling-up the

application of these models/schemes in other regions of China. The proposed project can be scaled up in the following directions: (1) application of low carbon development policies, standards, IRRs and best practices in rural towns and villages in other provinces; 2) application of the successful demo decentralized RE-based power generation and distribution and EE technology applications in other rural towns/villages; and (3) enhancement of the low carbon village models to low carbon town models, The scale-up will also be made possible through extensive information sharing, technical assistance, ICE programs, and promotional campaigns.

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[1] Mini/micro power grids in rural towns and villages can be designed to be smart enough and highly reliable. The smart grid concept as applied to rural towns and villages will enable the automatic collection of data and analysis of the grid system performance, behavior of electricity consumers and suppliers for improving efficiency as well as economics of electricity use. Such grid systems are typical features of distributed electricity systems and can detect sources of power outages more quickly, even at the customer levels.

[2] At least, the demonstrations shall consist of demo villages/towns that will showcase the application of: (a) 100% RE-based energy generation; (2) Reduction of fossil fuel consumption through the application of RE and EE technologies; and (3) village mini-grid systems with annual net power exchange with the national/provincial grids at zero or close to zero.

[3] The following are potential Renewable Energy technologies that can be demonstrated: (1) Solar PV-based village power generation and distribution (mini/micro-grid) system – Grid connected and stand-alone off-grid (with storage); (2) Diesel/Solar PV Hybrid village power generation and distribution (mini/micro-grid) system – Grid connected and stand-alone off-grid (with storage) – in places with existing diesel power generation or where back-up diesel power generation is used for ensuring power supply reliability; (3) Biomass-based village power generation and distribution (mini/micro-grid) system – Grid connected and stand-alone off-grid (with storage), with the following variations: (a) Biomass (straw/agri-waste) direct combustion – coupled to steam power generation unit, or steam-based combined heat and power system; (b) Biomass (straw/agri-waste) bio-gasification – coupled to gas-fired power generation unit (e.g., gas engine or diesel genset) or gas-based combined heat and power generation unit; (c) Biomass (animal waste) biogas generation – coupled to gas-fired power generation unit (e.g., gas engine or diesel genset) or gas-based combined heat and power generation unit; (4) Other available and feasible RE resource-based village power generation and distribution (mini/micro-grid) system – Grid connected and stand-alone off-grid (with storage); and, (5) Village power distribution system employing stand-alone household solar home systems (flat rate payment system or pre-paid meter system). For Energy Efficiency technologies, the possibilities include: (1) Applications of EE appliances and devices/equipment; (2) Applications of EE building materials (e.g., EE bricks) in rural houses; and, (3) Applications of practical/feasible demand side management actions.

[4] CER Price in Hubei Carbon Exchange Market is US$ 4.22/ton CO2. Ref: Climate Daily News: 09 October 2019 (http://www.factorCO2.com)

1b. Project Map and Coordinates

Please provide geo-referenced information and map where the project interventions will take place.

The project interventions will be carried out mainly in the following provinces: Heilongjiang, Hebei, Gansu, Anhui, Hubei, and Yunnan

2. Stakeholders

Select the stakeholders that have participated in consultations during the project identification phase:

Indigenous Peoples and Local Communities

Civil Society Organizations Yes

Private Sector Entities Yes

If none of the above,please explain why:

In addition, provide indicative information on how stakeholders, including civil society and indigenous peoples, will be engaged in the project preparation, and their respective roles and means of engagement.

Stakeholders	Roles and Responsibilities in Project Preparation
Ministry of Finance of the People's Republic of China	As the window unit of GEF in China, the Ministry of Finance, as a member of the project steering committee, has the responsibility of providing high-level strategic guidance in the design of the project. It will be the one of the GOC signatories to the project document
Ministry of Agriculture and Rural Affairs of the People's Republic of China	The leading department is the Science and Technology Education Department of MARA is responsible for guiding the design of the project, working with the project team to resolve key issues in the project design, provide inputs and support in the design of project activities related to enhancing national and provincial policy and institutional frameworks that are supportive of low carbon development in rural areas; identification of project baseline activities and providing appropriate matching funds. It is also responsible for effective coordination and communication with UNDP, the Ministry of Finance and relevant departments.
United Nations Development Programme	As the implementing agency of GEF, it is responsible for project design, coordination, implementation, monitoring and management.
National Development and Reform Commission	Participate in and guide the project design to ensure that the designed project will promote and encourage the participation of the whole society to promote the use of low carbon energy technologies and provide suggestions for China's social energy resource conservation and comprehensive energy utilization planning and policy measures.
Ministry of Ecology and Environment	Participate in and guide project design to ensure that the UN Framework Convention on Climate Change requirements are also considered.

Stakeholders	Roles and Responsibilities in Project Preparation
State Council Poverty Alleviation and Development Office	Participate in and guide sub-projects to ensure project mechanisms and outputs and effectively reflect China's poverty alleviation and development policies and strategic background, support the goal of poverty alleviation and development from the community level; clarify their responsibilities, participate in the project baseline activities and provide matching funds, and it is also responsible for coordinating the local and national poverty alleviation projects related to the entire project.
National Women's Federation and provincial women's federations in provinces	Participate in and guide project design to ensure women's participation, address women's needs, engage women actively in sub-projects, work to improve their livelihoods, and make them aware of the conservation and sustainability of agricultural biodiversity in rural communities. It will coordinate the local and national projects related to the proposed project, as well as local rural women's development projects supported by women's groups and organizations.
Local governments, including Beijing, Heibei, Heilongjiang, Gansu, Qinghai, Yunnan, Anhui, Sichuan, Hubei	Provincial-level agricultural (development and reform, housing and urban-rural development) departments and county-level governments will directly participate in project design and baseline research by providing technical support, guidance, in the design of the demonstrations. Provincial-level agricultural departments are responsible for supervising provincial and county-level work, including technical support, monitoring, and support. It will provide inputs in the design of the project's monitoring and evaluation plan as well as in the design of the project's capacity building activities.
Relevant scientific research institutions, including Chinese Academy of Agricultural Engineering Planning & Design, Agricultural Science Institute, Chinese Academy of Sciences, Tsinghua University, Renmin University of China, etc.	Provide advice and participate in project design, by effectively incorporating, and utilizing national scientific knowledge to conduct research on rural decentralized RE-based power generation and distribution (with and without energy storage) provide inputs regarding current baseline knowledge, provide inputs on how to contribute to project implementation, and how the project will be coordinated with national and provincial research projects.
Private sector, including: China Academy of Building Research, Haier Group, China Resources Group, Yunnan Tonghai Energy Technology co. LTD, Hebei Zhongdian Jing 'an Energy Saving and Environmental Protection Technology co. LTD, Beijing Haoying Environmental Science and Technology Development Center, Agricultural bank of China, etc.	Decentralized RE-based power generation (with energy storage) and distribution involves technology R&D, production and service enterprises. The participation of enterprises and the private sector in project design will provide better understanding of the economics of rural distributed RE-based power generation and distribution business. These will assist in the identification of current rural energy markets and supply and demand relationships to further promote the creation of relevant models. These private organizations will participate in low carbon energy projects, assess supporting potential, and support the promotion and sustainability of project outcomes in the private sector.

Stakeholders	Roles and Responsibilities in Project Preparation
NGO, Social community and the other social/civic groups in towns and villages, including: China Association of Rural Energy Industry, China Energy Conservation Association, China Association of Agricultural Science Societies, China Biogas Society, Beijing Energy Association, China Bricks & Tiles Industrial Association	Provision of assistance in the identification and analysis of barriers to the application of low carbon development principles, in general, and particularly low carbon energy technology applications. Also, the provision of advice in the design of the barrier removal activities of the project.

3. Gender Equality and Women's Empowerment

Briefly include below any gender dimensions relevant to the project, and any plans to address gender in project design (e.g. gender analysis).

In rural area of China, due to natural conditions, historical culture and traditional customs, many families have relatively obvious social division of labor, i.e., the family division mode of “male outside, female inside”, and adult male family members are responsible for relative heavy physical labor and the majority of the family's economic income sources, while adult female family members are responsible for the entire family's dietary life. To put it another way, in a typical rural Chinese family, women's main work is done under indoor environmental conditions, including cooking and heating. Thus, through addressing the barriers in clean energy supply in the construction of villages, on one hand, it can ease the labor intensity of rural women in access and using energy; one the other hand, project implementation can also improve indoor air quality, and strengthen women’s health.

The project also enables improvement of the working and living conditions of rural women who are typically responsible for household chores through clean energy supply that improve indoor air quality and improve women’s health. The envisioned project activities will significantly improve living environment conditions, reduce threats and damages to rural residents caused by energy-related indoor pollution (carbon monoxide, haze and dust) cause by using traditional energy sources. The project also facilitates rural household solid and liquid waste management through their processing and utilization as energy resources. In addition, this project will have a positive impact on rural women. Through targeted training, this project will improve women's energy conservation and environmental protection skills at the project site and promote them to apply low energy consumption technology and clean-living practices, thereby reducing the use of traditional rural energy sources and reducing rural living resources to increase their economic income.

The proposed GEF project presents opportunities for the involvement of women in the deployment of low carbon technologies and mitigation options and come up with gender-sensitive policies in the energy consuming operations and processes in China is an essential feature of the design and preparation of this proposed project. This also includes putting the potential contributions of women in the management and implementation of measures to mitigate climate change. The design and preparation of this project will ensure adequate consideration of the engagement of the technical services of women professional and indigenous people if there are opportunities to involve them.

Does the project expect to include any gender-responsive measures to address gender gaps or promote gender equality and women empowerment? Yes

closing gender gaps in access to and control over natural resources; Yes

improving women's participation and decision-making; and/or Yes

generating socio-economic benefits or services for women. Yes

Will the project's results framework or logical framework include gender-sensitive indicators?

No

4. Private sector engagement

Will there be private sector engagement in the project?

Yes

Please briefly explain the rationale behind your answer.

The design, engineering, installation operation and maintenance of commercial RE-based energy generation plants, as well as EE technology systems by and large involve private sector entities. There are credible and qualified engineering and consulting firms (local and foreign) in China that provide their services in the design and implementation of the demo activities of the project, and possibly the potential replications and scale up. These entities are among the stakeholders of the proposed project. They will also benefit from the various interventions that will be carried out under the project in terms of knowledge and skills uptake in low carbon energy technology applications, while complying with set low carbon development policies, standards and regulations.

Some of these engineering and energy consulting firms will play an important role in the design, financing and implementation of technical assistance and investment type activities of the project. Part of the investment type activities is the design and implementation of demonstrations on low carbon energy technology applications (e.g., decentralized RE-based energy generation and distribution, energy storage and EE technologies)[1]. These firms will also be involved in the conduct of researches to determine the feasible low carbon energy technologies that will be demonstrated and promoted for replication under the proposed project. There is a strong consensus among the project stakeholders that for this kind of project, to achieve success in the achievement of the set objective, the participation and contribution of the private sector is indispensable.

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[1] In 2016, China's private sector invested $32 billion in international clean energy projects, many of which were invested in developing countries such as Brazil, Egypt, Vietnam, and Kenya. The private sector has more competitive advantages and development potential in the field of renewable energy. Those in the clean energy industry have provided consumers with more convenient energy services. The huge benefits in terms of returns in investment in the clean energy industries have driven the private sector in China to work in the energy industry.

5. Risks

Indicate risks, including climate change, potential social and environmental risks that might prevent the Project objectives from being achieved, and, if possible, propose measures that address these risks to be further developed during the Project design (table format acceptable)

During the implementation of this project, risks that hinder the project from achieving the expected goals may be as follows:

Risk	Level of Risk	Mitigating Actions
The project management unit may not be able to effectively organize and coordinate the participation of relevant project stakeholders (e.g., relevant departments of local governments, specific project execution units, domestic and foreign experts, etc.).	Low	**Preventive**: The implementing agency of the project is the MARA, which is one of the main departments of the State Council's new rural construction management for rural revitalization. MARA has rich experience in GEF project design, implementation and management. With this asset, the proposed project will be designed to minimize the chances of this risk from happening. **Alleviative**: If the PMU indeed become unable to prevent this risk, the UNDP China will manage and expedite the procurement of external personnel who will work on the affected project activities. If need be, the affected activities may have to be modified to allow expeditious implementation and completion

Inadequate and possibly constrained coordination with the implementers of energy projects in local governments in the implementation of the project's barrier removal activities.	Medium	**Preventive**: The MARA, NDRC and the project management unit shall maintain close working relations with relevant departments of the State Council and can make necessary adjustments to the work in a timely manner according to the adjustment of national policies, which can ensure the implementation of the project and achieve optimal results. **Alleviative**: In case this happens, MARA/NDRC will facilitate discussions with project stakeholders and relevant government authorities through the project steering committee (PSC) to come up with decisions on the coordinated implementation of the agreed barrier removal activities.
The co-financing for the project activities may not be timely and enough for supporting project implementation	Medium	**Preventive**: MARA attaches great importance to the implementation of the project and provides relevant technical, resource, capital and institutional support. The relevant project provinces will also promise the project supporting funds in the early stage of project implementation. During the project design and implementation process, MARA will continuously promote the establishment of a diversified financing model to ensure that the project supporting funds are in place. **Alleviative**: In case this problem will occur, the reallocation of budget will be done to support the implementation of affected activities. This may entail the delivery of alternative outputs that are still contributing to the achievement of the relevant project outcome. Constant follow-up with the pertinent co-financers will be conducted either to secure the committed co-financing or negotiate the amount of co-financing.
Rural communities may not support the project implementation promptly and sufficiently.	Low	**Preventive**: Project includes strong promotional campaigns to target rural communities/towns, as well as outreach to relevant local governments to ensure their support. Liaison by capable project team personnel will further ensure support. Integration of productive use income generation opportunities will increase community interest in systems. **Alleviative**: If the project partners in the rural communities become remiss in their obligations and commitments to the project implementation, follow-up discussions between MARA/NDRC, and relevant local government leaders will be carried out to determine and resolve any issue.
The private sector in the rural areas will not be interested in investing in green development technologies	Low	**Prevention**: The project design, particularly the investment activities, will be coordinated with the relevant private sector entities in the target rural communities to involve them right away in the project planning, and get their inputs and comments in the design of the project activities. **Alleviation**: If this happens, the PMU, with the guidance of NDRC/UNDP will carry out direct consultations with target private sector entities to determine their concerns and explore ways to fulfill their initial commitments and ensure end-users better understanding about the use and benefits of EE/RE technology applications.
Recommended policies may not be approved by the relevant authorities or may be approved but not effectively enforced.	Medium	**Prevention**: The project will include the piloting of the application of the support policies for green town and village development to gauge the effectiveness of said policies. This will help guide the relevant government authorities in the finalization, approval and effective enforcement of such policies. **Alleviation**: In case this happens, MARA/NDRC will facilitate discussions with project stakeholders and relevant government authorities through the project steering committee (PSC) to come up with decisions on expediting the approval, or reformulation, of the recommended policies/regulations.

Sustaining the outcomes and benefits of GEF investment on the activities implemented will not be fully sustained.	Medium	**Prevention**: Sustainable follow-up plan for the replication of the demonstrated applicable and feasible EE/RE technologies associated with green town and village development in other provinces. The plan must be supported (financed) by the local governments. **Alleviation**: In case, despite the measures, sustainability of project outcomes and benefits is seen to be in jeopardy, MARA/NDRC, the project team, and the project steering committee will meet to come up with alternative measures to ensure sustainability.
RE-based energy generation (power and non-power purposes) and EE system installations can be seriously affected by adverse climate-related events.	Low	**Prevention**: It is already common in international design and engineering practices, as well as in the construction/installation of RE-based energy generation units to follow proper engineering and construction design and construction that ensure not only structural integrity but also climate resilience. This applies also in the procurement, design/engineering, installation and operation of the pertinent installations[1]. **Alleviation**: Depending on the extent of the impacts of the adverse climate –related events, appropriate modifications in the installations (and budget) will be done. Potential reduction in the number of installations, or replacement with alternative demos will be done while considering the need to ensure the resulting interventions are still contributing to the realization of the project outcomes.

[1] The design and construction/installation of the physical infrastructures that will be installed will be based on the technical and structural specifications that major bilateral and multi-lateral donors require for the infrastructure projects that they are funding in China.

6. Coordination

Outline the institutional structure of the project including monitoring and evaluation coordination at the project level. Describe possible coordination with other relevant GEF-financed projects and other initiatives.

The project will set up a national project steering committee, a national project expert committee, a national project management office, and related project provincial project offices, establish a project implementation monitoring plan for project annually, and in middle and final phases, hold various forms of project promotion coordination meetings, and organize the project annual work meeting.

Part of the work on the design and development of this project is identifying and understanding all GEF and non-GEF funded projects that are related to the proposed project. The coordination work will be mainly for exploring and possibly making use of potential synergies; for ensuring complementarities and building on best practices and lessons learned; and for potential sharing of project resources particularly on transport costs for trips to the country's outer islands. Among these projects are:

The project will carry out sustainable exchanges and cooperation with other relevant national implemented and GEF-funded projects to jointly promote the project work; the project will cooperate with related national, local plans and related projects in implementation to form a project-driven work synergy.

· All ongoing and planned MARA projects on rural development that involves the utilization of energy – Since MARA is the implementing partners, the project development team (PDT) will coordinate with them to determine how these projects can be utilized as baseline activities of the proposed GEF-project.

· The PDT will also coordinate with the implementers of ongoing and planned sustainable development projects in the country such as those funded by the GEF to determine how these projects can be utilized as baseline activities of the proposed GEF-project.

o China Renewable Energy Scale-up Program (CRESP) – This is a biomass energy policy development and investment project undertaken by the Chinese government in cooperation with the World Bank (WB)

o Enabling Solid State Lighting Market Transformation & Promotion of Light Emitting Diode (LED) Lighting – This UNDP-GEF project aims to reduce energy consumption for lighting in China through the improvement of the quality and energy efficiency of lighting products and promoting their application to save electricity and reduce the greenhouse gas emissions. Among the activities that are related to those that will be carried out under this proposed project are those that will contribute to the low-carbon and sustainable development of Chinese cities and towns, and provision of high-quality energy efficient lighting system in rural areas.

· Collaboration will also be explored with other GOC entities, particularly those working also on rural development. Such entities are expected to assist the project proponents in the identification and analysis of barriers to the application of low carbon energy technologies to support rural development. During the PPG stage, the project development team will assess these projects (ongoing and planned) in the rural areas for potential inclusion in the proposed project as baseline activities that the GEF project can build on, for example as a demonstration. Potential synergies in the implementation of capacity development and promotional activities will be explored and considered between those funded/implemented by local and regional organizations and the ones envisioned under this proposed project.

7. Consistency with National Priorities

Is the Project consistent with the National Strategies and plans or reports and assesments under relevant conventions

Yes

If yes, which ones and how: NAPAs, NAPs, ASGM NAPs, MIAs, NBSAPs, NCs, TNAs, NCSAs, NIPs, PRSPs, NPFE, BURs, INDCs, etc

- National Communications (NC) under UNFCCC

- Technology Needs Assessment (TNA) under UNFCCC

- National Capacity Self-Assessment (NCSA) under UNCBD, UNFCCC, UNCCD

- Poverty Reduction Strategy Paper (PRSP)

- Biennial Update Report (BUR) under UNFCCC

Alignment with national strategy/planning

This project will promote the development and application of low carbon energy technologies such as decentralized RE-based power generation and distribution and energy efficiency in rural China. In that regard, it will help achieve the green development objectives (environmentally friendly, low-carbon recycling and efficient energy use) in rural areas of China. This project is highly consistent with China's national strategy and planning. The relevant strategies, plans and policies of the Chinese government include:

a. The 18th National Congress of the Communist Party of China puts the construction of ecological civilization in a prominent position, vigorously promotes the construction of ecological civilization, and strives to promote "green development", with the goal of efficient resources usage, harmony between man and nature, and full integration of technology and nature, realize resources conservation, low-carbon and emission reduction, environmental friendliness, economic efficiency, ecological civilization and the improvement of human survival and development environment, maximize the productivity and creativity of villages and towns.

b. The Third Plenary Session of the 18th CPC Central Committee also proposed "constructing ecological civilization, establishing a systematic and complete ecological civilization system, and protecting the ecological environment with the system." General Secretary Xi Jinping made important instructions on improving the living environment in rural areas.

c. The Outline of the Thirteenth Five-Year Plan for National Economic and Social Development puts forward: "Strengthen the development of biomass energy and wind energy, solar energy, and strengthen the transformation of coal-saving and coal-saving stoves."

d. The 13th Five-Year Plan for Energy Conservation and Emission Reduction promulgated by the State Council of China clearly states that it is necessary to “promote energy conservation in agriculture and villages and towns”, including: “promoting the construction of energy-saving farmhouses” and “promoting the upgrading of coal-fired stoves in the province”, "Adapt to local conditions, multi-complementary development of small hydro power, wind energy, solar energy and straw utilization." In addition, “strengthen building energy conservation, conduct green building actions, comprehensively promote building energy conservation from planning, regulations, technology, standards, design, etc., and improve building energy efficiency.”

e. The “13th Five-Year Plan” Energy Saving and Emission Reduction Comprehensive Work released by the State Council proposes to adjust the energy structure, vigorously develop biomass renewable energy such as solar energy and biomass energy and strengthen supervision and inspection of energy conservation and emission reduction.

f. Medium and Long-term Development Plan for Renewable Energy released by the NDRC, biomass energy was listed as a key development area, and propose to gradually increase the proportion of renewable energy in the energy structure, reaching 15% by 2020.

g. "China National Climate Change Program" formulated by the Chinese government, it is necessary to develop low Carbon energy and renewable energy, improve energy structure, and support the development and utilization of new renewable energy sources such as biomass and solar energy in rural areas, remote areas and suitable areas.

h. The 18th National Congress proposed the national strategy of building a "beautiful China", wherein the MARA regards the construction of "beautiful villages" as an important part of the construction of beautiful China and regards "enhance the agricultural environmental protection efforts" and "promote the development of rural renewable energy" as a key work in the construction of beautiful countryside. 1,100 beautiful villages will be created across the country.

i. The 19th National Congress of the Communist Party of China clearly put forward the "Village Revitalization Strategy", which has brought new development opportunities to the development of rural areas. In implementing the overall requirements of the rural revitalization strategy, China has clearly proposed to promote the green development of villages and towns and create a new pattern of harmonious coexistence between man and nature.

The project development team that will design the project will coordinate with the owners/implementers of the activities carried out in line with the abovementioned GOC programs to explore and possibly make use of potential synergies and ensure complementarity and building on best practices and lessons learned. The establishment of links with the relevant agencies and ongoing programs is expected to help in identifying the relevant activities that will build on their respective achievements. The project will be developed in close cooperation with its stakeholders as well as with the UNDP-Asia Pacific Regional Centre in Bangkok. The UNDP country office in China will be fully involved in the project development through its participation in the various stakeholder and co-financing consultation meetings and technical workshops during project development, and in the multipartite review meetings.

8. Knowledge Management

Outline the Knowledge management approach for the Project, including, if any, plans for the Project to learn from other relevant Projects and initiatives, to assess and document in a user-friendly form, and share these experiences and expertise with relevant stakeholders.

The knowledge management system that will be employed in the proposed GEF project will consists of the conduct of training courses for pertinent personnel in rural towns and village communities that will participate in the project activities. Coordination with the implementers of ongoing GOC climate change and energy projects will be carried out to determine potential synergies in the knowledge management activities, particularly in the approach and methodologies that will be applied. There will be special training for people who will be tasked to operate and maintain the various demo RE-based energy systems (power and non-power) and EE technology systems that are part of the project. Among the outputs of this project is an established and operational information exchange network for the promotion and dissemination of knowledge on low carbon development within the country's rural sector (and possibly later to also be shared with other Asian countries). Part of the project activities will be the establishment and operationalization of an energy supply and consumption monitoring and reporting, database to be housed in the appropriate GOC central ministry, most probably MARA. This aspect of knowledge management, which involve the drawing on of information from a wide variety of sources, will be implemented, not only for the purpose of the country's rural energy planning but also to achieve an organized usage of knowledge about the energy situation in the country's rural sector. This will be made possible through the information exchange network that will be established and operationalized under the project. With such network, data/information on lessons learned and best practices in the application of low carbon development techniques and practices, as well as implementation of sustainable energy and low carbon technologies specifically in rural settings, can be obtained from other developed and developing countries, and applied to specific situations and rural towns/villages in the country. Additional source of knowledge that this project will explore is through the partnership of a relevant SE4All EE Accelerator. The results of the project activities will also be disseminated to other developing countries through the information exchange network. Lastly, this project will establish China Rural Distributed Renewable Energy Construction and Development Industry Association that can also be a future forum for knowledge generation and sharing in the area of rural RE development and in the implementation of RE technologies in rural towns and villages.

Part III: Approval/Endorsement By GEF Operational Focal Point(S) And Gef Agency(ies)

A. RECORD OF ENDORSEMENT OF GEF OPERATIONAL FOCAL POINT (S) ON BEHALF OF THE GOVERNMENT(S): (Please attach the Operational Focal Point endorsement letter with this template).

Name	Position	Ministry	Date
Pong Xiang	GEF Operational Focal Point for China	Department of International Economic and Financial Cooperation, Ministry of Finance	10/10/2019

ANNEX A: Project Map and Geographic Coordinates

Please provide geo-referenced information and map where the project intervention takes place

PROGRAM/PROJECT MAP AND GEOGRAPHIC COORDINATES

The preliminarily identified provinces that will be covered by the project are:

a) Heilongjiang (e.g., Lalin Town, Wuchang)
b) Hubei (e.g., Pengsi Town, Huanggang)
c) Anhui (e.g., Guomiao Town, Fuyang)
d) Yunnan (e.g., Tonghai County, Yuxi)
e) Gansu (e.g., Nanhua Town, Zhangye)
f) Hebei (e.g., Anping County, Hengshui)

The final line up of towns/villages with their geographic coordinates will be compiled during the project development phase (i.e., PPG Exercise).

Annex A-2: Zero Carbon Energy Technology Application Demonstrations

Exhibit 1: Tentative List of Zero Carbon Energy Generation and Supply Scheme Demonstrations

Province	Demonstration	RE Resources
Hebei	Zero carbon town (2 towns); Installation of RE-based power generation and distribution system to serve the current electricity demand of each town + utilization of biomass for biogas production and utilization to meet the energy needs of each village for cooking and heating.	Biomass & solar
Hebei	Zero carbon town (1 town); Installation of RE-based power generation and distribution system to serve the electricity demand of the town (all electric applications) for electric appliances, cooking and heating.	Biomass & solar
Hubei	Zero carbon village (1 village); Installation of RE-based power generation and distribution system to serve the electricity demand of the village (all electric applications) for electric appliances, cooking and heating.	Biomass, solar, hydro
Gansu	Zero carbon village (1 village); Installation of RE-based power generation and distribution system to serve the electricity demand of the village (all electric applications) for electric appliances, cooking and heating.	Biomass, solar, hydro
Heilongjiang	Zero carbon village (55 villages); Installation of RE-based power generation and distribution system to serve the current electricity demand of each village + utilization of biomass for biogas production and utilization to meet the energy needs of each village for cooking and heating.	Biomass & solar
Yunnan	Zero carbon village (1 village); Installation of RE-based power generation and distribution system to serve the electricity demand of the village (all electric applications) for electric appliances, cooking and heating.	Biomass, solar, hydro
Anhui	Zero carbon village (60 villages); Installation of RE-based power generation and distribution system to serve the current electricity demand of each village + utilization of biomass for biogas production and utilization to meet the energy needs of each village for cooking and heating.	Biomass & solar

Note: All RE-based energy technologies that will applied in the demos will be those that are not only applicable in the context of sustainable development of rural towns & villages but are in line with energy conservation/efficiency and circular economy principles. These will be technologies that can be operated cost-effectively and shall include components that are energy efficient.

Exhibit A-2: Estimated GHG Emission Reductions from the Planned Demos

A. Data and Assumptions

In 2017:

1 rural town is comprised on average 20 administrative villages

1 village is comprised on average 875 households

1 household is comprised of 3 persons

Total energy consumption in rural areas = 590 million tce (54.2% residential sector; 45.8% other sectors)

Average rural energy consumption distribution in China:

Energy Source	Per capita Energy Consumption, tce		
	Residential	Non-residential	Total
Coal	0.33	0.28	0.61
Electricity	0.07	0.06	0.13
Fuelwood	0.10	0.08	0.18
LPG	0.03	0.03	0.06
Natural Gas	0.02	0.01	0.03
Biogas	0.01	0.00	0.01
TOTAL	**0.55**	**0.47**	**1.02**

Note: The planned provinces where demos will be implemented do not have piped natural gas supply.

Standard Coal Equivalents

Solid: Raw coal 0.7143 kgce/kg; Kerosene 1.4714 kgce/kg; Other washed coal 0.2857 kgce/kg; Briquette 0.7143 kgce/kg; Coke 0.9714 kgce/kg

Liquid: Liquefied petroleum gas 1.7143 kgce/kg; Diesel 1.4571 kgce/kg; Gasoline 1.4714 kgce/kg.

Gas: Natural gas 1.1 kgce/cu·m; Coke oven gas 0.5714 kgce/m3; Other coal gas 0.1786 kgce/m3

Others: Electricity 0.1229 kgce/kWh; Heat 0.03412 kgce/MJ

GHG Emission Factors

Energy Source	Emission Factor	Remark
Coal	2.657	tCO2/ton, sub-bituminous coal, 28.22 MJ/kg heating value
Grid Electricity	1.067	tCO2/MWh, pulverized coal fired thermal power plant, sub-bituminous coal
Wood	1.462	tCO2/ton, firewood, 14.82 MJ/kg heating value, non-sustainable
LPG	2.969	tCO2/ton, 47.31 MJ/kg heating value
Natural Gas	1.800	tCO2/'000 m3, 34.54 MJ/m3 heating value

RE Technology Applications in Demonstrations

Heat utilization improvement = 20% average (from use of more energy efficient heating appliances and heating systems)

A. Estimated RE-based Energy Generation System Capacity and GHG Emission Reduction

Province	RE Resource Application %Distribution			RE Resource Power Application %Distribution			RE Resource Heat Application %Distribution	
	Biomass	Solar	Hydro	Biomass	Solar	Hydro	Biomass	Solar
Hebei	95	5		95	5		95	5
Hubei	80	10	10	80	10	10		
Gansu	80	10	10	80	10	10		
Heilongjiang	90	10		90	10		90	10
Yunnan	80	10	10	80	10	10		
Anhui	90	10		90	10		90	10

*GHG emission reductions are cumulative by end-of-project (Year 5). Accounting starts in Year 2.

Energy Savings from Improved Heating Systems in Demo Provinces

Demo: Utilization of biomass for biogas production and utilization to meet the energy needs of each village for cooking and heating).

Province	RE-based Electricity Generation, MW				RE-based Heat Generation, MW			Estimated GHG Emission Reduction, tCO_2*
	Biomass	Solar	Hydro	Total	Biomass	Solar	Total	
Hebei	3.4	0.7	-	4.1	22.5	1.2	23.6	445,492.0
Hebei	46.9	9.5	-	56.4			-	1,568,402.9
Hubei	3.3	1.6	1.6	6.6			-	132,571.7
Gansu	3.3	1.6	1.6	6.6			-	132,571.7

Heilongjiang	5.9	2.5	-	48.7	36.3	4.0	40.3	797,646.3
Yunnan	3.3	1.6	1.1	6.0			-	132,571.7
Anhui	6.4	2.7	-	53.1	39.6	4.4	44.0	870,159.6
TOTAL	**72.6**	**20.3**	**4.3**	**181.5**	**98.3**	**9.6**	**107.9**	**4,079,415.7**

Province	**Coverage**	**Annual Heating Energy Savings, GJ**		
		Biomass	**Solar**	**Total**
Hebei	2 towns	481,549	25,345	506,894
Heilongjiang	55 villages	778,024	86,447	864,471
Anhui	60 villages	848,753	94,306	943,059
TOTAL	145 villages	2,108,326	206,098	2,314,424