Facilitating Cleaner and Energy Efficient Phosphate Chemicals Industry in China (PhosChemEE) Project

Part I: Project Information

GEF ID
10722

Project Type
FSP

Type of Trust Fund
GET

CBIT/NGI
- [ ] CBIT
- [ ] NGI

Project Title
Facilitating Cleaner and Energy Efficient Phosphate Chemicals Industry in China (PhosChemEE) Project

Countries
China

Agency(ies)
UNDP

Other Executing Partner(s)
Ministry of Natural Resources ,Ministry of Industry and Information Technology

Executing Partner Type
Government

GEF Focal Area
Climate Change

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

Rio Markers
Climate Change Mitigation
Climate Change Mitigation 1

Climate Change Adaptation
Climate Change Adaptation 0

Duration
60 In Months

Agency Fee($)
887,621.00

Submission Date
10/28/2020

A. Indicative Focal/Non-Focal Area Elements

Programming Directions	Trust Fund	GEF Amount($)	Co-Fin Amount($)
CCM-1-3	GET	9,343,379.00	93,434,000.00
	Total Project Cost ($)	**9,343,379.00**	**93,434,000.00**

B. Indicative Project description summary

Project Objective

Enabling the extensive application of low carbon and energy efficient technologies in the phosphate chemicals industry in China.

Project Component	Financing Type	Project Outcomes	Project Outputs	Trust Fund	GEF Amount($)	Co-Fin Amount($)
1. Green and Low-carbon Development and Operation of Phosphate Mines	Technical Assistance	Improved interest and commitment of the phosphate chemical industry in the green, low carbon and energy efficient operations of the phosphate mining sub-sector in China.	**Output 1.1.1:** Formulated, recommended, approved, and enforced policy and institutional frameworks supporting green, energy efficient low carbon development initiatives in phosphate rock (phosrock) mining and refining. **Output 1.1.2:** Formulated, recommended, and enforced standards, policies and implementing rules and regulations on the promotion and practice of green, energy efficient, low carbon technologies/techniques, in the development and operations of phosphate mines. **Output 1.1.3:** Documented annual evaluation reports on the energy performance and environmental impacts of each demo project and documented and disseminated demo project results[1]. **Output 1.1.4:** Completed capacity needs assessment in the area of green, energy efficient low carbon technologies applied in phosphate mining and refining, and designed capacity development program to be implemented for the phosrock mines in Weng'an, Guizhou, Jinning, Yunnan, and Mabian and Leibo counties, Sichuan. **Output 1.1.5:** Fully conducted and post-evaluated capacity development program on the principles and application of green, energy efficient low carbon technologies/techniques in phosphate mining and refining. **Output 1.1.6:** Published and disseminated technical	GET	872,000.00	8,719,000.00

guides and reference documents for the application of energy conserving and energy efficient practices in the phosphate mining sub-sector.

Output 1.1.7: Established the online monitoring, reporting and verification (MRV) system for energy-saving and GHG emission reduction from the application green, energy efficient low-carbon technologies in the PCI[2] including information sharing scheme.

Output 1.1.8: Published and disseminated publicity information about China's green, energy efficient and low-carbon phosrock mining and refining.

[1] This include results of the assessment of the environmental impacts on the upper reaches of the Yangtze River of the green, energy efficient low carbon technology application demos in the partner phosrock mines located in the lower reaches of Jinsha River and the Central Yunnan Basin.

[2] This MRV system will also be used for the demonstrations of green, energy efficient low carbon technologies/techniques and practices in phosrock mining and refining, phosphate chemical manufacturing, and by-product processing. It will also be used in the MRV of any replication and scale-up of the demos during and after the GEF project lifetime.

1. Green and Low-carbon Development and Operation of Phosphate Mines	Investment		GET	1,619,400.00	16,200,000.00

Enhanced confidence in the feasibility of the application of green, energy efficient low carbon technologies in phosrock mining and refining in China.	**Output 1.2.1:** Completed designs and plans of demonstrations of green, energy efficient and low carbon technologies in phosphate mines development and operations including: (a) Improved design for the mining and refining operations in the demo phosrock mines in Weng'an, Mabian, Guizhou, Sichuan[1]; (b) Feasibility analyses of the application and operation of green, energy efficient and low carbon phosrock mining and refining systems; and, (c) Implementation plans (including financing arrangements) for each green, energy efficient and low carbon technology application in the demo phosrock mines. (GEF Project Financing $242,900, Co-financing$2,430,000) **Output 1.2.2:** Installed and operational green, energy efficient low carbon technology application demos in phosrock mining and refining in Weng'an, Guizhou, Jinning, Yunnan, and Mabian and Leibo counties, Sichuan. (GEF Project Financing $1,328,000, Co-financing$13,608,000) **Output 1.2.3:** Approved and financed follow-up plan for the replication of the application of demonstrated green, energy efficient low carbon technologies in phosrock mining and refining in other localities. (GEF Project Financing $48,500, Co-financing$162,000)

[1] The demonstrations will be on the application of new technologies and equipment for phosrock mining and refining, improved resource utilization and waste reduction schemes, and improved processing and utilization technologies for phosrock waste and tailings in central Yunnan. The indicative technologies that will be showcased are the following: Phosphate

			mining and refining: (1) Improved phosrock transportation from mine site to refining section by phosrock conveying (5 million tons/year) and phosrock slurry pumping and pipeline transportation (5 million tons/year); (2),, XRT sorting (2 million tons/year); and, (3) Biological phosphate fertilizer from phosrock refining tailings (1 million tons/year). As to the corresponding capital investments: (1) phosrock transportation, depending on the terrain complexity for raw phosrock conveying and phosrock slurry pumping, is estimated at US$ 3M – 4.5M/mile for a 5 million tons/year transfer rate; (2) XRT sorting system will cost about US$ 4.5M – 7.5M for a 2 million tons/year processing rate; and, (3) a bio-phosphate fertilizer production plant cost about US$ 3M – 4.5M for a 1 million tons/year production rate.			
2. Green and Low-Carbon Design and Operation of Phosphate Chemicals Production Facilities	Technical Assistance	Established a green and low-carbon development model for phosphorus chemicals	**Output 2.1.1:** Formulated, recommended, approved, and enforced policy and institutional frameworks supporting green, energy efficient low carbon technology applications in phosphate chemicals production. **Output 2.1.2:** Formulated, recommended, and enforced standards, policies and implementing rules and regulations on the promotion and practice of green, energy efficient, low carbon technologies/techniques, in phosphate chemicals production. **Output 2.1.3:** Documented annual evaluation reports on the energy performance and environmental impacts of each demo project and documented and disseminated demo project results based on the MRV system (Output 1.1.7) established under Component 1. **Output 2.1.4:** Completed capacity needs assessment in the area of green, energy efficient low carbon technologies applied in phosphate chemicals production, and designed capacity development program to be implemented for the phosphate chemical companies in Yunnan, Guizhou, Sichuan, and Hubei	GET	934,400.00	9,345,000.00

		panies in Yunnan, Guizhou, Sichuan, and Hubei. **Output 2.1.5:** Fully conducted and post-evaluated capacity development program on the principles and application of green, energy efficient low carbon technologies/techniques in phosphate chemicals production. **Output 2.1.6:** Published and disseminated technical guides and reference documents for the application of energy conserving and energy efficient practices in the phosphate chemicals production sub-sector. **Output 2.1.7:** Completed market analysis report on the international trade trends for phosrock and phosphate chemicals, and the indirect carbon emission and ecological impacts in the international trading of these products. **Output 2.1.8:** Published and disseminated publicity information about China's green, energy efficient and low-carbon phosphate chemicals manufacturing.			
2. Green and Low-Carbon Design and Operation of Phosphate Chemicals Production Facilities	Investment		GET	2,803,000.00	28,034,000.00

Enhanced confidence in the feasibility of the application of green, energy efficient low carbon technologies in phosphate chemicals production in China.	**Output 2.2.1:** Designed and approved pilot financing scheme for small and medium enterprises (SMEs) that manufacture phosphate chemicals. (GEF Project Financing $70,100, Co-financing$0) **Output 2.2.2:** Completed designs and plans of demonstrations of green, energy efficient low carbon technologies in phosphate chemicals production including: (a) Improved design for cleaner production demos[1]; (2) Feasibility analyses of the application and operation of green, energy efficient and low carbon phosphate chemical production systems; and, (3) Implementation plans (including financing arrangements) for each green, energy efficient and low carbon technology application in the demo phosphate chemical companies (GEF Project Financing $ 210,200 , Co-financing$2,103,000) **Output 2.2.3:** Installed and operational green, energy efficient low carbon technology application demos in phosphate chemicals production. (GEF Project Financing $ 2,130,300 , Co-financing$23,830,000) **Output 2.2.4:** Operational pilot financing scheme for phosphate chemicals SMEs in 2 to 3 regions. (GEF Project Financing $350,400 , Co-financing$ 1,680,000) **Output 2.2.5:** Approved and financed follow-up plan for the replication of the application of demonstrated green, energy efficient low carbon technologies in phosphate chemicals production in other localities. (GEF Project Financing $42,000 , Co-financing$421,000)

[1] The demonstrations will be carried out in partner phosphate chemical companies in Yunnan, Guizhou, Sichuan, and Hubei, including the companies in the supply chains of the demo companies. Included in the demo is the application of the green (ecological)

			design (new and retrofit) design of phosphate chemical manufacturing processes. The indicative technologies that will be demonstrated are: Phosphate chemicals production: (1) Process optimization and the improved heat recovery in thermal phosphoric acid production: (2) Medium- pressure steam production using tail gas (CO) from the electric furnace used in yellow phosphorus production; and, (3) Improved wet-process phosphoric acid production. Both for large companies and SMEs that produce phosphate chemicals, green and low carbon technologies, and practices (e.g., waste heat recovery, application of energy efficient electric motors and equipment, distributed control systems, energy management systems, etc.) that will improve and optimize their production operations and processes for improved productivity, cleaner production and energy efficiency will be demonstrated. The specific demonstrations will be designed to fit the appropriate partner entities that will be able to showcase cost-effective implementation of the green low carbon technologies, generate high energy savings and bring about high GHG emission reductions.			
3.Green and Low Carbon Design and Operation of Waste Management Systems in the Phosphate Chemicals Industry	Technical Assistance	Enhanced commitment of the phosphate chemical industry in green and low carbon waste management.	**Output 3.1.1:** Completed research reports on: (1) annual volume of waste production in phosrock mining and refining, and in phosphate chemicals production in China; (2) green and low carbon waste management systems for waste recycling and reuse developed and implemented in other countries and their energy utilization performances; and, (3) potential commercial markets for processed waste, e.g., phosphogypsum. **Output 3.1.2:** Formulated and recommended schemes, standards, policies/regulations on the application of green and low carbon waste management technologies in the phosphate chemicals industry in China. **Output 3.1.3:** Documented annual evaluation report	GET	801,000.00	8,013,000.00

		s on the energy performance and environmental im pacts of each demo based on the MRV system (Out put 1.1.7) developed under Component 1. **Output 3.1.4:** Completed capacity needs assessme nt in the area of green and low carbon technologies applied in waste management in the phosphate che micals industry, and designed capacity developmen t program to be implemented. **Output 3.1.5:** Fully conducted and post-evaluated c apacity development program on the principles and application of green and low carbon waste manage ment technologies/techniques in the phosphate ch emicals industry. **Output 3.1.6:** Published and disseminated technical guides and reference documents for the application of green and low carbon technologies/techniques i n waste management in the phosphate chemicals i ndustry. **Output 3.1.7:** Published and disseminated publicity information about China's green and low-carbon wa ste management in the phosphate chemicals indus try.			
3.Green and Low Carbon Design and Operation of Waste Manageme nt Systems in the Phosphate Chemicals Industry	Investme nt	**Output 3.2.1:** Completed designs and plans of demonstrations of the application of green and low carbon technologies/techniques in waste management in the phosphate chemicals industry, including: (a) improved phosrock mining tailings recycling and reuse; and (b) energy efficient processing of phosphogypsum and marketing of the gypsum products[1]. (GEF Project Financing $280,300, Co-financing$ 2,616,000) **Output 3.2.2:** Installed and operational green and low carbon waste management technology application demos in the phosphate chemicals industry. (GEF Project Financing $1,541,600, Co-financing$ 15,886,000)	GET	1,868,656.00	18,689,000.00

	Increased confidence in the feasibility of the application of green and low carbon technologies in the management of waste in the phosphate chemicals Industry in China.	**Output 3.2.3:** Approved and financed follow-up plan for the replication of the application of demonstrated green, low carbon waste management technologies in the phosphate chemicals industry in other localities. (GEF Project Financing $46,756, Co-financing$187,000) *NOTE: The implementation and realization of the abovementioned outcomes and outputs will be regularly monitored by the project's implementing partners (MIIT and MNR). The indicative monitoring & evaluation plan and budget is shown in Annex D.* [1]The demonstrations will be on the application of green, energy efficient low carbon technologies in the commercial processing of phosrock mining waste and refining tailings, as well as phosphate chemicals production by-product wastes for the production of other value added products. The indicative technologies that will be demonstrated includes the following: PCI waste management: (1) Improved phosphogypsum pre-treatment (200,000 tons/year); (2) improved production of α high-strength gypsum that is used as building material and molding compound, replacing silicate cement (200,000 tons/year); and, (3) improved production of β gypsum that is commonly used as building material (200,000 tons/year). Regarding the corresponding capital investment for the stated production rates: (1) Improved phosphogypsum pre-treatment is estimated at US$ 1.5M; (2) Improved α high-strength gypsum production is estimated at US$ 7.5M; and (3) improved β gypsum production is about US$ 3M.		
		Sub Total ($)	**8,898,456.00**	**89,000,000.00**
Project Management Cost (PMC)				
		GET	444,923.00	4,434,000.00

	Sub Total($)	444,923.00	4,434,000.00
	Total Project Cost($)	9,343,379.00	93,434,000.00

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($)
Recipient Country Government	Ministry of Industry and Information Technology	Grant	Investment mobilized	3,000,000.00
Recipient Country Government	Ministry of Industry and Information Technology	In-kind	Recurrent expenditures	900,000.00
Recipient Country Government	Ministry of Natural Resources	Grant	Investment mobilized	2,000,000.00
Recipient Country Government	Ministry of Natural Resources	In-kind	Recurrent expenditures	650,000.00
Recipient Country Government	Local people's government at project demonstration and replication area, including Sichuan, Yunnan, Guizhou, etc.	Grant	Investment mobilized	10,600,000.00
Recipient Country Government	Local people's government at project demonstration and replication area, including Sichuan, Yunnan, Guizhou, etc.	In-kind	Recurrent expenditures	2,650,000.00
Private Sector	Relevant companies and farmer cooperatives in project sites	Grant	Investment mobilized	66,434,000.00
Private Sector	Relevant companies and farmer cooperatives in project sites	In-kind	Recurrent expenditures	7,000,000.00
GEF Agency	UNDP	Grant	Investment mobilized	200,000.00
			Total Project Cost($)	93,434,000.00

Describe how any "Investment Mobilized" was identified

The proposed implementing partners for this project (MIIT and MNR) have been developing and implementing projects (including those funded by the GEF). Both ministries are also mobilizing counterpart funding to such projects. They work together with multi-lateral and bilateral donor agencies for funding projects that especially are geared towards the development and conservation of the country's natural resources, and the development of the industry and information

technology sectors. From discussions with the MIIT and MNR, they have informed that the local governments of the provinces that will be working on this proposed project are themselves also doing their own financial mobilization efforts for provincial socio-economic development. The partner PCI companies that will also be involved in the project, particularly in hosting the demonstration activities, are also by themselves mobilizing investment for plant facilities upgrade and expansions to improve productivity, save on energy and process raw material inputs, reduce production losses and waste, and for environmental regulations compliance. During the stakeholder consultations that were conducted with the technical personnel in both ministries, they committed to seek expressions of interest and commitments from these local governments to participate and co-finance the envisioned activities of this proposed project. Similar discussions were also held with targeted PCI companies soliciting their financial support to co-finance the project. In that regard, the project would leverage some of the ongoing and planned investments and initiatives in the project partners. Both ministries will explore further commitments as needed during the design and development stage of the project. Note on Private Sector Co-financing; Includes Yunnan Phosphate Group, Guizhou Wengfu Group Co. Ltd., Sichuan Huarui Mining Co., Ltd., Sichuan Ruifeng Mining Co., Ltd., China Blue Changhua Engineering Co., Ltd., Wengfu (Group) Co., Ltd., Guizhou Kailin Group Mineral Fertilizer Co., Ltd., Guizhou Phosphate Group, Jixing Chemical Group, Yuanan Industrial Park, and Hubei Yidu Chemical Industrial Park. The private sector partners will cover part of the costs for the planning, design, engineering, installation, operation and maintenance of the demo green, energy efficient, low carbon technologies that will be implemented in their respective facilities. It should be noted that since the proposed project will only cover biological/chemical phosphate fertilizer production, farmer cooperatives will not be involved

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($)
UNDP	GET	China	Climate Change	CC STAR Allocation	9,343,379	887,621	10,231,000.00
				Total GEF Resources($)	**9,343,379.00**	**887,621.00**	**10,231,000.00**

E. Project Preparation Grant (PPG)

PPG Required ☑

PPG Amount ($)

200,000

PPG Agency Fee ($)

19,000

Agency	Trust Fund	Country	Focal Area	Programming of Funds	Amount($)	Fee($)	Total($)
UNDP	GET	China	Climate Change	CC STAR Allocation	200,000	19,000	**219,000.00**
				Total Project Costs($)	**200,000.00**	**19,000.00**	**219,000.00**

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)	35961000	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)	0			
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)	35,961,000			
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)	173,000,000,000			

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)

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	600,000			
Male	600,000			
Total	1200000	0	0	0

Part II. Project Justification

1a. Project Description

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

Global environmental problems and their causes

Since the 19th century, the rapid development of industry and the scale of human activities have become the main contributors to global climate change. At present, the global average land and ocean surface temperature is 0.85 ℃ higher than before, and the atmospheric CO_2 concentration is more than 400 ppm. In October 2018, the United Nations Intergovernmental Panel on Climate Change warned that if global warming is not controlled within 1.5 ℃, the earth will usher in a devastating climate after 2030. According to science news of the United States, by the end of 2019, global CO_2 emissions from fossil fuel combustion will reach 36.8 billion tons, up from 36.57 billion tons in 2018. To actively contribute to the global call for slowing down climate change, China committed in 2015, as per China's Nationally Determined Contributions (NDC) document that was submitted to the United Nations Framework Convention on Climate Change (UNFCCC), to increase the share of non-fossil fuels in the national energy mix to 20% by 2030; and to reduce its carbon intensity by 60% to 65% of the 2005 levels by 2030. In 2020, China put forward a more ambitious goal to the fight against climate change, as it aims to bring carbon emissions to a peak by 2030 and achieve carbon neutrality by 2060 with more forceful policies and measure.

Low-carbon transformation of the phosphate chemical industry (PCI) in China is regarded as an important component of China's response to global climate change. The PCI is an important sub-sector of China's industry sector. Fig. 1 shows the flowchart of the PCI chain in China. At present, the PCI is a relatively mature industry, which covers phosphate mining and refining and the production of phosphate chemical products. There are about 100 different phosphate chemical products that are produced by the industry, which can basically meet the domestic demand, and a large portion of the production is exported. In 2015, the Ministry of Agriculture issued the notice of action plan for zero growth of fertilizer use by 2020. The sales volume of phosphate fertilizer showed a downward trend in recent years. In 2018, the sales volume of phosphate fertilizer was 12.97 million tons, which was 17.1% lower than that in 2017. However, the demand for phosphate fertilizer has a certain degree of rigidity. With the increase in domestic fertilizer utilization rate and compound fertilizer conversion rate, the probability of phosphate fertilizer demand continuing to decline sharply is not high. On the whole, the situation of capacity contraction of China's PCI has little change in the short term. Although the industry demand has a certain decline, the demand will tend to become stable in the later stage.

The carbon emission problem in the PCI in China is mainly manifested in three aspects, which are also the key problems to be solved in this project.

(1) **High energy consuming and GHGs emission in the chemical production process**. In terms of production capacity and output, China is the largest producer, exporter, and consumer of phosphate chemical products in the world, accounting for more than 80% of the world's total production capacity. In 2019, the national phosphate fertilizer production capacity was 22.5 million tons of P_2O_5. In 2019, the carbon emission of the PCI was about 59 million tons CO_{2eq}, accounting for about 4.3% of the carbon emission of the chemical industry. The extensive production mode of the PCI causes a lot of energy waste.

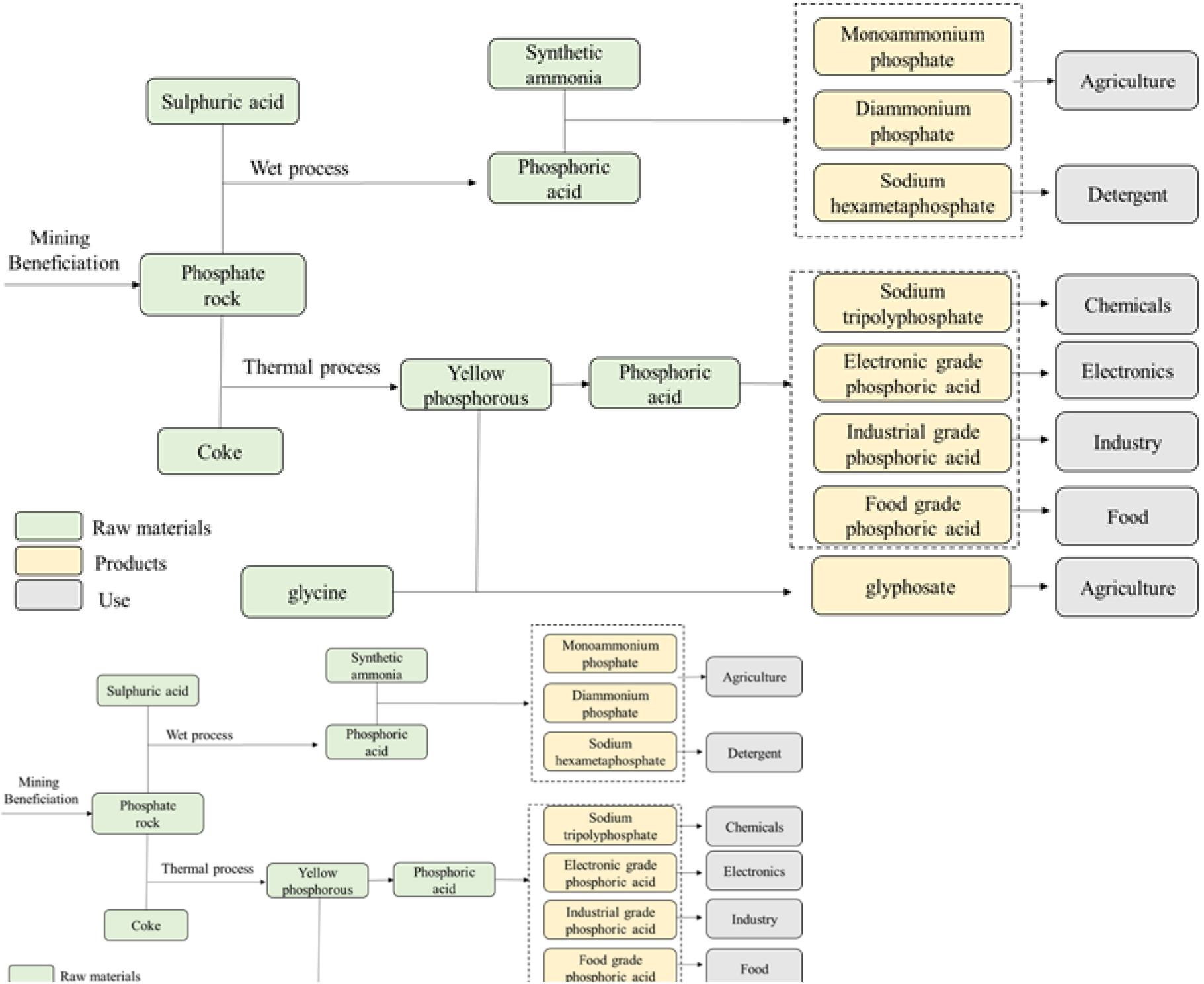
Sulphuric acid
Synthetic ammonia
Wet process
Phosphoric acid
Monoammonium phosphate
Diammonium phosphate
Sodium hexametaphosphate
Agriculture
Detergent
Mining Beneficiation
Phosphate rock
Thermal process
Yellow phosphorous
Phosphoric acid
Coke
Sodium tripolyphosphate
Electronic grade phosphoric acid
Industrial grade phosphoric acid
Food grade phosphoric acid
Chemicals
Electronics
Industry
Food
Raw materials
Products
Use
glycine
glyphosate
Agriculture

Figure 1. The flowchart of PCI chain in China.

(2) **The inadequate utilization of the industry by-products particularly phosphogypsum**. At present, the annual output of phosphogypsum in China is about 85 million tons. The comprehensive utilization rate of this byproduct is about 40%, and the annual additional storage of phosphogypsum is 51 million tons. The historical storage of phosphogypsum in China is more than 800 million tons, and the problems of environmental pressure and safety risks are increasingly prominent. Among them, nearly 650 million tons of phosphogypsum piles exist along the main stream and upstream tributaries of the Yangtze River in the provinces of Hubei, Yunnan, Guizhou, Sichuan, etc., which is the key and difficult problem in the ecological environment restoration of the Yangtze River economic belt. In addition, the low quality of phosphate concentrate leads to high energy consumption in the downstream phosphoric acid production, and the disposal of by-product phosphogypsum is difficult. Phosphate rock needs to be enriched to obtain the proper phosphate concentrate before it can be used in to produce phosphate fertilizer. At present, the grade of phosphate concentrate in China is about 28-30%, and the main impurity is silica. In other countries, phosphate concentrate is mainly extracted from apatite, and the highest grade of phosphate concentrate can reach 40%. When the grade of phosphate concentrate is increased by one percentage point, the consumption of sulfuric acid and phosphogypsum production can be reduced by 17.2 kg and 10 kg, respectively.

(1) **The ecological environment impact in the process of phosphate rock mining**. The development of mineral resources such as phosphate rock is of great significance for human survival. The extraction of mineral resources like phosrock involves several energy consuming physical and chemical separation processes, as well as the generation of gaseous emissions, liquid effluents, and solid waste materials. In order to obtain the resources, it is usually necessary to refine or beneficiate the mined mineral produce value added materials. In the mining development activities, due to the social development level and development and utilization technology and other reasons, there are various problems in the production process, such as high energy consumption, large volume of waste materials, and waste rock tailings management. China's phosphate rock resource endowment is poor, and consequently its extraction and utilization requires high energy consumption, and the resource utilization rate is low. Collophanite is the main phosphate rock in China. This kind of resource is produced in layers, which has the characteristics of thin ore body, low grade of raw ore, high impurity content and difficult separation. Moreover, the phosrock mining areas are typically large, the land surface damage is serious, and the comprehensive utilization rate of waste rock and tailings is low. By end 2019, the phosrock mines in Yunnan, Guizhou, and Sichuan are expected to discharge 104.7 million tons of waste rock, and about 41.4 million tons of that will be used, with an average utilization rate of 39.53%. Large quantities of waste rocks and tailings are just stacked in the waste rock dump and tailings in tailings ponds for long periods of a long time.

Obstacles to achieve green and low-carbon development of PCI chain

The existing extensive development mode of PCI chain. At present, China's phosphate chemical industry is geared towards extensive production in pursuit of economic benefits. Most enterprises within the industry do not take reducing carbon emissions and achieving cleaner production as their social responsibility, but to maximize their economic benefits while complying with industry regulations. This general attitude of enterprises pursuing short-term interests makes it difficult to implement and realize green and low-carbon development objectives.

The industry standards, systems and related policies are not sufficient. Like in any mineral resource development in China, the PCI involves many processes and operations such as phosrock extraction, enrichment/refining, phosphate product (chemicals) manufacturing, and waste management (e.g., recycling, reprocessing, reuse). The relatively low quality phosrock leads to higher energy consumption, and larger amounts of waste products, as compared to other countries where the phosrock quality is better. The waste produced in the downstream production processes is more difficult to use, resulting in large amounts of stacking, which poses a direct threat to the natural environment in the phosrock mining areas and in the phosphate, chemicals manufacturing enterprises. There are some standards for the utilization of the phosphogypsum by-product, but these are only limited to the building materials industry. Because of that, the market recognition for the large scale applications of this by-product as a low carbon building material is low.

Technology innovations in the PCI in China are insufficient. At present, there is a lack of technological innovation in improving the operations and processes in the PIC in China. There are limited innovation efforts geared towards technologies on the phosrock resource development and utilization technology, including research and application of new, more energy efficient and less polluting processes, systems and equipment for phosrock mining and refining that reduce the

discharge of solid waste such as waste rock and tailings, reduce energy consumption in the mining operations, improve the quality of refined phosrock and reduce the energy consumption and waste generation in the phosphate chemicals production. There is also limited applications of cleaner production technologies and by-product treatment technologies in the PIC. As the disposal of phosphogypsum has not been given enough attention, the current phosphogypsum disposal and utilization rates are relatively low. The current technologies that are applied do not help in further exploiting the high value-added utilization of the PCI's phosphogypsum by-product while at the same time reducing the environment risks that the ever-growing stacks of phosphogypsum poses to the surrounding areas of PCI enterprises. Technological innovations must be carried out by the industry in areas such as on-line quality control technology of phosphogypsum production and discharge, and pretreatment technology of low-cost secondary pollution.

Lack of cooperation among the different phosphate products producing regions in China. Due to the geographical distribution of regional phosrock resources and transportation requirements, the production, storage, and comprehensive utilization of phosphogypsum vary greatly in different regions. The discharge and storage of phosphogypsum are mainly concentrated in Yunnan, Guizhou, Sichuan, and parts of the southwest region of the country, while the consumption of gypsum is mainly concentrated in areas with large demand for building gypsum and cement, such as the eastern provinces and cities with developed economy. Due to the existing transportation infrastructure, the supply of gypsum in areas with large amount of gypsum is in short supply, while the area with concentrated emission can only be stored in large quantities. The spatial mismatch between the areas where there is demand for gypsum and areas where there is gypsum production (from phosphogypsum) makes the comprehensive utilization policy of phosphogypsum not fully coordinated and promoted by different regional governments.

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

Baseline scenario

Current situation and future forecast of energy consumption and carbon emission of PCI

(1) In 2019, with the existing technologies applied in the PCI, the carbon emissions in the production of phosphate chemical products is 1.31 tons CO2 per ton. In 2010, this was about 1.62 tons CO2 per ton. This is a cumulative reduction in carbon emissions per ton of phosphate chemical products of about 19% during the span of 9 years. Based on the current policies of the Chinese government regarding the PCI, it is estimated that the carbon emission per ton of phosphate chemical products will be reduced to 1.25 tons CO2 in 2025. However, due to limitations in the application of new, energy efficient and low carbon technologies in the industry, there is still a big gap between the current level of carbon intensity and that in the PCI of developed countries (≈ 1.2 tons). There is still substantial room for improvement in the PCI's carbon intensity through the cost-effective application of new, energy efficient and low carbon technologies.
(2) In 2019, the average energy consumption per ton of raw phosrock in phosphate mining in China is 1.94 kg standard coal, and the corresponding carbon emission is 5.04 kg CO_2. The average energy consumption per ton of raw phosrock is 7.93 kg standard coal, and the corresponding carbon emission is 20.6 kg. The average utilization rate of waste rock is 39.5%. The average utilization rate of tailings is 23.86%. According to the PCI estimate, there are potentials for reduction in the industry's energy consumption by 3% and for an increase in utilization rate of generated waste products by 3% in 2025. Compared to the PCI in developed countries, China PCI's mining efficiency, beneficiation efficiency, waste rock utilization rate and tailings utilization rate are relatively low ((an average lower by about 10%).
(3) The current trend of phosrock production and phosphate fertilizer consumption in China are expected to continue to grow at the same rates in the past 5 years and are expected to peak during the period 2020-2025 where the demand for phosrock is estimated to reach 100 million tons/year. The current average specific energy consumption and CO2 emission in phosphate mining and beneficiation, and phosphate chemicals production will more or less remain the same. All improvements in the processes and operations of the PCI will mainly involve replacement and upkeep of the process equipment, and upgrades are mainly for scaling up production. Nonetheless, it is expected that at best, the energy utilization performance (and corresponding CO2 emission generation) in the major production processes and operations in the PCI will remain the same unless further improvements involving green, energy efficient low carbon technologies are introduced and applied in the various PCI entities in China.
(4) The PCI has not fully endeavored in the processing of the waste generated from its various operations and processes. The utilization of phosrock refining tailings for use in the production of biological phosphate fertilizer instead of chemical phosphate fertilizer, has not yet been done comprehensively. Such scheme can substantially reduce carbon emission in chemical phosphate fertilizer production. The annual output of phosphogypsum in China is about 85 million tons in 2019. The 69 million tons produced in Hubei, Yunnan, Guizhou, and Sichuan accounts for 81.2% of the national total phosphogypsum production. The utilization rate of phosphogypsum is expected to increase to 39.7% This was 20.3% back in 2010. According to the current relevant policies of the Chinese government, the comprehensive utilization rate of phosphogypsum is expected to increase to about 42% in 2025. At present, there is still a big

gap between the utilization rate of phosphogypsum in China compared to that of developed countries (> 55%). One way of using phosphogypsum is as replacement for cement. About 1.0 tons of carbon emissions will be generated per ton of cement gypsum to replace cement, so the carbon emission will be about 1.0 tons per ton of cement gypsum. At present, China has a large amount of phosphogypsum production and accumulation. If the comprehensive utilization rate of phosphogypsum reaches levels achieved in developed countries, this will bring about very large carbon emission reduction benefits.

Relevant policies and measures.

In recent years, the Chinese government has made some efforts for the low-carbon transformation and green development of the PCI chain, and has done the following:

(1) Promotion of energy conservation and emission reduction in phosphate rock mining through the strategy of building "green mine". In 2017, the Ministry of Land and Resources (MLR), the Ministry of Finance (MoF), the then Ministry of Environmental Protection, the General Administration of quality supervision, inspection and Quarantine of the People's Republic of China, China Banking Regulatory Commission and China Securities Regulatory Commission jointly issued the implementation opinions on speeding up the construction of green mines. It requires all newly-built mines to meet the requirements of green mine construction. In 2019, there were 953 mines in China that met the green mine standard, of which 37 were phosphate mines, accounting for about 4%. About 12.3% of all phosphate mines in China passed the green mine selection. In 2019, the Ministry of Natural Resources (MNR) issued the notice of its General Office on updating the catalogue of advanced and applicable technologies for savings and comprehensive utilization of mineral resources. It requires the technical progress recommended by the provincial natural resources department authorities through selection and comprehensive demonstration and screening with the first 6 batches of 334 technologies from 2012 to 2017. There were 360 technologies that were selected, including 19 technologies on phosphate rock development.
(2) The phosphate chemical industry has policy constraints on environmental protection and energy saving. The Ministry of Ecology and Environment (MEE) issued the implementation plan for the special investigation and remediation action of "*three phosphorus*" in the Yangtze River, focusing on the pollution of "*three phosphorus*" on May 2, 2019. The plan specifies the overall requirements and work arrangements for the special investigation and regulation of "*three phosphorus*" projects in the Yangtze River, which can be summarized as three key points and five stages. China Inorganic Salt Industry Association put forward the 13th Five Year Plan development idea of PCI and put forward the target of energy utilization efficiency of the industry. The Ministry of Industry and Information Technology (MIIT) also supports the research and development of key technologies for green and low-carbon development of phosphate chemical industry.
(3) The government has gradually attached importance to the treatment and disposal of phosphogypsum. In 2011, the MIIT issued the "guidance on comprehensive utilization of industrial by-product gypsum", to improve the tax preferential policy of industrial by-product gypsum used in cement retarder production, and guide enterprises to use industrial by-product gypsum as cement retarder. Local governments have gradually attached importance to the comprehensive utilization of phosphogypsum. In 2017, Guizhou Province formulated a special plan for the development of phosphogypsum industry and implemented the "fixed production by use" of phosphogypsum. Governments in Hubei, Sichuan, Yunnan, and other provinces have issued policies to promote green transformation of the PCI in their provinces. The MIIT issued the "industrial green development plan (2016-2020)", which proposed to promote a number of advanced and applicable technology and equipment around phosphogypsum and other industrial solid waste and promote enhanced resource utilization.

Although national and local governments have made efforts to promote the energy conservation and emission reduction of the PCI chain, there are still some fundamental obstacles that are difficult to overcome in the short term, which need the external technical assistance and funds. It is mainly reflected in the obstacles of cooperation between different departments in formulating standard policies, the technical barriers in the process of incorporating green and low-carbon technologies into the existing PCI processes and operations, and the financial obstacles for enterprises to carry out spontaneous low-carbon green transformation initiatives.

Baseline Projects

The following table lists the completed and ongoing projects that promote green and low-carbon development of the phosphate industry chain. Some of the relevant activities of these projects will also be among the baseline activities of the proposed project.

Project	Project outputs that can be used in the proposed project	Implementation period	Source of funds	Executive Agency
Construction of green phosphate mines	Promote some phosphate mines to realize energy saving and emission reduction	2017-2022	Ministry of Land and Resources, Ministry of Finance, Ministry of Environmental Protection, AQSIQ, CBRC and CSRC	Various phosphate mine companies
Wet purification phosphoric acid green manufacturing system integration project	Construction of phosphogypsum modified building gypsum powder and α - type high strength gypsum.	2018-2020	Ministry of Finance Ministry of Industry and Information Technology	Wengfu (Group) Co., Ltd
Green key process system integration project of phosphate fertilizer chemical industry	Developed and applied green key technologies for phosphate fertilizer production Results of the green phosphate fertilizer production demonstration.	2017-2021	Ministry of Finance Ministry of Industry and Information Technology	Guizhou Kailin group mineral fertilizer Co., Ltd

With the current trend of production in the PCI, the still rather relatively low attention to environmental concerns within the industry will lead to higher energy consumption, increasing waste generation and pollution, and GHG emissions. While the national and pertinent local governments in the country has already initiated actions to encourage the industry to adopt and implement green, energy efficient and low carbon technologies, techniques and practice, their widespread applications in the PCI remains much to be desired. Without efforts to bridge the current significant gap in adopting, supporting and effectively implementing low carbon development efforts, the current trend of ever increasing energy consumption in the operations and processes within the industry, waste and pollution generation from these, and the resulting generation of increasing amounts of GHG emissions from the PCI activities will continue. The continuation or persistence of these and faced with increasing level of environmental and product quality specifications in the global market, this trend could negatively affect the economic growth of the industry.

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

Proposed Alternative Scenario

With the forecast growth rate of phosrock production, phosphate chemicals and phosphate fertilizer production, it is expected that additional production capacities will be installed, or the productivity rates will be improved with existing installed capacities. In that regard, the alternative scenario in the PCI features the application of new improved production technologies in the new plants that will be built and in existing facilities that will be retrofitted. These improvements are mainly in line with the achievement of the envisioned alternative scenario, whereby the productivity rates are improved, and at the same time the specific energy consumption in the phosrock mining and refining operations/processes, and phosphate chemicals and the management of PCI waste. The alternative scenario is also characterized by the widescale application of circular economy initiatives that will feature waste recovery, recycling and utilization, which will bring about improved resource conservation, reduced production losses and process wastage, and reduced accumulation of PCI mining and refining waste, as well as the phosphate chemicals production waste by-products. Such scenario will feature lesser energy consumption as the specific energy consumption for the PCI operations and processes will be reduced, with the corresponding reduction in GHG emissions from the PCI, as well as lesser environmental footprint, with the minimization of the generation of solid, liquid, and gaseous wastes from the industry.

In the alternative scenario, through the application of green energy efficient low carbon technologies, some of which are mentioned above, it is expected that the recovery rate in phosrock mining will improve from 72% to 75%. Carbon emissions per ton of phosphate chemical products will be reduced by an average of 0.04 tons by 2025, i.e., from 1.25 tons CO_2 per ton phosphate chemicals to 1.20 tons. Furthermore, the comprehensive utilization rate of PCI waste will

increase to 80% by 2025, which is 30% higher than the utilization on current policy trajectory. Refer also to improvement assumptions used in Annex E.

To enable the realization of the envisioned alternative scenario, the widespread application of several potential green, energy efficient and low carbon technologies in the 3 major sub-sectors of the PCI (phosrock mining and refining; phosphate chemicals production; and waste management) is very essential. This however is not straightforward since there are also enabling conditions that must be in place to facilitate the widespread application of these technologies, and there are also some challenges/barriers in the creation of such enabling environment.

Theory of Change

The extensive application of green, low carbon and energy efficient technologies in the Phosphate Chemicals Industry (PCI) in China will be achieved if two essential changes will happen: (1) the enabling conditions that will facilitate this will be put in place; and, (2) the interest and confidence of the industry in the cost-effective application of such technologies are improved.

In this regard, the removal of the identified barriers that hinder the realization of these important changes in the PCI is necessary. Hence, the overall strategy to facilitate these changes is barrier removal. By implementing strategic barrier removal activities, specific outputs will be delivered, which collectively will bring about these two major changes in the phosphate rock mining and refining, phosphate chemicals production, and phosphate by-products and waste management in the PCI in China. With the facilitation of the achievement of these major changes, there will be extensive application of green, low carbon and energy efficient technologies in this industry. Among the resulting desirable impacts of this is the reduction of the annual growth rate in GHG emissions from the PCI in China. The other desirable impacts are: (1) optimal utilization of phosphate mineral resources and improved recycling and reuse of waste from the PCI; and (2) improved conservation of the surrounding natural environment in phosphate mines and phosphate chemical production companies. Fig. 2 illustrates the theory of change that will be the basis for the design of the proposed project.

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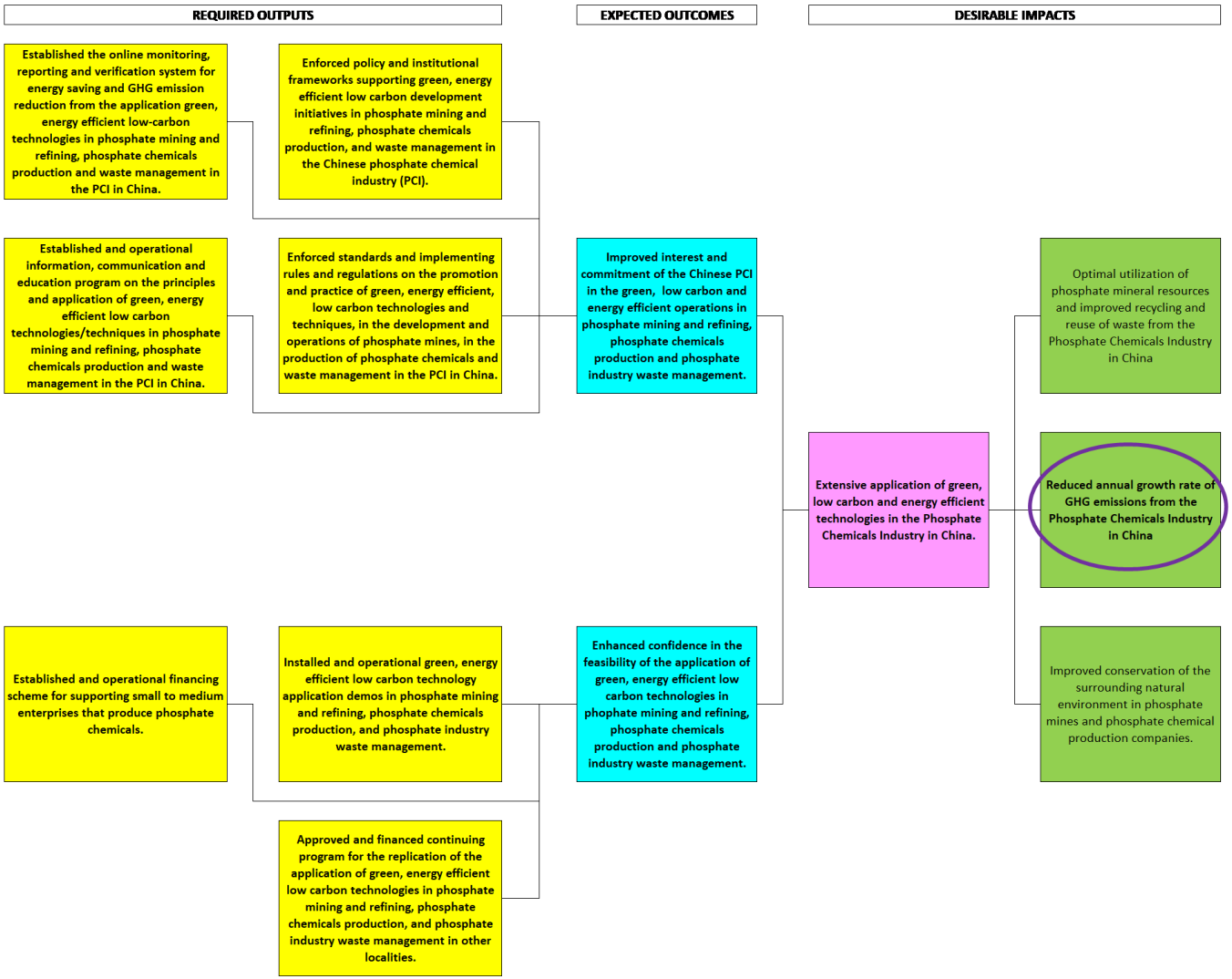


Fig. 2: Project Theory of Change

Based on the theory of change, the envisioned project will develop and promote a green, low-carbon sustainable development model for the PCI in line with China's national circumstances, form a green low-carbon development system for phosrock mining and refining, improve energy efficiency in all sub-sectors of the PCI, and establish a circular economy model for the industry. The project will cover the following:

1. Green and low carbon mining of phosphate rock (phosrock) and recycling of phosrock mining wastes and phosrock refining tailings.
2. Promoting the cost-effective application of energy efficient, green, low-carbon technologies/techniques and measures in the production of phosphate chemicals.
3. Comprehensive utilization of PCI waste, involving the utilization of phosrock mining and refining wastes, and phosphate chemicals production by-products particularly phosphogypsum.

The cost-effective applications of green, energy efficient low carbon technologies in the energy consuming operations and processes of the PCI will be demonstrated under the project. Depending on the current state of the production facilities and operations and processes in each company within the PCI, there are proven applicable technologies that can be applied by each of them to transform their operations to a more sustainable green and low carbon track. Among these are the following, which are also those that are envisioned to be promoted and demonstrated in the proposed project:

- Phosphate mining and refining: (1) Improved phosrock transportation from mine site to refining section by phosrock conveying and phosrock slurry pumping and pipeline transportation; (2) XRT sorting; and (3) Biological phosphate fertilizer from phosrock mining waste and refining tailings.
- Phosphate chemicals production: (1) Process optimization and the improved heat recovery in thermal phosphoric acid production: (2) Medium- pressure steam production using tail gas (CO) from the electric furnace used in yellow phosphorus production; and (3) Improved wet-process phosphoric acid production.
- PCI waste management: (1) Improved phosphogypsum pre-treatment; (2) improved production of α high-strength gypsum; and (3) improved production of β gypsum.

The specific designs of the application of each technology will be done during the project design. Nonetheless, suffice to say that each technology will be designed based on the design practices and experiences from the technology application that will ensure technical and financial viability, reliability, climate resilience, safety, and environmental integrity. Not only the application of green, energy efficient low carbon technologies in the production operations and processes in each of these sub-sectors of the PCI will be promoted and showcased in the project, but also in the design and operation of the utility systems (e.g., production and supply of electricity, process water, compressed air, steam, etc.) will also be included. For example, in the phosphate chemicals production, apart from improved wet process phosphoric acid production processes, improved waste energy recovery system will be promoted and demonstrated in the case of thermal phosphoric acid production process that is used in the production of yellow phosphorus. Such process produces CO waste gas that can be used as energy source in the other thermal energy operations/processes in the plant. In companies where the sulfuric acid that is used in the phosphoric acid production, increased heat recovery from the sulfur dioxide coolers with the generation of steam for electricity production will also be promoted. Existing utility systems that utilize fossil fuels (e.g., coal) will be improved in their energy performance to reduce greenhouse gas emissions. The application of proven cleaner production processes, where these are feasible in selected PCI operations and processes, will also be demonstrated. Lastly, apart from the improved efficiency in energy consuming operations/processes in phosphate chemical production, comprehensive management, and utilization of waste by-products, particularly phosphogypsum (wet process phosphoric acid production), and high temperature phosphorus slag waste (thermal phosphoric acid production) will be promoted.

Components of the Proposed Project

The objective of the proposed project is the facilitation of the extensive application of low carbon and energy efficient technologies in the phosphate chemicals industry in China. The strategy to achieve this objective is to remove the barriers that hinder the promotion and deployment of these technologies, including applicable energy efficient techniques, measures and practices in cleaner production in the 3 sub-sectors of the phosphate chemicals industry, namely: (1) Phosrock mining and refining; (2) Phosphate chemicals production; and, (3) By-products and waste processing. In this regard, there will be 3 project components, one for each sub-sector. Each project component is comprised of activities addressing the various barriers (i.e., policy/regulatory,

institutional, technical, financial, information and awareness). The achievement of the project objective will contribute to the achievement of China's climate change mitigation targets and the achievement of the United Nations 2030 Sustainable Development Goals (SDGs), specifically SDG 3 "Good health and well-being"; SDG – 7 "Sustainable Energy"; SDG 9 "Industry, Innovation and Infrastructure"; and, SDG 13 "Climate Action".

Component 1: Green and Low-carbon Development and Operation of Phosphate Mines

This project component is intended for the removal of barriers to the application of green, energy efficient low carbon technologies/techniques and practices in the mining and refining of phosphate rock (phosrock) for use in the production of phosphate chemicals. The delivery of the envisioned outputs from this project component will bring about two main outcomes: (1) Improved interest and commitment of the phosphate chemical industry in the green, low carbon and energy efficient operations of the phosphate mining sub-sector in China; and, (2) Enhanced confidence in the feasibility of the application of green, energy efficient low carbon technologies in phosrock mining and refining in China.

To bring about the first outcome, the following indicative activities will be implemented: (1) Formulation and advocacy work for the approval and enforcement of policy and institutional frameworks supporting green, energy efficient low carbon development initiatives in phosphate rock (phosrock) mining and refining; (2) Formulation and enforcement of standards, policies and implementing rules and regulations on the promotion and practice of green, energy efficient, low carbon technologies/techniques, in the development and operations of phosphate mines; (3) Documentation and annual evaluation of the energy performance and environmental impacts of each demo project; (4) Design, conduct and post-evaluation of a capacity development program on the principles and application of green, energy efficient low carbon technologies/techniques in phosphate mining and refining; (5) Preparation, publication for dissemination of technical guides and reference documents for the application of energy conserving and energy efficient practices in the phosphate mining sub-sector; (6) Establishment of an online monitoring, reporting and verification system for energy-saving and GHG emission reduction from the application green, energy efficient low-carbon technologies in the PCI; and, (7) Publication and dissemination of publicity information about China's green, energy efficient and low-carbon phosrock mining and refining.

The second outcome will be realized with the delivery of the required outputs from the implementation of these indicative activities: (1) Design, engineering, financing and implementation planning of demonstrations of green, energy efficient and low carbon technologies in phosphate mines development and operations; (2) Installation of the designed/engineered and operational green, energy efficient low carbon technology application demos in phosrock mining and refining; (b) Operation, monitoring and evaluation of the demo facilities; and, (3) Preparation and approval for financing of a follow-up plan for the replication of the application of demonstrated green, energy efficient low carbon technologies in phosrock mining and refining in other localities.

Component 2: Green and Low-Carbon Design and Operation of Phosphate Chemicals Production Facilities

This component of the project will address the barriers to the application of green, energy efficient low carbon technologies/techniques and practices in phosphate chemicals production. This is comprised of activities that will deliver outputs that will collectively bring about two main outcomes: (1) Enhanced interest and commitment of the phosphate chemical industry in the green, low carbon and energy efficient production of phosphate chemicals in China; and, (2) Enhanced confidence in the feasibility of the application of green, energy efficient low carbon technologies in phosphate chemicals production in China.

To bring about the first outcome, the following indicative activities will be carried out: (1) Formulation, recommendation and enforcement of policy and institutional frameworks supporting green, energy efficient low carbon technology applications in phosphate chemicals production; (2) Development and enforcement of standards, policies and implementing rules and regulations on the promotion and practice of green, energy efficient, low carbon technologies/techniques, in phosphate chemicals production; (3) Preparation of annual evaluation reports on the energy performance and environmental impacts of each demo including demo results based on the MRV system established under Component 1; (4) Design, conduct and post-evaluation of capacity development program on the principles and application of green, energy efficient low carbon technologies/techniques in phosphate chemicals production; (5) Publication and dissemination of technical guides and reference documents for the application of energy conserving and energy efficient practices in the phosphate chemicals production sub-sector; and (6) Conduct of a market analysis of the international trade trends for phosrock and phosphate chemicals, and the indirect carbon emission and ecological impacts in the international trading of these products.

The following are the indicative activities to be implemented to deliver the outputs that will collectively bring about the second outcome: (1) Design and promotion for approval of pilot financing scheme for small and medium enterprises (SMEs) that manufacture phosphate chemicals; (2) Design, engineering, financing and planning of demonstrations of green, energy efficient low carbon technologies in phosphate chemicals production[1]; (3) Installation of the

systems/facilities for the demonstration of the application of green, energy efficient low carbon technologies and techniques in phosphate chemicals production; (4) Operation of the installed demos in demo phosphate chemicals manufacturing companies; (5) Operation of the pilot financing scheme for phosphate chemicals SMEs for the implementation of green, energy efficient low carbon technologies in their production operations; and, (6) Preparation and approval of financed follow-up plan for the replication of the application of demonstrated green, energy efficient low carbon technologies in phosphate chemicals production in other localities.

Component 3: Green and Low Carbon Design and Operation of Waste Management Systems in the Phosphate Chemicals Industry

This component of the project will address the barriers to the application of green, energy efficient low carbon technologies/techniques and practices in waste management systems in the phosphate chemicals industry. This focuses on the green and low carbon management of solid wastes generated in phosrock mining and refining and in phosphate chemicals production. It is comprised of activities that will deliver outputs that will collectively bring about two main outcomes: (1) Enhanced commitment of the phosphate chemical industry in green and low carbon waste management; (2) Increased confidence in the feasibility of the application of green and low carbon technologies in the management of waste in the phosphate chemicals industry in China.

To bring about the first outcome, the following indicative activities will be implemented: (1) Conduct of research on circular economy schemes application in the phosphate industry in China and in other countries; (2) Formulation and recommendation of schemes, standards, policies/regulations on the application of green and low carbon waste management technologies in the phosphate chemicals industry in China; (3) Monitoring, reporting and evaluation of the energy performance and environmental impacts of each demo based on the MRV system developed under Component 1; (4) Design, conduct and post-evaluation of capacity development program on the principles and application of green and low carbon waste management technologies/techniques in the phosphate chemicals industry; (5) Publication and dissemination of: (a) technical guides and reference documents for the application of green and low carbon technologies/techniques in waste management in the phosphate chemicals industry; and (b) publicity information about China's green and low-carbon waste management in the phosphate chemicals industry.

The indicative activities that will deliver the outputs that will collectively bring about the second outcome are the following: (1) Designing, engineering, financing and planning of demonstrations of the application of green and low carbon technologies/techniques in waste management in the phosphate chemicals industry, specifically on phosrock mining tailings recycling and reuse; and, (b) energy efficient processing of phosphogypsum and marketing of the gypsum products; (2) Installation of the demo facilities for showcasing cost-effective green and low carbon waste management technology application in the phosphate chemicals industry; (3) Commercial operation and maintenance of the installed demo facilities in the partner phosphate chemical industry companies; and, (4) Preparation and approval of financed follow-up plan for the replication of the application of demonstrated green, low carbon waste management technologies in the phosphate chemicals industry in other localities.

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

This project is in line with GEF-7 climate change mitigation objective of promoting innovation and technology transfer. This project is in line with the specific entry points under CCM-1.3: Acceleration of promoting energy efficiency. Presently, China attaches great importance to promoting the energy conservation and green development in its major industry sectors such as the PCI (inclusive of phosrock mining, phosphate chemical production, and by-products processing). The country has existing policies and programs on industrial energy conservation and on green, and low carbon development that can support the achievement of a more energy efficient and environment-friendly PCI. However, despite these bringing positive progress in the industry, there is still significant room for improvement in the understanding and application of green, energy efficient low-carbon technologies in this major energy consuming industry in China. The facilitation of the widescale application of these technologies is the objective of the project, and this will be done through the removal of identified barriers/problems through various technical assistance and investment-type barrier removal activities.

Additionally, the implementation of this project will mobilize more rural women in the project areas and enable women to play significant roles in the implementation of this 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 gender 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 projects in improving the PCI. These baseline projects are meant to improve the operational efficiency of the PCI through the application of green, energy efficient low carbon technologies in the 3 sub-sectors of the PCI (phosrock mining and refining, phosphate chemicals production, and by-product processing). While the idea of cost savings, environmental protection and operational efficiency improvement are among the driving force for the MNR and MIIT to improve the energy and environmental performance of the PCI, due to lack of knowledge of green, energy efficient and low carbon technologies/techniques, and practice, their current efforts are still largely based on the traditional industrial production model which does not take an integrated approach toward minimizing energy and environmental impacts at every stage of the PCI value chain. With these, the full potential for energy savings, operational cost savings, and GHG emission reductions in the PCI will not be realized.

For the effective showcasing and promotion of the application of the green, energy efficient low carbon technologies in the PCI, enhancements of the current efforts regarding this will be carried out through the removal of barriers associated with the lack of capacity and knowledge about the application, design, financing and operation of the various energy consuming processes and operations in the 3 sub-sectors of the PCI.

Based on the current projects (i.e., to be implemented, and/or planned and budgeted) of the identified partner PCI companies for their respective production operations and processes, further improvements on the planning, design and application of green, low carbon technologies were preliminarily identified. These projects will be subsumed into the proposed project as baseline demos that will be enhanced/improved (or modified) to bring about more energy saving s and GHG emission reductions. Among these technologies are those presented in the response to the previous comment regarding the alternative scenario that this proposed project intends to bring about. The cost for such improvements are practically the incremental costs that the proposed project requires the GEF to financially support. The improvements in the baseline activities will depend on their type and original design. In the case of the demonstrations, these improvements will basically involve making the applied strategy/methodology or technology application: (1) more energy conserving and energy efficient, e.g., improved waste heat recovery, utilization of more energy efficient equipment/process; (2) more economically feasible, e.g., provision of financial support/incentives; (3) more environment-friendly, e.g., application of cleaner production techniques; (4) more resource conserving, e.g., application of improved phosphogypsum processing; and, (5) addressing the absent or insufficient enabling conditions (e.g., policies, regulations, standards, capacity and skills upgrading). Without these incremental features, the envisioned alternative scenario for the development of the PCI in China that the proposed project intends to bring about will not be realized. The detailed incremental cost analysis will be carried out during the design and development (PPG) stage of the proposed project.

Incremental support activities are necessary to facilitate the demonstrations of the application of the energy-saving and environment conserving aspects of the operations and processes in these sub-sectors of the industry. GEF support is necessary to encourage the major stakeholders in the PCI (national and local government authorities, phosphate mining and phosphate chemical manufacturing companies) to support the facilitative interventions of the project (e.g., demonstration of the installation and operation of improved, green, energy efficient PCI infrastructures; and facilitate the cost effective utilization of such infrastructures and the enabling of the various support policy and regulatory frameworks. Otherwise, without such incremental enabling activities the achievement of the desired alternative scenario for China's PCI will not be realized. The incremental activities to remove barriers through the establishment and enforcement of supportive policy and regulatory frameworks that are supportive (through effective institutional arrangements, financial/fiscal incentives, information sharing, etc.) will be necessary to sustain the application of green, energy efficient and low carbon development of the PCI as well as the substantial sustainable development benefits that result from them.

Without GEF support for funding the incremental cost for removing the barriers that this proposed project will address, the expected potential additional global environmental benefits (in terms of avoided CO2 emissions linked from the fossil fuels that will be saved) would not be realized. Without this proposed project, China would have limited success in promoting energy efficient and environment friendly techniques and practices in an energy-intensive industry like the PCI, and consequently the potential contribution to achieving the country's GHG emissions reduction targets will not be fully realized. With the GEF support for the incremental cost needed to create the much needed enabling conditions to remove the barriers that will in turn facilitate the widespread application of green, energy efficient and low carbon technologies/techniques, and ultimately realize the expected global environmental benefits of reducing GHG emissions (from energy savings derived from the energy efficient phosrock mining and refining; phosphate chemicals production, and by-product processing in the country's PCI.

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

The GHG emission reductions that will be derived from the interventions that will be carried out under the proposed project are direct and indirect. The direct emission reductions will come from improvements that will facilitated by the proposed project in phosphate rock mining is expected to reduce the current specific energy consumption in phosrock mining by 15%, and that for phosrock beneficiation/refining by 15%. The improvement of the mining efficiency (including improving mine recovery rate, mining dilution rate, and beneficiation recovery rate) is also expected to achieve an energy consumption reduction of about 0.987 kgce per ton of refined phosrock. In phosphate chemicals production, the EE and cleaner production technologies/techniques applications that the proposed project will facilitate will bring about a reduction of about 5% of process energy consumption. The direct energy savings that will be derived from these process and operational improvements will bring about direct GHG emission reductions. The project activities on low-carbon waste management systems will be carried out in: (1) phosphate chemicals production; (2) phosrock mining and refining. The first one is on the utilization of the by-product phosphogypsum in cement production, which will result indirectly in the reduction of energy consumption in cement clinker production. The second one is on the utilization of phosrock mine tailings for the production of natural/biological phosphate fertilizer as replacement for the use of phosphate fertilizer. The resulting indirect energy savings will be from the reduced production of chemical phosphate fertilizers. Both of these indirect energy savings will have corresponding consequential GHG emission reduction. Another potential source of indirect GHG emission reduction is from the ecological restoration of depleted phosphate mines that can be facilitated by the project. Such afforestation activity will bring about carbon sequestration.

Collectively, all of the above can result in an estimated total GHG emission reduction by end-of-project that is attributable to the project of about 36.97 million metric tons of CO2. Please refer to Annex D. It should be noted that as the project application and approval process progresses, the MNR and MIIT will organize experts to conduct further detailed analysis and calculation of the direct and indirect energy savings and GHG emission reductions that can result from, and influenced by, the successful implementation of the proposed project.

In addition, there are other national benefits in terms of the reduced pollution of the water bodies that are near the PCI enterprises, reduction of the regional pollutant concentration in rural areas of Yunnan, Guizhou, Sichuan, and Hubei, promote the sustainable improvement of ecological environment in rural areas, and protect the livelihood of rural areas in these provinces.

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

Innovativeness: This project will promote and facilitate the greening and low carbon transformation of China's PCI through innovative (in the context of China) interventions that will address the current issues of the industry such as low quality products produced, high resource (process material and energy) consumption and environment damaging operations and processes. Innovative production management approaches that are green, energy efficient, resource and environment-conserving will be introduced not only to respond to the needs to be productive, cost-effective, but also responsive to climate change issues. These innovative technology applications in the PCI are estimated to bring about improvements in the specific energy consumption (SEC) in the various sub-sectors of the PCI. For example, about 15% and 10% reduction in the specific energy consumption in the phosrock mining, and phosrock refining/beneficiation, respectively. The proper application of these technologies will also reduce the overall SEC in phosrock mining and refining operations (e.g., improved mine recovery rate, mining dilution rate, and beneficiation recovery rate) to 0.987 kgce per ton phosrock. As shown in Annex E, for a demo capacity of 10 million tons/year phosrock, the total energy savings would be = 20,710 tce/year, and the corresponding total GHG emission reduction is 54,260 tCO2/year. With the same strategy, green, energy efficient low carbon technology applications in phosphate chemicals production will result in a reduction in the overall SEC by 5%. At a demo capacity of 18.2 million tons/year, this translates to a total energy savings of $1.34x10^{10}$ MJ/year and a corresponding GHG emission reduction of about 1.2 million tCO2/year. Please refer to Annex E for the potential energy savings and corresponding GHG emission reductions in the implementation of innovative circular economy technology applications in the management and utilization of the mining and refining wastes, and phosphate chemicals production by-product wastes from the PCI. Another innovative feature is the employment of comprehensive assessment methods of energy savings and emissions reduction, improved carbon accounting system of the industry, analysis of the synergies between emission reduction efforts of the PCI and other industries, and formulation and enforcement of the standards for energy conservation and low-carbon development of the industry.

Sustainability: The potential for a wider adoption of green, energy efficient low carbon technologies and techniques in the PCI is quite high, considering the support that the GOC is providing to the industry. The activities that will be carried out under this proposed project are barrier removal in nature. 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. Such action plan will be implemented after the project as per the institutional arrangements that will be developed for such purpose. Close coordination with the China Inorganic Salt Industry Association that is also fully committed to

improving the PCI's energy utilization efficiency can also help sustain efforts of the phosphate chemicals SMEs to replicate the green, energy efficient low carbon energy technologies that are showcased and promoted by the project. Estimates based on the number of companies in the PCI, it is estimated that the replication of the demos that will be implemented under the proposed project is in the order of 3 to 4 per demo.

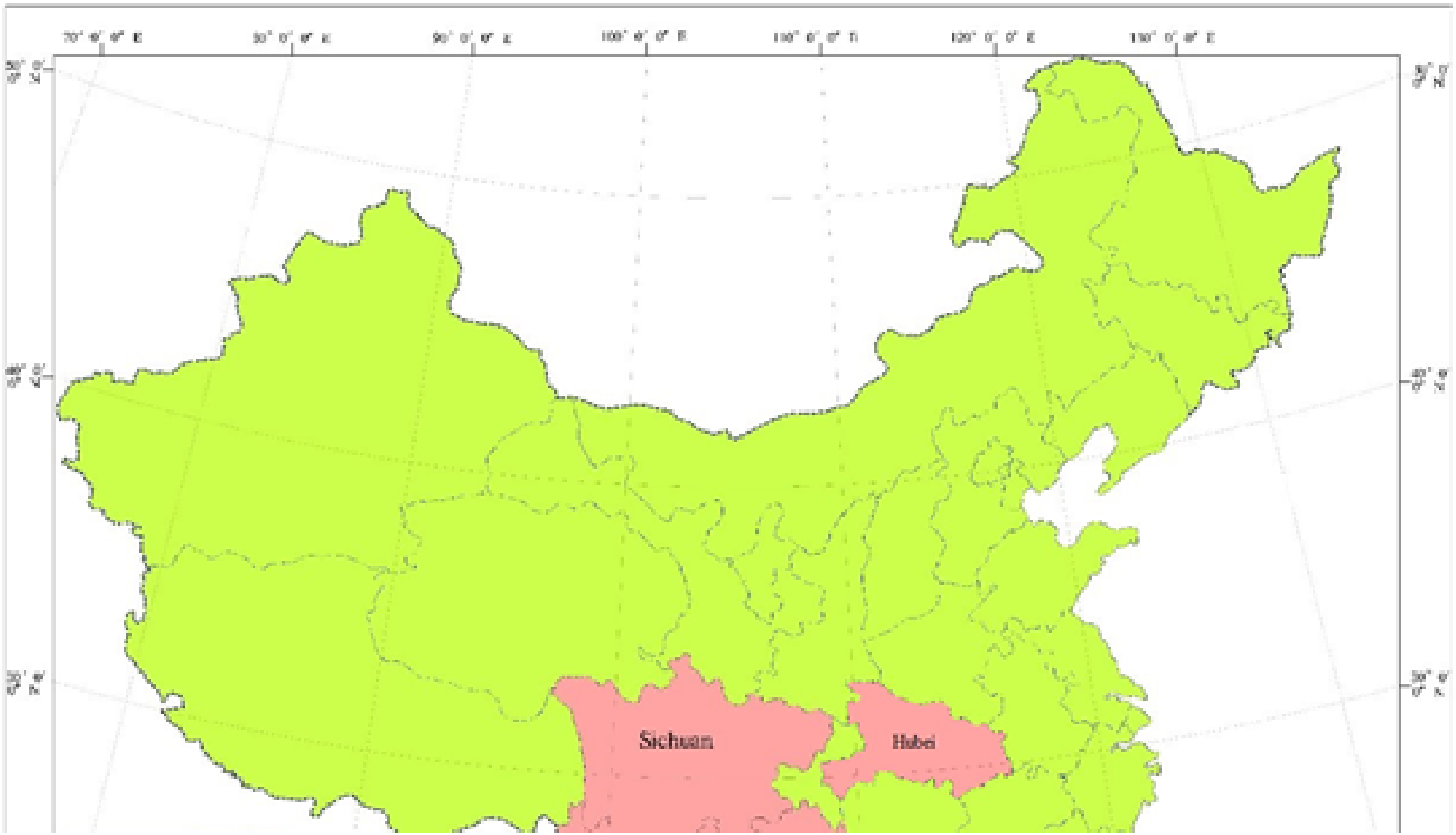
Scale-up Potential: The removal of barriers and the effective and seamless implementation of the procedures and regulatory and policy and institutional frameworks, as well as the financing schemes that will be established will influence the scaling-up of the project, e.g., to carry out the same interventions in other provinces with phosphate rock deposits. The proposed project will lay a solid basis for scaling up with the successful demonstration of the applicable green, energy efficient and low carbon technologies/techniques, as well as the financing models that will support such applications by the phosphate chemicals SMEs. These, aside from the barrier removal activities, provide the possibility for scaling-up the application of these models/schemes in the other provinces, as well as in other countries. The scale-up will also be made possible through the project's information sharing, technical assistance, and promotional activities. In the case of the EE and environmental footprint improvements in the phosrock mining and refining operations of the PCI and considering the number and production capacities of the big phosrock mining companies, the planned demo capacity in this proposed project can potentially be scaled up 5 times. In that case, the PCI in China can potentially be among the significant contributors to the achievement of the country's NDC targets.

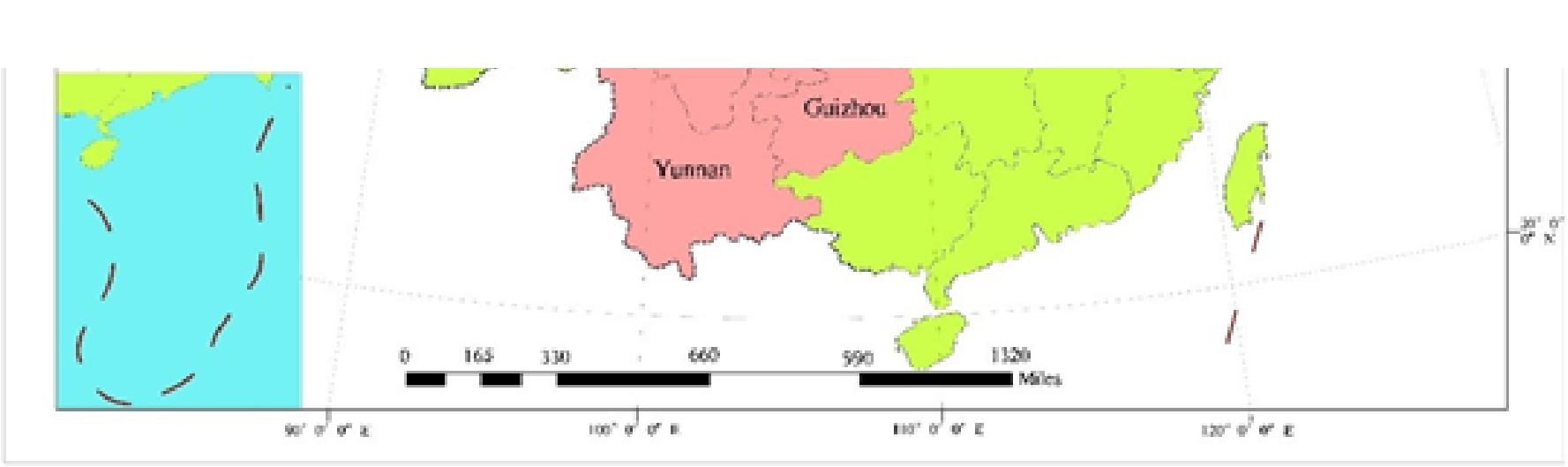
1b. Project Map and Coordinates

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

Geographical Coordinates of the Demonstration Provinces:

Sichuan: 97° 21' - 108° 12' E, 26° 03' - 34° 19' N
Yunnan: 97° 31' - 106° 11' E, 21° 8' - 29° 15' N
Guizhou: 103° 36' - 109 ° 35' E, 24° 37' - 29° 13' N
Hubei: 108° 21' - 116° 07' E, 29 01' - 33° 6' N




Guizhou
Yunnan
0
165
330
660
990
1320
Miles

2. Stakeholders

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

Indigenous Peoples and Local Communities Yes

Civil Society Organizations Yes

Private Sector Entities Yes

If none of the above,please explain why:

Indigenous Peoples and Local Communities[1];

[1] There are some minorities living in the mining areas, and some are living near the planned demo sites. According to the project proponents (MIIT and MNR), the local governments that cover the planned project sites have contacted the local people in each of these areas, including people that belong to minority groups. The planned project has been promoted to these people as something that will bring substantial benefits to the citizenry inasmuch as the project will significantly contribute to the sustainable development of the local economy and improve/conserve the national environment. The expressed interest and support of the local residents are among the motivations to the project proponents to proceed with the development of the proposed project.

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	Respective Roles in Project Preparation	
	Responsibilities	Project Outputs to Work on
UNDP	As the implementing agency of GEF, it is responsible for project design, coordination, implementation, monitoring and management.	Coordination of design of activities for each outputs.
Ministry of Finance	As the communication authority with GEF in China, the Ministry of finance provides high-level strategic guidance and participates in project proposal endorsement	
Ministry of Industry and Information Technology	Its core responsibility is to undertake the management of the PCI, formulate and organize the implementation in energy conservation, greenhouse gas emission reduction, comprehensive resources utilization and clean production promotion policy and organize and coordinate the promotion and application of major green and low-carbon demonstration projects and new products, new technologies, new equipment and new materials. It is responsible for providing guidance for the design of low-carbon phosphorus chemical projects, working with the team to solve the main problems of the PCI identified in the framework of this project, supporting the construction of national and provincial policy and institutional framework, participating in the whole project baseline activities and providing corresponding supporting funds, and responsible for the effective cooperation with UNDP, the Ministry of Finance and relevant departments in the energy conservation and emission reduction activities of PCI Coordination and communication.	Advice for all Component 2 T.A. Outputs (2.1.1 to 2.1.7) Output 2.2.5 Advice for pertinent Component 3 T.A. Outputs (3.1.1 to 3.1.7) Output 3.2.3
	Its core responsibility is the management of low-carbon and efficient ut	Advice for all Co

Ministry of Natural Resources	its core responsibility is the management of low-carbon and efficient utilization of phosphorus resources production areas. The leading department of this project is the International Cooperation Department of the Ministry of Natural Resources. Responsible for providing guidance for the design of low-carbon phosphorus mine projects and, working with the project team to solve the main problems identified in the framework of this project, supporting the construction of national and provincial policy and institutional framework; clarifying its responsibilities, participating in the whole project baseline activities and providing corresponding supporting funds; and responsible for the effective coordination with UNDP, the Ministry of Finance and relevant departments in the phosphorus mine energy conservation and emission reduction activities and communication.	Advice for all Component 1 T.A. Outputs (1.1.1 to 1.1.8) Output 1.2.3 Advice for pertinent Component 3 T.A. Outputs (3.1.1 to 3.1.7) Output 3.2.3
National Development and Reform Commission	In the preparation phase of this project, the NDRC participates in and guides the planning of this project to ensure that the output of the project can guide and encourage the participants of phosphorus resources development activities to promote the comprehensive utilization of phosphorus resources, and also put forward suggestions for the planning and policy measures of resource conservation and comprehensive utilization in China.	Advice for the following Outputs: 1.1.1, 1.1.2, 1.1.6, 1.1.7; 2.1.1, 2.1.2, 2.1.6; 3.1.1, 3.1.2, 3.1.6.
Ministry of Ecology and Environment	Participate in and guide the planning of this project during the preparation period to ensure that the project's mechanism can provide intellectual support for China's participation in international climate change negotiations and the implementation of the United Nations Framework Convention on Climate Change.	Advice for the following Outputs: Same as for NDRC, plus 1.2.1, 2.2.2, 3.2.1
Local governments, including Sichuan, Yunnan, Guizhou, Hubei etc.	The Provincial Department of natural resources (development and reform, industry and information technology, environment). Municipal and county-level governments directly participate in project design and baseline survey, provide technical support, guidance, and logistics support. During project implementation, provincial natural resources departments are responsible for supervising municipal and county-level work, including technical support, monitoring, supporting, coordination with partners, and capacity-building.	Advice/Support for the following Outputs: 1.1.3 to 1.1.6; 2.1.3 to 2.1.6; 3.1.3 to 3.1.6.
Relevant scientific research institutions[1]	Provide suggestions and participate in project design, effectively incorporate, reflect and utilize national scientific knowledge to carry out research on energy saving and green low-carbon technology and low-carbon and high-efficiency comprehensive utilization technology of phosphorus resources in PCI; relevant national and provincial scientific research institutions should clarify the current baseline knowledge, regarding to the implementation of the project and the coordination of the whole project with the national and provincial research projects.	Design and advice of selected TA activities: Outputs 1.1.2, 1.1.3, 1.1.6, 1.1.7, 1.2.1; 2.1.2, 2.1.3, 2.1.7, 2,2.1, 2.2.2; 3.1.1, 3.1.3, 3.1.6; 3.2.1
Enterprises and private sector organizations [2]	Low carbon and efficient comprehensive utilization of phosphorus resources, clean production of PCI and low-carbon reuse of phosphogypsum involve technology R&D, production, and service enterprises. The participation of enterprises and the private sector in project design can ensure that this project is based on clear understanding of the marketization of by-products of comprehensive utilization of phosphorus resources. The design team should cooperate with the private sector to clarify the current by-products of comprehensive utilization market and supply-demand relationship, so as to further promote the establishment of rele	Design and financing of Investment Activities in all Components: Outputs 1.2.1 and 1.2.2; 2.2.1 to 2.2.4; 3.2.1 and 3.2.2. These will also be involved in the im

	demand relationship, so as to further promote the establishment of relevant models; project consulting design should explore ways to involve private organizations in this project, evaluate the supporting potential, and support the promotion and sustainability of project achievements by the private sector.	involved in the implementation of the project demos.
Non-governmental organizations[3]	Non-governmental organizations at national, provincial and local levels should also participate in the process of project consultation to ensure the utilization of this project and effective coordination with the activities and projects of non-governmental organizations; project design should also clarify the supporting facilities provided by non-governmental organizations, including community organizations, and clarify the ways of project achievements promotion and sustainability that local organizations participate in	Design and advice of selected TA activities, e.g., 1.1.6, 1.1.8; 2.1.6, 2.1.7; 3.1.6, 3.1.7.

Some of the above stated stakeholder groups will also be involved in the implementation of the outputs that they assisted in the design. For example, relevant scientific research institutions will be involved in the delivery of outputs involving research related activities, and enterprises and private sector organizations will be involved in the implementation of the demonstrations that they have assisted and supported in the design.

The future engagement of the stakeholders is more or less ensured inasmuch as almost all of them will be involved in the project implementation, particularly the project proponents (MIIT and MNR) and the private sector entities (i.e., PCI companies). In particular, the PCI companies will be involved in the project implementation since the main target beneficiary is the local PCI in the provinces that will be involved in this project. This would naturally ensure constant engagement with them from design, implementation, and completion of the project. To formalize this, a Stakeholders Engagement Plan (SEP) will be prepared during project design and development (PPG) stage. A stakeholder analysis will be carried out to identify further all the relevant stakeholders of the project that will be engaged as partners to deliver specific outputs of the project and collectively with their outputs bring about the project outcomes. The main output of the analysis is the SEP. In such plan, the roles and responsibilities of the pertinent stakeholders are identified, including their perception of likely benefits, risks and impacts of the proposed project. This is also to assess how to mitigate risks on stakeholders as a result of the implementation of the project.

It is the clear understanding of the UNDP that it being the GEF Agency for this project is mainly responsible for the project development and approval/endorsement. Later, in regards project implementation, it is clear to the project proponents that UNDP's role is limited to project oversight, seeing to it that actions carried out by the project's designated implementing partner and other responsible parties in regards their management and execution of the project are as per the signed project document, aligned to the country program, and do not contravene the principles of the financial regulations and rules of UNDP and GEF. To emphasize, UNDP has no role in the execution of any project activity nor any project management task. Its role is limited to overseeing the project implementation on behalf of the GEF.

[1] Includes Chinese Academy of Social Sciences, Institute of Mineral Resources Multi-Utilization of China Geological Survey, Sichuan University, Kunming University of science and technology, Guizhou Academy of Sciences and Wuhan University of Engineering, etc.
[2] Includes Yunnan Phosphate Group, Guizhou Wengfu Group, Sichuan Huarui Mining Co., Ltd., Sichuan Ruifeng Mining Co., Ltd., China blue Changhua Engineering Co., Ltd., Wengfu (Group) Co., Ltd., Guizhou Kailin group mineral fertilizer Co., Ltd.
[3] Includes The Chemical Industry and Engineering Society of China, China Petroleum and Chemical Industry Federation, China chemical energy conservation technology association, China Phosphate and Compound Fertilizer Industry Association, local mining associations.

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).

The project will be designed and implemented guided by principles of gender equality and women's empowerment. Women are involved in both the management and technical departments of the national and local government agencies/institutions and play major roles in the top-level decision-making and strategic design process. On the ground level, the implementation of the proposed project will promote the welfare of, and offer equal opportunities to, both men and women, but particularly women in the areas where the project will be implemented. Firstly, implementation of this project will improve the technical level and reduce the intensity of labor in the PCI, which will in turn improve the work environment, job adaptability and enhanced chances of job advancement for women who are in some form or another involved in the PCI. Education and professional training opportunities that the proposed project will provide to PCI employees will contribute to improving women's professional competitiveness in the workplace and expand women's scope of employment in the underdeveloped and agriculture-based regions of the country, some of which include the planned demo sites of the proposed project. Secondly, the implementation of this project will directly improve the quality of local ecological environment and indirectly improve women's and children's health. Thirdly, the implementation of this project will help ensure agriculture and food security through the reduction of rural pollution, and thus reduce the risk in women's major source of income in these regions.

In general, the socioeconomic condition of the project's demo sites is underdeveloped, and the ecological environment is very fragile. The implementation of this project will effectively improve the ecological environment quality and directly improve the health conditions of women and children. Furthermore, the implementation of this project helps to guarantee agriculture and food security, reduce rural pollution and the threat of crop failure, reduce women's risk of income loss. It is estimated that about 600,000 women and girls, and 600,000 to 1 million men would get benefits from the project through the implementation of the above measures.

During the project design and development (PPG) stage an assessment will be carried out to determine how the project will facilitate gender equity in the PCI with the implementation of green, energy efficient low carbon technologies in all aspects of the day-to-day operations and processes in the industry. Considering the limited information regarding the current gender equity context in China's PCI that are currently available to the project proponents, the following indicative gender actions are recommended to reduce some of the existing inequalities and comply with national and international gender regulations and best practices. Details of these indicative recommended actions, as well as others that will be identified later, will be determined during the project design and development stage.

· Ensure that the project will be guided by principles of gender equality and women's empowerment. Women are involved in both the management and technical departments of the China's government agencies/institutions and play major roles in the top-level decision-making and strategic design process.
· Ensure the proposed policies, regulations, standards on the application of green, energy efficient, low carbon technologies in the PCI are gender responsive;
· Complete the gender action plan and ensure that it is implemented thoroughly;
· Ensure gender equity is included as a criterion for providing/distribution of goods and services to communities in the project sites;
· Strengthen existing governance structures that promote gender equality and leadership in local governance structures in the PCI to support project implementation;
· Encourage information exchange and learning for men, women, and youths in the communities where the phosrock mines and phosphate refining and phosphate chemicals production facilities are situated to promote green, energy efficient and low carbon practices to other communities;
· Gender disaggregated data is collected during trainings, workshops, discussions, interviews, or focus group interaction;
· Consult both men and women during baseline data assessments, mid-term evaluations and terminal evaluations in the project sites;
· Ensure both men and women access information sharing sessions e.g. individuals with child-caring responsibilities or individuals with work obligations or disability;
· Support the development and promotion of service provision jobs in the relevant downstream activities of the PCI

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?

Please briefly explain the rationale behind your answer.

In China, most of the participants in the whole phosphorus industry chain are small and medium-sized enterprises, so in the whole process of project implementation, enterprises are the providers of technology, products, and services. Therefore, the private sector will participate in the construction of project demonstration sites in an all-round way and lay out a foundation for promoting this work in the country and even other countries in the future. The participation of the private sector in this project is mainly based on the following aspects:

First of all, private sector participation in energy conservation and green production is a more cost-effective way. Under the policy incentives, the private sector will explore the most cost-effective technologies for low-carbon mining of phosphate rock, energy-saving of phosphorus chemical industry and low-carbon recovery of phosphogypsum. Considering that the innovation power of traditional large-scale chemical state-owned enterprises under the economic incentive of energy-saving and green is lower than that of small and medium-sized enterprises, in this field, the private sector is often the pioneer of energy-saving and green technology innovation, and leads the development of the industry to achieve technological innovation. In addition, after the subsidy of phosphogypsum pretreatment technology, there are greater benefits and potential market returns in the field of phosphogypsum replacing cement, which enables the private sector to engage in phosphogypsum comprehensive utilization industry. Therefore, the private sector will use the most cost-effective way to achieve low-carbon emission reduction of phosphate rock, energy-saving and green production of phosphorus chemical industry, and comprehensive utilization of phosphogypsum under the economic subsidy provided by project funds and the information and technology exchange provided by the project’s organizer.

Secondly, the characteristics of the phosphorus chemical industry make it possible for China's private sector to participate in and dominate the industry. The phosphate rock production and phosphorus chemical industry mainly constitutes of small and medium-sized enterprises, which are limited to knowledge and fixed cost and use relatively backward production technology. The phosphorus chemical industry has many production links and chemical products, small and medium-sized enterprises who have wide business scope and appropriate scale become the backbone of the phosphorus chemical industry If policy incentives are provided for energy-saving, green production and comprehensive utilization of phosphogypsum, small and medium-sized enterprises will be encouraged to participate in market competition, which will help to ensure the establishment of phosphogypsum comprehensive utilization market and achieve market equilibrium.

Thirdly, the private sector has more competitive advantages and development potential in the field of energy conservation and green production of phosphate rock and phosphorus chemical industry and comprehensive utilization of phosphogypsum. The private sector's energy-saving and green production technology reform can bring economic income. Its technological innovation can also radiate to other enterprises in the industry, forming an industrial cluster of energy-saving and green production, which will have a positive impact on the technical reform of the whole industry. Through economic incentives, enterprises will explore energy-saving and green production technology and comprehensive utilization mechanism of phosphogypsum, which can stimulate the creativity of the private sector and lay a solid foundation for the vitality and sustainable development of the industry.

This project will select phosphorus industry chain enterprises in Yunnan, Guizhou, Sichuan, and Hubei regions to launch pilot projects, provide policy incentives and communication platform, and ensure the full participation of enterprises.

5. Risks to Achieving Project Objectives

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)

Potential Risks	Risk Level	Measures to Address Risks
The project management office (PMO) cannot effectively organize and coordinate the participation of stakeholders (including relevant departments of local government, specific project implementation units, experts in various fields, etc.).	Medium	Preventive: The MIIT and MNR have adequate experiences in GEF project implementation, and have established long-term cooperative relationships with various ministries, local departments, industry related supporting units and relevant organizations, and can establish a scientific and efficient collaborative working mechanism to ensure the policy implementation of the project. Alleviative: If coordination problems arise, the project team will have direct contact with the MNR and MIIT to ensure smooth coordination. Besides, investment from MIIT and MNR could facilitate building new program management team and increase management costs to ensure effective problem solving.
Coordination of the relationship between project objectives and the implementation of comprehensive utilization technology.	Low	Preventive: The MNR, MIIT and implementation units maintain close contact with relevant departments and can apply necessary adjustment promptly according to the adjustment of national policies, so as to ensure the implementation of this project and achieve the optimal effect. Alleviative: Workshops shall be carried out on a regular basis to adjust project technology employment so that the overall goal will be achieved.
Unemployment caused by the reduction of chemical phosphate fertilizer production (possibly in cement manufacturing too)	High	Preventive: In the process of realizing green and low-carbon transformation of PCI, the United Nations '2030 agenda for sustainable development' was benchmarked to explore the formation of a multi-objective collaborative green development model to achieve ecological compensation, reduce poverty, improve ecological diversity, and ensure agricultural and food security. Focus on green employment action in the PCI, improve the employment quality of the PCI, create new employment growth points in the comprehensive utilization of phosphogypsum, and reduce the unemployment risk caused by industrial transformation. Alleviative: Training programs will be carried out for displaced workers to relocate them to emerging industrial enterprises that will be facilitated by the project, i.e. renewable energy, phosphogypsum processing, waste water treatment, natural phosphate fertilizer production, etc.
	Medium	Preventive: Energy saving, green and low-carbon development and green mine construction are the important contents of China's ecological civilization goals, which make an important basis for guaranteeing supporting funds. The MNR and MIIT attach great importance to the i

Allocated funds cannot support project implem entation in time and in f ull.		mplementation of this project, and provide relevant technology, resou rces, funds, and system support. Relevant project provinces will also make commitment to supporting funds for the project in the early sta ge of implementation. In the process of project design and implemen tation, it will continue to promote and attract the establishment of div ersified financing modes including private enterprises to ensure the s upporting funds are fully in place. Alleviative: Constant follow-up with the pertinent co-financers will be conducted either to secure the committed co-financing or negotiate t he amount of co-financing. Where required 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.
Low level of commitme nt of stakeholders (inclu ding government agenci es and PCI companies) in the implementation o f project activities	Low-to-medium	Preventive: Policy regulations will be published to ensure stakeholder s participate in the project. Market mechanism for phosphogypsum r eplacing cement will be established to encourage participation. Alleviative: Incremental costs will be applied to increase subsidy for c ement substitution and low-carbon mining technologies.
Difficulties in the replica tion of successful result s of the project.	Medium	Preventive: PMO will organize regional and national workshops to en sure timely spread of experience and knowledge. In these workshops other regions could share pilot projects results and experiences. Alleviative: Research and seminars will be carried out to identify the c ritical problems in replication and proper solutions. PMO, will carry ou t direct consultations with target private sector entities to determine t heir concerns and explore ways to fulfill their initial commitments an d ensure end-users better understanding about the use and benefits of green, EE and LC technology applications
Availability of co-financi ng is delayed and negati vely affects the implem entation of the project a ctivities	Low	Preventive: The MIIT and MNR will ensure that committed co-financin g from the national and local governments is available and during the required time. Constant follow-up with the project partners in the priv ate sector in the planning and implementation of the activities that th ey are co-financing will ensure that their financial support is available in a timely manner Alleviative: If financing problems arise, the project team will have dire ct contact with the MNR and MIIT to potentially secure additional fun ding from other sources of funds. If necessary, the project activities may have to be modified or replaced to adapt to the available funds.
Varying vested interests and objectives of PCI co mpanies as well as othe r stakeholders in the loc al and central governme nts may prevent the effe ctive organization and c oordination of their part	Low-to-Medium	Preventive: Policy as a regulative measure will be carried out to ensur e PCI companies stick to the project, and financial support will be pro vided to companies to ensure their participation. Alleviative: In regular workshops, companies could express their prob lems and together with the MNR and MIIT find proper solutions when faced with difficulties.

icipation and support of the project		
The Project could lead to adverse impacts on enjoyment of the human rights (civil, political, economic, social, or cultural) of the affected population in the rural areas where the on-the-ground project activities will be carried out.	Low	Preventive: This project will be based in the underdeveloped western regions of Yunnan, Guizhou, Sichuan, and Hubei, and will focus on promoting the economic and social welfare of local enterprises and communities. The project will create employment opportunities and reduce poverty among the local communities through the upgrade of existing phosphate chemical industry including the integrated processing of phosphate chemical byproducts such as phosphogypsum. The design of the project will be extensively negotiated with local people and cooperate with relevant national and provincial government. Alleviative: If adverse impacts occur, the MIIT and MNR will mobilize existing resources and experience to deal with harm on human rights. Workshops will be carried out to facilitate policymaking to make up for the affected population.
Potential adverse impacts to habitats (e.g. modified, natural, and critical habitats) and/or ecosystems and ecosystem services in some possible changes to the use of lands and resources in the implementation of the demonstrations[1].	Medium	Preventive: The impacts related to construction activities are temporary and mostly reversible. The demos will involve the conduct of a detailed feasibility study on the local area before the demo implementation. The demos will be designed and constructed in accordance with international standards to ensure compliance with relevant environmental ordinances/regulations. Alleviative: If adverse impacts occur, the MIIT and MNR will mobilize existing resources and experience to deal with harm on habitats. Workshops will be carried out to facilitate policymaking to conserve the affected landscape.
The associated construction, operation, or decommissioning of the demo installations may have potential health and safety risks to local communities due to the transport, storage, and use and/or disposal of any hazardous or dangerous materials (e.g. explosives, fuel and other chemicals) that may be used during construction and operation.	Low-to-medium	Preventive: Environmental Risk Assessment (ERA) will be conducted before project construction, which identifies the critical impact and solutions. ERA is valuable for insuring sound project construction and protecting local communities. The project will promote the application of new and advanced technologies for cleaner production, which are expected to reduce emissions, process wastes, effluents compared to the current processes. The demonstration component of the proposed project will be designed taking into consideration the need to prevent a potential for the release, in the environment, of hazardous materials resulting from their handling, storage and use for the demonstrations and replications that will be carried out under the project. Appropriate training will be provided to the demonstration enterprises to ensure that they operate the installed system correctly and safely, and properly control and manage the release or disposal of waste. The project will minimize or avoid health risks and safety issues in the construction work of demonstration facilities in the project sites. Alleviative: China is experienced in risk management and each area is guarded by a team of firefighters to ensure local safety in case accidents happen. Through demonstration projects, the project will minimize and manage the waste, effluents and emissions generated during project implementation

The project would potentially result in the generation of waste (non-hazardous).	Medium	Preventive: During the design and implementation of the project, strict environmental and social assessments will be conducted, and relevant recommendations will be made to reduce related environmental and safety risks. The project will promote the application of new and advanced technologies for cleaner production, which are expected to reduce emissions, process wastes, effluents compared to the current processes. The demonstration component of the proposed project will be designed taking into consideration the need to prevent a potential for the release, in the environment, of hazardous materials resulting from their handling, storage and use for the demonstrations and replications that will be carried out under the project. Alleviative: As the phosphate chemical industry is concentrated in Yunnan, Guizhou, Sichuan province, and other underdeveloped and ecologically fragile areas, the potential waste generation will be controlled and evaluated in the design and implementation stages. During operation, advanced waste disposal methods will be used to treat waste generated in the project to minimize the impact of waste on the environment. For example, solidification treatment of fluorine-containing waste and highly-charged heavy metal waste generated in the process of phosphogypsum reuse will minimize the impact of phosphate chemical waste on the environment.
Low local and international prices of phosrock and phosphate chemicals will discourage PCI companies to implement green, EE, and LC technology application projects	Medium	Preventive: MIIT and MNR will provide subsidies for green technologies and will carry out policies to favor companies in PCI with green technologies. Alleviative: Subsidizing policies should be flexible in order to provide proper incentives when market prices fluctuate.
COVID-19 will negatively impact the social-economic development of the project areas. See Annex F for PhosChem EE Project Covid-19 Response	High	Preventive: The project development team will make use of China's effective institutional system to address the pandemic situation in a timely manner taking into consideration potential socio-economic impacts. Care will be taken in the design and implementation of the project especially when the pandemic persists to ensure that hardware installation works will be done safely in the demo sites with the health, safety, and welfare of the people in the demo sites and local communities in mind. If vaccination is not be ready, public health measures will be taken as is currently being done in China to ensure safety of the project participants and beneficiaries. Alleviative: If the pandemic persists during the project implementation phase, the project activities that will not involve on-the-ground work will be prioritized and implemented with the help of virtual means. The scheduling of, and action planning for, the hardware-related activities will be reviewed regularly by keeping abreast with the status of the pandemic and the public health situation in the country, in general, and particularly in the project demo sites.

Extreme climate events in the project areas will delay and negatively affect the installation, operation and monitoring of the demonstration activities. See Annex G for PhosChemEE Project Climate Risk Screening	Low	Preventive: Yunnan, Sichuan, Guizhou, and Hubei have higher risks of extreme weather, but they are therefore experienced in dealing with risks. Local governments shall strengthen their capacities to deal with extreme climate events in general. The project will also cover climate risk adaptation capacity building sector in technology training workshops. Alleviative: 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 planned phosphate mining and refining demos will be implemented in mines whose operations have already been approved by the government as compliant with current environmental regulations. The favorable results of the environmental assessments of these mines enable these to be in operation. The environmental assessments were done under the auspices of the Chinese Government's "Green Mine" Project. One of the core objectives of that project is to minimize the disturbance of natural environment during mining operations with the requirements for compliance with specific measures such as enclosed mining area, waste water recycling, solid waste utilization and/or dry piling, and ecological restoration. The planned technology application demos on the mining and refining of phosrock and the proper management of the mining/refining and phosphate chemical production by-product wastes in the identified "Green Mine" phosrock mines will be designed in such a way to maintain the various environmental protection features that these mines have already put in place, and where possible, include improved incremental features that can be showcased as part of the planned demos.

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.

This project will set up a national project steering committee, a national project expert committee, a national project management office, establish a project implementation annual, middle, and final monitoring plan, hold various forms of project promotion coordination meetings, and organize annual work meeting.

The MIIT undertakes the administration of the chemical industry, participates in the formulation and implementation of policies on energy conservation and comprehensive utilization of resources, promotion of cleaner production and pollution control, and organizes and coordinates the promotion and application of major demonstration projects and new products, new technologies, new equipment, and new materials. The MNR is responsible for the management of the phosphate chemical industry (PCI) and organizes the implementation of policies to promote the green and low-carbon development of the PCI, with emphasis on promoting incentive policies and the formulation of relevant technical standards for the comprehensive utilization of phosphate tailings resources.

Collaboration will also be explored with other GOC entities, particularly those who working on low-carbon development of PIC value chain. Such entities are expected to assist proponents of this project in the identification and analysis the barriers of the application of low-carbon technologies to support the PCI. During the PPG stage, the project development team will assess these projects (ongoing and planned) in the phosphorus industry for potential inclusion in the proposed project as baseline activities that the GEF project can build on. For example, as a demonstration, explore and consider 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. Among the ongoing GEF-funded projects in China that this proposed project can coordinate with in the implementation of common project interventions such as those on policy barrier removal, capacity building, and EE technology application demonstrations are the following:

- Promoting Energy Efficient Electric Motors in Chinese Industries (PREMCI)
- Greening the Logistics Industry in Zhejiang Province (GLIZP)
- Enabling Solid State Lighting Market Transformation & Promotion of Light Emitting Diode (LED) Lighting
- Energy Efficiency Improvement in Public Sector Buildings in China

The project proponents will also coordinate with the project development team that is currently working on the design and development of another UNDP-GEF RE/EE project in China, which is the Enabling Zero Carbon Energy in Rural Towns and Villages in China (EZCERTV) Project. This project also include the design, development, and implementation of green, energy efficient low carbon energy technologies in selected rural towns and villages in a number of provinces in China.

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

-UNFCCC Related Technology Needs Assessment (TNA)
-UNCBD, UNFCCC, UNCCD National Capacity Assessment (NCSA)
-Poverty Reduction Strategy Paper (PRSP)
-UNFCCC Biennial Update Report (BUR)
-National Biodiversity Strategy and Action Plan (NBSAP)
-GEFSEC National Project Development Plan (NPFE)

Alignment with national strategy/planning

This project will explore a green and low-carbon sustainable development mode of the whole phosphorus industry chain in line with China's conditions, improve the energy efficiency of the industry, establish a phosphorus chemical circular economy mode, drive the green and low-carbon coordinated development of upstream and downstream enterprises, and minimize carbon emissions of the phosphorus chemical industry. This project is highly consistent with China's national strategic planning. The relevant strategies, plans and policies of the Chinese government include:

Ecological civilization as a major strategy for China's national development. The 19th National Congress of the Communist Party of China placed ecology-conserving construction in a prominent position, and clearly proposed to "accelerate the reform of ecological civilization system and build a beautiful China". This requires new developments and constructions to be innovative and green. It puts forward new and higher requirements for speeding up the implementation of green manufacturing, improving the utilization efficiency of resources and energy, and reducing environmental pollution.

Formulation and issuance of green development plans. The MIIT formulated and issued the 13th Five Year Plan for industrial green development, which clearly required the acceleration of R&D and application of technology on energy conservation and green development, and improve the level of efficiency of process technology and equipment. It also requires the building of a green manufacturing system actively, accelerate the construction of green factories, development of green products, construction of green supply chain and construction of green parks.

Issuance and implementation of policies on industrial upgrading and transformation. “The Guideline Catalogue for Industrial Restructuring (2019 Edition)” was released, in which the contents related to the green and low-carbon development of phosphorus chemical industry were put forward. These include the development and application of green technologies for the comprehensive utilization of phosrock mining wastes and refining tailings, mining and utilization of medium and low grade phosphate, fluorite, and barite ores, etc. “The implementation plan for special investigation and remediation of "three phosphorus" in the Yangtze River” was issued to focus on the pollution of "three phosphorus". The outline of “the 13th Five Year Plan for national economic and social development” puts forward "promoting the conservation and intensive utilization of resources" and "vigorously promoting the construction of green mines and green mining development areas". Moreover, in the "leading action of circular development" that was jointly issued by the NDRC and 14 departments, also proposed to "vigorously promote resource conservation and comprehensive utilization, and earnestly promote the construction of green mines and green mining development demonstration areas and improve the efficient use of energy resources ".

Alignment with GEF focus areas / strategies

Through the promotion and facilitation of the application of green, energy efficient low-carbon technologies in the phosphate chemicals industry (PCI) and the formulation and enforcement of the supportive policy and regulatory frameworks (including standards), this project will bring about the acceleration of energy efficiency in this major industry in China. In this regard, it is in line with the GEF-7 CCM-1.3 objective of promoting innovation and technology transfer for sustainable energy breakthroughs through the acceleration of energy efficiency adoption, specifically in China’s PCI. This will not only bring about improved

productivity, conservation of phosrock resources, and energy savings but also substantial GHG emission reduction and reduced environmental pollution. The energy savings that will be realized in the introduction of green and cleaner technologies in the industry will bring about GHG emission reductions that will contribute to achieving the country's NDC targets[1]. It is in line with the development goals set out in the "UN 2030 agenda for sustainable development", including the promotion of persistent, inclusive, and sustainable economic growth, the promotion of full and productive employment and decent work for all, and the reduction of inequality within and among countries. Women's participation will be taken into account in the design, development, and implementation of the proposed project. This is consistent with the goals of UN sustainable development goals, such as poverty eradication, gender equality and empowerment of all women and children. It is also consistent with GEF's focus on gender equality.

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[1] The PCI in China is an important part of the country's industry sector. The goal of this project is the reduction of GHG emissions from the PCI. The planned direct interventions from the project itself is expected to bring about 35.96 million tons direct CO2 emission reduction. The sustained promotion and replication/scale-up of the project demonstrations after the end of the project are expected to further bring about more substantial GHG emission reduction. All these will be an important contribution to the achievement of China's committed GHG emission reduction targets to the Paris Agreement and its carbon neutrality target by 2060. This project would contribute to the achievement of China's nationally determined contributions (NDCs) set out in the Paris Agreement at an earlier date and China's 2060 Net-Zero-Carbon goal through the promotion an integrated region-wide energy conservation, green and low carbon development of the country's PCI. Apart from the GHG emission reductions from the implementation and replication of the demonstrations, the enabling frameworks (e.g., policies/regulations/incentives) and conditions that the project will establish and operationalize, and the technical and institutional capacity that will be enabled will facilitate further development and application of green, energy efficient low carbon technologies and practices in the PCI, and potential influence also the other industry sectors with significant carbon and environmental footprints to follow suit.

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.

During the implementation of this project, the knowledge management system that will be used includes the following aspects: Firstly, to carry out exchanges and cooperation between different regions and provide training for project participants. Secondly, to identify knowledge management activities through coordination with project stakeholders. Thirdly, special training will be given to relevant personnel to cultivate a group of professional leaders in the development of the PCI chain. These technical leaders will influence the process of knowledge management, which is of great significance to the implementation of this project and will play a positive role in promoting the development of the industry.

In regards knowledge management, there are several project outputs on this. These include:

(1) Established green and low carbon PCI demonstration platform covering the whole industry chain - This platform will provide the basis for other segments of the PCI to improve energy utilization efficiency, and involves the promotion of process optimization, achievements of the project demonstration activities, and green low carbon growth of the PCI.
(2) Green and low carbon PCI technical specification, standardization, and evaluation system – These will be used for promoting industrial green and low-carbon technological reform and development of the phosphate mining industry in regions of the country.
(3) Established construction plan and publicity plan for green and low carbon PCI – This will promote advanced technology and successful practices in China, and help improve the green development capacity of the global PCI as well as in the countries included in the “Belt and Road” initiative.

During the implementation of this project, knowledge management experience and lessons learned from other projects of other development partners (e.g., WB and ADB) related to industrial energy conservation and green development will be used in the implementation of the knowledge management activities of the project. Refer to Annex I for the elaboration of the envisioned knowledge management system for the proposed project.

9. Environmental and Social Safeguard (ESS) Risks

Provide information on the identified environmental and social risks and potential impacts associated with the project/program based on your organization's ESS systems and procedures

Overall Project/Program Risk Classification*

PIF	CEO Endorsement/Approval	MTR	TE
High or Substantial			

Measures to address identified risks and impacts

Provide preliminary information on the types and levels of risk classifications/ratings of any identified environmental and social risks and potential impacts associated with the project (considering the GEF ESS Minimum Standards) and describe measures to address these risks during the project design.

During the PPG, the following safeguards documents will be prepared, covering this risk and all other risks, to meet the SES requirements of a High risk project:

- a stakeholder analysis and comprehensive Stakeholder Engagement Plan
- a gender analysis and Gender Action Plan
- an Environmental and Social Management Framework (ESMF), with initial FPIC procedures (if confirmed as required)
- a Grievance Redress Mechanism (draft/outline)

The design of the project will be extensively negotiated with local people and cooperate with relevant national and provincial government.

The ESMF will outline the procedures for the (site-specific) Environmental and Social Impact Assessments (ESIAs) and Environmental and Social Management Plans (ESMPs) that will be prepared during project implementation.

Supporting Documents

Upload available ESS supporting documents.

Title	Submitted
6618 SESP-09252020_final	

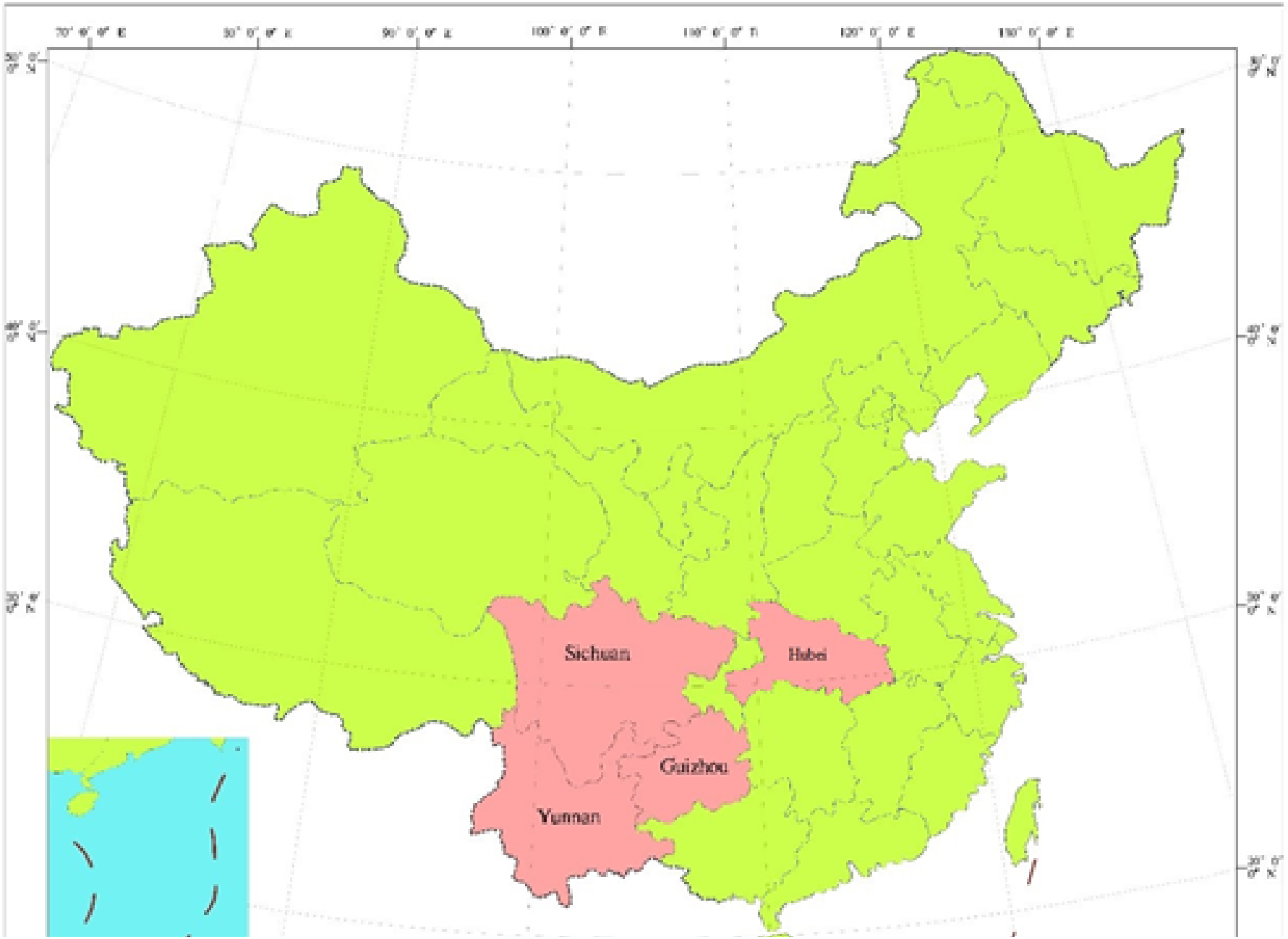
Part III: Approval/Endorsement By GEF Operational Focal Point(S) And Gef Agency(ies)

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
Peng Xiang	GEF Operational Focal Point for China	Ministry of Finance	

ANNEX A: Project Map and Geographic Coordinates

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



Geographical Coordinates of the Demonstration Provinces:

Sichuan: 97° 21' - 108° 12' E, 26° 03' - 34° 19' N
Yunnan: 97° 31' - 106° 11' E, 21° 8' - 29° 15' N
Guizhou: 103° 36' - 109 ° 35' E, 24° 37' - 29° 13' N
Hubei: 108° 21' - 116° 07' E, 29 01' - 33° 6' N

The geographical coordinates of the specific project sites (demo sites) will be confirmed during the project design and development (PPG) stage.

The envisioned project sites in Yunnan Province are far from the China-Myanmar border. As far as the project proponents know, there is known territorial dispute in that province. Note that Myanmar and China are currently working together on development initiatives under the Belt & Road Initiative