GEF Upgrading of China SHP Capacity Project

Monitoring and Evaluation of the Implementation of Environmental and Social Management Plan (ESMP)

Final Report

Ref No. 51272

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Abstract

The Global Environment Facility (GEF) "Upgrading of China SHP Capacity Project" ("GEF Project") aims to better respond to the challenges of climate change by reducing the negative impact of small hydropower (SHP) stations on the environment, so as to support the 13th National Refurbishment Project in rural China.

The GEF project helps improve the industrial competitiveness of existing SHP stations by promoting the upgrading, green transformation, and better management of the SHP stations. In addition to crucial social and economic benefits, the project will also improve the ecological environment of local rivers and enable SHP stations to better adapt to climate change. The project helps spread knowledge and technologies in the field of green hydropower in China, bringing positive environmental impacts.

According to the requirements of the GEF project, environmental and social management is a must-do. In 2020, the environmental and social management plan (ESMP) for each pilot SHP station was prepared. In order to ensure the smooth implementation of the ESMP, the corresponding environmental and social management must be monitored and evaluated. The implementation of the ESMP in each pilot SHP station was also monitored and evaluated to identify problems and provide corresponding suggestions and mitigation measures, thereby minimizing the environmental impact of the construction of the GEF project. Therefore, it is necessary to monitor and evaluate environmental/social management.

Through the monitoring and evaluation, we have found that the owners of pilot SHP stations all laid great emphasis on the ESMP and arranged people for its implementation. They took environmental mitigation measures in line with the ESMP and properly used funds for

environmental protection. Local environmental monitoring stations and township/town healthcare centers were entrusted to help fulfill the environmental monitoring plan and train project managers, construction workers, and all company employees to improve their ability to manage the environment. The owners all performed well in the environmental/social management of the pilot SHP stations.

To mitigate the environmental/social impact of the implementation of GEF project, each pilot SHP station performed well in taking environmental mitigation measures in the ESMP during the period and operation period, regarding water pollution, noise pollution, air pollution, solid waste, soil erosion, the safety of water supply and irrigation, local employment, ecological environment, water consumption downstream the SHP station, benefits of the SHP station, protection of women's rights and interests, etc. Environmental measures during the construction period include septic tanks, sedimentation basins, dust masks, vehicle washing, trash bins, drainage systems, revetments/retaining walls, etc. Environmental mitigation measures during the operation period include buried sewage treatment units, sound-proof doors/windows, garbage stations, waste tanks and vacuum oil filters, trash racks and mechanical trash cleaning machines, ecological dams, premises landscaping, revetment restoration, fry stock enhancement, discharge of ecological flow, production/domestic water facility building/refurbishment, an increase benefits from power generation, protection of women's rights and interests, transport/lighting facility building, etc. The environmental mitigation measures taken were comprehensive, diversified, targeted, effective, and up-to-standard. Project implementation had no significant impact on the external environment, met requirements for environmental protection, ensured smooth progress of the GEF project,

and yielded greater economic, social, and environmental results.

To make an accurate evaluation on ESMP implementation in the GEF project, each pilot SHP station owner carried out well the environmental monitoring plan in the ESMP during the construction and operation periods. For oversight of the water/acoustic environment, a third-party testing organization was entrusted to monitor ecological flow online in real time, conduct field surveys and monitoring of dust, solid waste, production/domestic water downstream each SHP station, and collect statistics on benefits, rights, and interests of each SHP station. Comprehensive contents, fair frequency, and up-to-standard results of environmental monitoring indicated that project implementation had a minor impact on the water, noise, atmospheric, and ecological environment, the consumption of downstream production/domestic water, etc. The effective implementation of the environmental monitoring plan is conducive to making an objective evaluation of the effectiveness of environmental mitigation measures and providing an important basis for the monitoring and evaluation of ESMP implementation.

Taking into account the interests of all parties, each pilot SHP station owner garnered extensive public advice on the construction of the project, through means such as convening consultation meetings, posting announcements, and distributing questionnaires. A total of 224 people attended 18 consultation meetings, with relevant questionnaires given out and announcements posted. In response to public advice, each pilot SHP station owner took multipronged environmental/social mitigation measures and produced remarkable results to the satisfaction of local residents and authorities.

Through monitoring and evaluation of ESMP implementation in the project, we promptly found the ineffective implementation of

environmental monitoring plans and environmental mitigation in each SHP station and provided relevant advice, notifications, and feedback to facilitate communication with each SHP station and have problems solved in time. The monitoring and evaluation of ESMP implementation in the GEF project were instrumental in lessening the environmental impact of the GEF project and ensuring the smooth progress of the ESMP.

Currently, environmental management is drawing to an end as all pilot SHP stations have started to operate. The stations, however, still have to strengthen their environmental care during subsequent operations so as to continuously play an exemplary and leading role as green SHP stations.

To ensure a more authentic, fair, and scientific evaluation, opinions and suggestions were widely solicited from relevant organizations and leaders during the preparation of the Final Report. Meanwhile, we were fortunate to receive significant support and collaboration from various entities including the International Center on Small Hydro Power (ICSHP), provincial, municipal, and county-level administrative authorities, and the owners of the pilot SHP stations. I would like to take this opportunity to extend my heartfelt gratitude to all the leaders, experts, and individuals who have provided guidance and assistance throughout the monitoring and evaluation process.

1 Project Background

1.1 Overview of the GEF Project

The Global Environment Facility (GEF) "Upgrading of China SHP Capacity Project" ("GEF Project") is a five-year project jointly carried out by the United Nations Industrial Development Organization (UNIDO) and the Ministry of Water Resources (MWR) as its international and domestic implementing agencies respectively, along with the Ministry of Finance (MOF) as the counterpart of the GEF for the project at the national level, International Center on Small Hydropower (ICSHP) designated to implement the project, and relevant water resources departments in 8 pilot provinces (autonomous regions and municipalities) and 19 pilot small hydropower (SHP) stations in these places.

The project aims to better respond to the challenges of climate change by reducing the negative impact of SHP on the environment, so as to support the 13th National Refurbishment Project in rural China. The objective of the GEF project is to reduce greenhouse gas (GHG) emissions and reliance on fossil fuels and improve the industrial competitiveness of SHP stations by promoting the upgrading, green transformation, and better management of existing SHP stations. In addition to important social and economic benefits, the project will also improve the ecological environment of local rivers, thereby helping SHP stations to better adapt to climate change. The project helps spread knowledge and technologies in the field of green hydropower in China, bringing positive environmental impacts.

1.2 Overview of the Pilot SHP Stations

To ensure the smooth progress of environmental and social management of the GEF project, an ESMP must be developed for the

pilot SHP stations (as shown in Table 1-1) in 8 pilot provinces to identify the project's local environmental and socio-economic risks and clarify, put in place corresponding mitigation measures, and evaluate the implementation of the ESMP by the pilot SHP stations during the construction and operation periods to ensure the successful environmental and social management of the GEF Project.

Table 1-1 Basic information about pilot SHP stations

Province	Pilot SHP Station	Installed Capacity Before Refurbishment (kW)	Installed Capacity After Refurbishment (kW)	Location
Fujian	Tangban SHP Station	11,000	12,600	Tangban Village, Pandu Town, Lianjiang County, Fuzhou City
	Jiaosan/Tantou SHP Station	6,800	7,320	Jiaoxi Village, Dalong Town/Shancheng Town, Taining County, Sanming City
	Gaofang Stage II SHP Station	2,000	2,350	Dashuikou Village, Fuling Town, Pucheng County, Nanping City
Guangdong	Guanxi SHP Station	4,800	6,000	Xinxing Administrative District, Hougongdu Town, Ruyuan County, Shaoguan City
Guangxi	Aibu Stage II/III SHP Station	1,860	5,600	Aibu Village, Huatong Town, Jingxi, Baise
	Sandieling/Tongpai SHP Station	15,000	15,000	Xinling Village/Tongpai Village, Hurun Town, Jingxi, Baise
Zhejiang	Qingshuitan SHP Station	960	1,200	Waijiao Village, Dazhou Town, Qujiang District, Quzhou City
	Panxi Cascade SHP Station	6,400	7,000	Huyuan Town, Jinyun County, Lishui City (Baoguling Village, Jiaokeng Village, Hucun Village)
Hubei	Yangdaohe Cascade SHP Station	16,250	17,000	Xiakou Town, Xingshan County, Yichang City (Shijiaba Village, Yangdaohe Village, Lijiashan Village)
	Jiangjunzhu SHP Station	3,000	3,000	Gaolan Village, Shuiyuesi Town, Xingshan County, Yichang City
	Zhoujialiang SHP Station	2,230	2,630	Jiangwan Village, Nanhuatang Town, Yunyang District, Shiyan City
Chongqing	Taiping SHP Station	2,000	4,000	Nixi Town, Yunyang County
	Xiaokeng SHP Station	480	1,200	Tianma Village, Xiema Town, Beibei District

Province	Pilot SHP Station	Installed Capacity Before Refurbishment (kW)	Installed Capacity After Refurbishment (kW)	Location
	Gaokeng SHP Station	4,060	4,600	Hetan Village, Jiuxian Town, Tongliang District
	Majing SHP Station	5,000	6,400	Liqun Village, Yongxin Town, Qijiang District
Yunnan	Mabozi SHP Station	3,650	5,300	Gaoda Village, Gaoda Township, Tonghai County, Yuxi City
	Chahe SHP Station	4,000	4,800	Gebaikong Village, Baoxiu Town, Shiping County, Honghe Prefecture
	Maoyandong Stage II SHP Station	12,600	15,000	Fayi Village, Yongning Township, Luxi County, Honghe Prefecture
Shaanxi	Xinpingya SHP Station	2,500	3,200	Xinpingya Village, Bantao Town, Ziyang County, Ankang

2 Contract Requirements

According to the requirements of the GEF project, environmental and social management is a must-do. In 2020, the environmental and social management plan (ESMP) for each pilot hydropower station was prepared. In order to ensure the smooth implementation of the ESMP, the corresponding environmental and social management must be monitored and evaluated.

In February 2021, as an independent expert, I signed a contract (No. 46379) with UNIDO to implement all the requirements set out in the contract and monitor and evaluate the environmental/social management of 8 pilot SHP stations in Fujian, Guangdong, Guangxi, and Zhejiang Provinces.

In January 2022, as an independent expert, I signed a contract (No. 51272) with UNIDO to implement all the requirements set out in the contract and monitor and evaluate the environmental/social management of 11 pilot SHP stations in Hubei Provinces, Chongqing Municipality, Yunnan Province, and Shaanxi Province.

2.1 Preparation of the Inception Report

The preparation of the Inception Report mainly lays out the project background, as well as work objectives, content, principles, methodology, results, and other tasks, and sorts out key work for implementation to create a detailed work plan. The Inception Report serves to guide and arrange the smooth implementation of the entire project. For the two contracts above, the *Inception Report* prepared in March 2021 and April 2022 respectively has been e-mailed to ICSHP and UNIDO, specifying plans for monitoring environmental/social management.

2.2 Preparation of the Monitoring Report

The ESMP specifies local environmental and socio-economic risks of

the refurbishment of each pilot SHP station and clarifies corresponding mitigation plans, including mitigation measures, monitoring plans, implementation progress, institutional responsibilities, capacity building, and public inquiries. The ESMP also includes all relevant indicators such as gender issues.

In accordance with Environmental and Social Security Policies and Procedures (ESSPP) of the UNIDO, *Environmental and Social Management Plan (ESMP) for Pilot SHP Stations in the GEF Project*, *Requirements for the Preparation of Environmental and Social Management Plan (ESMP)*, etc., environmental/social management monitoring and evaluation were carried out in 19 pilot SHP stations of 8 pilot provinces through environmental monitoring, field surveys, data sorting and analysis, and public engagement in the investigation. Through the monitoring and evaluation of ESMP implementation, we have identified problems from each station and proposed relevant proposals and mitigation measures. The monitoring and evaluation of ESMP implementation ensured the smooth progress of environmental/social management in the GEF project. For the two said contracts, the *Monitoring Report on Implementation of ESMP* prepared in December 2021 and April 2023 respectively has been e-mailed to ICSHP and UNIDO.

2.3 Preparation of the Final Report

The implementation of the environmental monitoring plan and environmental mitigation measures is evaluated for each pilot SHP station project based on field surveys, data collection, ESMP preparation, and other activities as well as their results, and all the work done during the contract period is summarized for the preparation of this Final Report.

3 Work Contents of Monitoring and Evaluation

3.1 Working Process

To ensure the smooth progress of environmental/social management, monitoring and evaluation were made on environmental/social management of each SHP station in February 2021-May 2023 through field monitoring and investigation, inquiries, owner interviews, and query of monitoring data and image data, followed by the presentation of rectification proposals for existing problems. In November 2022, all SHP station owners were trained on the essentials of monitoring and evaluation of ESMP implementation via video conferencing, based on which, the *Inception Report, Monitoring Report on Implementation of ESMP* and *Final Report* were prepared.

3.2 Work Contents

(1) Preparation of an inception report

Jobs, plans, monitoring and evaluation were orchestrated among other tasks of ESMP monitoring, a detailed monitoring and evaluation program was worked out, and the *Inception Report* was prepared.

(2) Data collection, collation, and analysis

Through organization and analysis of the collected data, questionnaires of environmental mitigation measures and environmental/social management plans were prepared according to the environmental/social management plan (ESMP) of each pilot SHP station.

(3) Site survey and monitoring investigation

Site surveys on the pilot SHP stations were conducted, and monitoring and evaluation were performed for environmental and social mitigation measures, environmental monitoring, public participation investigations, institution capacity building during the construction and operation of SHP stations in the form of research, visits, communication, emails,

video shooting, etc.

(4) Preparation of a monitoring report

Based on field survey findings and materials collected, environmental/social monitoring plans and environmental mitigation measures of each SHP station were monitored and evaluated to identify problems and make relevant proposals, and the *Monitoring Report on Implementation of ESMP* was prepared.

(5) Preparation of the final report

According to contract requirements, the ESMP monitoring activities and results were summarized and evaluated, and the Final Report was prepared.

3.3 Technical route

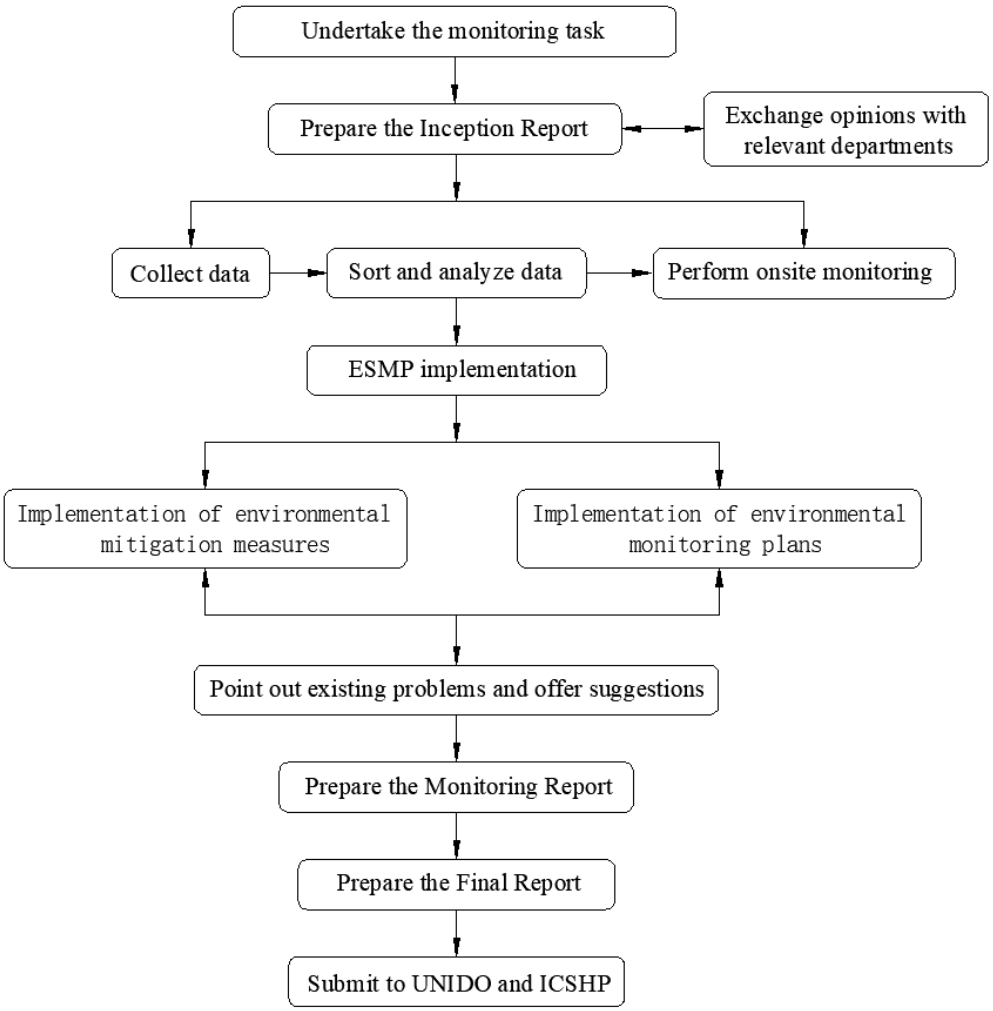


Figure 3-1 Technical route

4. Implementation Process of the Project

From February 2021 to January 2022, as an independent expert, I signed a contract (index No. 00511448) with UNIDO to monitor and evaluate the environmental/social management of 21 pilot SHP stations in 8 provinces and implement all the requirements set out in the contract.

4.1 Preparation of the Inception Report

I submitted the *Inception Reports* prepared in March 2021 and April 2022 respectively to ICSHP, and through the exchange of views with ICSHP, e-mailed the altered reports to UNIDO.

In the Inception Report, the survey form of environmental and social mitigation measures and that of environmental and social monitoring plan are designed based on potential environmental and social risks of the pilot SHP stations, as shown in Figures 4-1 and 4-2.

Stage	Environmental and Social Risks		Mitigation Measures Planned in the ESMP	Mitigation Measures Actually Implemented	Location	Start/End Time	Responsible Company
Construction period	Environment	Wastewater			Construction area and living area	Throughout the construction period	Contractor
		Noise			Living area		Contractor
		Solid waste			Construction area		Contractor
		Dust			Construction sites and roads		Contractor
		Soil erosion			Construction area and downstream waterway		Contractor
	Social	Water supply security			Downstream residents	Throughout the construction period	Project owners
		Irrigation security			Downstream farmland		Project owners
		Resident employment and income			Surrounding residents		Contractor
Operation period	Environment	Domestic sewage			Living area	Operation period	Constructor
		Operation noise			Main plant		
		Solid waste			Production area and living area		
		Ecological environment			Plant area and downstream waterway		
		Ecological flow			Downstream waterway		
	Social	Income of an SHP station			Plant area	Operation period	Constructor
		Women's rights			Plant area		
		Downstream water supply			Downstream of the SHP station		

Figure 4-1 Survey form of environmental and social mitigation measures for pilot SHP stations

Stage	Environmental and Social Risks		Detection Parameters	Monitoring Methods and Procedures Adopted	Detection Time/Frequency Planned in the ESMP	Actual Detection Time/Frequency	Sample/Monitoring Location	Responsible Company
Construction period	Environment	Wastewater	pH, SS, COD_{Mn}, petroleum, ammonia nitrogen, and total phosphorus	Subject to relevant provisions concerning surface water monitoring in the Technical Specifications Requirements for Monitoring of Surface Water and Waste Water (HJ/T 91-2002)			Discharge outlets of production wastewater and domestic sewage treatment facilities	Qualified monitoring institution
		Noise	L_{Aeq}	Subject to relevant provisions of the Measurement Method for Noise from Construction Site			Around the plant boundary	Qualified monitoring institution or the SHP station itself
		Solid waste	Construction waste and domestic garbage	Field surveys			Construction area	Contractor
		Dust	TSP and PM_{10}	Field surveys			Construction sites and roads	Contractor
		Soil erosion	Effectiveness of soil and water conservation facilities	Field surveys			Construction area and downstream waterway	Contractor
	Social	Water supply security	Water supply facilities	Field surveys			Downstream residents	Project owners
		Irrigation security	Irrigation facilities	Field surveys			Downstream farmland	Project owners
		Resident employment and income	Resident employment and income	Statistics collection, survey, and monitoring			Construction staff related to the refurbishment project, managerial personnel of the SHP stations, and downstream residents	Contractor

Stage	Environmental and Social Risks		Detection Parameters	Monitoring Methods and Procedures Adopted	Detection Time/Frequency Planned in the ESMP	Actual Detection Time/Frequency	Sample/Monitoring Location	Responsible Company
Operation period	Environment	Domestic sewage and tailwater of SHP stations	pH, SS, COD_{Mn}, petroleum, ammonia nitrogen, and total phosphorus	Subject to relevant provisions concerning surface water monitoring in the Technical Specifications Requirements for Monitoring of Surface Water and Waste Water (HJ/T 91-2002)			Outlets of a sewage treatment facility in the living area of an SHP station, downstream waterways of the tailwater	Qualified monitoring institution
		Operation noise	L_{Aeq}	Subject to relevant provisions of the Standard of Noise at Boundary of Industrial Enterprises			Around the plant	Qualified monitoring institution or the SHP station itself
		Solid waste	Disposal method and final location	Field surveys			Garbage station in the living area of SHP stations	Project owners
		Ecological protection	Terrestrial and aquatic ecological environment	Field surveys			Plant area and downstream waterway	Project owners
		Ecological flow	Discharge flows	Online flow monitoring equipment			At the locations of water discharge facilities and online flow monitoring equipment	Project owners
	Social	Income of an SHP station	Generating capacity	Investigation, monitoring, and statistics collection			Plant area	Project owners
		Promotion of women's rights	Proportion of females	Calculation of the percentage of female employees			Plant area	Project owners
		Water supply for downstream residents	Domestic and irrigation water	Investigation and monitoring			Domestic and irrigation water for downstream residents	Project owners

Figure 4-2 Survey form of environmental and social monitoring for pilot SHP stations

4.2 Collection of Materials and Field Survey

At the early stage of the project, data such as preliminary design reports on refurbishment, environmental monitoring reports, environmental mitigation measures, equipment completion reports, and relevant pictures and videos were collected from all pilot SHP stations. Field surveys were conducted to analyze the environmental and social risks involved in the implementation of the project. Figures 4-3, 4-4, and 4-5 show photos related to data collection, environmental mitigation measures taken, and field surveys in the pilot SHP stations, respectively.

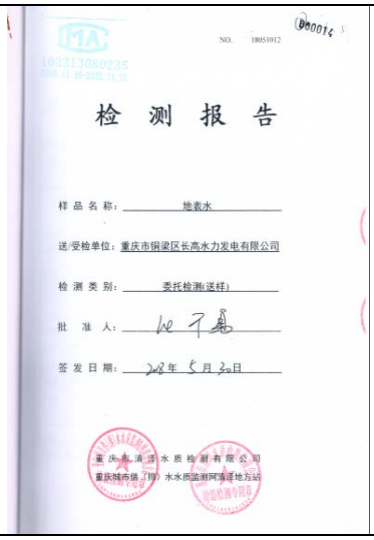
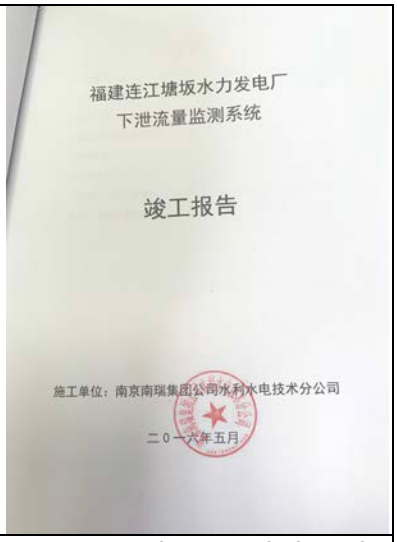
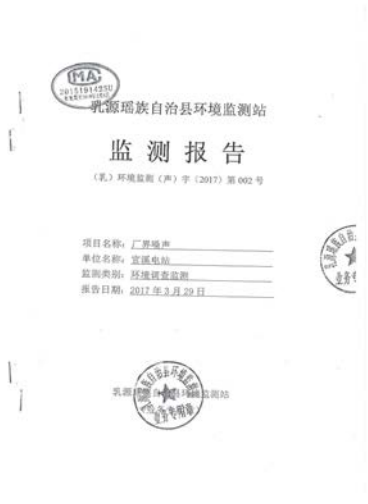
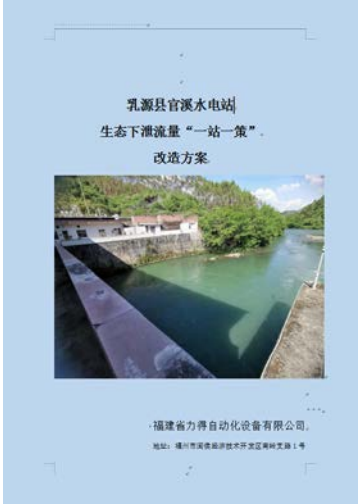
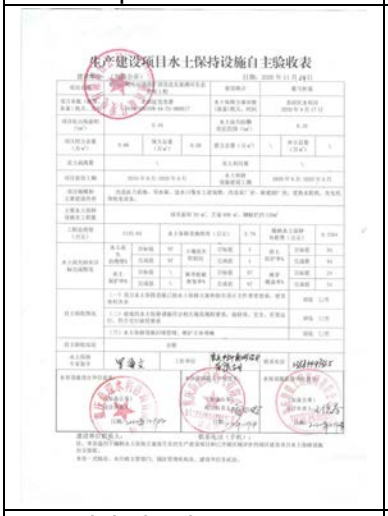
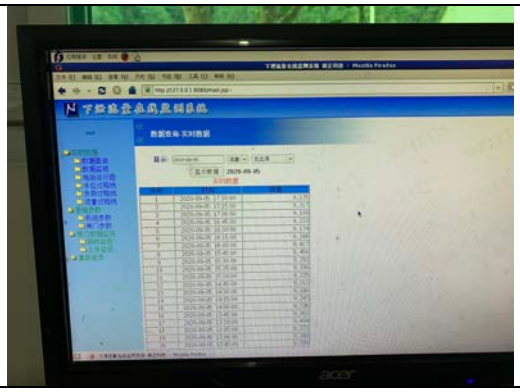
		
Preliminary design report	Water quality test report	Report on the completion of the ecological flow monitoring system
		
Aquatic ecosystem questionnaire	Noise test report	Plan on the refurbishment of ecological discharge flows
		
Materials for the acceptance of soil and water conservation facilities	Equipment purchase and sale contract	Approval of an environmental impact assessment report

Figure 4-3 Photos of data collected from pilot SHP stations

	
Landscaping in the premises of Fujian Tangban SHP Station	Landscaping field survey on Guangxi Tongpai SHP Station
	
Ecological dam beneath Fujian Gaofang Stage II SHP Station	Ecological Dam in Panxi Cascade SHP Station in Zhejiang Province
	
Discharge flow at Tantou Hydropower Station in Fujian Province	Ecological flow discharge facility in Panxi Cascade Hydropower Station in Zhejiang Province
	
Online ecological flow monitoring data of the Fujian Jiaoxi Stage III SHP Station	Online ecological flow monitoring data of Yunnan Mabozi SHP Station

	
Sewage treatment facility in the Zhejiang Panxi Stage II SHP Station	Sewage treatment system of Tangban Hydropower Station in Fujian Province
	
Ecological flow discharge and online monitoring equipment in Chongqing Taiping SHP Station	Online ecological flow monitoring equipment in Yunnan Mabozi SHP Station
	
Stock enhancement under Fujian Gaofang Stage II SHP Station Dam	Stock enhancement under the dam of the Yunnan Mabozi SHP Station
	
Oil filter in the power house of Guangdong Guanxi SHP Station	Oil filter in the plant of Chongqing Majing SHP Station

	
Landscape planting in Panxi Cascade Hydropower Station in Zhejiang Province	Landscaping on the premises of Chongqing Gaokeng SHP Station
	
Ecological water-retaining dam at the losing section of Tantou Hydropower Station in Fujian Province	Ecological water-retaining dam of Yangdaohe Hydropower Station in Hubei Province
	
Refurbishment of irrigation facility in the Guangdong Guanxi SHP Station	Ecological unit in Yunnan Mabozi SHP Station
	
Trash rack of Chongqing Gaokeng SHP station	Garbage station of Chongqing Majing SHP Station

Figure 4-4 Photos of pilot SHP stations that have adopted environmental and social mitigation measures

	
Field survey meeting at Yangdaohe Hydropower Station in Hubei Province	Field survey of generating units of Jiaosan Hydropower Station in Fujian Province
	
Field survey personnel and owner of Jiangjunzhu Hydropower Station in Hubei Province	Field survey personnel communicating with the staff of Yangdaohe Hydropower Station in Hubei Province

Figure 4-5 Photos of field surveys at pilot SHP stations

4.3 Preparation of the Monitoring Report on Implementation of ESMP

In February 2021-April 2023, the monitoring and evaluation of ESMP implementation were carried out on 19 pilot SHP stations in 8 pilot provinces, through environmental monitoring, field investigation, data sorting and analysis, and public engagement in the investigation. And the *Monitoring Report on Implementation of ESMP* prepared in December 2021 and April 2023 respectively was submitted to ICSHP, and upon exchange of views with ICSHP, the altered report was e-mailed to UNIDO.

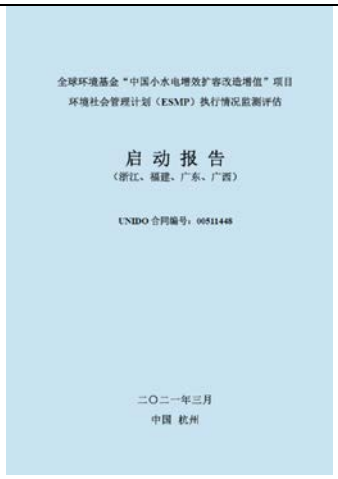
4.4 Preparation of the Final Report

The Final Report was completed in May 2023, summarizing all the work undertaken during the contract period based on the above activities.

5 Main Work Results

5.1 Inception Report

After signing a contract with UNIDO in February 2021, I devoted myself to familiarity with the project background and work contents. After reading a lot of readily available materials about the project, I have formulated detailed work procedures, and sorted out key stages for the progress of work in accordance with the ESMP prepared by each SHP station and laws, regulations, and standards in connection with environmental protection. Each work plan and schedule set and deliverables submitted give an instruction on the follow-up work. Figure 5-1 shows the completed Inception Reports.


全球环境基金“中国小水电增效扩容改造增值”项目
环境社会管理计划（ESMP）执行情况监测评估

启 动 报 告
（浙江、福建、广东、广西）

UNIDO 合同编号：00511448

二〇二一年三月
中国 杭州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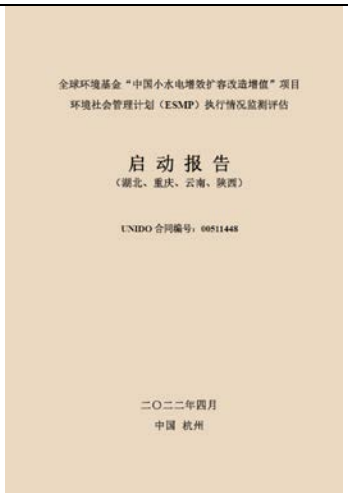
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UNIDO 合同编号：00511448

二〇二二年四月
中国 杭州


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Inception Report (Zhejiang, Fujian, Guangdong, and Guangxi)

Inception Report (Hubei, Chongqing, Yunnan, and Shaanxi)

Figure 5-1 Completed Inception Report

5.2 Monitoring Report on Implementation of ESMP

5.2.1 Monitoring and Evaluation of the Implementation of Environmental Mitigation Measures

The GEF Upgrading of China SHP Capacity Project has environmental and social impacts during the construction and operation periods. According to the requirements of the GEF project, environmental and social management is a must-do. In 2020, the environmental and social management plan (ESMP) for each pilot SHP station was prepared. With environmental mitigation measures taken during the construction and operation periods, each SHP station has been hitherto completed and put into use. According to the monitoring and evaluation, all sub-project owners with strenuous environmental/social management efforts performed well in taking environmental mitigation measures in the ESMP. During the construction and operation periods, monitoring and evaluation were made on the implementation of the environmental mitigation measures in ESMP by each pilot SHP station.

(1) Monitoring of the implementation of environmental mitigation measures during the construction period

During the construction period, the owners of the pilot SHP stations protective measures against water pollution, noise pollution, air pollution, solid waste, soil erosion, water supply and irrigation crisis, resident employment crisis. To address challenges such as single wastewater quality and low water yield during the construction period, original septic tanks on the premises and newly-set sedimentation basins were made full use of to meet requirements by and large; for the noise of construction, allocation of earplugs and no nighttime construction were adopted for protection; domestic garbage arising out of construction was typically collected in trash bins before being and transported; construction workers wore dust masks and washed

vehicles to keep clear of dust incurred in construction; and soil erosion was prevented amidst construction by drainage system construction, revetment and retaining wall renovation, as well as comprehensive utilization of excavated earthwork in place of spoil, in a bid to facilitate conservation of water and soil. Given minor "water, air, noise and solid waste" pollution arising out of construction owing to the low workload of civil engineering and a small area of land disturbed in the refurbishment of pilot SHP stations, with the preceding treatment measures taken, the refurbishment had no significant impact on the environment and met requirements for environmental protection.

(2) Monitoring of the implementation of environmental mitigation measures during the operation period

During the operation period, appropriate protective measures were also taken against water pollution, noise pollution, solid waste pollution, and impact on the ecosystem, ecological flow, downstream water supply, income of each SHP station, and rights and interests of women.

As SHP stations typically employed a few staff for operation and produced not high quantity of domestic sewage, the domestic sewage was disposed of in original septic tanks of stations and regularly and transported to farmland as organic fertilizers. In some SHP stations, such as Fujian Tangban SHP Station, Zhejiang Panxi Cascade SHP Station, Hubei Yangdaohe SHP Station, and Chongqing Xiaokeng SHP Station, domestic sewage was put into centralized disposal in a buried integrated sewage treatment plant and the treated water up to standard flowed into the artificial wetland. With less pollution in nearby waters, downstream water quality was ensured. For noise stemming from SHP stations in operation, each central control room and duty room were mounted with soundproof doors and windows for denoising. And some SHP stations installed horizontal turbine generator sets for lowering the

intensity of noise sources. For all SHP stations, boundary noise met the *Emission Standard for Industrial Enterprise Noise at Boundary* (GB12348-2008) and relevant executive standards. For all SHP amidst operation, domestic garbage remained being collected in garbage stations and trash bins before being cleared and transported for disposal. Waste oil arising out of equipment maintenance in SHP stations was collected in additional waste oil drums and vacuum oil filters before being delivered to designated locations for centralized disposal. And the flotage held up by trash racks and trash cleaning machines at the water inlets was put into hazard-free incineration.

For ecosystem protection, all pilot SHP stations typically took such protective measures as ecological dam building in reaches with water reduced, landscaping, and revetment restoration. In some SHP stations such as Fujian Tangban SHP Station, Gaofang Stage II SHP Station, Zhejiang Panxi Cascade SHP Station, Hubei Zhoujialiang SHP Station, and Yunnan Mabozi SHP Station, fry stock enhancement was to protect aquatic organisms and promote a virtuous circle of the ecosystem. In response to environmental mitigation measures ecological water consumption and household water consumption in downstream river channels amidst the operation of SHP stations, an ecological discharge facility was added in SHP station refurbishment to discharge ecological flow, matched with an online ecological flow monitoring device installed. Based on analyzed online monitoring data collected, each pilot SHP station discharged the verified ecological flow. This way, ecological flows were fulfilled except for individual dry months. Whilst discharging ecological flow, each pilot SHP station also set an ecological dam in the downstream river channel with reduced water for retaining ecological water, erected or refurbished water supply and irrigation facilities, so as to secure downstream river ecosystem and

household water consumption for production and life.

Each refurbished SHP station saw an increase in female employees. In most SHP stations, female employees represented over 25%; and in some SHP stations such as Gaofang Stage II SHP Station in Fujian Province, Qingshuitan SHP Station in Zhejiang Province, Mabozi SHP Station in Yunnan Province, female employees even accounted for 50%, improving the participation of women and protection of their rights and interests. In addition, a 9.6% to 380% surge was seen in the income of power generation for the refurbished SHP stations, along with greater economic and social benefits drawn from transport facilities and lighting facilities built for residents nearby.

In all, each pilot SHP station carried out environmental mitigation measures with effectiveness. With funds well allocated, all environmental mitigation measures yielded pretty satisfactory results, including a high up-to-standard ratio and reduction of the negative impact of project implementation on the environment, thus leading to the successful implementation of the GEF project.

The implementation of environmental/social risks and mitigation measures for each pilot power station is shown in Tables 5-1 and 5-2.

Table 5-1 Implementation of environmental/social risks and mitigation measures in pilot SHP stations（Zhejiang, Fujian, Guangdong, Guangxi）

EMP Mitigation Measures		Implementation of Environmental Mitigation Measures in the Pilot SHP Station							
		Fujian Tangban SHP Station	**Fujian Jiaoxi Stage III/Tantou SHP Station**	**Fujian Gaofang Stage II SHP Station**	**Guangdong Guanxi SHP Station**	**Guangxi Aibu Stage II/III SHP Station**	**Guangxi Sandieling/Tongpai SHP Station**	**Zhejiang Panxi Cascade SHP Station**	**Zhejiang Qingshuitan SHP Station**
Construction Period	Wastewater disposal	Original septic tank was used, along with a newly built buried sewage treatment plant	Domestic sewage was disposed in the original septic tank of the SHP station	Waste water arising out of construction and production was disposed in the sedimentation tank while domestic sewage was disposed in the original septic tank of the SHP station	Disposed in the original septic tank of the SHP station	Disposed in the original septic tank of the SHP station	Disposed in the original septic tank of the SHP station	One septic tank was built in the Stage II SHP station and 1 buried sewage treatment plant was erected in the Stage II/III/IV SHP station respectively	Domestic sewage was disposed in the original septic tank of the SHP station
	Noise control	The construction workers wore earplugs and no construction in the nighttime	The construction workers wore earplugs and no construction in the nighttime	Mechanical operation was banned in the nighttime and construction vehicles were required to slow down while passing residential quarters	No nighttime construction	No nighttime construction	No nighttime construction	Construction was banned in the nighttime	The construction site was far away from any residential quarters and construction was banned in the nighttime

EMP Mitigation Measures		Implementation of Environmental Mitigation Measures in the Pilot SHP Station							
		Fujian Tangban SHP Station	**Fujian Jiaoxi Stage III/Tantou SHP Station**	**Fujian Gaofang Stage II SHP Station**	**Guangdong Guanxi SHP Station**	**Guangxi Aibu Stage II/III SHP Station**	**Guangxi Sandieling/Tongpai SHP Station**	**Zhejiang Panxi Cascade SHP Station**	**Zhejiang Qingshuitan SHP Station**
	Solid waste disposal	Garbage station and trash bins were arranged for sorting out and collecting waste to be cleared and transported for disposal	Trash bins were arranged for collecting waste to be cleared and transported in time	Trash bins were arranged for collecting waste to be cleared and transported in time	Trash bins were arranged for collecting waste to be cleared and transported in time	Trash bins were arranged for collecting waste to be cleared and transported in time	Trash bins were arranged for collecting waste to be cleared and transported in time	Garbage station and trash bins were arranged for sorting out and collecting waste to be cleared and transported for disposal	Domestic garbage was collected in trash bins before being cleared and transported for disposal in time
	Dust disposal	Basically, no dust pollution for no civil engineering facility involved	The construction workers wore dust masks for protection	The construction workers watered the site and wore dust masks	The construction workers wore dust masks for protection	The construction workers wore dust masks for protection	The construction workers wore dust masks for protection	The construction workers wore dust masks for protection	The construction site was fully enclosed for construction and vehicles into and out of the site were washed for dust prevention
	Soil erosion control	Drainage system was completed and exposed side slopes and vegetation were restored in the premises	Site was leveled along with comprehensive utilization of excavated earthwork and afforestation in the SHP station	Comprehensive utilization of excavated earthwork and afforestation were realized in the SHP station	Vegetation was restored in the premises	Vegetation was restored in the premises	Vegetation was restored in the premises	Revetment was restored and site was leveled, along with comprehensive utilization of excavated earthwork, and afforestation in the SHP station	Retaining walls and drain ditches were arranged along with afforestation in the premises

EMP Mitigation Measures		Implementation of Environmental Mitigation Measures in the Pilot SHP Station							
		Fujian Tangban SHP Station	**Fujian Jiaoxi Stage III/Tantou SHP Station**	**Fujian Gaofang Stage II SHP Station**	**Guangdong Guanxi SHP Station**	**Guangxi Aibu Stage II/III SHP Station**	**Guangxi Sandieling/Tongpai SHP Station**	**Zhejiang Panxi Cascade SHP Station**	**Zhejiang Qingshuitan SHP Station**
	Water safety	Power generation was suspended in concurrency with the utilization of existing water supply facility for securing continuous water supply amidst refurbishment of the SHP station	No demand for water supply in the SHP station's downstream reach with water reduced	Power generation was suspended in concurrency with the utilization of existing water supply facility for securing continuous water supply amidst refurbishment of the SHP station	Power generation was suspended in concurrency with the utilization of existing water supply facility for securing continuous water supply amidst refurbishment of the SHP station	Power generation was suspended in concurrency with the utilization of existing water supply facility for securing continuous water supply amidst refurbishment of the SHP station	Power generation was suspended in concurrency with the utilization of existing water supply facility for securing continuous water supply amidst refurbishment of the SHP station	Power generation was suspended in concurrency with the utilization of existing water supply facility for securing continuous water supply amidst refurbishment of the SHP station	Power generation was suspended in concurrency with the utilization of existing water supply facility for securing continuous water supply amidst refurbishment of the SHP station

EMP Mitigation Measures		Implementation of Environmental Mitigation Measures in the Pilot SHP Station							
		Fujian Tangban SHP Station	**Fujian Jiaoxi Stage III/Tantou SHP Station**	**Fujian Gaofang Stage II SHP Station**	**Guangdong Guanxi SHP Station**	**Guangxi Aibu Stage II/III SHP Station**	**Guangxi Sandieling/Tongpai SHP Station**	**Zhejiang Panxi Cascade SHP Station**	**Zhejiang Qingshuitan SHP Station**
	Irrigation safety	Power generation was suspended and abundance of water in the downstream reach was secured, particularly for irrigation, by leverage of existing irrigation facility during the refurbishment of the SHP station	No demand for irrigation water downstream from the SHP station	The reservoir level was maintained and artesian water was pumped out for irrigation during the renovation of the irrigation canal	Power generation was suspended and abundance of water in the downstream reach was secured, particularly for irrigation, by leverage of existing irrigation facility during the refurbishment of the SHP station	Power generation was suspended and abundance of water in the downstream reach was secured, particularly for irrigation, by leverage of original irrigation facility and pump if necessary, during the refurbishment of the SHP station	Power generation was suspended and abundance of water in the downstream reach was secured, particularly for irrigation, by leverage of original irrigation facility during the refurbishment of the SHP station	Power generation was suspended and abundance of water in the downstream reach was secured, particularly for irrigation, by leverage of original irrigation facility during the refurbishment of the SHP station	Power generation was suspended and abundance of water in the downstream reach was secured, particularly for irrigation, by leverage of existing irrigation facility during the refurbishment of the SHP station
	Guarantee on resident employment and income	Manpower and material resources needed in refurbishment of the SHP station may spur employment and increase economic income of residents							

EMP Mitigation Measures		Implementation of Environmental Mitigation Measures in the Pilot SHP Station							
		Fujian Tangban SHP Station	**Fujian Jiaoxi Stage III/Tantou SHP Station**	**Fujian Gaofang Stage II SHP Station**	**Guangdong Guanxi SHP Station**	**Guangxi Aibu Stage II/III SHP Station**	**Guangxi Sandieling/Tongpai SHP Station**	**Zhejiang Panxi Cascade SHP Station**	**Zhejiang Qingshuitan SHP Station**
Operation Period	Domestic sewage treatment	In residential quarters, original septic tank was used along with a newly built buried sewage treatment plant and artificial wetland for advanced treatment	Domestic sewage was disposed in the original septic tank which was cleared on a regular basis for delivering organic fertilizers	Domestic sewage was disposed in the original septic tank of the SHP station	Domestic sewage was disposed in the original septic tank which was cleared on a regular basis for delivering organic fertilizers, along with 1 artificial wetland	Domestic sewage was disposed in the original septic tank of the SHP station	Domestic sewage was disposed in the original septic tank of the SHP station	One septic tank was built in the Stage II SHP station and 1 buried sewage treatment plant was erected in the Stage II/III/IV SHP station respectively	Domestic sewage was disposed in the original septic tank of the SHP station
	Noise control amidst SHP station operation	Acoustic panels and soundproof windows were installed in the central control room	Soundproof doors and windows were installed in the central control room	Soundproof doors and windows were installed in the central control room	Soundproof windows were installed in the central control room	Soundproof doors and windows were installed in the central control room	The central control room was isolated from the power house for power generation	Sound insulation was built in the central control room	Soundproof doors and windows were mounted in the duty room

EMP Mitigation Measures		Implementation of Environmental Mitigation Measures in the Pilot SHP Station							
		Fujian Tangban SHP Station	**Fujian Jiaoxi Stage III/Tantou SHP Station**	**Fujian Gaofang Stage II SHP Station**	**Guangdong Guanxi SHP Station**	**Guangxi Aibu Stage II/III SHP Station**	**Guangxi Sandieling/Tongpai SHP Station**	**Zhejiang Panxi Cascade SHP Station**	**Zhejiang Qingshuitan SHP Station**
	Solid waste disposal	Garbage station and trash bins were arranged to collect domestic garbage to be transported for disposal; waste oil drums were arranged to collect waste oil to be transported for disposal on a regular basis; trash racks and garbage collection devices were arranged at the water inlet	Trash bins were arranged to collect garbage and trash racks and garbage collection devices were arranged at the water inlet	Trash bins were arranged to collect domestic garbage; and trash racks; waste oil drums were arranged to collect waste oil to be transported for disposal on a regular basis	Trash bins were arranged to collect garbage and oil filters were arranged for filtering impurities; trash racks and garbage collection devices were arranged at the water inlet	Trash bins were arranged to collect garbage, along with original trash racks arranged at the water inlet for intercepting garbage	Trash bins were arranged to collect garbage, along with original trash racks arranged at the water inlet for intercepting garbage	Garbage station and trash bins were arranged to collect domestic garbage, along wish waste oil drums intended to collect waste oil to be transported for disposal on a regular basis; trash racks were arranged at the water inlet	Trash bins were arranged to collect garbage and trash racks and garbage collection devices were arranged at the water inlet

EMP Mitigation Measures		Implementation of Environmental Mitigation Measures in the Pilot SHP Station							
		Fujian Tangban SHP Station	**Fujian Jiaoxi Stage III/Tantou SHP Station**	**Fujian Gaofang Stage II SHP Station**	**Guangdong Guanxi SHP Station**	**Guangxi Aibu Stage II/III SHP Station**	**Guangxi Sandieling/Tongpai SHP Station**	**Zhejiang Panxi Cascade SHP Station**	**Zhejiang Qingshuitan SHP Station**
	Ecosystem protection	Stock enhancement of 250-300 fries per year and expanded area of vegetation in the SHP station	A total of 7 ecological dams were erected with expanded area of vegetation in the SHP station (560m^2)	One ecological dam was erected beneath the dam, along with stock enhancement of 1,000 fries and vegetation of the premises	Dispatching via increased discharge quantity amidst fish spawning and reproduction; vegetation restored in the premises	Vegetation was restored in the premises	Vegetation was restored in the premises, and retaining walls were erected in some reaches for avoidance of river bank erosion and collapse	Damaged revetments were restored, along with 3 refurbished ecological dams, vegetation restored in the flood land and premises and stock enhancement of 232 fries	Two ecological dams were erected, along with afforestation in the premises and power generation prioritized in ecological discharge water supply in dry season for dispatching
	Ecological flow discharge	Gates were refurbished to reach discharged ecological flow of 5.99m^3/s	Ecological sluice gates were refurbished to reach discharged ecological flow of 3.69~4.67m^3/s	Drain holes were arranged on the right of the dam to reach discharged ecological flow of 0.48m^3/s	Drain valves were refurbished to reach discharged ecological flow of 4.1m^3/s	Ecological drain holes were refurbished to reach discharged ecological flow of 1.66m^3/s	Ecological water outlets were refurbished to reach discharged ecological flow of 1.66m^3/s	Control valves were built below the dam to reach discharged ecological flow of 0.08m^3/s	Ecological drain pipes and valves were built on the dam to reach discharged ecological flow of 0.29m^3/s

EMP Mitigation Measures		Implementation of Environmental Mitigation Measures in the Pilot SHP Station							
		Fujian Tangban SHP Station	**Fujian Jiaoxi Stage III/Tantou SHP Station**	**Fujian Gaofang Stage II SHP Station**	**Guangdong Guanxi SHP Station**	**Guangxi Aibu Stage II/III SHP Station**	**Guangxi Sandieling/Tongpai SHP Station**	**Zhejiang Panxi Cascade SHP Station**	**Zhejiang Qingshuitan SHP Station**
	Income of an SHP station	The refurbished SHP station saw a 10% surge in its generating capacity and built roads and lighting facilities for residents nearby	The refurbished SHP station saw a 10.6% surge in the generating capacity, built roads and subsidized public electricity charges for residents nearby	The refurbished SHP station saw a 9.6% surge in the generating capacity and built lighting facility for residents nearby	The refurbished SHP station saw a 15.6% surge in the generating capacity	The refurbished SHP station saw a 96% surge in its generating capacity and built roads and lighting facilities for residents nearby	The refurbished SHP station saw a 41% surge in the generating capacity and built roads and lighting facilities for residents nearby	The refurbished SHP station saw a 20.4% surge in the generating capacity	The refurbished SHP station saw a 23.5% surge in its generating capacity and built roads and lighting facilities for residents nearby
	Rights and interests of women (participation)	After the refurbishment, the percentage of female employees grew from 21% to 27.9%	After the refurbishment, the percentage of female employees was flat (26.3%)	After the refurbishment, the percentage of female employees grew from 48.3% to 56.5%	After the refurbishment, the percentage of female employees grew from 25.7% to 45%	After the refurbishment, the percentage of female employees dropped from 29.2% to 5.3%	After the refurbishment, the percentage of female employees grew from 25.8% to 30%	After the refurbishment, the percentage of female employees grew from 15.6% to 37%	After the refurbishment, the percentage of female employees was flat (50%)

EMP Mitigation Measures		Implementation of Environmental Mitigation Measures in the Pilot SHP Station							
		Fujian Tangban SHP Station	**Fujian Jiaoxi Stage III/Tantou SHP Station**	**Fujian Gaofang Stage II SHP Station**	**Guangdong Guanxi SHP Station**	**Guangxi Aibu Stage II/III SHP Station**	**Guangxi Sandieling/Tongpai SHP Station**	**Zhejiang Panxi Cascade SHP Station**	**Zhejiang Qingshuitan SHP Station**
	Downstream water consumption	For the SHP station at dam toe with no dewatered reaches, gravel in the downstream reach of the SHP station was cleared to lower downstream tailwater level	Downstream from the SHP station is a less populated canyon, indicating no water demand for production or life within scope of influence	Irrigation canal was reinforced by 200m to ensure water consumption for production downstream	Irrigation tank was erected along with 2km long irrigation canal for securing water consumption for production downstream	Irrigation canal and other facilities were built to expand area of irrigation by 140,000 m^2 and thus ensure water consumption for irrigation downstream	Irrigation canal and other facilities were built to expand area of irrigation by 153,333 m^2 and thus ensure water consumption for irrigation downstream	Existing water supply and irrigation facilities were leveraged and well dispatched to ensure water consumption for production and life downstream from the SHP station	Irrigation facility and household water consumption facility were refurbished and reaches of the SHP station, downstream or upstream, were cleared and dredged to ensure water consumption for production and life downstream

Table 5-2 Implementation of environmental/social risks and mitigation measures in pilot SHP stations（Hubei, Chongqing, Yunnan, and Shaanxi）

EMP mitigation measures		Implementation of environmental mitigation measures in the pilot SHP station										
		Hubei Yangdaohe SHP Station	**Hubei Jiangjunzhu SHP Station**	**Hubei Zhoujialiang SHP Station**	**Chongqing Taiping SHP Station**	**Chongqing Xiaokeng SHP Station**	**Chongqing Gaokeng SHP Station**	**Chongqing Majing SHP Station**	**Yunnan Mabozi SHP Station**	**Yunnan Chahe SHP Station**	**Yunnan Maoyandong SHP Station**	**Shaanxi Xinpingya SHP Station**
Construction Period	Wastewater disposal	Production wastewater was disposed of in a sedimentation tank for recycling. The domestic sewage was put into integrated embedded sewage treatment facilities.	Production wastewater was disposed of in a sedimentation tank for recycling. The domestic sewage generated during construction was fed into an urban sewage treatment plant.	The wastewater generated during construction and production was disposed of in a sedimentation tank while domestic sewage generated during construction was disposed of in septic tanks for watering mountain forests.	The wastewater generated during construction and production was disposed of in a sedimentation tank while domestic sewage generated during construction was disposed of in septic tanks for watering mountain forests.	Production wastewater was disposed of in a sedimentation tank for recycling. The domestic sewage was put into integrated embedded sewage treatment facilities.	The production wastewater was disposed of in a sedimentation tank for recycling, while the domestic sewage generated during construction was disposed of in a grease trap and septic tank for farmland irrigation.	The wastewater generated during construction and production was disposed of in a sedimentation tank while domestic sewage generated during construction was disposed of in septic tanks before discharge.	The domestic sewage was disposed of in septic tanks, and there was no sewage generated during construction.	The original septic tanks were refurbished into embedded septic tanks.	A new septic tank and grease trap were built.	The construction/ production wastewater and domestic sewage were disposed of in septic tanks and discharged for watering mountain forests.

EMP mitigation measures		Implementation of environmental mitigation measures in the pilot SHP station										
		Hubei Yangdaohe SHP Station	Hubei Jiangjunzhu SHP Station	Hubei Zhoujialiang SHP Station	Chongqing Taiping SHP Station	Chongqing Xiaokeng SHP Station	Chongqing Gaokeng SHP Station	Chongqing Majing SHP Station	Yunnan Mabozi SHP Station	Yunnan Chahe SHP Station	Yunnan Maoyandong SHP Station	Shaanxi Xinpingya SHP Station
	Noise control	Construction workers wore earplugs and stopped working in the nighttime.	Construction workers wore earplugs and stopped working in the nighttime.	Construction workers wore earplugs and stopped working in the nighttime.	Construction workers wore earplugs and stopped working in the nighttime.	Construction workers wore earplugs and stopped working in the nighttime.	Construction workers wore earplugs and stopped working in the nighttime.	Construction workers wore earplugs and stopped working in the nighttime.	Construction workers wore earplugs and stopped working in the nighttime.	Construction workers wore earplugs and stopped working in the nighttime.	The construction site was far away from any residential quarters and no construction was made in the nighttime.	Construction workers wore earplugs and stopped working in the nighttime.
	Solid waste disposal	Waste transfer stations and trash bins were set up, with all waste cleared and removed by the town's sanitation department in time.	Waste transfer stations and trash bins were set up, with all waste cleared and removed by the city/town's sanitation department in time.	Waste transfer stations and trash bins were set up, with all waste cleared and removed by the city/town's sanitation department in time.	Waste transfer stations and trash bins were set up, with all waste cleared and removed by the city/town's sanitation department in time.	Waste transfer stations and trash bins were set up, with all waste cleared and removed by the city/town's sanitation department in time.	Waste transfer stations and trash bins were set up, with all waste cleared and removed by the city/town's sanitation department in time.	Trash bins were arranged, with waste cleared and transported in time.	Garbage stations and trash bins were arranged for sorting out and collecting waste to be cleared and transported for disposal in time.	Waste was sorted out, collected, cleared, and transported for disposal in time.	Trash bins were arranged, with waste cleared and transported in time.	Trash bins were arranged, with waste cleared and transported in time.
	Dust disposal	Construction workers watered the site and wore dust masks.	Construction workers watered the site and wore dust masks.	Construction workers watered the site and wore dust masks.	Construction workers watered the site and wore dust masks.	Construction workers watered the site and wore dust masks.	Construction workers watered the site and wore dust masks.	Construction workers were well-protected and wore dust masks while working.	Basically, there was no dust pollution as no civil engineering facility was involved.	Basically, there was no dust pollution due to a low amount of civil engineering construction work.	Basically, there was no dust pollution as no civil engineering facility was involved.	Construction workers were well-protected and wore dust masks while working.

EMP mitigation measures		Implementation of environmental mitigation measures in the pilot SHP station										
		Hubei Yangdaohe SHP Station	**Hubei Jiangjunzhu SHP Station**	**Hubei Zhoujialiang SHP Station**	**Chongqing Taiping SHP Station**	**Chongqing Xiaokeng SHP Station**	**Chongqing Gaokeng SHP Station**	**Chongqing Majing SHP Station**	**Yunnan Mabozi SHP Station**	**Yunnan Chahe SHP Station**	**Yunnan Maoyandong SHP Station**	**Shaanxi Xinpingya SHP Station**
	Soil erosion control	The following measures were taken: topsoil stripping and protection, tree planting on the premises of the SHP station, temporary drainage and sedimentation, construction site leveling, etc.	The following measures were taken: topsoil stripping and protection, tree planting on the premises of the SHP station, temporary drainage and sedimentation, construction site leveling, etc.	The following measures were taken: topsoil stripping and protection, tree planting on the premises of the SHP station, temporary drainage and sedimentation, construction site leveling, etc.	The following measures were taken: revetment of collapsed bank slopes, protection of dam slopes with concrete protective walls, comprehensive utilization of excavated earthwork, etc.	The following measures were taken: topsoil stripping and protection, tree planting on the premises of the SHP station, temporary drainage and sedimentation, construction site leveling, etc.	Drainage systems were completed and exposed side slopes and vegetation were restored in the premises.	During construction, damage on the plantation outside the working areas was minimized to retain the existing plantation.	Drainage systems were completed and exposed side slopes and vegetation were restored in the premises.	Basically, there is no soil erosion due to a low amount of civil engineering construction work.	Side slopes along the river were repaired and cemented and exposed side slopes and vegetation were restored in the premises.	The following measures were taken: topsoil stripping and protection, tree planting on the premises of the SHP station, temporary drainage and sedimentation, construction site leveling, etc.

EMP mitigation measures		Implementation of environmental mitigation measures in the pilot SHP station										
		Hubei Yangdaohe SHP Station	**Hubei Jiangjunzhu SHP Station**	**Hubei Zhoujialiang SHP Station**	**Chongqing Taiping SHP Station**	**Chongqing Xiaokeng SHP Station**	**Chongqing Gaokeng SHP Station**	**Chongqing Majing SHP Station**	**Yunnan Mabozi SHP Station**	**Yunnan Chahe SHP Station**	**Yunnan Maoyandong SHP Station**	**Shaanxi Xinpingya SHP Station**
Construction Period	Water safety	Power generation was suspended and existing water supply facilities were used to ensure continuous water supply amidst the refurbishment of the SHP station.	Power generation was suspended and existing water supply facilities were used to ensure continuous water supply amidst the refurbishment of the SHP station.	Power generation was suspended at the SHP station to increase water in riverways and extract water from riverways instead of channels.	Power generation was suspended at the SHP station to drain off reservoir water via overflow weirs and increase water in riverways.	Power generation was suspended at the SHP station to drain off reservoir water via overflow weirs and increase water in riverways.	Power generation was suspended at the SHP station to increase the flow of riverways and ensure downstream water supply via existing river barrages.	Power generation was suspended at the SHP station to increase the flow of riverways and ensure downstream water supply via existing river barrages.	Power generation was suspended and existing water supply facilities were used to ensure continuous water supply amidst the refurbishment of the SHP station.	Power generation was suspended and existing water supply facilities were used to ensure continuous water supply amidst the refurbishment of the SHP station.	Power generation was suspended and existing water supply facilities were used to ensure continuous water supply amidst the refurbishment of the SHP station.	Situated downstream of Jieling Town, the SHP station with no reservoir storage had no impact on the water for production and lives in Jieling Town.
	Irrigation safety	Power generation was suspended and existing facilities were used for irrigation amidst the refurbishment of the SHP station.	Power generation was suspended and existing facilities were used for irrigation amidst the refurbishment of the SHP station.	During channel construction, the water outage was minimized to avoid affecting the supply of irrigation water.	With increased water in riverways, existing retaining barrages and irrigation channels were made the best of to ensure the supply of irrigation water.	With increased water in riverways, existing retaining barrages and irrigation channels were made the best of to ensure the supply of irrigation water.	Power generation was suspended at the SHP station, to increase the flow of riverways and ensure downstream water supply for irrigation via existing river barrages.	Power generation was suspended at the SHP station, to increase the flow of riverways and ensure downstream water supply for irrigation via existing river barrages.	Power generation was suspended and existing water supply facilities were used for downstream irrigation amidst the refurbishment of the SHP station.	Power generation was suspended and existing water supply facilities were used for downstream irrigation amidst the refurbishment of the SHP station.	Power generation was suspended and existing facilities were used to ensure downstream water supply amidst the refurbishment of the SHP station.	Situated upstream of Jieling Town, the SHP station with no regulated reservoir storage had no impact on downstream irrigation.

EMP mitigation measures		Implementation of environmental mitigation measures in the pilot SHP station										
		Hubei Yangdaohe SHP Station	**Hubei Jiangjunzhu SHP Station**	**Hubei Zhoujialiang SHP Station**	**Chongqing Taiping SHP Station**	**Chongqing Xiaokeng SHP Station**	**Chongqing Gaokeng SHP Station**	**Chongqing Majing SHP Station**	**Yunnan Mabozi SHP Station**	**Yunnan Chahe SHP Station**	**Yunnan Maoyandong SHP Station**	**Shaanxi Xinpingya SHP Station**
	Guarantee on resident employment and income	Workers, building materials, agricultural and forestry products, and daily necessities are needed during the construction period, which can bring more jobs and income to local residents.										
Operation Period	Domestic sewage treatment	A sewage treatment station was arranged for disposal and up-to-standard effluent discharge.	The domestic sewage was disposed of in septic tanks before being fed into the urban sewage treatment plant.	The domestic sewage was disposed of in septic tanks for watering farmland and mountain forest.	The domestic sewage was fed into a sewage treatment system of Nixi Town.	Integrated sewage treatment facilities were arranged for disposing of domestic sewage.	Septic tanks were arranged for disposing of water for watering farmland.	Septic tanks were arranged for disposing of domestic sewage for watering farmland.	The domestic sewage was disposed of in existing septic tanks.	An embedded sewage treatment facility was built for disposing of water for landscaping.	A new septic tank and grease trap were built for water disposal.	The domestic sewage was disposed of in septic tanks for watering mountain forest, which was not drained off.
	Noise control amidst SHP station operation	Acoustic panels and soundproof windows were installed in the central control room and duty room.	Acoustic panels and soundproof windows were installed in the central control room and duty room.	The central control room was isolated from power plants with double-layered soundproof windows.	Soundproof doors and windows were installed in the central control room and duty room.	Walls in the power plant were made from soundproof materials, with soundproof doors and windows installed in the central control room and duty room.	Acoustic panels and soundproof windows were installed in the central control room, with earplugs arranged for employees.	Soundproof doors and windows were installed in the central control room and duty room.	Acoustic panels and soundproof windows were installed in the central control room	Soundproof windows were installed in the central control room.	Acoustic panels and soundproof windows were installed in the central control room	Soundproof doors and windows were installed in the central control room and duty room.

EMP mitigation measures		Implementation of environmental mitigation measures in the pilot SHP station										
		Hubei Yangdaohe SHP Station	**Hubei Jiangjunzhu SHP Station**	**Hubei Zhoujialiang SHP Station**	**Chongqing Taiping SHP Station**	**Chongqing Xiaokeng SHP Station**	**Chongqing Gaokeng SHP Station**	**Chongqing Majing SHP Station**	**Yunnan Mabozi SHP Station**	**Yunnan Chahe SHP Station**	**Yunnan Maoyandong SHP Station**	**Shaanxi Xinpingya SHP Station**
	Solid waste disposal	Garbage stations and trash bins were arranged, with waste cleared and removed by the urban sanitation department in time.	Garbage stations and trash bins were arranged, with waste cleared and removed by the urban sanitation department in time.	New trash racks were arranged at the water inlet, with domestic garbage cleared and removed by the urban sanitation department.	New trash racks were arranged at the water inlet, with domestic garbage cleared and removed by the urban sanitation department.	Garbage stations and trash bins were arranged, with waste cleared and removed by the urban sanitation department in time.	Trash racks and garbage clearing devices were arranged at the water inlet, with domestic garbage cleared and removed by the sanitation department.	Trash racks were arranged at the water inlet, along with oil leak storage tanks and vacuum oil filters. The domestic garbage was cleared and removed by the sanitation department.	Trash racks were arranged at the water inlet, along with waste oil containers. The domestic garbage was cleared and removed by the sanitation department.	Trash racks and garbage clearing devices were arranged at the water inlet, along with a temporary storeroom for waste oil. The domestic garbage was cleared and removed by the sanitation department.	Trash racks and garbage clearing devices were arranged at the water inlet, along with a temporary storeroom for waste oil. The domestic garbage was cleared and removed by the sanitation department.	Garbage stations and trash bins were arranged, with waste cleared and removed by the urban sanitation department in time.
	Ecosystem protection	Vegetation was restored in the premises, and submerged dikes were erected in some reaches to improve the ecological environment of riverways.	Original ecological dams of dewatered reaches of the SHP station were refurbished, and flood land was ecologically restored to improve water ecology.	The tailwater channel was refurbished, with ecological dams added downstream for fish stock enhancement.	Apart from landscaping in the premises of the SHP station, discharged ecological flow was increased to improve the ecological environment under the dam in dewatered reaches.	Original ecological dams of dewatered reaches of the SHP station were refurbished, and flood land was ecologically restored to improve water ecology.	Dewatered reaches of the SHP station were refurbished, and flood land was ecologically restored to improve water ecology.	Apart from landscaping in the premises of the SHP station, discharged ecological flow was increased to improve the ecological environment under the dam in dewatered reaches.	Apart from the stock enhancement of 250-300 fry per year, the area of vegetation was expanded in the SHP station.	The vegetation was expanded in the SHP station.	Side slopes along the water in the dam area were reinforced, besides landscaping in the dam area and premises.	The vegetation was expanded in the SHP station.

EMP mitigation measures		Implementation of environmental mitigation measures in the pilot SHP station										
		Hubei Yangdaohe SHP Station	**Hubei Jiangjunzhu SHP Station**	**Hubei Zhoujialiang SHP Station**	**Chongqing Taiping SHP Station**	**Chongqing Xiaokeng SHP Station**	**Chongqing Gaokeng SHP Station**	**Chongqing Majing SHP Station**	**Yunnan Mabozi SHP Station**	**Yunnan Chahe SHP Station**	**Yunnan Maoyandong SHP Station**	**Shaanxi Xinpingya SHP Station**
Operation Period	Ecological flow discharge	Measures were taken to ensure that the ecological flow of Chaotianhou, Yangdaohe, and Shijiaba reached 0.78, 1.37, and 1.52m^3/s respectively.	Water discharge facilities and online flow monitoring equipment were added to ensure an ecological flow of 0.48m^3/s.	Online flow monitoring equipment was installed to ensure an ecological flow of 0.72m^3/s.	Water discharge facilities and online flow monitoring equipment were added to ensure an ecological flow of 0.91m^3/s.	Water discharge facilities and online flow monitoring equipment were added to ensure an ecological flow of 0.74m^3/s.	A discharged ecological flow of 1.65m^3/s was ensured via an ecological gate.	Water discharge facilities and online flow monitoring equipment were added to ensure an ecological flow of 0.57m^3/s.	Small ecological flow units were added to ensure a discharged ecological flow of 0.7m^3/s.	Gates were refurbished to reach discharged ecological flow of 5.99m^3/s	Gates were refurbished to achieve a discharged ecological flow of 0.724m^3/s.	Online flow monitoring equipment was installed to ensure an ecological flow of 0.43m^3/s.
	Income of an SHP station	Upon refurbishment, Chaotianhou, Yangdaohe, and Shijiaba SHP stations saw an increase of 16.832 million kW·h in power generation and a 25.6% surge in income.	Years after the refurbishment of the SHP station, average power generation rose by 2.848 million kW·h, and income shot up by 22.1%.	After the refurbishment and operation of the SHP station, power generation rose by 4.9238 million kW·h, and income shot up by 28%.	Years after the refurbishment of the SHP station, average power generation rose by 1.97 million kw·h/a, and income shot up by 18.11%.	Years after the refurbishment of the SHP station, average power generation rose by 2.54 million kW·h, and income exploded by 163%.	Upon the refurbishment of the SHP station, power generation rose by 3.95 million kW·h/a, and income is expected to increase by 20.8%.	Upon the refurbishment of the SHP station, power generation rose by 12.7 million kW·h/a, and income is expected to increase by 44%.	Upon the refurbishment of the SHP station, power generation rose by 18.19 million kW·h/a, and income exploded by 380.5%.	Upon the refurbishment of the SHP station, power generation rose by 16.7048 million kW·h/a, and income exploded by 175.9%.	Upon the refurbishment of the SHP station, power generation rose 16.53 million kW·h/a, and income went up by 31.8%.	Upon the refurbishment of the SHP station, power generation rose by 2.17 million kW·h, and income was 22.37% higher than before.
	Rights and interests of women (participation)	The percentage of female employees grew from 33.3% to 42.3%.	The percentage of female employees grew from 15.6% to 37.5%.	The percentage of female employees in the SHP station remained unchanged at 33.3%.	The percentage of female employees in the SHP station grew from 20% to 40%.	The percentage of female employees decreased from 33.3% to 30.8%.	The percentage of female employees grew from 12.5% to 22.22%.	The percentage of female employees grew from 10.5% to 14.3%.	The percentage of female employees grew from 50% to 52.9%.	The percentage of female employees grew from 0% to 20%.	The percentage of female employees grew from 31.5% to 33.3%.	The percentage of female employees in the SHP station grew from 20% to 40%.

EMP mitigation measures		Implementation of environmental mitigation measures in the pilot SHP station										
		Hubei Yangdaohe SHP Station	**Hubei Jiangjunzhu SHP Station**	**Hubei Zhoujialiang SHP Station**	**Chongqing Taiping SHP Station**	**Chongqing Xiaokeng SHP Station**	**Chongqing Gaokeng SHP Station**	**Chongqing Majing SHP Station**	**Yunnan Mabozi SHP Station**	**Yunnan Chahe SHP Station**	**Yunnan Maoyandong SHP Station**	**Shaanxi Xinpingya SHP Station**
	Downstream water consumption	The dry season had barely any impact on the water supply to local residents. Riverbed water only occupied a small portion of the water for farmland irrigation.	Ecological drain pipes were laid out and well deployed to ensure a constant supply of water to downstream residents for production, living, and ecological purposes.	A water supply pool was built and equipped with pumps, pipes, and disinfection facilities to ensure water safety.	Water discharge facilities were arranged and existing retaining barrages downstream were used to ensure a supply of water to downstream residents for production, living, and ecological purposes.	Retaining barrages downstream from the dam site were used to retain water discharged from the reservoir and ensure a supply of water to residents on both banks for production and living purposes.	Two newly built retaining barrages downstream from the dam site were used to retain water discharged from the reservoir and ensure the supply of water to residents on both banks for production and living purposes.	Existing irrigation channels were refurbished, drain pipes were added and well deployed, and existing retaining barrages of downstream reaches were leveraged to ensure downstream water supply.	For the SHP station at a dam toe, dewatered reaches were restored, and gravel in the downstream reaches of the SHP station was cleared to lower downstream tailwater levels.	Downstream reaches were dredged to lower downstream tailwater levels.	Reaches upstream and downstream of the SHP station were dredged, and funds were allotted to clear irrigation channels in the village.	Situated downstream of Jieling Town, the SHP station with no reservoir storage had no impact on the water for production and lives in Jieling Town.

5.2.2 Monitoring and Evaluation of the Implementation of ESMP

The implementation of the ESMP requires a large amount of monitoring data, and the effectiveness of environmental and social risk mitigation measures can be properly assessed only with monitoring tools. As such, monitoring and evaluation of ESMP implementation is of vital significance.

So far, each SHP station has been completed and put into use. According to the monitoring and evaluation, all pilot SHP station owners performed well in carrying out the environmental monitoring plan in ESMP with strenuous efforts. During the construction and operation periods, monitoring and evaluation were made on the implementation of the environmental monitoring plan in ESMP by each pilot SHP station.

(1) Implementation of the environmental monitoring plan during the construction period

All pilot SHP station owners hired third-party testing agencies, e.g., local environmental monitoring stations, to monitor the water and sound environment, monitor ecological flow discharge online in real-time, and perform data statistics and analysis for income of each SHP station and participation of female employees therein, and perform field survey and surveillance on dust, domestic garbage, water supply and irrigation, and ecosystems. They accomplished environmental management in accordance with the monitoring plan in the ESMP. And it is noteworthy that Qingshuitan SHP Station in Zhejiang Province, Guanxi SHP Station in Guangdong, Yangdaohe SHP Station in Hubei Province, Gaokeng SHP Station in Chongqing, Majing SHP Station, and Maoyandong SHP Station in Yunnan Province monitored the surface water environment in the downstream reaches during construction, in addition to fulfillment of monitoring programs listed in the monitoring plan. As analyzed on third

party monitoring data, disposed construction waste water hit Level I in the *Integrated Wastewater Discharge Standard* (GB8978-1996) and boundary noise during construction period was tested to below the limit of noise emission stipulated in the *Emission Standard of Environment Noise for Boundary of Construction Site* (GB12523-2011). And as monitored and surveyed by each SHP station owner, dust, solid waste, conservation of water and soil, and downstream water consumption were monitored on the strength of ESMP during the construction period. With basically up-to-standard monitoring frequency, monitoring results suggest a minor impact on the atmosphere, soil, and downstream water consumption for production and life after environmental mitigation measures were taken by each SHP station.

In addition, narrow range of environmental monitoring contents, low monitoring frequency and other problems found in the implementation of environmental monitoring plan should be noted and put under tight management in the follow-up project.

(2) Implementation of environmental monitoring plan during the operation period

According to the analysis of monitoring data, during the operation period, treated wastewater met Level I discharge standards specified in the Integrated Wastewater Discharge Standard (GB8978-1996), and water quality in reaches downstream from each SHP station met Class I-III surface water quality standards in the Environmental Quality Standards for Surface Water (GB3838-2002) with satisfactory results. Nevertheless, the water quality indicators of some SHP stations, such as Yunnan Maoyandong SHP Station and Shaanxi Xinpingya SHP Station, were partially substandard, with total phosphorus out of limits. In the corresponding period, boundary noise monitored in the premises hit Class 2~3 noise in the *Standard of Noise at Boundary of Industrial*

Enterprises (GB12348-2008) but for some SHP stations, including Fujian Jiaoxi Stage III/Tantou SHP Station, Guangxi Aibu Stage II/III SHP Station, and Guangxi Sandieling/Tongpai SHP Station, nighttime noise was beyond Class 3 noise standard and thus not up to standard. And as monitored and surveyed by each SHP station owner, solid waste, ecological flow, ecosystem, the income of each SHP station, rights and interests of women, and downstream water consumption for production and life were monitored on the strength of ESMP during the operation period. With up-to-standard monitoring frequency, monitoring results suggest a minor impact on the soil, ecological environment and downstream water consumption for production and life after environmental mitigation measures were taken by each SHP station.

In all, an environmental monitoring plan was effectively put into practice in each pilot SHP station. With funds well allocated, the bulk of environmental monitoring was up to standard and the objective evaluation of the effectiveness of environmental mitigation measures in the GEF project provided grounds for the monitoring and evaluation of the ESMP implementation.

The implementation of environmental/social risks and mitigation measures

Environmental/social sustainability monitoring plan for each pilot power station is shown in Tables 5-3 and 5-4.

Table 5-3 Environmental/social sustainability monitoring plan（Zhejiang, Fujian, Guangdong, Guangxi）

Environmental Monitoring plan		Implementation of Environmental Monitoring Plan in the Pilot SHP Stations							
		Fujian Tangban SHP Station	**Fujian Jiaoxi Stage III/Tantou SHP Station**	**Fujian Gaofang Stage II SHP Station**	**Guangdong Guanxi SHP Station**	**Guangxi Aibu Stage II/III SHP Station**	**Guangxi Sandieling/Tongpai SHP Station**	**Zhejiang Panxi Cascade SHP Station**	**Zhejiang Qingshuitan SHP Station**
Construction Period	Wastewater monitoring	Sewage treatment and drain outlets were monitored in August 2018, proving that discharged water hit Level I in the Table 4 of GB8978. But monitoring was infrequent.	Waste water was regularly cleared and transported from the septic tank as organic fertilizers instead of being discharged.	Waste water was regularly cleared and transported from the septic tank as organic fertilizers instead of being discharged.	Guanxi SHP Station was monitored 100m upstream and 100m downstream respectively in February 2017. The water quality met Class II~III surface water standard in the GB3838.	Waste water was regularly cleared and transported from the septic tank as organic fertilizers instead of being discharged.	Waste water was regularly cleared and transported from the septic tank as organic fertilizers instead of being discharged.	Waste water was regularly cleared and transported from the septic tank as organic fertilizers instead of being discharged.	Waste water was regularly cleared and transported from the septic tank as organic fertilizers instead of being discharged; Qingshuitan SHP Station was monitored 500m downstream in September 2016. The water quality met Class II surface water standard in the GB3838.

Environmental Monitoring plan		Implementation of Environmental Monitoring Plan in the Pilot SHP Stations							
		Fujian Tangban SHP Station	**Fujian Jiaoxi Stage III/Tantou SHP Station**	**Fujian Gaofang Stage II SHP Station**	**Guangdong Guanxi SHP Station**	**Guangxi Aibu Stage II/III SHP Station**	**Guangxi Sandieling/Tongpai SHP Station**	**Zhejiang Panxi Cascade SHP Station**	**Zhejiang Qingshuitan SHP Station**
	Noise monitoring	The central control room, operational layer, operational interlayer, loading apron, and lobby were monitored in August 2018. The monitoring results were below the limit for noise emission specified in GB12523-2011.	Noise monitoring was conducted at 6 points around the boundary of the Tantou SHP stations and in the control room in December 2016. Boundary noise in the daytime/nighttime met the Class 3 standard of the GB12348 standard.	The construction workers wore earplugs and no construction in the nighttime	In the monitoring on 2 monitoring points at the boundary of Guanxi SHP Station in March 2017, monitoring results were below the limit for noise emission specified in GB12523-2011.	The construction workers wore earplugs and no construction in the nighttime	The construction workers wore earplugs and no construction in the nighttime	The construction workers wore earplugs and no construction in the nighttime	In the monitoring on 4 monitoring points of Qingshuitan SHP Station and 1 monitoring point of Jiuying Village in September 2016, monitoring results were below the limit for noise emission specified in GB12523-2011.
	Dust monitoring	Monthly survey and monitoring	Monthly survey and monitoring	Monthly survey and monitoring	Monthly survey and monitoring	Monitored once per month during construction period.	Monitored once per month during construction period.	Monitored once per month during construction period.	Monitored once per month during construction period.
	Solid waste monitoring	Monthly survey and monitoring	Monthly survey and monitoring	Monthly survey and monitoring	Monthly survey and monitoring	Domestic garbage was monitored once per month, which has been well disposed.	Domestic garbage was monitored once per month, which has been well disposed.	Solid waste was monitored once per two months, which has been well disposed.	Solid waste was monitored once per quarter, which has been well disposed.
	Monitoring of conservation of soil and water	Monthly survey and monitoring	Monthly survey and monitoring	Monthly survey and monitoring	Monthly survey and monitoring	Monitoring was conducted on a monthly basis along with a temporary sedimentation tank set.	Afforestation in the premises and monthly monitoring during the construction period.	Monitoring was conducted once per 2 months along with a temporary sedimentation tank set.	Afforestation in the premises and quarterly monitoring during construction period.

Environmental Monitoring plan		Implementation of Environmental Monitoring Plan in the Pilot SHP Stations							
		Fujian Tangban SHP Station	**Fujian Jiaoxi Stage III/Tantou SHP Station**	**Fujian Gaofang Stage II SHP Station**	**Guangdong Guanxi SHP Station**	**Guangxi Aibu Stage II/III SHP Station**	**Guangxi Sandieling/Tongpai SHP Station**	**Zhejiang Panxi Cascade SHP Station**	**Zhejiang Qingshuitan SHP Station**
	Monitoring of water safety	Monthly survey and monitoring	Quarterly survey and monitoring	Quarterly survey and monitoring	Quarterly survey and monitoring	Monthly monitoring ensured abundant water supply downstream during construction period.	Monthly monitoring ensured abundant water supply downstream during construction period.	Quarterly monitoring ensured abundant water supply downstream during construction period.	Quarterly monitoring ensured abundant water supply downstream during construction period.
	Monitoring of irrigation safety	Monthly survey and monitoring	Quarterly survey and monitoring	Quarterly survey and monitoring	Quarterly survey and monitoring	Monthly monitoring ensured abundant water supply downstream during construction period.	Monthly monitoring ensured abundant water supply downstream during construction period.	Quarterly monitoring ensured abundant water supply downstream during construction period.	Quarterly monitoring ensured abundant water supply downstream during construction period.
	Monitoring of resident employment and income	Irregular survey and monitoring	Irregular survey and monitoring	Annual survey and monitoring	Irregular survey and monitoring	Irregular survey and monitoring	Irregular survey and monitoring	Irregular survey and monitoring	Irregular survey and monitoring

Environmental Monitoring plan		Implementation of Environmental Monitoring Plan in the Pilot SHP Stations							
		Fujian Tangban SHP Station	**Fujian Jiaoxi Stage III/Tantou SHP Station**	**Fujian Gaofang Stage II SHP Station**	**Guangdong Guanxi SHP Station**	**Guangxi Aibu Stage II/III SHP Station**	**Guangxi Sandieling/Tongpai SHP Station**	**Zhejiang Panxi Cascade SHP Station**	**Zhejiang Qingshuitan SHP Station**
Operation Period	Monitoring of domestic sewage and SHP station tailwater	Main sewage drain outlet of the SHP station was monitored in November 2021, proving that discharged water hit Level I in the Table 4 of GB8978. SHP station tailwater was monitored in November 2021. The water quality met Class II~III surface water standard in the GB3838.	Waste water was regularly cleared and transported from the septic tank as organic fertilizers instead of being discharged; As indicated in routine water quality monitoring data of Taining County for June 2021, SHP station tailwater quality met Class I surface water quality standard of GB3838.	Waste water was regularly cleared and transported from the septic tank as organic fertilizers instead of being discharged; SHP station tailwater was monitored in July 2020. The water quality met Class II~III surface water standard in the GB3838.	Waste water was regularly cleared and transported from the septic tank as organic fertilizers instead of being discharged; SHP station tailwater was monitored in October 2021. The water quality met Class II surface water standard in the GB3838.	Waste water was regularly cleared and transported from the septic tank as organic fertilizers instead of being discharged; Tailwater was monitored in Aibu Stage II/III SHP Station respectively in October 2021. The water quality met Class I surface water standard in the GB3838.	Waste water was regularly cleared and transported from the septic tank as organic fertilizers instead of being discharged; Tailwater was monitored in Tongpai/Sandieling SHP Station respectively in October 2021. The water quality met Class I surface water standard in the GB3838.	Main sewage drain outlet was monitored in Panxi Stage II/III/IV SHP Station respectively in October 2021, proving that discharged water hit Level I in the Table 4 of GB8978. Tailwater was monitored in Panxi Stage II/III/IV SHP Station respectively in October 2021. The water quality met Class II surface water standard in the GB3838.	Waste water was regularly cleared and transported from the septic tank as organic fertilizers instead of being discharged; Tailwater was monitored 500m downstream from Qingshuitan SHP Station in February and August 2019 respectively. The water quality met Class I surface water standard in the GB3838.

Environmental Monitoring plan		Implementation of Environmental Monitoring Plan in the Pilot SHP Stations							
		Fujian Tangban SHP Station	**Fujian Jiaoxi Stage III/Tantou SHP Station**	**Fujian Gaofang Stage II SHP Station**	**Guangdong Guanxi SHP Station**	**Guangxi Aibu Stage II/III SHP Station**	**Guangxi Sandieling/Tongpai SHP Station**	**Zhejiang Panxi Cascade SHP Station**	**Zhejiang Qingshuitan SHP Station**
	Noise monitoring during SHP station operation	Daytime/nighttime monitoring was conducted in 4 points around the boundary of the SHP station in November 2021. Boundary noise in the daytime/nighttime met Class 2 standard of GB12348.	Daytime/nighttime monitoring was conducted at 5 points around the boundary of the Jiaoxi Stage III SHP Station in October 2021, suggesting boundary noise in the daytime/nighttime met Class 2 standard of GB12348; in the corresponding period, Tantou SHP Station was monitored as well, with daytime/nighttime noise of 6 monitoring points around the boundary of the SHP station in line with Class 3 standard of GB12348 by and large. But at some monitoring points, nighttime noise was beyond Class 3 standard.	Daytime/nighttime monitoring was conducted at 4 points around the boundary of the Gaofang Stage II SHP Station and 1 point inside and outside the central control room therein in November 2021. Boundary noise in the daytime/nighttime met Class 2 standard of GB12348.	Daytime/nighttime monitoring was conducted in 4 points around the boundary of the SHP station in October 2021. Boundary noise in the daytime/nighttime met Class 2~3 standard of GB12348.	Daytime/nighttime monitoring was conducted at 4 points around the boundary of the Aibu Stage II/III SHP Station and 1 point inside and outside the central control room therein in October 2021. Boundary noise in the daytime met Class 2 standard of GB12348 but boundary noise in the nighttime at some points was beyond Class 3 standard.	Daytime/nighttime monitoring was conducted at 4 points around the boundary of the Tongpai/Sandieling SHP Station and 1 point inside and outside the central control room therein in October 2021. Boundary noise in the daytime met Class 2 standard of GB12348 but boundary noise in the nighttime at some points was beyond Class 3 standard.	Daytime/nighttime monitoring was conducted at 4 points around the boundary of the Panxi Stage II/III/IV SHP Station and 1 point inside and outside the central control room therein in October 2021. Boundary noise in the daytime/nighttime met Class 2~3 standard of GB12348.	Daytime/nighttime monitoring was conducted at 4 points around the boundary of the SHP station and 1 point in Jiuying Village in February and August 2019 respectively. Boundary noise in the daytime/nighttime met Class 2 standard of GB12348 and noise in the Jiuying Village met Class 1 standard of GB3096-2008.
	Monitoring of solid waste treatment	Field survey once per 2 months	Quarterly field survey	Quarterly field survey	Quarterly field survey	Domestic garbage was monitored once per month, which has been well disposed.	Domestic garbage was monitored once per month, which has been well disposed.	Domestic garbage was monitored once per quarter, which has been well disposed.	Domestic garbage was monitored once per month, which has been well disposed.

Environmental Monitoring plan		Implementation of Environmental Monitoring Plan in the Pilot SHP Stations							
		Fujian Tangban SHP Station	**Fujian Jiaoxi Stage III/Tantou SHP Station**	**Fujian Gaofang Stage II SHP Station**	**Guangdong Guanxi SHP Station**	**Guangxi Aibu Stage II/III SHP Station**	**Guangxi Sandieling/Tongpai SHP Station**	**Zhejiang Panxi Cascade SHP Station**	**Zhejiang Qingshuitan SHP Station**
	Ecosystem monitoring	Terrestrial ecosystem surveyed for two-four times per year and aquatic ecosystem surveyed for once per year.	Quarterly field survey	Quarterly field survey	Quarterly field survey	Quarterly survey on terrestrial/aquatic ecosystem.	Quarterly survey on terrestrial ecosystem and monthly survey on aquatic ecosystem.	Quarterly survey on terrestrial/aquatic ecosystem.	Quarterly survey on terrestrial/aquatic ecosystem.
	Monitoring of ecological flow	Online ecological flow monitoring device was installed for monitoring in real time and networking with administration of environmental protection	Online ecological flow monitoring device was installed for monitoring in real time	Online ecological flow monitoring device was installed for monitoring in real time	Online ecological flow monitoring device was installed for monitoring in real time	Online ecological flow monitoring device was installed for monitoring in real time	Online ecological flow monitoring device was installed for monitoring in real time	Online ecological flow monitoring device was installed for monitoring in real time	Online ecological flow monitoring device was installed for monitoring in real time
	Monitoring of income of SHP station	Annual statistics of generating capacity data of the refurbished SHP station	Annual statistics of generating capacity data of the refurbished SHP station	Annual statistics of generating capacity data of the refurbished SHP station	Annual statistics of generating capacity data of the refurbished SHP station	Annual statistics of generating capacity data of the refurbished SHP station	Annual statistics of generating capacity data of the refurbished SHP station	Annual statistics of generating capacity data of the refurbished SHP station	Annual statistics of generating capacity data of the refurbished SHP station

Environmental Monitoring plan		Implementation of Environmental Monitoring Plan in the Pilot SHP Stations							
		Fujian Tangban SHP Station	**Fujian Jiaoxi Stage III/Tantou SHP Station**	**Fujian Gaofang Stage II SHP Station**	**Guangdong Guanxi SHP Station**	**Guangxi Aibu Stage II/III SHP Station**	**Guangxi Sandieling/Tongpai SHP Station**	**Zhejiang Panxi Cascade SHP Station**	**Zhejiang Qingshuitan SHP Station**
	Monitoring of rights and interests of women (participation)	Calculation of the total and percentage of female employees of the refurbished SHP station for once during the operation period	Calculation of the total and percentage of female employees of the refurbished SHP station for once during the operation period	Calculation of the total and percentage of female employees of the refurbished SHP station for once during the operation period	Calculation of the total and percentage of female employees of the refurbished SHP station for once during the operation period	Calculation of the total and percentage of female employees of the refurbished SHP station for once during the operation period	Calculation of the total and percentage of female employees of the refurbished SHP station for once during the operation period	Calculation of the total and percentage of female employees of the refurbished SHP station for once during the operation period	Calculation of the total and percentage of female employees of the refurbished SHP station for once during the operation period
	Monitoring of downstream resident water consumption	Monthly monitoring ensured abundant water supply downstream during the operation period.	No demand for water consumption, thus not surveyed	Annual monitoring ensured abundant water supply downstream	Annual field survey	Monthly monitoring ensured abundant water supply downstream during the operation period.	Monthly monitoring ensured abundant water supply downstream during the operation period.	Quarterly monitoring ensured abundant water supply downstream during operation period.	Quarterly monitoring ensured abundant water supply downstream during operation period.

Table 5-4 Environmental/social sustainability monitoring plan（Hubei, Chongqing, Yunnan, and Shaanxi）

Environmental monitoring plan		Implementation of environmental monitoring plan in the pilot SHP station										
		Hubei Yangdaohe SHP Station	**Hubei Jiangjunzhu SHP Station**	**Hubei Zhoujialiang SHP Station**	**Chongqing Taiping SHP Station**	**Chongqing Xiaokeng SHP Station**	**Chongqing Gaokeng SHP Station**	**Chongqing Majing SHP Station**	**Yunnan Mabozi SHP Station**	**Yunnan Chahe SHP Station**	**Yunnan Maoyandong SHP Station**	**Shaanxi Xinpingya SHP Station**
Construction Period	Wastewater monitoring	Water was monitored in the upstream and downstream reaches of Chaotianhou, Yangdaohe, and Shijiaba SHP stations, respectively in September 2019. The water quality met the Class I surface water standard of the GB3838-2002 standard.	The production wastewater was disposed of for recycling, which was not discharged. Domestic sewage generated during construction was fed into an urban sewage treatment plant for disposal to meet a relevant standard.	As surveyed and monitored through visual inspections, water was lucid and impurity-free.	With basically no wastewater discharged, organic fertilizers were regularly cleared and removed from septic tanks.	The production wastewater was disposed of for recycling and not discharged. The domestic sewage was put into an integrated embedded sewage treatment facility for disposal, with basically no wastewater discharged.	Riverway water was monitored in May 2018. The water quality met the Class III surface water standard of the GB3838 standard.	Water downstream from the SHP station was monitored in May 2018. The water quality met the Class III surface water standard of the GB3838 standard.	With basically no wastewater discharged, organic fertilizers were regularly cleared and removed from septic tanks.	The refurbished septic tank had a better disposal capacity. With basically no wastewater discharged, organic fertilizers were regularly cleared and removed from the septic tank.	Water downstream and upstream from the SHP station was monitored in July 2017. The water quality met the Class III surface water standard in the GB3838.	With basically no wastewater discharged, organic fertilizers were regularly cleared and removed from septic tanks.

Environmental monitoring plan		Implementation of environmental monitoring plan in the pilot SHP station										
		Hubei Yangdaohe SHP Station	**Hubei Jiangjunzhu SHP Station**	**Hubei Zhoujialiang SHP Station**	**Chongqing Taiping SHP Station**	**Chongqing Xiaokeng SHP Station**	**Chongqing Gaokeng SHP Station**	**Chongqing Majing SHP Station**	**Yunnan Mabozi SHP Station**	**Yunnan Chahe SHP Station**	**Yunnan Maoyandong SHP Station**	**Shaanxi Xinpingya SHP Station**
	Noise monitoring	Noise monitoring was conducted at 4 points around the boundary of the Chaotianhou, Yangdaohe, and Shijiaba SHP stations in September 2019. Boundary noise in the daytime/nighttime met the Class 2 standard of the GB12348 standard.	The construction workers wore earplugs and no construction in the nighttime	The construction workers wore earplugs and no construction in the nighttime	The construction workers wore earplugs and no construction in the nighttime	The construction workers wore earplugs and no construction in the nighttime	The construction workers wore earplugs and no construction in the nighttime	Noise monitoring was conducted around the boundary of the SHP station in October 2018. Boundary noise in the daytime/nighttime met the Class 1 standard of the GB12348 standard.	Noise was monitored in the control room monthly during June 2018 to November 2019. The noise value was within the emission limit of the GB12523-2011 standard.	The construction workers wore earplugs and no construction in the nighttime	A total of 9 points were monitored, including the central control room, high-pressure chamber, generator floor, turbine floor, transformer, and water filter, in December 2020. The monitoring results were below the limit for noise emissions specified in the GB12523-2011 standard.	The construction workers wore earplugs and no construction in the nighttime
	Dust monitoring	Visual inspection was performed monthly, with basically no dust pollution.	Visual inspection was performed monthly, with basically no dust pollution.	Visual inspection was performed monthly, with basically no dust pollution.	Visual inspection was performed monthly, with basically no dust pollution.	Surveys and monitoring were performed monthly, with basically no dust pollution.	Surveys and monitoring were performed monthly, with basically no dust pollution.	Surveys and monitoring were performed weekly during the construction period, with basically no dust pollution.	Surveys and monitoring were performed monthly, with basically no dust pollution.	Basically, there was no dust pollution due to a low amount of civil engineering facility construction work.	Surveys and monitoring were performed monthly, with basically no dust pollution.	Surveys and monitoring were performed monthly, with basically no dust pollution.

Environmental monitoring plan		Implementation of environmental monitoring plan in the pilot SHP station										
		Hubei Yangdaohe SHP Station	**Hubei Jiangjunzhu SHP Station**	**Hubei Zhoujialiang SHP Station**	**Chongqing Taiping SHP Station**	**Chongqing Xiaokeng SHP Station**	**Chongqing Gaokeng SHP Station**	**Chongqing Majing SHP Station**	**Yunnan Mabozi SHP Station**	**Yunnan Chahe SHP Station**	**Yunnan Maoyandong SHP Station**	**Shaanxi Xinpingya SHP Station**
	Solid waste monitoring	Visual inspection was performed monthly.	Visual inspection was performed monthly during the construction period.	Visual inspection was performed monthly.	Surveys and monitoring were performed monthly.	Surveys and monitoring were performed monthly.	Surveys and monitoring were performed weekly.	Weekly surveys and monitoring were performed during the construction period, with solid waste well disposed of.	Surveys and monitoring were performed monthly.	Surveys and monitoring were performed irregularly.	Surveys and monitoring were performed monthly.	Visual inspection was performed monthly.
	Monitoring of conservation of soil and water	Visual inspection was performed monthly.	Visual inspection was performed monthly during the construction period.	Visual inspection was performed monthly.	Surveys and monitoring were performed monthly.	Surveys and monitoring were performed monthly.	Surveys and monitoring were performed monthly.	Surveys and monitoring were performed weekly during the construction period, with no soil erosion.	Surveys and monitoring were performed monthly.	Basically, there is no soil erosion due to a low amount of civil engineering construction work.	Surveys and monitoring were performed monthly.	Visual inspection was performed monthly.
	Monitoring of water safety	Monthly monitoring ensured abundant water supply downstream during the construction period.	Visual inspection was performed monthly during the construction period.	Monthly monitoring ensured abundant water supply downstream during the construction period.	Surveys and monitoring were performed monthly.	Surveys and monitoring were performed monthly and abundant water supply was ensured downstream.	Surveys and monitoring were performed monthly.	Surveys and monitoring were performed weekly during the construction period and abundant water supply was ensured downstream.	Surveys and monitoring were performed monthly.	Power generation was suspended amidst the refurbishment of the SHP station.	Surveys and monitoring were performed monthly.	Monthly monitoring ensured abundant water supply downstream during the construction period.

Environmental monitoring plan		Implementation of environmental monitoring plan in the pilot SHP station										
		Hubei Yangdaohe SHP Station	**Hubei Jiangjunzhu SHP Station**	**Hubei Zhoujialiang SHP Station**	**Chongqing Taiping SHP Station**	**Chongqing Xiaokeng SHP Station**	**Chongqing Gaokeng SHP Station**	**Chongqing Majing SHP Station**	**Yunnan Mabozi SHP Station**	**Yunnan Chahe SHP Station**	**Yunnan Maoyandong SHP Station**	**Shaanxi Xinpingya SHP Station**
	Monitoring of irrigation safety	Monthly monitoring ensured abundant water supply downstream during the construction period.	Monthly monitoring ensured abundant water supply downstream during the construction period.	Monthly monitoring ensured abundant water supply downstream during the construction period.	Monthly monitoring ensured abundant water supply downstream during the construction period.	Surveys and monitoring were performed monthly and abundant water supply was ensured downstream.	Monthly monitoring ensured abundant water supply downstream during the construction period.	Surveys and monitoring were performed weekly during the construction period and abundant water supply was ensured downstream.	Surveys and monitoring were performed monthly abundant water supply was ensured downstream.	Surveys and monitoring were performed irregularly and abundant water supply was ensured downstream.	Surveys and monitoring were performed monthly abundant water supply was ensured downstream.	Monthly monitoring ensured abundant water supply downstream during the construction period.
	Monitoring of resident employment and income	Relevant statistics were collected annually with stable employment and an annual income per capita of RMB14,731.	Relevant statistics were collected monthly during the construction period.	Local residents were hired to engage in the SHP station refurbishment and agricultural and sideline products were bought from them.	Surveys and monitoring were performed irregularly.	Surveys and monitoring were performed irregularly.	Surveys and monitoring were performed irregularly.	Monitoring was performed annually.	Surveys and monitoring were performed irregularly.	The manpower and material resources needed in refurbishment spurred employment and increased the income of local residents	Surveys and monitoring were performed irregularly.	Local employment was stabilized, and staff in the SHP station had a stable annual income per capita.

Environmental monitoring plan		Implementation of environmental monitoring plan in the pilot SHP station										
		Hubei Yangdaohe SHP Station	**Hubei Jiangjunzhu SHP Station**	**Hubei Zhoujialiang SHP Station**	**Chongqing Taiping SHP Station**	**Chongqing Xiaokeng SHP Station**	**Chongqing Gaokeng SHP Station**	**Chongqing Majing SHP Station**	**Yunnan Mabozi SHP Station**	**Yunnan Chahe SHP Station**	**Yunnan Maoyandong SHP Station**	**Shaanxi Xinpingya SHP Station**
Operation Period	Monitoring of domestic sewage and SHP station tailwater	Water was monitored in the upstream and downstream reaches of Chaotianhou, Yangdaohe, and Shijiaba SHP stations, respectively in August 2020, April 2021, and April 2022. The water quality met the Class I surface water standard of the GB3838-2002 standard.	SHP station tailwater was monitored in May 2020. The water quality met the Class I surface water standard of the GB3838 standard.	Domestic sewage vents of the SHP station were monitored in December 2022, and the effluent met the Level I standard in Table 4 of the GB8978-1996 standard; water upstream and downstream of the SHP station was monitored, and water quality met the Class II surface water standard of the GB3838-2002 standard.	The water of upstream and downstream reaches was monitored in October 2020. The water quality met the Class I-II surface water standards of the GB3838 standard.	Sewage treatment facility outlets were monitored from March to April 2021, and the effluent met the Level I standard in Table 4 of the GB8978-1996 standard.	As specified in the monthly report on the quality of water resources in Chongqing in March 2020, the tailwater from power generation in the Gaokeng SHP Station was monitored and met the Class III standard of the GB3838-2002 standard.	The water quality of Majing Reservoir and Yongxin Waterworks was monitored in May 2018. The water quality met the Class III surface water standard of the GB3838 standard.	The water of upstream and downstream reaches was monitored in May 2023. The water quality met the Class III surface water standards of the GB3838 standard.	The tailwater of the SHP station was monitored 3 times on December 9, 2022, and water quality basically met the Class I standard of the GB3838-2002 standard.	Domestic sewage vents of the SHP station were monitored in November 2022, and the treated effluent met the Level I water standard in Table 4 of the GB8978-1996 standard; water downstream of the SHP station was monitored, and the overall water quality met the Class III standard of the GB3838-2002 standard with total phosphorus slightly exceeding the upper limit.	Domestic wastewater was monitored in November 2022, and the effluent met the Level I discharge standard in Table 4 of GB8978-1996; the tailwater of the SHP station was monitored, and water quality met the Class IV standard in the GB3838 standard.

Environmental monitoring plan		Implementation of environmental monitoring plan in the pilot SHP station										
		Hubei Yangdaohe SHP Station	**Hubei Jiangjunzhu SHP Station**	**Hubei Zhoujialiang SHP Station**	**Chongqing Taiping SHP Station**	**Chongqing Xiaokeng SHP Station**	**Chongqing Gaokeng SHP Station**	**Chongqing Majing SHP Station**	**Yunnan Mabozi SHP Station**	**Yunnan Chahe SHP Station**	**Yunnan Maoyandong SHP Station**	**Shaanxi Xinpingya SHP Station**
	Noise monitoring during SHP station operation	Noise monitoring was conducted at 4 points around the boundary of the Chaotianhou, Yangdaohe, and Shijiaba SHP Stations and 1 point inside the central control rooms of the stations in August 2020, April 2021, and April 2022; boundary noise in the daytime/nighttime met the Class 2 standard of the GB12348 standard.	Daytime/nighttime noise monitoring was conducted around the boundary and living quarters of the SHP station in May 2020. Noise in the daytime met the Class 2 standard of the GB12348 standard.	Noise monitoring was conducted around the boundary of the SHP station in December 2022. Boundary noise in the daytime/nighttime met the Class 2 standard of the GB12348 standard.	Noise monitoring was conducted at 2 points around the boundary of the SHP station in October 2020, and boundary noise met the Class 2 standard of the GB12348 standard. Noise monitoring was conducted at 4 points around the boundary of the SHP station in January 2021, and boundary noise met the Class 2 standard of the GB12348 standard.	Noise monitoring was conducted at 3 points around the boundary of the SHP station in March-April 2021, and boundary noise in the daytime/nighttime met the Class 2 standard of the GB12348 standard.	The generator room, switchgear room, and other points were monitored in September 2020. The monitoring results were below the limit for noise emissions specified in the GB12523-2011 standard.	Noise monitoring was conducted around the boundary of the SHP station in April 2019. Boundary noise in the daytime/nighttime met the Class 1 standard of the GB12348 standard.	Noise monitoring was conducted around the boundary of the SHP station in May 2023. Boundary noise in the daytime/nighttime met the Class 2 standard of the GB12348 standard.	Noise monitoring was conducted at 4 points around the boundary of the SHP station on December 9, 2022. Boundary noise in the daytime/nighttime met the Class 1 standard of the GB12348 standard.	Noise monitoring was conducted around the boundary of the SHP station on November 29, 2022. And noise in the daytime met the Class 2 standard of the GB12348 standard.	The central control room and staff dormitory were monitored monthly.
	Monitoring of solid waste treatment	Domestic garbage was monitored once per month and well disposed of.	Solid waste was well disposed of.	Domestic garbage was monitored once per month and well disposed of.	Surveys and monitoring were performed monthly.	Domestic garbage was monitored once per month and well disposed of.	On-site surveys were conducted monthly.	Surveys and monitoring were performed monthly, with solid waste well disposed of.	On-site surveys were conducted monthly.	On-site surveys were performed bimonthly.	On-site surveys were conducted monthly.	Domestic garbage was performed monthly, with garbage well disposed of.

Environmental monitoring plan		Implementation of environmental monitoring plan in the pilot SHP station										
		Hubei Yangdaohe SHP Station	**Hubei Jiangjunzhu SHP Station**	**Hubei Zhoujialiang SHP Station**	**Chongqing Taiping SHP Station**	**Chongqing Xiaokeng SHP Station**	**Chongqing Gaokeng SHP Station**	**Chongqing Majing SHP Station**	**Yunnan Mabozi SHP Station**	**Yunnan Chahe SHP Station**	**Yunnan Maoyandong SHP Station**	**Shaanxi Xinpingya SHP Station**
	Ecosystem monitoring	Terrestrial and aquatic ecosystems were inspected semiannually.	Visual inspection was performed monthly.	Terrestrial and aquatic ecosystems were inspected twice per year.	Terrestrial and aquatic ecosystems were inspected monthly.	Terrestrial and aquatic ecosystems were inspected monthly.	Terrestrial ecosystems were inspected 4-5 times per year and aquatic ecosystems once per year.	Terrestrial and aquatic ecosystems were inspected monthly.	Terrestrial ecosystems were inspected semiannually, while aquatic ecosystems were inspected quarterly.	Terrestrial ecosystems were inspected 2-4 times per year and aquatic ecosystems once per year.	Terrestrial ecosystems were inspected 2-4 times per year and aquatic ecosystems once per year.	Terrestrial and aquatic ecosystems were inspected monthly.
	Monitoring of ecological flow	An online ecological flow monitoring device was installed for monitoring in real-time.	An online ecological flow monitoring device was installed for monitoring in real-time.	An online ecological flow monitoring device was installed for monitoring in real-time.	An online ecological flow monitoring device was installed for monitoring discharge flows in real-time and connected to the network of the water resources administration.	An online ecological flow monitoring device was installed for monitoring in real-time.	An online ecological flow monitoring device was installed for monitoring discharge flows in real-time and connected to the network of the water resources administration.	An online ecological flow monitoring device was installed for monitoring in real-time.	An online ecological flow monitoring device was installed for monitoring in real-time and connected with the network of the water resources department.	An online ecological flow monitoring device was installed for monitoring in real-time and connected with the network of the environmental protection authority.	An online ecological flow monitoring device was installed for monitoring in real-time and connected with the network of the environmental protection authority.	An online ecological flow monitoring device was installed for monitoring in real-time.
	Monitoring of income of SHP station	The generating capacity data of the refurbished SHP station was collected annually.	The generating capacity data of the refurbished SHP station was collected annually.	The generating capacity data of the refurbished SHP station was collected annually.	The generating capacity data of the refurbished SHP station was collected annually.	The generating capacity data of the refurbished SHP station was collected annually.	The generating capacity data of the refurbished SHP station was collected annually.	The generating capacity data of the refurbished SHP station was collected annually.	The generating capacity data of the refurbished SHP station was collected annually.	The generating capacity data of the refurbished SHP station was collected annually.	The generating capacity data of the refurbished SHP station was collected annually.	The generating capacity data of the refurbished SHP station was collected annually.

Environmental monitoring plan		Implementation of environmental monitoring plan in the pilot SHP station										
		Hubei Yangdaohe SHP Station	**Hubei Jiangjunzhu SHP Station**	**Hubei Zhoujialiang SHP Station**	**Chongqing Taiping SHP Station**	**Chongqing Xiaokeng SHP Station**	**Chongqing Gaokeng SHP Station**	**Chongqing Majing SHP Station**	**Yunnan Mabozi SHP Station**	**Yunnan Chahe SHP Station**	**Yunnan Maoyandong SHP Station**	**Shaanxi Xinpingya SHP Station**
	Monitoring of rights and interests of women (participation)	Calculation of the total and percentage of female employees of the refurbished SHP station for once during the operation period	The total and percentage of female employees of the refurbished SHP station were calculated annually during the operation period.	Calculation of the total and percentage of female employees of the refurbished SHP station for once during the operation period	Surveys and monitoring were performed irregularly.	Calculation of the total and percentage of female employees of the refurbished SHP station for once during the operation period	Surveys and monitoring were performed irregularly.	Calculation of the total and percentage of female employees of the refurbished SHP station for once during the operation period	Calculation of the total and percentage of female employees of the refurbished SHP station for once during the operation period.	Calculation of the total and percentage of female employees of the refurbished SHP station for once during the operation period.	Calculation of the total and percentage of female employees of the refurbished SHP station for once during the operation period.	Calculation of the total and percentage of female employees of the refurbished SHP station for once during the operation period
	Monitoring of downstream resident water consumption	Quarterly monitoring ensured abundant water supply downstream during the operation period.	Monthly monitoring ensured abundant water supply downstream during the operation period.	Monthly monitoring ensured abundant water supply downstream during the operation period.	Surveys and monitoring were performed monthly and abundant water supply was ensured downstream.	Monthly monitoring ensured abundant water supply downstream during the operation period.	Surveys and monitoring were performed monthly and abundant water supply was ensured downstream.	Quarterly monitoring ensured abundant water supply downstream during the operation period.	Monthly monitoring ensured abundant water supply downstream during the operation period.	Monthly monitoring ensured abundant water supply downstream during the operation period.	Monthly monitoring ensured abundant water supply downstream during the operation period.	Monthly monitoring ensured abundant water supply downstream during the operation period.

5.2.3 Monitoring and Evaluation of Institutional Capacity Building for Environmental Administrations

During the implementation of environmental management in the GEF project, each pilot SHP station was composed of the owner, construction unit, environmental monitoring organization, rural healthcare center, and other organizations, which, in tight collaboration and division of duties, made effective operation and secured smooth implementation of ESMP. And project managers, construction workers, and all enterprise staff were trained to improve their environmental management capabilities.

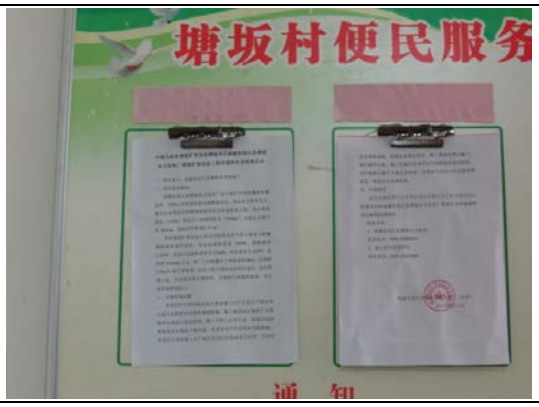
5.2.4 Monitoring and Evaluation of Public Involvement in the Implementation

To take into account the interests of all parties, extensive public advice on the construction of the project was garnered. In the preparation of ESMP, multipronged measures such as convening consultation meetings, posting announcements, distributing questionnaires, etc. were taken for public consultation engaging project stakeholders.

Each pilot SHP station owner prepared an environmental/social management plan (ESMP) as required and organized public consultation, with 224 attendees of 18 consultation meetings, and relevant questionnaires given out and announcements posted as shown in Figure 5-2.

Concerns of residents nearby each SHP station proposed in sessions of public consultation include minimizing effects of production/domestic sewage arising out of construction, construction noise and dust on river waters and residents in the proximity, tightening ecosystem conservation, e.g., aquatic ecosystem, securing irrigation and domestic water consumption downstream through SHP station dispatching, expecting social benefits from SHP station building to residents in the

proximity, etc. In response to public advice, each pilot SHP station owner took multipronged environmental/social mitigation measures such as wastewater treatment facilities, fry stock enhancement, refurbishment of ecological flow discharge facilities, refurbishment of water supply and irrigation facilities, premises landscaping, and greater support and assistance for local villagers, and produced remarkable results to the satisfaction of local residents and authorities.

	
Public consultation session of Fujian Tangban SHP Station	Disclosure of Fujian Tangban SHP Station
	
Public consultation session of Guangdong Guanxi SHP Station	Public consultation session of Fujian Gaofang Stage II SHP Station
	
Public consultation session of Guangxi Tongpai/Sandieling SHP Station	Disclosure of Guangxi Tongpai/Sandieling SHP Station

	
Public consultation session of Zhejiang Panxi Cascade SHP Station	Disclosure of Zhejiang Panxi Cascade SHP Station
	
Public consultation session of Hubei Jiangjunzhu SHP Station	Information disclosure of Hubei Yangdaohe SHP Station
	
Public consultation session of Shaanxi Xinpingya SHP Station	Information disclosure of Chongqing Xiaokeng SHP Station
	
Public consultation session of Chongqing Gaokeng SHP Station	Information disclosure of Chongqing Majing SHP Station

Public consultation session of Yunnan Mabozi SHP Station

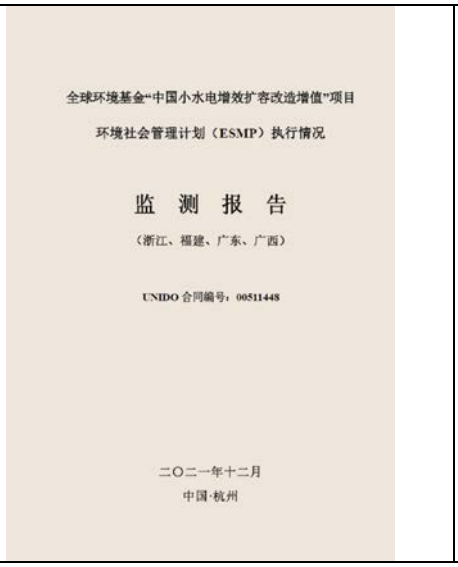
Public consultation session of Yunnan Maoyandong SHP Station

Figure 5-2 Photos of public consultation session and disclosure of each pilot SHP station

5.2.5 Monitoring Results of the Implementation of ESMP

The results of monitoring the implementation of ESMP in the GEF project include the monitoring report and separate monitoring and evaluation reports of 19 pilot SHP stations in 8 pilot provinces. The monitoring and evaluation report of each pilot SHP station is included in the monitoring report as an attachment.

Figure 5-3 shows the monitoring results of the implementation of ESMP.



全球环境基金"中国小水电增效扩容改造增值"项目

环境社会管理计划（ESMP）执行情况

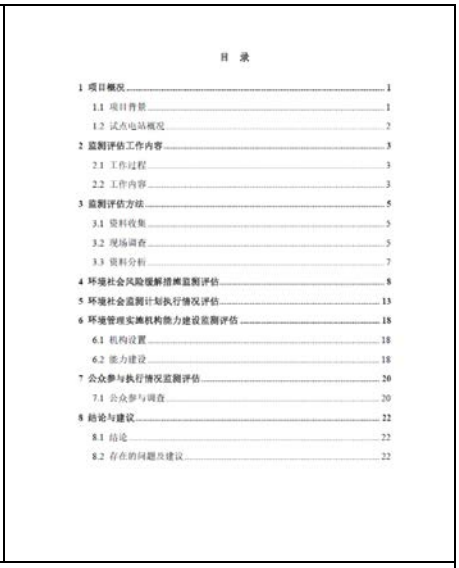
监 测 报 告

（浙江、福建、广东、广西）

UNIDO 合同编号：00511448

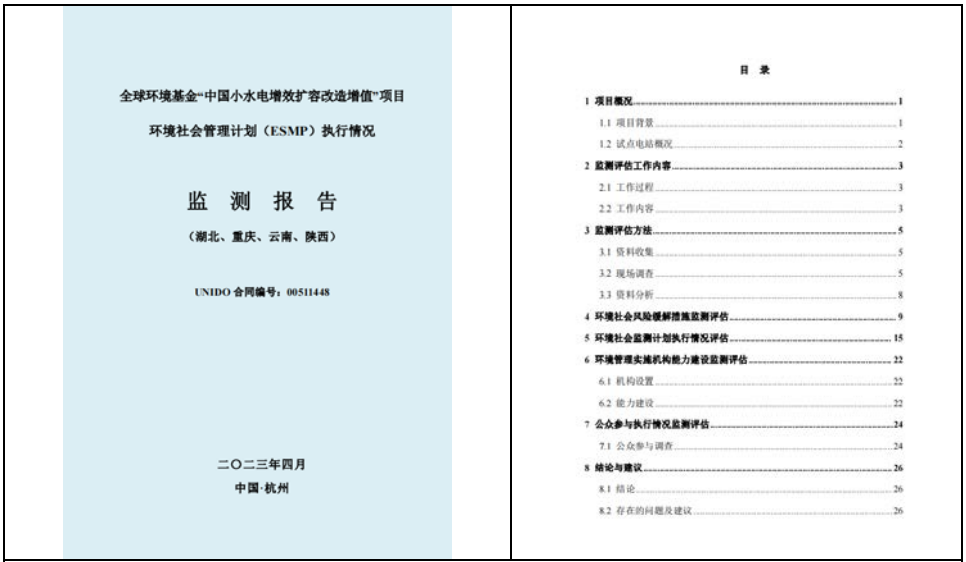
二〇二一年十二月

中国·杭州



目 录

Monitoring Report on Implementation of ESMP (Zhejiang, Fujian, Guangdong, and Guangxi)



Monitoring Report on Implementation of ESMP (Hubei, Chongqing, Yunnan, and Shaanxi)

Figure 5-3 Monitoring results of the implementation of ESMP

5.3 Final Report

The rationality of the environmental monitoring plan and environmental mitigation measures is evaluated for each pilot SHP station project based on site surveys, data collection, collation, and analysis, the preparation of the Inception Report and Monitoring Report, and other activities as well as their results, and all the work done during the contract period is summarized for the preparation of the Final Report.

6 Conclusion and Suggestions

6.1 Conclusion

(1) Each pilot SHP station owner ascribed great importance to the ESMP and specially assigned staff in this respect. Environmental management work progressed smoothly and satisfied project requirements. During project construction and operation, no major environmental problems occurred.

(2) Each pilot SHP station owner took environmental mitigation measures in line with the ESMP during construction and operation and yielded pretty satisfactory results along with fair use of funds for environmental protection. Local environmental monitoring stations and township/town healthcare centers were entrusted to help fulfill the environmental monitoring plan and train project managers, construction workers, and all company employees to improve their ability to manage the environment. With good environmental management in each pilot SHP station, the environmental impact of project construction was lessened.

(3) To mitigate the environmental/social impact of the implementation of the GEF project, each pilot SHP station performed well in taking environmental mitigation measures in the ESMP during the construction period and operation period, regarding water pollution, noise pollution, air pollution, solid waste, soil erosion, the safety of water supply and irrigation, local employment, ecological environment, water consumption downstream the SHP station, benefits of the SHP station, protection of women's rights and interests, etc. The environmental mitigation measures taken were comprehensive, diversified, targeted, effective, and up-to-standard. Project implementation had no significant impact on the external environment, met requirements for environmental protection, ensured smooth

progress of the GEF project, and yielded greater economic, social, and environmental results.

(4) To make an accurate evaluation of ESMP implementation in the GEF project, each pilot SHP station owner carried out well the environmental monitoring plan in the ESMP during the construction and operation periods. For oversight of the water/acoustic environment, a third-party testing organization was entrusted to monitor ecological flow online in real time, conduct field surveys and monitoring of dust, solid waste, production/domestic water downstream each SHP station, and collect statistics on benefits, rights, and interests of each SHP station. Comprehensive contents, fair frequency, and up-to-standard results of environmental monitoring indicated that project implementation had a minor impact on the water, noise, atmospheric, and ecological environment, the consumption of downstream production/domestic water, etc. The effective implementation of the environmental monitoring plan is conducive to making an objective evaluation of the effectiveness of environmental mitigation measures and providing an important basis for the monitoring and evaluation of ESMP implementation.

(5) Taking into account the interests of all parties, each pilot SHP station owner garnered extensive public advice on the construction of the project, through means such as convening consultation meetings, posting announcements, and distributing questionnaires. A total of 224 people attended 18 consultation meetings, with relevant questionnaires given out and announcements posted. In response to public advice, each pilot SHP station owner took multipronged environmental/social mitigation measures and produced remarkable results to the satisfaction of local residents and authorities.

(6) Through monitoring and evaluation of ESMP implementation in the

GEF project, we promptly found the ineffective implementation of environmental monitoring plans and environmental mitigation measures in each SHP station and provided relevant advice, notifications, and feedback to facilitate communication with each SHP station and have problems solved in time. The monitoring and evaluation of ESMP implementation in the GEF project were instrumental in lessening the environmental impact of the GEF project and ensuring the smooth progress of the ESMP.

(7) Currently, environmental management is drawing to an end. The pilot SHP stations still have to continue to strengthen their environmental care during subsequent operations so as to continuously play an exemplary and leading role as green SHP stations.

6.2 Suggestions

(1) For the inadequate implementation of some environmental mitigation measures amidst environmental management (e.g., the underperformance of Chongqing Taiping SHP Station and Fujian Gaofang Stage II SHP Station in the conservation of water and soil during the construction period), each SHP station needs to make a greater effort in adjusting future management and give full play to its role in environmental protection in time.

(2) For their underperformance in the frequency, contents, and duration of wastewater and noise monitoring during the construction period, Guangxi Aibu Stage II/III Station, Hubei Zhoujialiang SHP Station, Chongqing Xiaokeng SHP Station, Yunnan Chahe SHP Station, and Shaanxi Xinpingya SHP Station need to strengthen management and make further improvement for future work.

(3) Chongqing Majing SHP Station, Yunnan Chahe SHP Station, and Guangxi Aibu Stage II/III Station need to increase the percentage of female employees.