

Sustainability Assessment Report of Shuibuya Hydropower Project

**Assessment Panel for Shuibuya Hydropower Project
December 2009**

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1 Forward

1.1 Assessment Background

The International Hydropower Association (IHA) issued the draft *Hydropower Sustainability Assessment Protocol* in September 2009 and launched a three-month consultation and trail. The trail would be conducted selectively on hydropower projects of different stages in different regions, referring to the Draft Protocol for assessment which highlights the Protocol's practicability, applicability, usability, presentation methods, etc., and offers comments and insights for further improvement.

During the IHA World Congress held in Iceland in June 2009, Shuibuya Hydropower Project of Qingjiang River was identified as China's trail assessment project. Later in October of the year, National Research Center for Sustainable Hydropower Development launched tentative assessment panel and initiated preparations together with HoHai University, China Three Gorges Corporation, World Wide Fund for Nature (WWF), The Nature Conservancy (TNC), Hubei Qingjiang Hydropower Development Co., Ltd. On November 19th-26th, 2009, the assessment panel travelled to Yichang and Enshi of Hubei Province for survey and assessment.

1.2 Assessment purposes

The main purposes of the assessment activities include:

- (1) Assess the content, effectiveness, practicability, etc. of the Protocol, and put forward suggestions for improvement combining with the trail assessments;
- (2) Propose insights on the sustainability of Shuibuya Hydropower Project of Qingjiang River according to contents and requirements of the Protocol;
- (3) Learn about major focal problems of China's hydropower projects for sustainable development via the research activities of Shuibuya Hydropower Project.

1.3 Assessment contents

As Shuibuya Hydropower Project is a hydropower project at the stage of operation, Section IV of the Protocol can be applied for assessment.

The main assessment content of Section IV, "Project Operation", is as follows:

Economic / Technical / Management Aspect	Social Aspect	Environmental Aspect
Transboundary Issues	Social Management Plan	Environmental Management
Hydrological Resource Management	Project Affected Communities	Catchment Management
Economic Viability	Indigenous Peoples	Reservoir Management
Financial Viability	Benefit Sharing	Environmental Flows & Downstream Sustainability
Corporate Governance	Labor & Working Conditions	Biodiversity & Invasive Species
Procurement	Cultural Heritage	Erosion & Sedimentation
Markets, Innovation & Research	Public Health	Water Quality
Asset Reliability	Asset & Community Safety	

For the Protocol, it needs to be evaluated with regard to the following aspects:

(1) Practicability

Does the Draft Protocol seem like a practical assessment tool, and if not, how could it be improved to increase practicability?

(2) Applicability

Whether the Protocol has good applicability for hydropower projects of different regions, sizes, as well as types, and if there is any problem, how to effectively improve it?

(3) Content

Whether the Protocol is comprehensive enough and if there should be more to add.

(4) Implementation guidance

The Protocol provides implementation guidance in order to help users better understand the assessment standards and make assessment. Is the Protocol introduction and guide instructions are useful and how might they be improved.

(5) Scoring methodology

Bring forward opinions and recommendations for the scoring methodology of the Protocol as well as scoring criteria of all grades.

(6) Presentation of results

Evaluate and propose expression methods of the assessment results.

(7) Usability

Is the Protocol easy to use?

2 Trail assessment process

2.1 Assessment panel's composition and work division

The assessment Protocol is mainly related to economic, environmental and social aspects, and both the content and process are strongly professional, so this assessment panel is divided into three groups to do professional assessments on economic, environmental and social aspects, respectively. The composition of each group is as follows:

(1) Assessment on economic aspect

① China Three Gorges Corporation: Liu Qinghua, Cheng Xueyuan

② Hubei Qingjiang Hydropower Development Co., Ltd.: Yu Xiangming, Sun Dingguo

③ Local Government Representative: Xie Jianping

(2) Assessment on environmental aspect

① National Research Center for Sustainable Hydropower Development: Yu Xuezhong, Yang Tonghe

② WWF Beijing Office: Liu Tiejun

③ TNC Beijing Office: Lv Tong

(3) Assessment on social aspect

① Hohai University: Shi Guoqing, Zhang Xiaochen, Su Yu, An Tongkan

② Hubei Qingjiang Hydropower Development Co., Ltd.: Chen Dezheng

2.2 Assessment process

The assessment covers the three stages of preparation, field survey, and assessment meetings, and the main contents of each stage are as follows:

2.2.1 Preparation

As the Protocol lays great emphasis on the role of evidence, in order to ensure

the effect of the assessment, the assessment staff and Shuibuya Hydropower Project management organizations made preparations before the assessment:

(1) The leaders of three groups of assessment panel are responsible for carrying out preparatory work and developing the work plans of each professional assessment according to the content involved in their own specialties. Based on the requirements of the Protocol, they should put forward basic data that needs to be collected to support the assessment, and submit document list to Shuibuya project management organizations for preparation.

(2) Shuibuya Project management organizations should prepare relevant basic data, in accordance with basic data requirements made by the assessment professionals, complete preparatory work within a week before the assessment, and provide relevant information in the process of assessment.

2.2.2 Field survey

From November 21st to 23rd, 2009, the assessment staff participated an on-the-spot investigation in Shuibuya Hydropower Project. The objective is to probe into the actual impact of construction and operation of the project on economy, environment and society in the reservoir area, by the manner of interviews and review.

(1) Survey meeting on sustainable development for Shuibuya Project

On the morning of November 21st, members of the assessment panel organized a workshop on sustainable development for Shuibuya Project in Enshi Autonomous Prefecture for Tujia and Miao Nationalities. Dong Yongxiang, Deputy Governor of the Prefecture, and Zheng Donglai, Deputy Secretary-General attended the forum. The leaders and representatives of a total of 10 local authorities also attended the workshop. Leaders and representatives gave positive affirmation on the local socio-economic impacts brought by Shuibuya Project, and also proposed suggestions to improving its level of sustainable development.

(2) Visits to and review on resettlement sites and reservoir area of Shuibuya Project

From the afternoon of November 21st to 23rd, assessment members conducted visits to and review on resettlement sites and reservoir area of Shuibuya Project. A meeting was held in Sancha Township of Enshi City, which was attended by leaders of township government and of migrant villages, and by representatives of migrants. Assessment members learned in detail about the resettlement policy of Shuibuya

Project, its implementation and results, and went into the homes of the migrants to understand their actual living conditions. Panel members also visited the resettlement sites of Jingyang Town, and found that Zhenjiang Middle School, Minzu Primary School, and the Kindergarten of Jingyang Town are in good conditions, and are equipped with complete facilities.

2.2.3 Assessment meeting

The assessment panel held a trail assessment meeting in Yichang on November 23rd to 25th, 2009. On the basis of relevant information analysis and on-site investigation, assessment panelists adopted the *Draft Hydropower Sustainability Assessment Protocol* developed by International Hydropower Association, and conducted a trail assessment on Shuibuya Project.

The Protocol is primarily involved with the three aspects of economy, environment and society. In the beginning, three group assessments were conducted respectively. Then the plenary discussion is organized to determine the assessment results, and the specific arrangements were as follows:

(1) Social professional assessment (socio-professional group has completed team assessment ahead of schedule) in the afternoon of November 23rd;

(2) Economic and environmental professional assessment in the morning of November 24th;

(3) Economic professional collective assessment in the afternoon of November 24th;

(4) Environmental professional collective assessment in the morning of November 25th;

(5) Plenary session of assessment panel was held, and assessment summary and discussion were conducted in the afternoon of November 25th.

According to the knowledge acquired from this survey and assessment, the panel brought forward a number of recommendations and suggestions on the *Hydropower Sustainability Assessment Protocol*, and proposed advices to further achieve sustainable development of Qingjiang Hydropower Development Co., Ltd..

3 Overview of Shuibuya Hydropower Project

Located in Badong County, Enshi City, Enshi Autonomous Prefecture for Tujia and Miao Nationalities of Hubei Province, Shuibuya Hydropower Project is the

leading power station on the main stream of Qingjiang River, which is the third one following the construction of Geheyan Hydropower Station and Gaobazhou Hydropower Station. It is also the backbone power plant of Central China Grid Company Limited for peak modulation and frequency modulation; the dam site is 117 km away from upstream Enshi and 92 km away from downstream Geheyan Hydropower Station, and it is a large-scale water conservancy and hydropower control project integrated with power generation, flood control as well as navigation.

The power station reservoirs is a multi-year regulating storage reservoir, with a total capacity of 4.58 billion cubic meters and normal water level elevation of 400 meters. The power station installed four generator sets, with a total installed capacity of 1.84 million KW and average generating capacity of 3.984 billion KWh. The Station is made up of a dam, underground power stations, spillways, etc.. The dam is a concrete face rockfill dam, with the filling volume amounting to 16.664 million cubic meters, and the top height is 233 meters, which is currently the world's highest of such dam type.

The pre-feasibility report of Shuibuya project was completed in May, 1995; detailed feasibility report was fully compiled in October, 1998. In May 2000, the State Council approved the project proposal; in June 2001, the State Council approved the feasibility report. In 2002, the main body of the project started construction; in 2007, the first set generated electricity; and in August 2008, all the generator sets were put into operation comprehensively.

4 Assessment contents

4.1 Assessment of social aspects

Socio-professional assessment includes IV-9 Social Management Plan, IV-10 Project Affected Communities, IV-11 Indigenous Peoples, IV-12 Benefit Sharing, IV-13 Labor and Working Conditions, IV-14 Cultural Heritage, IV-15 Public Health, IV-16 Assets and Community Safety, which are a total of eight levels of contents. As during the period of construction and operation of Shuibuya Hydropower Project, there is no newly discovered cultural heritage in the affected areas, IV-14 is not relevant.

4.1.1 Assessment results

Assessment results of social aspects at all levels can be found in the corresponding worksheet(Omitted).

4.1.2 General assessment

As for Shuibuya Hydropower Project, the scores of various attributes of social aspects were mostly around 3-4 points, and the scores of some attributes in Indigenous Peoples aspect attained 5 points. Overall, social aspects of Shuibuya Hydropower Project are relatively good.

In the process of resettlement of indigenous peoples for the project of Shuibuya Hydropower Project, given that the reservoir area is mountainous, on the basis of agricultural resettlement, a multi-format and multi-method resettlement mode was adopted, combining centralization and decentralization. In the course of migrants' resettlement, the construction of resettled towns has been constructed on a high level and standard, which enhanced town functions, accelerated the construction of small towns in the reservoir area, and stimulated their economic development.

After the four power generating sets of Shuibuya Hydropower Project were put into operation, its average annual power generation has amounted to 4 billion KWh; calculating on the basis that power price onto the electricity grid is 0.4 yuan per KWh, its annual output value is 1.6 billion yuan, which can effectively increase the GDP of the reservoir area and add to its fiscal revenue. The formation of Shuibuya reservoir area has added a golden watercourse to southwest Hubei Province. It provides a convenient, safe and economical water transport channel for the mineral resources development and transportation of iron ore, coal and other resources in the reservoir area, and plays a significance role in giving full play to the advantages of water transportation of Qingjiang River and promoting coordinated development of the transport structure in the river watershed.

Currently, further improvements could be made in the development and implementation of Social Management Plan in Shuibuya Hydropower Project, which is mainly reflected the benefit sharing of the hydropower projects. Subject to the current policies implemented by the government, the extent that the location (reservoir area and impacted area) of hydropower projects can benefit is relatively limited. Further supplement and improvement also can be made to the targeted groups and contents of social management plan; at present, focuses are placed on resettlement

of reservoir migrants, but more attention should be paid to a broader community affected by the projects, as well as the life styles, physical and psychological conditions, social interaction and mental state of these communities.

4.2 Assessment of economic aspects

Economic professional assessment covers a total of six aspects, i.e. IV-3 Economic Viability (including Additional Benefits), IV-4 Financial Viability, IV-5 Corporate Governance, IV-6 Procurement, IV-7 Markets, Innovation & Research, as well as IV-8 Asset Reliability & Efficiency. As China's electric market is an orderly and competitive market under government control, and cannot be viewed as a free and competitive market. Therefore, Markets, Innovation & Research aspect is not relevant.

4.2.1 Assessment results

Assessment results of social aspects at all levels can be found in the corresponding worksheet(Omitted).

4.2.2 General assessment

As for attributes of economic aspect of Shuibuya Hydropower Project, most of the scores lie in the level of 4-5 points, and many attribute scores reach 5 points. Overall, the performance of Shuibuya Hydropower Project in social aspect is at outstanding level.

According to its actual situation, Shuibuya Hydropower Project substantially optimized the programming of tourism, transportation, education, shipping and other additional benefits. Net income of the project surpassed expectations, compared with the economic assessment of project feasibility report. Hubei Qingjiang Hydropower Development Co., Ltd. established a clear and comprehensive financial assessment model, analyzed various cost-effectiveness and other certainty elements of the project, and conducted risk analysis on uncertainty factors. Financial indicators of the project are prior to the original ones of feasibility report expectations, with steady Debt Service Coverage Ratio. The company with stable management has established an effective management system such as tendering and bidding to prevent the risk of corruption. The assets of power station have relatively high validity and reliability, with rare unplanned outages, and the project owner is confident of the two properties

of the assets in the future.

4.3 Assessment of environmental aspects

Environmental professional assessment includes a total of nine dimensions contents of IV-1 River Basin & Transboundary Issues, IV-2 Hydrological Resource Availability & Management, IV -17 Environmental Management Plan, IV -18 Catchment Management, IV-19 Reservoir Management, IV-20 Environmental Flows & Downstream Sustainability, IV-21 Biodiversity & Invasive Species, IV-22 Erosion & Sedimentation as well as IV-23 Water Quality. As downstream area of Shuibuya belongs to Geheyan reservoir, Environmental Flows & Downstream Sustainability aspect is not related.

4.3.1 Assessment results

Assessment results of social aspect at all levels can be accessed through the corresponding worksheet(Omitted).

4.3.2 General assessment

As for attributes of environmental aspect of Shuibuya Hydropower Project, their scores are mostly at the level of 3-4 points, and in general, the performance of Shuibuya Hydropower Project in environmental aspect is at relative good level.

Shuibuya Hydropower Project is the leading reservoir in the three cascades of the Qingjiang River, has improved the overall capacity through a joint regulation of three reservoirs, and gives full play to the cascade benefits as well as promotes tourism, shipping and other related industries. Through joint regulation of the reservoirs, flood-proof pressure on the Yangtze River has been mitigated. Sediment concentration of Shuibuya is $0.70\text{kg}/\text{m}^3$, which belongs to a lower level, so there is no significant sedimentation in the reservoir area or evident downstream river erosion. The reservoir area of Shuibuya pertains to mountainous areas, currently, there is no large-scale industrial and agricultural pollution sources, water quality in the reservoir area as a whole is in line with the national water standard grade II, at a relatively good level, and there is no large scale agricultural irrigation in downstream area of the reservoir,

so the problem of discharged low-temperature water does not pop out.

Among the Shuibuya Hydropower Project environmental management plan, part of its contents has not yet implemented, which is a major point of environmental management in the next phase for Hubei Qingjiang Hydropower Development Co., Ltd. to focus on. In approval comments of environmental impact assessment report, it has been pointed out that in order to alleviate the adverse effects on fish of the discharged cold water reservoir, fish protected areas shall be established, but the measure has not yet been implemented. With the completion and operation of Shuibuya Hydropower Project, project management organization needs convert environmental management focus from the construction period to operation period, and scheme an environmental management plan suitable to the run-time characteristics and requirements. As the content and the importance of environmental management of hydropower projects gradually grow more prominent during the operation stage, it is recommended that Hubei Qingjiang Hydropower Development Co., Ltd. strengthen institution construction of environmental management, and provide a guarantee for the run-time environmental management from the two aspects of systems and personnel.

4.4 Overall assessment results

Figure 1 shows assessment results of all aspects, each fan-shaped region manifests scores of an aspect as well as the minimum and maximum ones, and the assessment perspectives of economic, environmental along with social aspects are respectively denoted in different colors.

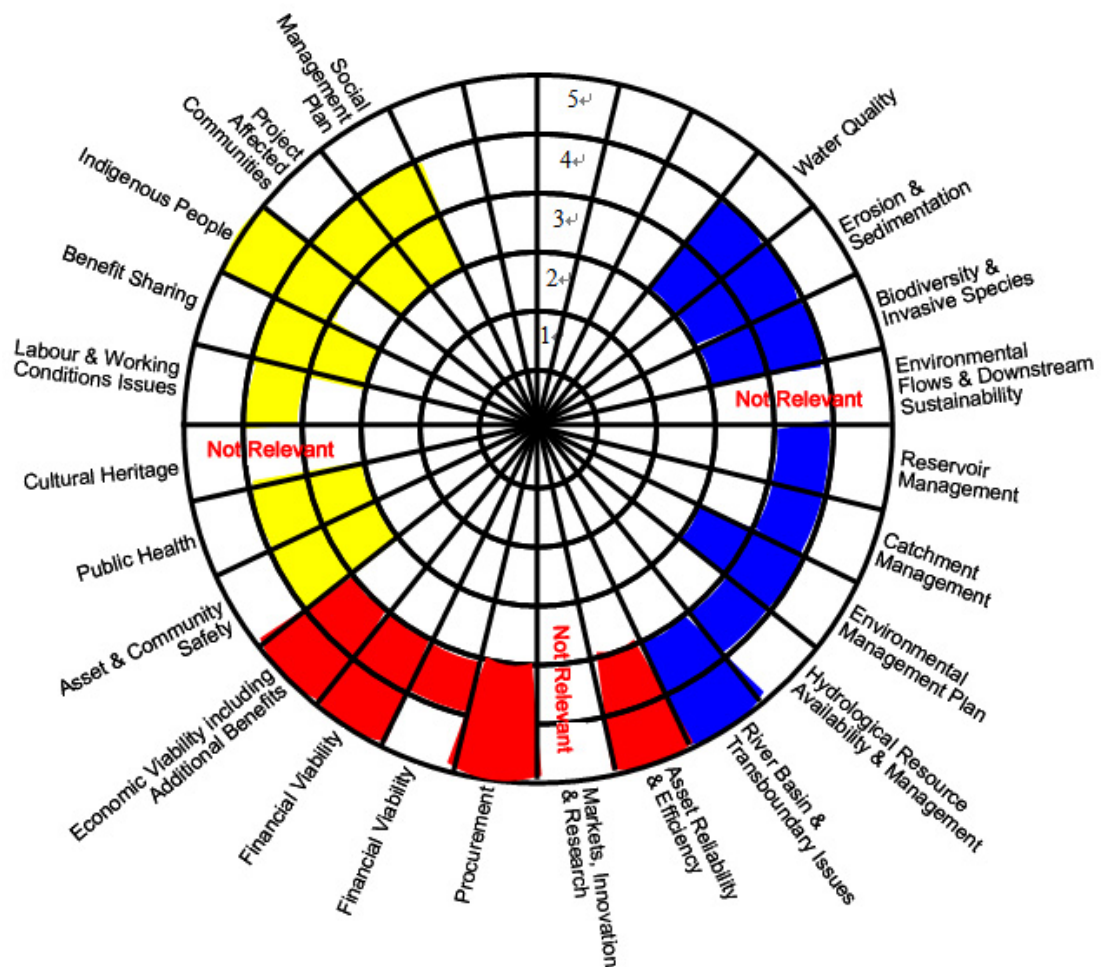


Figure 1 Sustainability assessment scores of Shuibuya Hydropower Project

5. Comments and suggestions on assessment protocol

During the assessment process, through soliciting views from the assessment panel and participants to the assessment, the following comments and suggestions have been put forward regarding the Protocol.

5.1 Practicability

The Protocol proposed by IHA laid out specific descriptions for the sustainability of hydropower projects, and established quantitative assessment criteria, which is a significant progress in advocating the practicability of sustainability in hydropower projects.

During the assessment process, it was found that the specification of a number of marking standards for attributes in the Draft Protocol is too broad and too subjective,

and based on different knowledge and understanding, scores given by different auditors are likely to vary widely, so it is recommended to further improve the objectivity of assessment criteria.

5.2 Applicability

Via this pilot assessment, it was found out that the content in the Draft Protocol is mostly consistent with that embodied in China hydropower project management systems and standards, and thus we believe that the protocol is basically applicable to China hydropower project sustainability assessment.

Owing to the differences between international and China's management institutions and systems, coupled with the language problem, it is necessary to translate the content and presentation to carry out assessment, when assessing in China. In order to ensure the accuracy during the conversion process, first of all, it needs to improve the original English formulation, convenient for understanding; second, language translation can achieve accurate conversion; third, training can help to improve the applicability of the Protocol in China.

5.3 Content of the Protocol

For the aspect of IV-19 Reservoir Management, there are two attributes related to greenhouse gas emissions of reservoirs, namely "the quality of understanding process of high-risk greenhouse gas emissions" and "the mapped-out measures in response to high-risk greenhouse gas emissions". Greenhouse gas emissions of reservoirs seem to be identified as high risk by this sort of expression. Actually the GHG emission level is quite different with different climate, vegetation, shape conditions and it is still in the research stage. So it is not appropriate to conclude high risk here.

5.4 Implementation guide

Based on the experience of the current pilot assessment, it is proposed that in the content of implementation guide, assessment process should be given a clearer and more detailed stipulation, specifically including the following:

(1) It is recommended that assessment staff qualification requirements should be regulated in the implementation guidelines. All levels of the Draft Protocol related to

social, economic and environmental aspects need a joint consultation of several experts of the aspects during the assessment process, and requires the participation of specialists with relevant background in order to achieve effective and credible assessment results.

(2) Taking it into account that economic, environmental and social aspects of the assessment have a strong professional property, this pilot assessment working panel, according to professional contents, is divided into three small groups. First, small groups assessment should be conducted, convening plenary working team session for collective assessment based on their results. This assessment process not only ensures characteristics and requirements of professional work, but also comprehensively adopts a collective opinion. It is suggested that more detailed and effective regulations should be given in the implementation guide during assessment process.

(3) The assessment meeting process is stipulated in the implementation guide, it is recommended to supplement the content of information collection and field visit. Before the assessment meeting, there are many basic data collection and preparation work, such as on-site information collection, physical evidence, questionnaires, and other related personnel interviews, which are indispensable to support assessment.

5.5 Scoring methodology

As for assessment scoring, the difference between adjacent points is too vague, the requirements for 5 points are too demanding, and the boundary between 5 points--“excellent” and 4 points --“very good” is not clear enough, with too small distinctions. It is suggested to be altered as: 5 points--“excellent”, 4 points-- “good”, 3 points--“General”, 2 points --“poor”, and 1point -- “very poor”. We suggest that examples for “best practice” can be provided in the Protocol or supported documents.

5.6 Presentation of results

The currently adoptive presentation of results is basically rational; it is recommended that a more specific one should be stipulated as follows:

(1) It is recommended to express the minimum and maximum points of all levels in the histogram manner in the text of the Protocol as well as by way of pie chart in briefing introduction document. The eventual presentation way should be specified.

(2) The results of this assessment were presented in the pie chart manner, and the contents of the economic, environmental and social aspects were displayed in different colors, respectively, which can not only show the scores of all levels, but also differences among the three aspects.

5.7 Usability

The specification of the Protocol seems obscure and elusive, even English itself is also difficult to understand, and when translated into Chinese, its usability is further debased.

6 Summary and Recommendations

Given the content and results of this pilot assessment, the *Draft Hydropower Sustainability Assessment Protocol* proposed by the International Hydropower Association has been tested, the sustainability level of Shuibuya Hydropower Project has been assessed, and discussions have been conducted over the pathways to improve the sustainable development of hydropower projects in China.

6.1 Work Summary

(1) Through field investigations, group assessment, centralized assessment, etc., an assessment of the sustainability level of Shuibuya Hydropower Project was conducted, and the assessment results show that the sustainability of Shuibuya Hydropower Project falls into the level of Very Good, among which its economic aspects fall into the level of Excellent.

In the aspect of drafting and implementation of social management plan, further improvements can be made to Shuibuya Hydropower Project; as the project has entered the operation stage, improvements need to be made to the development and implementation of environmental management plan, as well as strengthening the establishment of environmental management institutions and systems.

(2) Through this round of trial assessment activities, the main features of sustainability assessment protocol of hydropower projects were tested and analyzed. On the whole, the assessment protocol laid out specific descriptions for the sustainability of hydropower projects, and established quantitative assessment criteria, which is significant progress in advocating the practicability of sustainability in

hydropower projects.

The protocol still needs to be improved on aspects of objectivity, language comprehensibility, guidance on process for application of the protocol, and other aspects of the assessment process, in order to further enhance its practicability and usability.

6.2 Comments and suggestions

The construction and operation of Shuibuya Hydropower Project indicates that hydropower development can play a significant role in promoting economic and social development in remote and poor regions of China. At the same time, joint efforts should be made by hydropower development companies and local governments to achieve its sustainable development, and support should be provided in government regulations and policies.

At present, hydropower development companies, as important main bodies of responsibility for sustainable development of hydropower, are encountered with a number of difficulties in practical activities, and need guidance and support from government regulations and policies. For example, in order to further enhance the level of social and environmental management, national policies should be made to clarify the responsibilities that should be jointly assumed by hydropower owners and local governments. Meanwhile, as to the social and environmental responsibilities that need to be borne and implemented by development companies, clear policy support should be provided to address the problems of policy basis and source of funding.