Response to the Request for Review on Sichuan Baishuijiang Shuanghe Hydro Power Project

1. Further clarification is required on how the DOE has validated the appropriateness of additional costs in line with the requirements of EB 38 paragraph 54(b), as they are sourced from 4 additional PDRs and not from the original PDR.

Response from the Project Participant:

According to the Approval on Preliminary Design Report (PDR) of Shuanghe Hydropower Station (the Project) issued by Sichuan Province Development and Reform Commission (SDRC), the total static investment cost for Shuanghe project is 565.86 million CNY, excluding the investment cost for transmission networks[1].

However, the transmission networks are a necessary and indispensable part of the Project because without it the electricity generated by the Project could not be delivered to the power grid. According to the following documents, the investment cost for the transmission networks is the responsibility of the PP.

- Approval for the Feasibility Study Report (FSR) of Baishuijiang Transmission Networks, issued by Sichuan Grid Company[2].

The Baishuijiang transmission networks consist of three components: the communication project, the Shuanghe switch station, and the double electricity transmission lines. As identified in their PDRs approved by Sichuan Grid Company, the static investment costs associated with these three components are shown in Table 1 below:

Table 1. Investment costs for three components of the Baishuijiang transmission networks connected to the Project

Component Investment Cost	Million CNY	Data Source

[1] Approval on Preliminary Design Report (PDR) of Shuanghe Project, Sichuan Province Development and Reform Commission, November 29th 2005

[2] Approval for Feasibility Study Report (FSR) of Baishuijiang Transmission Networks, Sichuan Grid Company, October 26th 2004

Communication project	11.9966	PDR of Communication project[3,4]
Shuanghe switch station	57.6078	PDR of Shuanghe switch station[5,6]
Double electricity transmission lines	282.549	PDR of Double electricity transmission lines[7,8]
Total Cost	352.1534	

The transmission networks will be fully constructed by the PP to serve seven hydropower stations on the Baishuijiang river, including the Project, with a total installed capacity of 490MW[2]. Total investment cost for the transmission networks will be equitably shared among the stations served by this transmission networks based on their capacity[9]. The portion for the Project is calculated as follows:

$$352.1534 \times \frac{81MW}{490MW} = 58.2131 \text{ Million CNY}$$

Therefore, the total fixed investment cost for the Project is 624.0731 million CNY (=565.86 +58.2131), based on four approved PDRs specified in the PDD, which are:

- PDR of Shuanghe Hydropower Station
- PDR of Communication project
- PDR of Shuanghe switch station
- PDR of Double electricity transmission lines.

In addition, according to the Approval for the Baishuijiang Transmission Networks Project issued by the SDRC on August 22nd 2007[10], the total static investment cost for Baishuijiang Transmission networks is 361.057 million CNY and is the responsibility of the PP. It demonstrates that 58.2131 million CNY is appropriate and conservative,

[3] Preliminary Design Report for Communication Project, Sichuan Electric Power Design & Consulting Co., Ltd., March 2005
[4] Approval for Preliminary Design Report for Communication Project, Sichuan Grid Company, March 22nd 2005.
[5] Preliminary Design Report of Switch Station Project, Chengdu Hydroelectric Investigation & Design Institute of CHECC, January 2005
[6] Approval for Preliminary Design Report of Switch Station Project, Sichuan Grid Company, December 31st 2005.
[7] Preliminary Design Report of Double Electricity Transmission Lines Project, Sichuan Electric Power Design & Consulting Co., Ltd., January 2005
[8] Approval for Preliminary Design Report of Double Electricity Transmission Lines Project, Sichuan Grid Company, February 21st 2005.
[9] Jiuzhaigou Electric Power Development Limited Corporation 3rd Session of the 1st Board of Directors Resolution (3rd issue), Jiuzhaigou Electric Power Development Limited Corporation, 24th March 2005
[10] Approval for the New-built 220KV Double Electricity Transmission Project between Shuanghe and Shaxiba on Baishuijiang, Sichuan Province Development and Reform Commission, August 22nd 2007

and is a necessary and indispensable part of the total static investment cost for the Project.

2. The DOE is requested to further clarify the suitability of the input values to the investment analysis as per the requirements of EB 38 paragraph 54(c) guidance, including the reported values (more specifically the difference of 10.5% between) the annual electricity generation and power supply to grid.

Response from the Project Participant:

a) The input values to the investment analysis of the Project were in accordance with the guidance of EB 38 paragraph 54.

All input values to the investment analysis of the Project (including the value of power supply to the Sichuan Power Grid (the Grid)) were taken from the approved PDRs. As required in *Specification on Compiling Preliminary Design Report of Water Conservancy and Hydropower Projects* (DL5021-93) issued by Ministry of Power Industry and Ministry of Water Resources, the PDR should be complied based on the approved FSR and it should provide more technical details with less uncertainties compared with the FSR. Therefore, the information in the PDR was also included in the decision-making process regarding whether to proceed with the investment of a hydropower project.

The PDR of the Project was prepared by a certified and independent third party, Chengdu Hydroelectric Investigation & Design Institute of China Hydropower Consulting Group, and was approved by the SDRC dated 29th November 2005, which was two months prior to the construction of the Project after being evaluated by independent experts.

Therefore, the input values to the investment analysis of the Project were in accordance with the guidance of EB 38 paragraph 54.

b) The reason for the difference of 10.5% between the annual electricity generation and power supply to grid.

The 10.5% is the difference between the maximum electricity (351,540 MWh/y) that can be generated by the Project at its full load, and the actual electricity (314,800 MWh/y) that will be supplied to and accepted by the Grid.

During high-water seasons, the electricity that can be generated by the hydropower stations running at full load exceeds what is actually needed by the Grid; however, this excess of electricity cannot be accepted by the Grid. Due to lack of economic benefit of operating at full load, the hydropower stations normally release some "surplus" water through spillway. Based on comprehensive considerations of the annual average surplus water ratio of hydropower stations in the Sichuan Grid and the forecasted surplus water ratio of the Project, 10% was finally selected as a reasonable value to be used in the designed surplus water ratio for the Project (Attachment 1). This means that only 90% of the maximum electricity, that is 316,386 MWh/y (351,540 MWh/y ×90%), will be generated by the Project and can be accepted by the Grid.

According to the approved PDR, the internal consumption of the Project is 0.5%, and the transmission loss is 0%. Therefore, the electricity actually supplied to the Grid is designed 314,800 MWh/y (316,386 MWh/y ×99.5%).

In addition, even if 100% annual electricity generation is used for investment analysis, the project IRR is 7.99% (Attachment 2). However, it is impossible for a hydropower project to deliver 100% electricity generated to the Grid due to the reasons described above.

3. The DOE is requested to confirm that the ex-ante emission factor of 0.9745tCO2/MWh complies with the requirements of the methodology regarding the use of the most up-to-date data at the time of validation as the PDD for the GSC used a different emission factor (0.9445 tCO2/MWh). If not, the emission factor should be based on the latest available data at the time of commencing validation.

Response from the Project Participant:

The emission factor used in the PDD for GSC is 0.9445 tCO_2e/MWh, which is data published by the Chinese DNA before August 9th 2007.

China Electric Power Yearbook (2006) was published in November 2006 and China Energy Statistical Yearbook (2006) was published in March 2007. Then, on August 9th 2007, the Chinese DNA updated the emission factor of the power grids on its website, and the emission factor of the CCPG was updated from 0.9445 tCO_2e/MWh to 0.9745 tCO_2e/MWh accordingly, which is the data used in the PDD for registration.

According to *Tool to calculate the emission factor for an electricity system*, the emission factor should be based on the latest available data at the time of commencing validation. The time of commencing validation of the Project is July 15th 2007. At that time, China Electric Power Yearbook (2006) and China Energy Statistical Yearbook (2006) were already publicly available. However, some vital data used for the calculation of the emission factor, such as the maximum power supply efficiency of the most advanced technology commercially used in China's coal-fired plants and oil- and gas-fired plants ($GENE_{best,coal}$, $GENE_{best,oil,gas}$), were not available. Therefore, the emission factor of the Project will be changed back to 0.9445 tCO_2e/MWh, which is more conservative, in the revised PDD.

Attachment 1

关于双河水电站年发电量和上网电量差额的说明

关于上网电量在《双河水电站初步设计报告》中有详细描述，现摘抄如下。

1. 设计水平年的确定

双河电站预计 2005 年开工兴建，2007 年左右建成发电[1]，在参照《水利水电工程动能设计规范》第 6.0.7 条规定[2]，并分析四川电网的负荷发展需要的基础上，设计院确定了本电站的设计水平年为 2015 年。

2. 年弃水率计算

2.1电力发展规划

根据国家电力公司和四川省人民政府对四川省2000年～2020年的电力负荷发展预测，2015 年四川省内最大用电负荷为 2932 万 kW，电网外送电力 1200 万 kW，因此，2015 年四川电网最大发电总负荷为 4132 万 kW，电量为 2247 亿 kW·h[3]。

2.2 电力平衡原则

按照四川省 2015 年的电力负荷预测及电源建设安排，设计院完成了 2015 年中水年电力月平衡成果表。计算原理见《水能设计》第四章[4]。

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[1] 《双河水电站初步设计报告》上册 1.4 章节
[2] 《水利水电工程动能设计规范》
[3] 《双河水电站初步设计报告》上册 4-7 页、4-8 页。
[4] 《水能设计》，电力工业出版社出版

平衡原则如下：

（1）系统负荷备用容量采用系统最大负荷的3%[2]，主要由靠近负荷中心、调节性能好的大中型水电站承担。系统事故备用容量采用系统最大负荷的8%，由具有调节能力且有库容保证的水电站及火电站担负。由于装机容量及调节库容相对较小，本电站不承担上述备用容量。

（2）水电机组的检修一般安排在枯水期。每台机组每年的检修时间平均为1个月。

（3）在平衡中，根据各类电站的技术经济运行特点安排其工作位置，具有日调节以上能力的水电站共同承担系统尖峰负荷，并首先充分发挥已建电站的容量和电量效益。平衡中考虑向区外（华东、重庆）送电1200万kW。

2.3 年弃水率计算

根据2015年中水年电力月平衡成果表，汇总得到2015年中水年电量平衡成果表，该表显示：双河电站设计年弃水率（年弃水率=弃水电量/多年平均年发电量）约为8.4%，四川电网水电站群设计年平均弃水率约为11%。由于2015年的电力负荷是预测的，存在一定的不确定性，因此该表计算结果只能代表大概的水平，综合考虑四川电网水电站群的平均弃水率，最终确定双河电站设计年弃水率为10%。

3. 年发电量和上网电量差额的组成

双河水电站设计多年平均年发电量3.515亿kW·h。根据上述弃水率计

算结果，双河水电站的年弃水率为 10%，即双河水电站实际能被电力系统吸收的电量占其设计多年平均年发电量的 90%，为 3.164 亿 kW·h（3.515×90%＝3.164 亿 kW·h）。双河电站的厂用电率取 0.5%，不考虑线损，由此计算出正常运行期出厂电量（上网电量）为 3.148 亿 kW·h（3.164×99.5%＝3.148 亿 kW·h）。

中国水电顾问集团成都勘测设计研究院

二〇〇九年三月五日

Explanation on the Difference between Theoretical Annual Electricity Generation and Electricity Supplied to the Grid by Shuanghe Hydropower Station

There is a detailed description of the power supplied to the grid contained in the *Shuanghe Hydropower Station Preliminary Design Report* (PDR). The following contents have been extracted from the PDR:

1. Determination of the Design Level Year

Shuanghe Project (the Project) was planned to start construction in 2005 and commissioning operation in 2007[11]. According to item 6.0.7 of *Specification on Energy Economy Design of Water Resources and Hydroelectric Projects*[12], and based on the analysis on the power load development of the Sichuan Grid, the year 2015 was chosen as the Design Level Year of the Project.

2. Calculation of the Annual Surplus Water Ratio

2.1 Electric Power Development Plan

According to the estimations on the power load development of Sichuan Province from 2000 to 2020 by the national power company and Sichuan Provincial People's Government, the maximum power load of Sichuan Province in 2015 will be 29.32 million kW, and Sichuan Grid will export 12 million kW electric power to other grids. Therefore, the total maximum electricity generation load of Sichuan Grid in 2015 is 41.32 million kW with an electric power quantity of 224.7 billion kW·h[11].

2.2 Principle of Power Balance

The monthly power balance sheet of the Design Level Year 2015 as medium flow year [13] was

[11] Preliminary Design Report (PDR) of Sichuan Baishuijiang Shuanghe Hydropower Station, Chengdu Hydroelectric Investigation & Design Institute of CHECC, April 2005

[12] Specification on Energy Economy Design of Water Resources and Hydroelectric Projects, Ministry of Power Industry of the People's Republic of China, 4th March 1996

[13] Electricity balance sheet of Design Level Year 2015, Table 1-1~12.

undertaken according to the power load forecast and the power station construction plan of Sichuan Province in 2015. The calculation principle is shown in *Hydropower Design*. The balancing principles are as follows:

For the reserve capacity of the system load, 3% of the system's annual maximum load was applied[12], mostly being undertaken by the large and medium-sized hydropower stations that have good adjustment abilities which are close to the load center. For the reserve capacity of system accidents, 8% of the system's annual maximum load was applied, mostly being undertaken by the hydropower stations with good adjustment capacity and enough reservoir capacity, and the thermal power stations. Because the installed capacity and the adjustment capacity of the reservoir are relatively small, the Project does not undertake the reserve capacity.

The overhaul of the hydropower station's machinery is generally carried out during low water periods, and the period of duration for overhauling each line is about one month per year.

The balance task will be distributed according to the technical and economical character of the different kinds of power stations. The hydropower stations with daily regulating capacity bear the system peak loads jointly, and the capacity and the efficiency of the built plants are considered by priority. The exported electricity (delivered to the ECPG and the Chongqing Grid) of 12 million kW was taken into consideration for the balance system.

2.3 Calculation of Annual Surplus Water Ratio

According to the electricity balance sheet of the Design Level Year 2015 as medium flow year[14] which is based on the monthly power balance sheet of the Design Level Year 2015 as medium flow year[13], the annual surplus water ratio of the Project is about 8.4% (annual surplus water ratio = surplus electricity generation quantity / annual average of electricity generation), and the designed annual average surplus water ratio of hydropower stations in Sichuan Grid is about 11%. Because the load in 2015 is forecasted, there exists some uncertainty. The data of the tables only

[14] Electricity balance sheet of Design Level Year 2015, Table 3.

represent the general levels. After comprehensive consideration of the designed annual average surplus water ratio of hydropower stations in Sichuan Grid and the forecasted surplus water ratio of the Project, 10% was finally selected as the surplus water ratio of the design level year for the Project.

3. Composition of the difference between theoretical annual electricity generation and electricity supplied to the grid

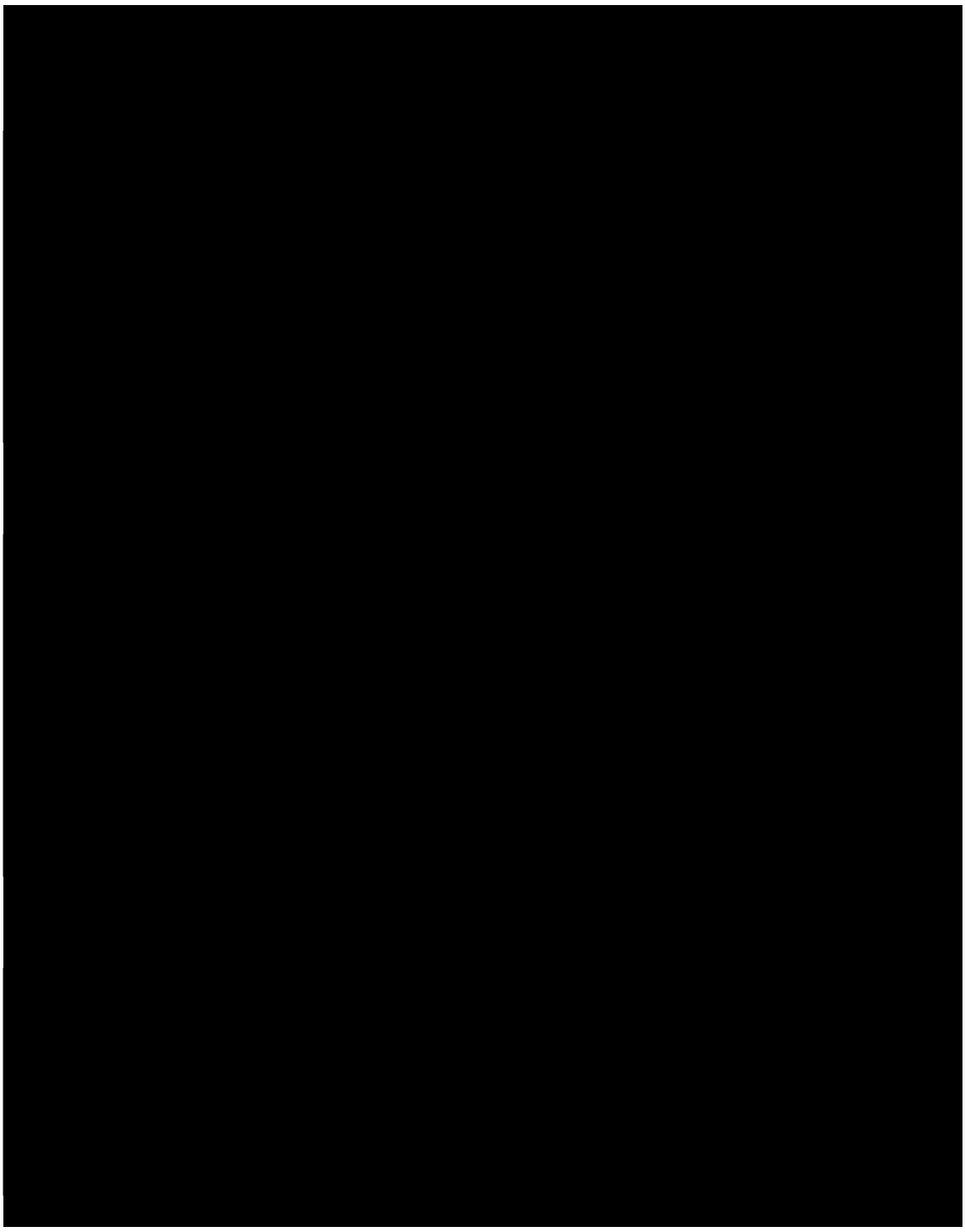
The maximum amount of electricity that can be generated by the Project at its full load is 351,500 MW/h. According to the calculation result of the annual surplus water ratio in 2015 mentioned above, the annual surplus water ratio of the Project is 10%, which means that only 90% of the maximum electricity, that is 316,386 MWh/y (=351,540 MWh/y×90%), will be generated by the Project and can be accepted by the Grid. The internal electricity consumption of the Project is 0.5%, and the transmission loss is zero, so the electricity actually supplied to the Grid is 314,800 MWh/y (316,386 MWh/y×99.5%).

February 5th 2009

Chengdu Hydroelectric Investigation & Design Institute

of China Hydropower Consulting Group

Attachment 2



Project IRR without CERs Unit: 10^4 Yuan

No.	Items \ Year	Total	Construction period			Operation period													
			1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	Cash inflow	239108	0	0	0	3557	8120	8120	8120	8120	8120	8120	8120	8120	8120	8120	8120	8120	8120	8120
1.1	Electricity revenue	239027			0	3557	8120	8120	8120	8120	8120	8120	8120	8120	8120	8120	8120	8120	8120	8120
1.2	CER revenue	0					0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.3	Recovered fixed assets	0																		
1.4	Recovered circulation fund	81																		
2	Cash outflow	137267	2626	14576	23762	22281	1427	1689	1729	1770	2201	2285	2372	2463	2557	2655	2758	2784	2784	2784
2.1	Fixed assets	62407	2626	14576	23762	21443														
2.2	Circulating fund	81				81														
2.3	O&M costs	39352				716	1332	1332	1332	1332	1332	1332	1332	1332	1332	1332	1332	1332	1332	1332
2.4	VAT and other tax	2778				41	94	94	94	94	94	94	94	94	94	94	94	94	94	94
2.5	Payable income tax	32648				0	0	263	302	344	774	858	945	1036	1130	1229	1331	1358	1358	1358
3	Net cash flow (1-2)	101841	-2626	-14576	-23762	-18724	6693	6430	6391	6349	5919	5835	5748	5657	5563	5464	5362	5335	5335	5335
4	Accumulated net cash flow	101841	-2626	-14576	-23762	-18724	6693	6430	6391	6349	5919	5835	5748	5657	5563	5464	5362	5335	5335	5335

IRR 7.99%

Project IRR without CERs Unit: 10^4 Yuan

No.	Items \ Year	Total	Operation period															
			16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
1	Cash inflow	239108	8120	8120	8120	8120	8120	8120	8120	8120	8120	8120	8120	8120	8120	8120	8201	
1.1	Electricity revenue	239027	8120	8120	8120	8120	8120	8120	8120	8120	8120	8120	8120	8120	8120	8120	8120	
1.2	CER revenue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1.3	Recovered fixed assets	0																
1.4	Recovered circulation fund	81															81	
2	Cash outflow	137267	2784	2784	2784	2784	2784	2784	2784	2784	2784	2784	2784	2784	2784	2784	2784	
2.1	Fixed assets	62407																
2.2	Circulating fund	81																
2.3	O&M costs	39352	1332	1332	1332	1332	1332	1332	1332	1332	1332	1332	1332	1332	1332	1332	1332	
2.4	VAT and other tax	2778	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94	
2.5	Payable income tax	32648	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	1358	
3	Net cash flow (1-2)	101841	5335	5335	5335	5335	5335	5335	5335	5335	5335	5335	5335	5335	5335	5335	5416	
4	Accumulated net cash flow	101841	5335	5335	5335	5335	5335	5335	5335	5335	5335	5335	5335	5335	5335	5335	5416	

IRR 7.99%