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Att: CDM Executive Board

Your ref.:
CDM Ref 2410

Our ref.:
ZXJ/PETMO/

Date:
15 June 2009

Response to request for review of the project “Sichuan Liangtan Hydropower Station Second Phase Project” (2410)

Dear Members of the CDM Executive Board,

We refer to the issue raised in the requests for review of project activity 2410 “Sichuan Liangtan Hydropower Station Second Phase Project” and would like to provide the following responses to the issues raised:

Question 1: Further explanation should be provided regarding: (a) the basis for the assumed electricity tariff in the PDR (b) The revised assumed electricity tariff used in the PDD submitted for registration, in particular, (i) how the price of 0.270 RMB/kWh (including VAT) agreed by the PP with the grid company has been derived and (ii) whether this tariff is in line with the general trend for similar projects exporting electricity to the same grid, which commenced after 2002, and (iii) how this tariff compares to the tariffs for thermal power plants.

DNV Response:

(a) The electricity tariff as per the PDR is a calculated/assumed tariff calculated backwards in order to identify the tariff necessary for the project to achieve the hurdle rate of 10% for small hydro projects as stipulated by the *Economic Evaluation Code for Small Hydropower Projects* (SL16-95) issued by the Ministry of Water Resources in 1995. The calculated tariff was interpreted and substantiated by Sichuan Nanchong Water Resource & Hydroelectric Engineering Exploration & Design Institute¹ (the developer of the PDR of the proposed project) as follows:

At the PDR development stage, Sichuan Nanchong Water Resource & Hydroelectric Engineering Exploration & Design Institute assessed the tariff as a variable factor to assess if the project is economically feasible based on other available data, such as the project total investment, the annual O&M expenses, the rate of residual life of the assets and taxes etc. The tariff of 0.39 RMB/kWh (excl. VAT) in the PDR of July 2005 was calculated to clearly tell the owner of the proposed project that only on the basis of a tariff of this level or above, the project could achieve or exceed the basis return of industry standard. The key point of this assessed tariff lies in offering a critical point of profit and loss of the proposed project.

The above approach is a commonly used tariff determination approach available at the time of the PDR preparation. The PDR dated July 2005 was developed by Sichuan Nanchong Water Resource

¹ Clarification by Sichuan Nanchong Water Resource & Hydroelectric Engineering Exploration & Design Institute, 04/06/2009

& Hydroelectric Engineering Exploration & Design Institute which is accredited by Ministry of China Construction. Further, an approval letter of PDR was issued by Guan An City Water Resources Bureau on 26 July 2005 after it passed the public assessment of the sector experts designated by the government.

(b) (i) DNV verified that the tariff of 0.36 RMB/kWh (including VAT) (*Please note that the UNFCCC CDM Secretariat has confirmed that the tariff cited in the request for review was mistakenly stated as 0.270 RMB/kWh, the correct one is 0.360 RMB/kWh*) was sourced from Grid Connection Letter of Intent dated 30 July 2005 between the grid company and the project developer. DNV 's judgement is that it is reasonable to apply the most up to date tariff in the Letter of Intent and not the tariff in the PDR to re-evaluate project's viability at the time when the project participant decided to go ahead with the project activity in accordance with EB41, Annex 45. The Grid Connection Letter of Intent is dated 30 July 2005, which is after the PDR finalising date of July 2005 and the PDR approval date of 26 July 2005, but before the project activity start date, corresponding to the construction start permits issued by Construction Supervision Engineering Co. Ltd. of Gansu Huayan on 6 September 2005. The tariff of 0.36 RMB/kWh (including VAT) adopted in PDD was further substantiated by the Power Purchase contract between the project owner and Guang'an AAA Public Electricity Co., Ltd. signed on 6 September 2007.

(b) (ii) Following the *Provisional Measures for the Administration of the Electricity On-Grid Tariff*² (On-Grid Tariff Measures) issued on 28 March 2005, three regulations/measures (coming into effect on 1 May 2005) establish a comprehensive tariff system for electricity in China, covering production, distribution and sale to end users. One of which aims to regulate the determination of the electricity tariff offered to power producers in order to stabilize tariffs and increase competitiveness in the electricity market. The term "On-Grid Tariff" is defined as the price at which an electricity generation enterprise and an electricity purchaser settle the price of electric power supplied to a grid.

Since the aforementioned "*On-Grid Tariff Measures*" has taken effect, Sichuan Province Price Bureau has issued a series³ of tariff guidance for power enterprises to follow and the on-grid tariff was verified to remain unchanged as 0.288 RMB/kWh (including VAT) for three consecutive years for 2005, 2006 and 2007. The 0.288 RMB/kWh (including VAT) was recently granted to 23 hydro stations⁴ according to the notice of Sichuan Province Price Bureau dated 20 November 2008 in accordance with ChuanJiaFa (2005) No. 123. The proposed project was also given tariff of 0.288 RMB/kWh (including VAT) in the new PPA signed in September 2008.

(b) (iii) It is stated in the ChuanJiaFa (2006) No.145⁵ issued 29 June 2006 and in effect on 30 June 2006, that the guiding tariffs for thermal power plants are 0.3328 RMB/kWh (with no desulfurization facilities) and 0.3478 RMB/kWh (with circulation sulfurization bed treatment facilities).

2 Electricity Tariff Reform http://www.hg.org/articles/article_805.html

3 ChuanJiaFa (2005) No.91, ChuanJiaFa (2005) No. 123 and ChuanJiaFa (2006) No.145

4 <http://www.scpi.gov.cn/newzcfg/zcfg-content.asp?id=3238>

5 <http://www.scpi.gov.cn/zcfg/zcfg-content.asp?id=1972>

The tariff of 0.36 RMB/kWh (incl. VAT)⁶ used in the financial analysis in PDD is based on the Letter of Intent dated 30 July 2005, which was available at the time of decision making, and this tariff is higher than both the guiding electricity tariff for hydropower projects and thermal power projects. Hence, the tariff used in the PDD is considered to be conservative and applicable at the time of decision making and adequately represent the economic situation of the project.

Question 2: Further clarification is required on how the DOE has validated the suitability of the input values to the investment analysis as per the requirement of the EB 38 paragraph 54(c) guidance, in particular: (a) the operating hours (4224) considering that the already operating plant runs 5570 hours and the higher operating hours for the projects considered in the common practice analysis; (b) the 8.57% power loss and (c) the investment costs.

DNV Response:

(a) Operating hours (4224)

DNV confirmed that PDD Version 10 of 10/02/2009 strictly followed the content of PDR in its design:

The “Sichuan Liangtan Hydropower Station Second Phase Project” involves installation of a hydropower station with an installed capacity of 20MW. The hydropower station is located on the other side of the dam from the original Liangtan Hydro Station (LHS) which has an installed capacity of 8.6MW which began operation in 1985 prior to the implementation of the project activity. The project activity shares the water resources from the same existing reservoir.

The PDR was developed by the qualified design institute Sichuan Nanchong Water Resource & Hydroelectric Engineering Exploration & Design Institute in July 2005 and approved by Guan An City Water Resources Bureau on 26 July 2005. Since these parameters were substantiated by the experts and authorized by the administration department, their use is deemed to be reasonable.

The annual generation has been estimated in the PDR as follows:

The annual water collected in the drainage basin where the project activity is located was analysed using professional application software based on the historical runoff data (1954-2002); the result of average runoff at yearly span is 675 m³/s. The accuracy of this is further checked by comparing its coefficient of variation (Cv) and the relation between Cv and the coefficient of skewness Cs (Cs/Cv). The yearly distribution of water runoff mode is based on the data after 1990. Sichuan Nanchong Water Resource & Hydroelectric Engineering Exploration & Design Institute's thus chose a representative runoff of a wet year (p=10%), normal year (p=50%) and dry year (p=90%) as per the theoretical runoff series. Three representative years were selected: wet year (May 2000-April 2001), normal year (May 1994-April 1995) and dry year (May 1999-April 2000). The theoretical annual average power generation was determined based on hydrological computation with the actual runoff data of the 3 representative years.

The theoretical annual gross power generation for the whole system (the original power station and the proposed one) was calculated to be 143 770 MWh as the sum of daily electricity output which is equal to daily useful water flow multiplied by net water head and generation efficiency.

The electricity generation for the proposed project is calculated assuming that the water demand of the original power station would first be met. The calculation is expressed as:

143,770 MWh (gross electricity generation of total capacity for the original power station and the project activity) – 51,300 MWh (gross electricity generation of the original power station) = 92,470 MWh. The installed capacity of the project activity units is 20 MW; therefore the 92,470

⁶ Please note that the UNFCCC CDM Secretariat has confirmed that the tariff cited in the request for review was mistakenly stated as 0.270 RMB/kWh, the correct one on 0.360 RMB/kWh

MWh is equivalent to 4,623 hours of operation of the project activity units (92,470MWh divided by 20MW).

When dividing the electricity delivered to the grid (84 544 MWh/year) by the installed capacity (20 MW), one arrives at 4224 hours. DNV would like to emphasize that this is calculated by considering the net delivered electricity only, when assuming that the water demand of the original power station is met.

DNV's sectoral experts can confirm that the number of operating hours is reasonable for this project, as also supported when comparing the project with similar projects validated by DNV in China. In our analysis, 12 hydropower projects with installed capacities between 10 MW – 50 MW, all connected to the Central China Power Grid were compared. Out of the 12 plants, 6 plants had operating hours based upon the net delivered electricity below 4224 h, while 5 plants were above.

(b) the 8.57% power loss

The net electricity delivered to the grid was calculated as follows:

$$E_{\text{deli}} = E_{\text{theoretical}} * E_{\text{eff}} * (1 - E_{\text{cons}}) * (1 - E_{\text{lost}}) \quad (1)$$

Where:

- E_{deli} : the net electricity amount will be delivered to the grid by the proposed project per annum;
- $E_{\text{theoretical}}$: the maximum theoretical amount of electricity that may be produced by the proposed project;
- E_{eff} : the effective electricity supply coefficient.
- E_{cons} : the fraction of the auxiliary electricity amount consumed by the proposed project.
- E_{lost} : the fraction of transmission loss during delivery.

For the proposed project, in PDR Chapter 15 page 2, the internal power use is 1% and power loss is 3.8% all in line with *Hydroenergy Design Code for Small Hydro Power Document* (No.SL 76-94)⁷. The effective electricity supply is a factor defined by the *Economic Evaluation Code for Small Hydropower Project* (SL16-95) to be the fraction of the theoretical electricity generation that can be utilized by the system or end users. This factor considers the probability that a hydropower plant will not be able to deliver the theoretical designed amount of electricity, due to e.g., variations of the river flow changes, grid load restraints, equipment maintenance and plant shut down periods. This factor is therefore included when calculating the profitability of a project. DNV would like to emphasize that this is standard procedure for Chinese hydropower projects, and that the IRR benchmark used for these projects are developed taking this factor into consideration.

During validation, the auxiliary electricity amount consumed by the proposed project (E_{cons}), the transmission loss during delivery (E_{lost}) and the coefficient of the effective electricity supply (E_{eff}) were confirmed to be stated in PDR. The 8.57% difference of theoretical annual power generation and expected power supplied to grid is considered to be suitable by DNV.

The project participant has re-calculated the project-IRR when using the theoretical annual electricity supplied (92470MWh/y) and deducting for the internal usage (1%) and the transmission

⁷ A technical regulation and standard applicable to hydropower projects below 25 MW published by the Ministry of Water Resources of the People's Republic of China, still valid as published by the Ministry of Water Resources of the People's Republic of China

loss (3.8%), but neglecting the efficient electricity supply factor ($E_{\text{eff}} = 1$). The resulting IRR is 8.92%, which is still lower than the benchmark of 10%.

(c) the investment costs

The investment costs for the project activity are verified from the PDR to be RMB 172 million. This figure was used in the financial analysis in the PDD.

From the financial audit⁸ dated 5 June 2009, DNV was able to verify that the investment costs actually incurred for the construction of the project activity were RMB 165 million and the unfinished investment costs are estimated to be RMB 6 million, including planting of trees and grass around the hydro power station, stabilization of the channel walls, completion of the flood defences, removal of the old buildings in the hydro power station and building walls around the hydro power station. In the total, this will give RMB171 million which is very close to the total investment estimated in the PDR. DNV verified the contracts⁹ as confirmation sources.

Question 3: Further clarification is required on how the DOE has validated the investment analysis as appropriate, in line with EB 41, Annex 45; in particular the exclusion of a fair value considering that the operational lifetime is 23 years and the investment analysis considers a 20 year period.

DNV Response:

DNV was able to verify from the PDR that the the project lifetime is 23 years, including a 3 year construction period. The operational lifetime is hence only 20 years as in the analysis submitted for registration of the proposed project. An operational lifetime of 20 years¹⁰ is common practise for small hydropower projects in China. For IRR analysis in the PDD, the 21 years lifetime (including 1 year construction period) instead of 23 years lifetime (including 3 year construction period) was applied and the former situation is conservative comparing with the later one. A revised financial analysis has been attached to the PP's response to this question.

DNV is hence of the opinion that the investment analysis is in line with EB41 annex 45.

We sincerely hope that the Board find our elaboration on the above satisfactory.

Yours faithfully

for DET NORSKE VERITAS CERTIFICATION AS



Michael Lehmann
Technical Director



Zhang Xiaojun Johnsen
Project Manager

⁸ Zhongruiyuehua Accounting Firm Co. Ltd., Sichuan sub-firm, an accredited independent third party

⁹ Construction contract for first phase and second phase dated 22 September 2005 between Sichuan Guang'an AAA Public Co., Ltd. & Sichuan Hydrological Engineering Co. Ltd.

Metal infrastructure and equipment install contract dated 8 December 2005 between Sichuan Guang'an AAA Public Co., Ltd. & Guandong Tianyuan Engineering Compamny.

Turbines and generators contract dated June 2005 between Sichuan Guang'an AAA Public Co., Ltd. & Sichuan Dongfeng Motor Co. Ltd.

¹⁰ Economic Evaluation Code for Small Hydropower Projects (SL16-95, term 1.7.3)