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Response to Request for Review

'Yunnan Youfanggou Hydropower Project (Ref. 3082)'

Korean Foundation for Quality (KFQ) had performed the validation of the 'Yunnan Youfanggou Hydropower Project' No. 3082 located in the P.R. China. The request for registration was made on 13/05/2010.

The UNFCCC Executive Board (EB) has issued a request for review for the above project. The request for review was received on 15/05/2010.

We thank the CDM Executive Board and the Secretariat for giving us the opportunity to clarify about our considerations in validating the said project.

Please find below KFQ's response to the issues raised by the request for review.

Request for review:

The DOE is requested to substantiate how it has validated the suitability of: a) the co-efficient of effective electricity (0.9); and b) the conservativeness of a residual value of zero; considered in the investment analysis. The application of a co-efficient of 1, yields an IRR above the benchmark.

Response by DOE: a) the co-efficient of effective electricity (0.9)

1. Background to the concept of "Coefficient of Effective Electricity (CEE)"

Experience shows hydropower stations do not reach their full electricity generation potential due to periodic accidents, overhaul requirements of equipment, emergency stops, electricity transmission limitation of local grids and the electricity demand in the area covered by the local grid. All of these considerably affect the amount of electricity a hydropower station can actually generate and supply to the grid.

For the Youfanggou Project the electricity transmission limitation of interconnected local grids and the electricity demand in the area covered by the local grid are the key constraints and these are clarified in paragraph 2.2 below.

In China, in order to make the economic evaluation of hydro projects realistic, a Coefficient of Effective Electricity (CEE) is applied for the calculation of actual electricity to be generated and supplied to the grid. The CEE is set out in the national standard *Economic Evaluation Code for Small Hydropower Projects* (SL16-95, issued by the Ministry of Water Resources of the People's Republic of China in 1994), which is commonly adopted to determine the CEE for both small and large-scale hydropower projects. The CEE is defined as the ratio of actual electricity generated and the theoretical electricity generation potential of a hydropower station.

The reason for the existence of CEE is the mismatch in supply and demand for power production in areas where power from hydropower plants can suddenly peak. When reservoirs are full, and demand, composed of demand on the local grid plus demand in the main grid to which the local grid is connected taking into account transmission constraints, is less than the potential supply, part of the water available will be released without being used for power generation. Typically this will happen in the wet season during periods of limited demand for power. The CEE allows the amount of power supplied to the grid to be calculated as:

Theoretical amount of power that could be generated.	Calculated on the basis of detailed data of water availability during the year, head, and installed capacity – resulting in a theoretical output that could be achieved if there are no transmission constraints restricting the effective demand for power
⇩ **Coefficient of Effective Electricity**	
Actual amount of power generated – sometimes also called the "average annual power generation"	This is the amount of power that is generated, taking into account the loss of water in period of high water availability and low demand.
⇩ **Transmission line loss (note: for Youfanggou project the financial analysis was treated conservatively and transmission loss was not taken into account)**	
Actual amount of power supplied – sometimes also called the "annual power output"	This is the amount of power that is supplied to the grid, after deducting transformation losses. It is this amount that is delivered to the grid and on which the revenues are based.

2. Determination of 90% of CEE for the Youfanggou project

KFQ was able to confirm on the basis of its sectoral and local expertise that the following formula, including the use of the CEE is adopted as standard practice in the Chinese hydropower industry:

Annual net power supplied to the grid = annual power generation × CEE × (1- internal consumption rate) × (1- transmission line loss rate)

During validation KFQ was further able to confirm the suitability of adopting the specific value of CEE (90%) as follows:

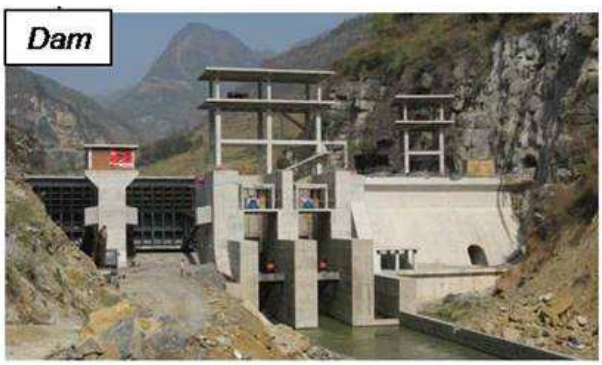
2.1 The design institute who developed the FSR of the proposed project the "Yunnan Investigation, Design & Research Institute of Water Resource & Hydropower" holds an "A" level engineering certificate. This puts it amongst the highest tier of qualified design institutes and its activities are strictly supervised. Given the extensive experience of the design institute as well as the government's approval of the FSR it can be confirmed that the adoption of 90% as the CEE is officially regarded as suitable and in line with industry standard practice. KFQ was able to trace the source of the CEE as the *Economic Evaluation Code for Small Hydropower Projects (SL16-95)* and confirms it is the only guidance for selecting the value of CEE. Table 1 shows the categories of different project types and the relevant CEE:

Table 1. The coefficient of effective electricity for different types of hydropower (SL16-95)

Type of hydropower stations	The coefficient of effective electricity
1.Grid connected, annual/ multi-year regulating hydropower stations	0.95-1.00
2.Grid connected, seasonal regulating hydropower stations	0.90-0.95
3. Grid connected, monthly/weekly/daily regulating hydropower stations	
The grid will take all electricity generated in rainy season and night	**0.80-0.90**
The grid will only take part of the electricity generated in rainy season and night	**0.70-0.80**
4. Not connected to the grid, Daily/No regulating capacity	0.60-0.70

The regulating capacity reflects the water storage capacity of the hydropower station. It means how long the reservoir of the hydropower station can contain the incoming water without generating power and discharging. A power station with a longer regulating capacity has greater operational flexibility by being able to store more water during times of low power demand and using that water to generate power during times of higher power demand. For example during low demand for electricity in the wet season, a project with limited storage capacity e.g. a daily regulating project, would be forced to release water from its dam without generating power from it. During the dry season such a project might be unable to generate power as it does not have a large reserve of water. Conversely a multi-year regulating project has a very large water store and therefore can generate power on demand regardless of rainfall.

As shown in the photograph of the Youfanggou project under construction, the dam of the project is relatively low (27.5 m) and the reservoir shallow giving limited reservoir capacity of 7.82 million m^3. Therefore the Youfanggou project only has daily water regulating capacity[1] and thus falls under category *3. Grid connected, monthly/weekly/daily regulating hydropower stations* in Table 1 above. It is the smallest scale project in this category (i.e. daily rather than weekly or monthly) and so the CEE should be at the bottom of the range of 0.7 to 0.9. Conservatively however the highest possible factor of 0.9 has been selected.



2.2 KFQ noticed that among factors determining CEE, electricity intake limitation of local grids and the

[1] Confirmed in FSR and official FSR approval.

electricity demand in the area covered by the local grid is the most significant[2]. From the case study KFQ's sectoral expert has confirmed that in reality hydropower station connected to Yunnan Power Grid can't reach the theoretical designed electricity generation in feasibility study, (i.e. the project cannot perform at a CEE of 1) for the following reasons:

- As described above, the proposed project's annual power generation is calculated based on statistical analysis of 47 years of hydrological data (1954-2001). From this the gross theoretical electricity output can be determined with the hypothesis that all the facilities and equipments are under good operation condition and 100% reliability level is achieved throughout the year. In addition the hypothesis assumes that the grid can absorb all the electricity input from the project. However KFQ's sectoral experience confirms that in reality no hydropower station can reach the theoretical designed electricity generation as presented in the FSR.[3]

- Hydropower makes up 65% of the Yunnan Power Grid[4]. During the wet season (June - October) the hydropower projects covered by the Yunnan Power Grid synchronously reach peak output while electricity demand from the Yunnan Power Grid doesn't increase accordingly. In first half of 2009 new installed hydropower capacity increased by 1,242MW an increase of 94% compared to previous years. This increment of capacity is far beyond the electricity demand load and this imbalance is particularly severe during the rainy season[5]. The high potential electricity supply in wet season and the off-peak electricity demand creates a situation of heavy stress to the grid. Yunnan Power Grid does not have the storage capacity to absorb this excess supply of electricity, so the hydropower stations have to stop operation and release surplus water without generating electricity[6,7]. During such periods, the theoretical electricity generation potential of a hydropower station can not be achieved. In addition, by referring to the Youfanggou Project's water flow table (Attachment 1, 2) it can be seen that the majority of electricity potential (73.10%) will be during the wet season (June - October). KFQ was able to confirm that the majority of electricity produced by the project will occur during a time when the risk for excess supply of electricity in the grid is therefore at its greatest. Inevitably this will result in a significant proportion of foregone electricity potential. This makes 100% grid electricity delivery impossible and the adoption of a CEE to estimate the actual expected electricity generation reasonable.

- As the Youfanggou project has not yet started full operation during the wet season the actual data for the project could not yet be cross-checked. Instead, to cross-check with the actual situation in Yunnan, KFQ sectoral expert assessed the actual planned and contracted electricity delivery with the estimated electricity delivered in the feasibility study[8] of two recently built hydropower projects connecting to the Yunnan Power Grid. For the nearby project the actual CEE of the yearly regulating Sinanjiang project in 2009 is 88.20% and actual CEE of the daily regulating Saizhu project in 2009 is 89.02%. As the result is below the value from table 1 this indicates the suitability and conservativeness of adopting the 90% CEE in the project feasibility study. By cross-checking KFQ could conclude that adopting the 90% CEE for CDM project design is reasonable and conservative.

3. Under the hypothetic scenario of 100% of CEE

3.1 KFQ recognizes that if the CEE is set to 1 this will result in the project IRR of 8.07% (Attachment 3) which is slightly above the benchmark of 8%; if the CEE is lowered even a little bit, such as 99%, the IRR will be 7.98% (Attachment 4) and below the benchmark. 100% CEE would mean all facilities and equipments will be in perfect condition and there is no repair and maintenance or emergency stop throughout the whole year, and all the electricity generated can be fed into the grid during the wet season. However, such a hypothetic scenario is not realistic. These arguments aside the conservativeness of the

[2] The Clarification on Effective Electricity Coefficient, conclusion 3 and 4, official web page of China DNA, http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File2134.pdf
[3] http://ardent.mit.edu/real_options/Real_opts_papers/Master_Thesis-Tao.pdf
[4] "Hydropower: the absolute dominance" Yunnan Power Newspaper, 27, July 2009 http://dlb.ydxw.com/html/html/2009-07/27/content_1026.htm
[5] http://www.yn.xinhuanet.com/newscenter/2009-08/10/content_17353664.htm
[6] Power purchase intent letter signed by Project Entity and Yunnan Power Grid Corporation on 20 Jan 2006.
[7] http://www.dpspioneer.com/southdps/2_1_2.html
[8] The FSR approval and electricity delivery plan contract of Yunnan Sinanjiang hydropower station and Saizhu hydropower station. The ac tual CEE is the ration between of actual annual contracted and planned electricity delivery and designed annual electricity generation.

estimated net electricity delivered to the grid was already established during validation as the FSR of the proposed project did not take into account transmission line loss between the proposed project and the Daguan substation[9] which needs to be connected by a 13km long line. It should be noted that the net amount of electricity (after deducting line loss) delivered to the grid is the only income of the project. Therefore, KFQ was able to confirm that taking calculated 0.887% (Attachment 5) line loss rate which is far below the average transmission loss rate 6.11%[10] of Yunnan Power Grid into consideration, the project's IRR with 100% CEE under purely ideal scenario is 7.99% and therefore still below the benchmark in such a scenario (Attachment 6).

3.2. Finally, KFQ was able to confirm during validation with reference to the Adjusted Financial Report (AFR, developed by the Yunnan Investigation, Design & Research Institute of Water Resources & Hydropower in April 2006) that the total static investment will reach 399.87 million RMB (131% of the total static investment 304.58 million RMB in FSR). Although the AFR was available before the time of concrete investment activity it was not adopted in the financial analysis for reasons of conservativeness. The validity of the AFR was cross-checked by KFQ through reference to actual contracts showing the 342 million RMB cost was already incurred by the time of validation even though the project was only 80% finished. Based on the above figures in AFR, we can conclude that even if we set 100% of CEE, the actual IRR 5.45% of the proposed project will be far below the benchmark (Attachment 7).

Based on KFQ's thorough investigation and analysis as above, KFQ can confirm that the co-efficient of effective electricity (0.9) of the proposed project is suitable and reasonable at the time of the investment decision. Furthermore, considering applied assumption, parameters, formulas etc. on the above calculation of the annual net power supplied to the grid comprehensively, we reach the conclusion that there are not any intended distortions to demonstrate the additionality of the project activity.

Response by DOE: b) the conservativeness of a residual value of zero

The residual value for this project activity is 0 % which is from the FSR. The FSR estimated the residual value in accordance with *Guo Shui Han* [2005] (883 issued by the National Tax Bureau on 14 September 2005) that indicates residual value should be estimated less than 5% of fixed asset and Accounting Standards for Business Enterprises (No.4), and Fixed Assets with *Caikuai* [2006] (No.3, by the Ministry of Finance) which states the enterprise should determine the working life and residue value of the fixed assets reasonably according to the fixed asset characteristic and using condition.

Therefore the design company, the Yunnan Investigation, Design & Research Institute of Water Resources & Hydropower selected 0% residual value because in general, the operation lifetime of the hydropower project is shorter than the operation time of equipments[11] moreover, due to the high disposal cost needed for dismantling of the electrical and mechanical equipments, which is almost equal to the residual value[12]. Therefore at the end of the operation time of the project activity, the equipments can be regarded as valueless, so the zero residual value was employed by the design company which is deemed as reasonable and valid. In addition, the investment of equipments only account for 16.24% of the total static investment according to the AFR, the other 83.76% investment was put into the construction of dam, sluice and discharging as well as diversion construction which is unrecoverable and valueless after operation time. Furthermore, according to "Implementing Regulations for the PRC Enterprise Income Tax Law (issued by State Council as No.512 Decree of the State Council on 06 December 2007)", once the residual value is determined (zero residual value for the proposed project in FSR and further ratified by Yunnan Development and Reform Commission's approval), it cannot be altered, therefore, the zero residual value of the proposed project is fixed.

[9] The Daguan substation belongs to Yunnan Power Grid to which the project will connect to.
[10] The average line loss rate for Yunnan Power Grid in 2007 is 6.11%: http://yn.people.com.cn/GB/7748748.html
[11] As per "financial regulations of industrial enterprise" issued by Ministry of Finance, the suggested period of depreciation is 12-20 years for power generating equipment, and it is less than the operation time 25 years of the proposed project, therefore, it is reasonable to emp loy aero residual value due to the longer operation time comparing with depreciation time. http://www.jsgs.gov.cn/Page/StatuteDetail.aspx?StatuteID=6839
[12] http://wiki.mbalib.com/wiki/%E5%9B%BA%E5%AE%9A%E8%B5%84%E4%BA%A7%E6%8A%98%E6%97%A7

In addition, the validation team checked residual value with available 9 similar projects out of 16 projects in Yunnan province and it was found 6 projects among 9 similar projects had adopted residual value of 0%. Furthermore KFQ investigate the 10 most recent registered similar projects and found that 7 of them employed 0% of residual value, only 3 projects used 5%. So we can conclude the 0% of residual value is commonly used in hydropower projects in China. Based on our sectoral scope knowledge, experience and public reference, high decommissioning cost after operation lifetime for the hydropower project, we justified that the market value of the fixed assets which the operation lifetime of the equipments has expired can be regarded as zero value.

In a conservative manner, the validation team tested applying 5%, the IRR of the project activity only increases to 7.18% (the final validation report), which is still well below the benchmark 8%.

Through the above assessment, KFQ can confirm that the selection of the residual vale of zero at the time of the investment decision is reasonable and applicable.

Note: the Project Participants (PPs) have agreed in adopting the response as formulated above by the DOE.

Yours sincerely

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