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UNFCCC Secretariat
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Germany

Response to request for review of project activity "Yunnan Lincang City Nanlinghe 1st level Small-scale Hydropower Project" (Ref. no. 2812)

1. The DOE should further validate the 0.9 effective electricity coefficient and the 5% transmission loss and internal consumption used in the investment analysis, in line with VVM parag. 109 and 112.

(1) For the 0.9 effective electricity coefficient

First, according to the explanation of the FSR design institute, the theoretical electricity generated are calculated by water flow rate multiply the natural water head, turbine efficiency, generator efficiency, in which, the water flow rate is the average water flow rate of three represent abundant, normal and dry years based on years of statistical hydrological information. Usually, the theoretical electricity generated is higher than the actual electricity generated because of the following reasons:

- The amount and stability of water runoff;
- The power plant's own performance, i.e., whether they have multi years/annual/seanonal/ weekly/daily regulation capacity or not. Normally, the grid is more inclined to receive the electricity supplied by the regulating hydropower station than non-regulated run-of-hydropower station;
- The situation of the grid, which include the capacity of the grid, the maintenance and management of the grid;
- The management level of power station which include the maintenance of the mechanical and electrical equipment, the safety of hydraulic structures, the skill level of the operator; the unit repair time and the rate of accidents, etc.;
- The impact of the natural environment, which include protection situation of the vegetation within the catchment area, the construction of the reservoir on the upstream and the human activity and so on.

As many factors cannot be controlled such as the amount of the water runoff, the capacity of the grid, to estimate the actual electricity generated a coefficient of effective electricity generation is specified in the "Economic Evaluation Code for Small Hydropower Projects (SL16-95)" dated on 1 July 1995[1], which is currently still valid. Based on this the coefficient of effective electricity generation values for hydropower plants are listed in the

[1] Please refer to reference 8.

table below:

Project type	Coefficient of effective electricity generation
1. Grid connected, annual/multi year regulating hydropower plants	0.95-1.00
2. Grid connected, seasonal regulating hydropower plants	0.90-0.95
3. Grid connected, monthly/weekly/daily/no regulating hydropower plants:	
The grid will accept all electricity generated in rainy season and night	0.80-0.90
The grid will only accept part of the electricity generated in rainy season and night	0.70-0.80
4. Stand alone hydropower plants, daily/no regulating capacity	0.60-0.70

According to FSR, the project is a grid connected hydropower plant with no regulation. The coefficient of effective electricity generation for the project is falling into category 3 of the table below. The applied value for the project is ranged from 0.7 to 0.9. The coefficient of effective electricity generation of 0.9 is used for the project in the FSR and PDD, which is conservative since it adopts the upper limit of the corresponding range in the SL 16-95.

Secondly, according to the information of some hydropower stations the actual coefficient of effective electricity generation for hydropower plants in Yunan Province ranges from 70%-90%, the statistic is based on actual net electricity generation data of hydropower plants in Yunnan Province[2].

Thirdly, even if the coefficient of effective electricity generation of the Project is equal to 1 which is the most conservative scenario the resulting IRR is 9.70%, still below the benchmark.

Fourthly, according to the actual net electricity generation for the Project from Jan.2009 to Oct. 2009 is only 19496 MWh. The net electricity generation for these 10 months only accounts for 54.05% (it equals to 19496 MWh/36072 MWh[3]) of designed annual power generation data.

Based on the above analysis, the 0.9 coefficient of effective electricity generation is correct and conservative.

(2) For the 5% transmission loss and internal consumption

First, according to the Chinese Hydro Energy Design Code for Small Hydropower Projects

[2] Response to the requests for clarification raised for project activity "Yunnan Dehong Nongling Hydropower Project" (1930).

[3] The data comes from the project owner, please refer to reference 1.

(SL76-94)[4] which issued by Ministry of Water Resource of People's Republic of China, the comprehensive transmission loss along should not more than 11% and the internal consumption alone is considered to be in the range 0.5-1%. For the Project, the installed capacity of the Project is 8MW and lower than 25MW, the Code can be applied. Furthermore, the totally 5% transmission loss and internal consumption satisfy the requirement of the Code.

Secondly, according to the FSR design institute[5], the main transmission loss can be calculated with the formula:

$$\triangle P=P^2RL/1000U^2\cos\varphi^2$$

where：△P：the main transmission loss（kW）;

R:the resistance of the transmission line， for the Project, R is equal to0.27/km;

L：the length of the transmission line, which is 12km for the Project;

U：transmission voltage, which is 35KV for the Project;

P：transformer capacity which is 10000kVA for the Project;

cosφ：power factor, which is 0.8

The result is 413kw, transforming to electricity is 0.413MW×4509h=1862.2MWh.

And the transmission loss rate is calculated with the following formula:

Transmission loss rate = the electricity loss / (the actual electricity generated by the Project*(1-internal consumption rate)) . For the Project, the electricity loss is 1862.2MWh, and the actual electricity generated is 32465MWh (installed capacity*operation hour*coefficient of effective power) and the internal consumption rate is 0.68%, so the transmission rate=1862.2MWh/(8MW*4509h*0.9*(1-0.68%)), which is equal to 6%.

The internal electricity consumption includes the electricity consumption for production and living which is about 220MWh per year. As the internal electricity consumption rate is equal to the internal consumption divided by the actual electricity generated, i.e.,internal consumption rate= 220MWh/(8MW*4509h*0.9), which is equal to 0.68%.

So the FSR adopt 5% is more conservative.

Thirdly, the actual net electricity generation after starting operation is 19496 MWh and the electricity supplied is 18024MWh for the Project from Jan.2009 to Oct. 2009. The actual transmission loss and internal consumption rate is 7.55%[6].

Based on the above analysis, the 5% transmission loss and internal consumption rate is correct and conservative.

2. The DOE should validate the operational hours of the project activity, in line with EB 48 Annex 11.

Firstly, according to the EB48 Annex 11:

The plant load factor shall be defined ex-ante in the CDM-PDD according to one of the

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[4] Please refer to reference 7.

[5] Please refer to reference 2.

[6] Please refer to reference 1.

following three options:

(a) The plant load factor provided to banks and/or equity financiers while applying the project activity for project financing, or to the government while applying the project activity for implementation approval;

(b) The plant load factor determined by a third party contracted by the project participants (e.g. an engineering company);

For the Project, the load factor comes from the FSR. The FSR is developed by lincang Region Water Resource and Hydropower Survey Design Institute, which is a third party contracted by the Project owner. At the same time the FSR has been approved by Lincang City Development and Reform Committee on 03/11/2006[7]. This is comply with the requirement of the EB48 Annex 11.

In china, operation hours = theoretical electricity generation (TEG) / installed capacity, in which TEG is calculated from water resource data, the installed capacity is calculated base on the economic analysis to the different candidates.

According to the explanation letter of FSR design institute[8], the load factor calculation adopts dry, average, rainy typical year's method as below:

(1) Achieving decades water resource (flow) data (1972-2002) from the referenced water resource station (Mengdong Water Resource Station which is same as the Project on the location, climate and geological factor), then, the three typical years (dry year, average year, rainy year) are selected.

(2) Listing daily flow (Q) data for these three years. The detailed calculation process please refers to the chapter 1-3 of the Hydrologic Calculation Report of Nanlinghe Power Station. The station flow-frequency curve please refers to the figure 3.4.6 of the Hydrologic Calculation Report of Nanlinghe Power Station.

(3) Identifying water head (H) according to local measuring. The water head of the Project is the height of the pressure pool minus the electricity generation units and the tail water. At the same time water head loss caused by the pipe diameter and trash rack. The calculation processes please refer to the FSR4.2.2.

(4) Calculating daily capacity for the three years by using equation $N=9.81*Q*H*\eta_t*\eta_g$. The capacity-frequency curve will be get based on the flow-frequency curve determined on the step 2.

(5) Since the operation hour of a hydropower station should be 4000-5000, i.e. the load factor should be 45.66%-57.08%. From the capacity-frequency curve identified in (4), it can be read the capacity of the Project should be 10MW to 6.4MW. According to type of turbine and generator, three options, 10MW, 8MW, and 6.4MW are selected to analysis and compare. Considering power generation, investment, construction, the 8MW (N_{final}) option results best water resource utilization. Please refer to chapter 4.3 of FSR.

(6) Using the identified capacity, calculating daily energy generation for these three years, and then calculating average annually energy generation (E), which is approximately

[7] Please refer to reference 6.

[8] Please refer to reference 2.

36070MWh.

(7) The operation hour can be achieved by dividing E by N_{final}, which is 4509h.

According to the above analysis, the load factor selection of the Project is appropriate.

3. The DOE is requested to further explain how the proposed tariff for the project activity has been determined, as with the application of the highest tariff issued for similar projects in the province, the IRR crosses the benchmark.

(1) The determination of the tariff

First, the 0.18yuan/kWh tariff adopted in the PDD comes from the FSR[9], and the FSR is developed by Lincang Region Water Resource and Hydropower Survey Design Institute, which is a professional design institute. At the same time the FSR has been approved by Lincang City Development and Reform Committee on 03/11/2006. This comply with VVM111(b).

Secondly, according to the Power Purchase Agreement[10], the actual tariff that project owner can get is only 0.18yuan/kWh for dry season and 0.16yuan/kWh for rainy season.

So, according to the above analysis 0.18yuan/kWh is conservative.

(2) as with the application of the highest tariff issued for similar projects in the province, the IRR crosses the benchmark

The tariff of hydropower station in Yunnan Province is mandated by two official documentations both of which issued by Development and Reform Commission of Yunnan Province as below:

- *Notification about Issues Regarding Trail Implementation of Rainy and Dry Tariff for New Operation Hydropower Unit (Yunfagaijiage [2006] No. 28, 06/01/2006)*[11]. In this notification, the average tariff of hydropower unit which connected to and managed by Yunnan Province Grid Branch, Southern China Power Grid directly (centralized regulating station) is mandated as 0.215 RMB/kWh with VAT[12].
- *Notification about Issues Regarding Trail Implementation of Rainy and Dry Tariff for Un-centralized Regulating Power within Yunnan Grid (Yunfagaijiage [2005] No. 792, 30/08/2005)*[13]. In this notification, the Un-centralized regulating power is defined as power generated by regional power station which does not contract with Yunnan Province Grid Branch, Southern China Power Grid and is not regulated by Yunnan Province Grid

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[9] In 2005, *Notification about Issues Regarding Trail Implementation of Rainy and Dry Tariff for Un-centralized Regulating Power within Yunnan Grid (Yunfagaijiage [2005] No. 792) has been issued on 30/08/2005. According to the Notification, the FSR design institute estimate the tariff of the Project is 0.18yuan/kWh.*

[10] Please refer to reference 9.

[11] Please refer to reference 4.

[12] Rainy tariff is 0.19 RMB/kWh, dry tariff is 0.24 RMB/kWh. Power generated in rainy season is much more than dry season, so actual tariff will be lower than average value 0.215 RMB/kWh.

[13] Please refer to reference 3.

directly[14]. The average tariff of un-centralized regulating hydropower station is 0.18 RMB/kWh with VAT[15].

The Project is located within Lincang City, Yunnan Province. Refer to the Power Purchase Agreement of the Project, the Project is connected to and regulated by Lincang Region Grid Company, so the Project is a typical un-centralized regulating hydropower station. According to the Letter of Tariff Statistic and Explanation offered by Lincang Region Grid Company, all issued tariffs for hydropower stations higher than 2MW within Lincang Region Grid are listed as below[16]:

Name of hydropower station	**Issued tariff (RMB/kWh)**
Zhenkang Fengweihe Hydropower Station	0.18
Zhenkang Dahebian Hydropower Station	0.18
Zhenkang Maanshan Hydropower Station	0.18
Zhenkang Nanzhahe Hydropower Station	0.18
Zhenkang Zhaoshouyan Hydropower Station	0.18
Cangyuan Xinyahe Zero Level Hydropower Station	0.16
Cangyuan Xinyahe 1st Level Hydropower Station	0.16
Cangyuan Manghui Hydropower Station	0.16
Cangyuan Yongan Hydropower Station	0.16
Yongde Manghai Hydropower Station	0.16

From above, the highest tariff is 0.18 RMB/kWh, therefore it is obvious the documentation of Yunfagaijiage [2005] No. 792 has been completed implemented within Lincang Region Grid. The Project has already adopted the highest tariff for IRR calculation in CDM-PDD, so the IRR will not be affected.

The extent of this tariff comparison can be expended to all registered and registration requested small scale hydropower projects (lower than 50MW) within Yunnan Province, the statistic is listed as below:

Registered	**Ref**	**Title**	**Capacity (MW)**	Tariff in PDD (RMB/kWh)[17]
Category 1:				
20-Dec-08	2055	Shangri-La Langdu River 3rd Level Hydropower Station	18	0.14

[14] These un-centralized regulating stations are finally connected to Southern China Power Grid via regional grid.

[15] Rainy tariff is 0.13 RMB/kWh, dry tariff is 0.23 RMB/kWh. Power generated in rainy season is much more than dry season, so actual tariff will be lower than average value 0.18 RMB/kWh.

[16] Please refer to reference 5. There are total more than 100 hydropower stations mandated by the Lincang City Local Grid, so the hydropower stations which the installed capacity is lower than 2MW have not been listed. But according to the Lincang City Local Grid, the highest tariff is 0.18yuan/kWh for all the hydropower stations.

[17] Tariffs in this table are adopted from FSR of each project, they are not actual issued tariff.

20-Dec-08	2059	Shangri-La Langtayong Hydropower Station	18	0.14
30-Dec-08	2050	Shangri-La Langdu River 1st Level Hydropower Station	21.6	0.14
19-Dec-08	2054	Shangri-La Langdu River 2nd Level Hydropower Station	22.5	0.14
10-Jan-09	2057	Shangri-La Langdu River 4th Level Hydropower Station	24	0.14
24-Nov-08	1862	Yunnan Lushui County Laowohe 25MW Hydropower Project	25	0.14
26-May-09	2080	Binglang River Tucang Hydropower station in Yunnan province, China	35	0.146
7-Aug-08	1743	Yunnan Yuanjiang Lutong Hydropower Station	10	0.15
31-Jan-09	2016	Yunnan Yingjiang Xiangbai River Zhina Hydropower Station	21	0.152
30-Oct-08	1777	Yunnan Lushui Jinman River Hydropower Station	12.6	0.153
Rejected	2006	Yunnan Nujiang Fugong Guquan River Hydropower Station	22	0.153
28-Jul-08	1775	Yunnan Weixi Gedeng Hydropower Project	12.6	0.155
31-Jul-08	1769	Yunnan Weixi Jicha Hydropower Project	12.6	0.155
16-Jul-09	2116	Yunnan Yingjiang Mangya River 1st Hydropower Station	12.6	0.155
Corrections (following request for review)	2608	Yunnan Shangri-La Shiwang River Hydropower Station	12.6	0.155
16-Oct-09	2690	Shangri-La Xinglonghe Cascade Hydropower Project	24	0.155
14-Aug-09	2106	Yunnan Lianghe Hulukou Hydropower Station	20	0.158
12-Sep-08	1605	Shaba 24MW Hydropower Project in Yunnan Province, China	24	0.16
12-Oct-09	2238	Yunnan Yingjiang Mangya River 2nd Hydropower Station	12.6	0.161
Requesting Registration	2803	Yunnan Yingjiang Binglang River Mengnai Hydropower Station Project	24	0.1637
24-Mar-09	1997	Yunnan Yingjiang County Binglang River Mangkang Hydropower Station	10.5	0.165
Requesting Registration	2940	Yunnan Yun County Pan River 3rd Level Hydropower Station	8	0.17
17-Jun-08	1523	Daguan Hongshayan 9.6 MW Small Hydropower Project in Yunnan Province, P.R.China.	9.6	0.17

25-Jun-08	1507	Yunnan Dehong Longchuan Bienaihe 1st and 2nd Level Hydropower Stations	10.5	0.17
26-Mar-09	2000	Yunnan Yingjiang Yinhe Hydropower Station	12.6	0.17
16-Feb-09	2063	Yunnan Longchuan Nanwanhe 2nd Level Hydropower Station	20	0.17
Requesting Registration	2879	Yunnan Province Luxi City Wanma River 2nd Level Hydropower Station	18.9	0.171
25-Mar-09	2003	Yunnan Guangnan Duimen River Hydropower Station	20	0.172
24-Mar-09	1988	Yunnan Yingjiang Zuanshui River Hydropower Station Project	14	0.174
Requesting Registration	2815	Yunnan Yingjiang Binglangjiang Shizishan Hydropower Station Project	24	0.1749
2-May-08	1451	Yunnan Lazhai Hydropower Project	120	0.175
Requesting Registration	2893	Yunnan Yingjiang Mengyong River 1st Level Hydropower Station	5	0.176
30-May-09	2114	Lijiang Wulanghe Secondary Hydropower Project	32	0.176
30-Jun-08	1511	Yunnan Zemahe 15MW Small Hydropower Project, P. R. China	15	0.177
Requesting Registration	2828	Yunnan Kunming Dongchuan Xiaoqing River 7th Level Hydropower Station	24	0.178
23-Feb-09	2010	Dachunhe 50 MW Hydropower Project in Yunnan Province	50	0.178
5-Jan-09	1982	Hangudi 5 MW Hydropower Project in Yunnan province	5	0.18
12-Jun-08	1485	Lishiluo Erji 6.4MW Small Hydropower Project in Yunnan Province	6.4	0.18
31-Mar-08	1489	Maocaoping 8 MW Small Hydropower Project in Yunnan Province	8	0.18
Review Requested	2812	Yunnan Lincang City Nanlinghe 1st level Small-scale Hydropower Project	8	0.18
13-Jan-09	1779	Yunnan Jinping Dapo Hydropower Station	8.2	0.18
21-Mar-08	1533	Daguan Linguanyan Small Hydropower Project in Yunnan Province, P.R.China	9.6	0.18
12-Jun-08	1496	Pihe 9.6MW Small Hydropower Project in Yunnan Province	9.6	0.18
8-Nov-08	1994	Yunnan Lincang Zhenai Hydropower Project	9.6	0.18
3-Apr-08	1430	Pushihe Erji 10 MW Small Hydropower Project in Yunnan Province	10	0.18
25-Jun-08	1504	Mujiajia Erji 10MW Small Hydropower Project in Yunnan Province	10	0.18
24-Mar-09	1978	Laowuhe Erji 10 MW Hydropower Project in	10	0.18

		Yunnan Province		
29-May-09	2429	Yunnan Xinya River 3rd Level Hydropower Project	10	0.18
29-Apr-08	1510	Yunnan Mopo River 12.5 MW Hydropower Project	12.5	0.18
3-Apr-08	1439	Aluhe 12.6 MW Small Hydropower Project in Yunnan Province	12.6	0.18
31-Mar-09	2045	Mujiajia Yiji 18.9MW Hydropower Project in Yunnan Province	18.9	0.18
Rejected	2164	Zilenghe 24MW Hydropower Project in Yunnan Province	24	0.18
Requesting Registration	2874	Sidehe 24.8MW Hydropower Project in Yunnan Province	24.8	0.18
18-Sep-09	2052	Yunnan Yingjiang Wakuhe Hydropower Station	61	0.18
Category 2:				
9-Feb-09	2151	Yunnan Leidatan 108MW Hydropower Project	108	0.1846
23-Nov-09	2903	Yunnan Province Yingjiang County Zhanda River Hydropower Station	7.5	0.2
25-May-09	2376	Yunnan Tengchong Longchuan River Stage I Hydropower Plant, China	24	0.205
Requesting Registration	2852	Yunnan Saizhu Hydropower Project	102	0.207
22-Jan-09	2236	Yunnan Dujiacun Small Hydropower Project	12.6	0.215
14-Apr-09	2015	Yunnan Dayao County Yupao River 3rd Level Hydropower Station	20	0.215
Requesting Registration	2859	Houpayan Hydropower Project in Qiubei County Yunnan Province, China	24	0.215
15-Jul-07	1102	Yunnan Heier 25MW Hydropower Project	25	0.215
4-Mar-09	2048	Lufeng 36MW Hydropower Project in Yunnan Province	36	0.215
20-Mar-08	1388	Yunnan Dali Yang_er 49.8MW Hydropower Project	49.8	0.215
5-Feb-09	2086	Yunnan Gangquhe No.1 Hydropower Project	60	0.215
Review Requested	2837	Weiyuan River 72MW Hydropower Project in Jinggu County Simao District Yunnan Province, China	72	0.215
2-Apr-07	841	Yunnan Whitewaters Hydropower Development Project	78	0.215
Review Requested	1930	Yunnan Dehong Nongling Hydropower Project	180	0.215
Review Requested	2580	Yunnan Yunpeng Hydropower Project	210	0.215

Requesting Registration	2877	Yunnan Sinanjiang Hydropower Project	201	0.2208
7-Jul-09	2064	Yunnan Jinping Miao-Yao-Dai Autonomous County Kesikou Hydropower Station	17	0.252

From above these are two tariff levels, 0.215 RMB/kWh for centralized regulating hydropower station and 0.18 RMB/kWh for un-centralized regulating hydropower station[18]. It can be demonstrated that two official documentations are fully respected by design institutes when they develop hydropower station FSR.

The design institute of the Proposed Project also employs official documentation (Yunfagaijiage [2005] No. 792) as guidance for determining tariff for the Proposed Project in FSR, so the tariff of 0.18 RMB/kWh is adopted. The CDM-PDD of the Project used tariff from FSR, i.e. the highest tariff of un-centralized regulating hydropower station has been used, so the IRR of the Project is the most conservative.

[18] Tariffs which lower than average values are expected by considering differences of power generation in rainy season and dry season during FSR development.

Reference list:

Reference number	discription
1	Explanation from the project owner on the electricity generated and supplied to the grid
2	Explanation of Loss and Load Factor Issued by Design Institute
3	Notification about Issues Regarding Trail Implementation of Rainy and Dry Tariff for Un-centralized Regulating Power within Yunnan Grid (Yunfagaijiage [2005] No. 792, 30/08/2005)
4	Notification about Issues Regarding Trail Implementation of Rainy and Dry Tariff for New Operation Hydropower Unit (Yunfagaijiage [2006] No. 28, 06/01/2006)
5	Tariff Statistic Offered by Lincang Region Grid
6	FSR approval
7	SL76-94 Hydroenergy design code for small hydro power projects
8	Economic Evaluation Code for Small Hydropower Projects (SL16-95)
9	PPA