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DIVISIONE GENERAZIONE ED ENERGY MANAGEMENT
AREA TECNICA ANALISI MERCATI E CAPACITY STRATEGY

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Issue 1: Further clarification is required how the DOE has validated the stop of construction, reason for stop of construction and the decrease in IRR (15.7% to 7.59%).

Response from the project participant:

In June 2003, the Feasibility Study Report 25MW of the project (hereafter referred to as "FSR (25MW)") has been completed by the Liangshan Yi Autonomous Prefecture Water Resource and Power Reconnaissance Design Institute. In the FSR (25MW), the IRR is 15.7%, which is higher than the benchmark of 10%. The project is seemingly feasible (because at that time, the project owner did not realize the grid price in the FSR (25MW) is reversely calculated based on the 10-year repayment of loan, see detailed in the Table 1 below). Therefore, the project has been started the construction on February 26, 2004, but only several months later, the construction had been stopped in August 2004[1]. Because:

- ✧ When the project just started construction, in order to utilize water resource sufficiently, the installed capacity has been planed to adjust, and then several months later, the Feasibility Study Report 50MW of the project (hereafter referred to as "FSR") has been completed by the same institute. In the FSR, the IRR is 10% and the grid price in the FSR is reversely calculated based on the benchmark of 10%, but at the same time, the project owner known the expected grid price of the project is only 0.167 Yuan RMB/kWh (VAT included)[2]. Based on the FSR and the expected grid price, the IRR of the project is only 7.59%; and
- ✧ The investment had been increased due to the installed capacity adjustment and bad geographical situation. Therefore, the project owner could not get enough capital [3].

Based on above two reasons, the construction had to be stopped in August 2004.

Table 1 Detail difference between the two FSRs

Parameters	Value from the FSR(25MW)	Value from the FSR(50MW)	Remark
Installed Capacity (MW)	25	50	
Annual Power Supplied to the Grid (MWh)	132,964.5	201,390	
Static Total Investment (Yuan	135,509,800	234,169,000	The final actual investment of the

[1] Directorate decision of stop construction
[2] Notice from the local Price Bureau
[3] Statement on the Construction Stop of the Yongning River Hydropower Station, there are several reasons for the project owner could not get enough capital, the first: the investment of the project is increased due to the installed capacity adjustment, rising price level and bad geological conditions; the second: the project can not get any loan from banks due to the policy restrictions for small scale hydropower station from banks and low IRR of the project.

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RMB)			project is 303,703,510.93 Yuan RMB
Estimated Grid Price	0.23 Yuan RMB/kWh (VAT included)	0.188 Yuan RMB/kWh (VAT excluded, 0.2 Yuan RMB/kWh VAT included)	The grid price of 0.23 in the FSR(25MW) is reversely calculated based on the 10-year repayment of loan; The grid price of 0.188 in the FSR(50MW) is reversely calculated based on the benchmark of 10%. The two different grid prices are the main reason, which leads to different IRR.
Operational lifetime (years)	20	20	
VAT(%)	6%	6%	
Income Tax (%)	33%	33%	
Annual Operational Costs (Yuan RMB)	2,440,800	4,464,100	
IRR (%)	15.7%	10%	

From the table above, it can be concluded that, the two FSRs have essential difference, and relevant parameters are necessary to change, such as, installed capacity, power supplied to the grid, investment, in particular, the reverse calculation method of the grid price. These changes are key reasons for the decrease in IRR of the project.

And then after CDM serious consideration as listed in the PDD submitted for registration, the project recommenced in July 2005.

Issue 2: The DOE is requested to clarify how the residual value and the operational lifetime has been validated as the validation report mentions 25 years operational lifetime according to FSR.

Response from the project participant:

Based on the approved FSR, the operational lifetime is 20 years, also in the PDD submitted for registration and IRR calculation sheets, the operational lifetime of 20 years has been employed. Therefore, the operational lifetime of 25 years in the validation report is only a typo. We believe that the DOE can provide their explanation and same conclusion.

In addition, based on the FSR, the depreciation rate of fixed assets is 5%, therefore, the operation lifetime is 20 years and the residual value is 0(zero). Therefore the operation lifetime of 20 years in FSR is correct, reasonable and valid.

Issue 3: 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 appropriateness of

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reported values of annual electricity generation and power supply to grid.

Response from the project participant:

According to paragraph 54 of the EB 38 report:

"54. The Board clarified that in cases where project participants rely on values from Feasibility Study Reports (FSR) that are approved by national authorities for proposed project activities, DOEs are required to ensure that:

(c) On the basis of its specific local and sectoral expertise, confirmation is provided, by cross-checking or other appropriate manner, that the input values from the FSR are valid and applicable at the time of the investment decision."

The FSR was completed in July 2004 by the "Liangshan Yi Autonomous Prefecture Water Resource and Power Reconnaissance Design Institute", which is an independent organization which is qualified to compile design reports for hydropower projects (it has obtained a "grade B" in water conservancy industry and electricity industry, issued by the Construction Bureau of People's Republic of China). In addition, the FSR was completed before investment decision (July 18, 2005, the earliest starting date of the project, which is the date of construction recommenced). Therefore, the input values from the FSR are valid and applicable at the time of the investment decision, and the period of time between the finalization of the FSR and the investment decision is only one year. Furthermore, the FSR has been approved by the local DRC in December 2004. As the FSR has been completed by an independent and certified institute and approved by the Yunnan Province Development and Reform Committee (Yunnan Province DRC), and the period of time between the FSR, the FSR approval and the investment decision is sufficiently short. Therefore, the FSR can be considered as an independent and realistic assessment of the proposed project activity, including the parameters listed and used as input values in the IRR calculation of the PDD submitted for registration.

The project is in operation, therefore in order to confirm the appropriateness of input values applied in the investment analysis, the input values are compared with the actual values as follows,

Static Total Investment:

The actual investment is 303,703,510.93 Yuan RMB [4], which is far higher than the designed value of 234.169.000 Yuan RMB in the PDD submitted for registration. Therefore, the lower investment from FSR used in IRR calculation is more conservative.

Net power supplied to the grid:

The actual net power supplied to the grid is 176,789.6MWh in 2008, which is far lower than the designed value of 201,390MWh. Therefore, the designed value ifrom the FSR used in IRR calculation is more conservative.

[4]The Investment Assessment Report by a third party

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We can also confirm the estimated value of power generation is calculated on a strong statistical basis, namely on 36 years of water flow measurements (1960-1995). Therefore, a significant change in power generation of the project during the crediting period is not likely to occur. Additionally, for the calculation of estimated power generation, it is assumed that the turbines/generators will operate at a 100% reliability level throughout the year, which is unlikely. Finally, during "the rainy seasons", the grid company cannot absorb all electricity generated by the project activity due to an oversupply of electricity, and during this period, the project will have to stop generating electricity, please see details below.

The loss of about 13.5% [5] between the designed annual power generation and the net power supplied to the grid is caused by the poor load of local grid (the coefficient of effective electricity [6] of the project is only 90%), the auxiliary power consumption (0.5%) and the line loss (2.926%).

The designed annual power generation and the net power supplied to the grid are both from the approved FSR. Therefore, the two values are applicable and credible.

As described in PDD requesting registration,

- ✧ The average expected/designed annual power generation is 231,670MWh, which was estimated in FSR according to the hydrological conditions in terms of water resource availability (36 years), does therefore differ from the actual power which will be generated, because full load conditions will be rarely set during the plant operation throughout the years due to the lack of absorption capability of the grid; and
- ✧ The net power supplied to the grid is estimated to be 201,390MWh.

The net power supplied to the grid of 201,390MWh is calculated based on coefficient of effective electricity (90%), the auxiliary power consumption (0.5%) and the line loss (2.926%):

Net power supplied to the grid (201,390MWh) = 231,670MWh × 90% × (1-0.5%)× (1-2.926%) [7]

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[5]The loss is equal to the difference between the "*designed annual power generation estimated in Feasibility Study Report according to the hydrological conditions in terms of water resource availability*" and the net power exported to the grid, including the difference between the "*(actual) power generation with considering the lack of absorption capability of the grid*" and the net power exported to the grid.

[6]The coefficient of effective electricity is the ratio of "*(actual) power generation with considering the lack of absorption capability of the grid*" and "*designed annual power generation estimated in Feasibility Study Report according to the hydrological conditions in terms of water resource availability*"

[7] In Section 3.2.1, 3.2.2, and 3.4 of the SL 16-95 regulation it is stated that the power supply to the grid by a project is calculated as the annual designed electricity generation × coefficient of effective electricity × (1 – auxiliary power consumption) × (1 – line loss). The annual designed electricity generation × coefficient of effective electricity is the effective electricity generation (which is based on amongst others the load factor, the electricity balance of the local grid). Section 3.4 of SL 16-95 further specifically states that for simplification purpose, the coefficient of effective electricity can be chosen from the Table 3.4 in the SL 16-95 document.

In the formula,

- ✧ 231,670MWh is the designed annual power generation, which is estimated in Feasibility Study Report according to the hydrological conditions in terms of water resource availability;
- ✧ 231,670MWh × 90% is the power generation with considering the lack of absorption capability of the grid;

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The calculation formula comes from approved FSR which in turn bases its calculation on the "the Economic Evaluation Code for Small Hydropower Projects (SL16-95) [8]" (same guidance used by the design institute preparing the FSR). Therefore, the net power supplied to the grid employed in the IRR calculation is reasonable.

- The coefficient of effective electricity of 90% comes from approved FSR and is further confirmed by the Hydroenergy Design Code for Hydro Power Projects (SL76-94) approved by the Ministry of Water Resources of the People's Republic of China: [9]
  - ✧ For small scale hydropower stations (with an installed capacity up to 50MW), the coefficient of effective electricity and effective power generation should be calculated according to the Economic Evaluation Regulation for Small Scale Hydropower Projects (SL16-92), which was substituted by "the Economic Evaluation Code for Small Hydropower Projects (SL16-95)", whose in Table 3.4 provides an overview of applicable coefficients for energy efficiency as follows:

Table 2 the coefficient of effective electricity for different types of hydropower stations:

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/no regulating (run-of-river) hydropower stations **The grid will take all electricity generated in rainy season and night** **The grid will only take part of the electricity generated in rainy season and night**	 **0.80-0.90** **0.70-0.80**
4. Not connected to the grid, Daily/No regulating capacity	0.60-0.70

  - ✧ The installed capacity of the project is 50MW and the project is a run-of-river hydropower station with daily regulating capacity. In accordance with the Table 3.4 in "the Economic Evaluation Code for Small Hydropower Projects (SL16-95)" as listed above, the coefficient of effective electricity should choose 0.70-0.90. The Design Institute has chosen to employ the higher value of 0.90 as the coefficient of electricity. This is the most *conservative* choice as a higher coefficient

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✧ 231,670MWh × 90% × (1-0.5%) × (1-2.926%) is the net power exported to the grid.
In addition, the approved Feasibility Study Report of the project also used the formula.
[8] http://www.cws.net.cn/guifan/bz/SL16-95/. In 2002, the Ministry of Water Resources of the People's Republic of China issued the "Bulletin of Valid Hydropower Technical Standard" currently. According to this hydropower document No [2002]07 the "Revision of Economic Evaluation Code for Small Hydropower Project (SL16-95)", is still effective and enforceable, reference website: http://www.ches.com.cn/jishubiaozhun/001.htm, and the Water Resources and Hydropower Planning and Design General Institute of the Ministry of Water Resources of the People's Republic of China confirm that it is still in effect in 2008, reference website: http://www.giwp.org.cn/index.do?act=mess&modu=160&mess=361
[9] Please see: http://www.chinawater.net.cn/guifan/bz_pdf/SL76-94/05.pdf

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leads to higher power supply and therefore an overestimation of the IRR compared to employing a lower values as coefficient of electricity generation.

- ✧ In addition, the coefficient of effective electricity is the result of the balance between the local grid absorption capability in the dry and rainy seasons, taking into consideration the demand for power in the two periods and the limited absorption capability of the grid. In particular it has been evidenced the coefficient of effective electricity reflects the conditions of insufficient water availability during the dry season and the condition of "over the grid capability" available power during the rainy season. The result is a production which changes significantly throughout the years and in particular between the dry and the rainy seasons, which affects the annual electricity exported to the grid. The potential power production which has been estimated in FSR according to the hydrological conditions in terms of water availability, does therefore differ from the actual power which will be generated, because full load conditions will be rarely set during the plant operation throughout the years due to the lack of absorption capability of the grid. In other words, during the rainy season, a considerable hydropower potential, which in theory could allow the plant to reach 100% of the designed production, will be partially wasted due to the evidenced limits in the grid transmission and distribution system[10]
- ✧ Furthermore, the actual annual power generation of the project from January to December of 2008 is 181,189.7MWh [11], while the annual power generation designed in FSR is 231,670MWh. Therefore, the actual coefficient of effective electricity is 78.2%, which is far lower than the expected coefficient of effective electricity of 90% in FSR.
- ✧ Finally, **even if the coefficient of effective electricity of 100% will be employed, the IRR is still far lower than the benchmark of 10%.**

Therefore, the coefficient of effective electricity of 90% in FSR is *conservative* and credible.

- ➢ The 0.5% for auxiliary power consumption is based on the "Economic Evaluation Code for Small Hydropower Projects (SL16-95)". According to this guidance, auxiliary power consumption is to be determined based on the actual situation or referred to from other similar projects. Based on "the

[10] Explanation for the coefficient of effective electricity, published by local grid company. In this document, local Grid Company (which the project connected) issued an explanation and the reasons to prove the validity of the coefficient of effective electricity of 80%-90%. The main reasons are as following:

- ✧ The structure of the local grid is frail and the transmission load capacity is limited (which caused the abandoned water in rainy seasons), so the bottleneck on transmission is rather common. Therefore, these factors resulting that the grid effective electricity could not reach the design standard.
- ✧ Due to low absorption ability and the lower load of local grid, there is large amount of the surplus of electricity during the rainy season and the grid company is not able to buy all of the power that could potentially be generated by the plants, so that this surplus electricity could not be utilized efficiently.
- ✧ Comparing with the construction of hydropower stations, the construction of power grid in Liangsha Yi Autonomous Prefecture (where the project is located) is lagging behind and it is beyond the capability of the power grid. The bottleneck on power generation will exist in long period, and the decreasing trend on coefficient of effective electricity will last for a few years.
- ✧ Therefore, the coefficient of effective electricity of 80%-90% is reasonable. The coefficient of effective electricity of 90% was employed by the project, it is conservative.

[11] The power generation of the project in 2008

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Regulation of Development Programming of Electrical Power in the Region Mainly Supplied by Rural Hydropower (SL22-92)"[12], auxiliary power consumption has been determined as 0.5% by the independent design institute preparing the FSR. This is reasonable and in accordance with the public guidance.

- The line losses of 2.926% have been determined by the independent and certified Design Institute preparing the FSR based on its professional experience. Additionally, the average line losses of Sichuan Province are 8.1%[13], which is higher than the value of 2.926% in the FSR. The Design Institute has chosen to employ the lower value of 2.926% as the line losses. This is a ***conservative*** choice as a lower line losses leads to higher power supply and therefore an overestimation of the IRR compared to employ a higher values as line losses.

  It can be concluded that the net power supplied to the grid used in the IRR calculation is *reasonable and conservative* at the time of investment decision.

Grid price:

The fixed grid price of 0.167 Yuan RMB/kWh with VAT used as input value for the financial calculation of the project activity is taken from the Grid Price Notice for the project published by the Grid Company, and Power Connection Contract (PCC), which was signed in August 2005. Based on the two documents above, the fixed grid price of 0.167 Yuan RMB/kWh with VAT during the whole operating period is applicable and appropriate at the time of investment decision.

In addition, the actual grid price of 0.167 Yuan RMB/kWh with VAT can be confirmed by electricity invoices later. It therefore can be concluded that the fixed grid price used as input value for the financial calculation is 100% accurate and applicable.

Therefore, the grid price in the PDD submitted for registration is reasonable, conservative and appropriate.

Annual operating cost

The annual operating cost are calculated according to the data from the approved FSR. Based on the FSR, the Interim Regulations of Hydropower Construction Project Financial Evaluation and hydropower No [1995]186 documents, annual operating cost mainly include payroll, overhaul cost, welfare fund, employee's insurance, material cost, insurance for fixed assets and other cost. Based on the Interim Regulations of Hydropower Construction Project Financial Evaluation and hydropower No [1995]186 documents, the overhaul cost, welfare fund, employee's insurance, material cost, insurance for fixed assets and other cost should use the fixed values, and only the salary of the employees has been increased from 9,000 Yuan RMB/Person annually in the FSR to 29,940 Yuan RMB/Person annually[14]. Therefore, the actual annual operating cost is higher than the designed value in the FSR. Moreover, the average

[12] Published by the Ministry of Water Resources of the People's Republic of China
[13] China Electric Power Yearbook 2008
[14] The payroll record of employees of the Yanyuan Yongning River Hydro-electric Development Co., Ltd.

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increasing rate of salary price index is 7.7% from 2002 to 2006 in Sichuan Province[15]. It is obvious that the salary indexes of annual operating cost increased during 2002-2006. Therefore, the IRR will be lower than that of the PDD obviously. As per conservativeness principle, the fixed input value of annual operating cost is reasonable, conservative and credible.

In addition, the unit operating cost 0.018 Yuan/kWh (annual operating cost of 4,205,900 Yuan RMB/Annual Power Generation of 231,670,000kWh, as listed in PDD) of the project has been confirmed to be a reasonable and conservative value according to the range 0.04-0.09 Yuan RMB/kWh [16].

Therefore, the annual operating cost used in the IRR calculation in the PDD submitted for registration is reasonable, conservative and credible.

Conclusion:

If use the actual investment, the actual grid price and the actual annual operating cost above, the IRR is only about 4.5%, which is far lower than the IRR in the PDD submitted for registration.

Therefore, all the input values in the investment analysis are valid and applicable in consistent with the EB 38 guidance, paragraph 54(c).

Issue 4: The DOE should clarify how it has validated the common practice analysis, in particular, the selected range of 15-50 MW, as the project activity is a 50 MW hydro power plant.

Response from the project participant:

According to the "Tool for the Demonstration and Assessment of Additionally", projects are considered "similar" in case they, amongst others, are of "similar scale". We have excluded projects with an installed capacity above 50MW as the scale of these projects differs significantly from the scale of the proposed project activity (i.e. 50MW). Beside the significant difference in scale which influences the technical and design specifications, the chosen range can be substantiated by means of official national policy document: The small scale hydropower industry benchmark "Economic evaluation code for small hydropower projects (SL16-95) provide a special 10% project IRR industry benchmark for small scale hydropower stations, and this industry benchmark is significantly higher than the benchmark for normal hydropower stations, and is only applicable to hydropower stations no more than 50MW according to the SL16-95 document above.

These Chinese policy and regulation (different standards/benchmarks) influence the feasibility of hydropower stations above and no more than 50MW in a different manner, besides the difference in scale

[15] China Statistics Year Book 2003-2007 (http://www.stats.gov.cn/tjsj/ndsj/), which is public official website of local government

[16] Published by a local consulting (Beijing Hualing Sifang Investment Consultant Company) as the reference for this parameter as evidenced with an article issued on 2006 and published on Chinese research website on industrial projects (http://www.badassets.com)

and size, which naturally exists. All Chinese policies and regulations (different standards/benchmarks) are applicable to total installed capacities of hydropower stations (individual unit capacity of turbine or generator is not considered). The total installed capacity of the project activity is 50MW and we conclude that it is reasonable to exclude hydropower stations above 50MW as they are not similar in scale in China. For the projects of installed capacity below 15MW are the small-scale projects which aren't considered in common practice analysis (in addition, there are no any hydropower stations with installed capacity from 0.5MW to 15MW in the Yearbook of China Water Resources 2006 and 2007), so the capacity range from 15MW to 50MW applied for common practice is reasonable and conservative.

However, in order to further analyze the common practice and for conservative purpose, the capacity range has been expanded to 75MW (±50% of the installed capacity of the project) from *Yearbook of China Water Resources 2006 and 2007* have been selected. Because the installed capacity between the 0.5MW to 50MW has been analyzed in the PDD submitted for registration, and the relevant evidences have been validated by DOE during the validation period, we only analyze the hydropower station in Sichuan Province between 50MW and 75MW in the response, which are listed in Table 3 below.

Table 3 Existing hydropower plants similar to the proposed activity

Name of hydropower plant	Capacity (MW)	Operation year	Location	Investor	Remark
Jiangkou Hydropower Station	51	1990s	Xuanhan County	-	-
Caoyutan Hydropower Station	75	1995	Hongya County	-	-
Yucheng Hydropower Station	60	1995	Lushan County	-	-
Tongzhong Hydropower Station	59	2001	Mao County	-	-
Yangcun Hydropower Station	66	2004	E'bian County	Sichuan Daduhe Electricity Co., Ltd	0.288Yuan/kWh[17] annual utilization hours of 5,441h[18]
Huilongqiao Hydropower Station	50	2005	Li County	Sichuan Li County Huilong Hydropower Co., Ltd.	Unit Investment 4,281Yuan RMB/kW [19] 0.288Yuan/kWh[same as 16] annual utilization hours 5,021h[20]

[17] http://www.qy12358.gov.cn/edit/UploadFile/2007418132228465.doc
[18] http://www.jrj.com.cn/NewsRead/Detail.asp?NewsID=494477
[19] The Sichuan Local Electricity Statistic Yearbook 2006
[20] http://gszx.cninfo.com.cn/finalpage/2006-04-28/17003614.PDF

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Kehe Hydropower Station	72	2005	Huidong County	Xichang Electric Bureau (State owned)	Unit investment 4,793.3Yuan RMB/kW annual utilization hours 5,214h [21] 0.288Yuan/kWh[22]

According to the tool for the demonstration and assessment of additionally, projects are considered "similar" in case they are located in the "same county/region", are of "similar scale", and "take place in a comparable environment with respect to regulatory framework, investment climate, access to technology, access to financing, etc". 4 projects, namely, Caoyutan, Yucheng, Jiangkou and Tongzhong Hydropower Station have been started operations before 2002, they were developed by the state under a power system environment that is substantially different from the current power system environment, because, the Power System Reform Blue Print has been published by State Council in February 2002, and the reform content mainly includes: power plants separating from the power grid, reforming enterprises for power plants and power grids; bidding to power grid, building a competitive and open power market initially; changing the current situation of all power purchased by the state owned grid enterprises. [23] Therefore, they are quite different with the project.

As mentioned above, the remaining 3 projects can be compared with the project, of which:

- Yangcun hydropower station has a higher grid price of 0.288Yuan RMB/kWh (VAT included) than the proposed project of 0.167Yuan RMB/kWh (VAT included), has higher annual utilization hours of 5,441h than the proposed project of 4,633 hours per year.
- Kehe hydropower station has a unit investment of 4,793.3Yuan RMB/kW, which is much lower than the proposed project's unit investment of 6,074Yuan RMB/kW, a higher annual utilization of 5,214 hours than the proposed project of 4,633 hours per year and a higher grid price of 0.288Yuan RMB/kWh (VAT included) than the proposed project of 0.167Yuan RMB/kWh (VAT included).
- Huilongqiao Hydropower Station has a lower unit investment (4,281 Yuan RMB/kW), far lower than the proposed project of 6,074Yuan RMB/kW, a higher grid price of 0.288Yuan RMB/kWh (VAT included) than the proposed project and a higher annual utilization of 5,021 hours than the proposed project of 4,633 hours per year.

Therefore, based on explanation above and the PDD submitted for registration, the project is not common practice.

[21] Feasibility Study Report for Kehe Hydropower Station
[22] The approval of grid price of Kehe Station
[23] Power System Reform Blue Print, published by State Council, February 10, 2002