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Response to Request for Review

Dear Sirs,

Please find below the response to the request for review formulated for the CDM project with the registration number 1991. In case you have any further inquiries please let us know as we kindly assist you.

Yours sincerely,

Cuiyun Zhang
Carbon Management Service

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Response to the CDM Executive Board

Issue 1:
The DOE is requested to clarify how it has validated the investment analysis, in particular, the appropriateness of a benchmark issued in 1995 when assessing the additionality of a project with investment decision made in 2005.

Response by TÜV SÜD:
The applied benchmark "Economic evaluation code for small hydropower projects (SL16-95)" is still applicable today, and so it was at the time of the investment decision. It applies to hydropower installations with a capacity below 25 MW, extended to capacities below 50MW if the installation is located in rural areas; the proposed project, which installed capacity is 30MW and is located in rural areas, applies the mentioned benchmark document SL16-95.

The SL16-95 was issued by the Ministry of Water Resources of the People's Republic of China (MWR). Both in 2007 and 2008 the validity of the code has been re-confirmed, as could be evidenced by:

1) The answer to the Request for Review of project 996 - Zhoubai Hydroelectric Project, dated 04/06/2007.

2) The statements of the Research and Design Institute of No.14 China Hydro Engineering Bureau and the National Research Institute for Rural Electrification, accredited by the Chinese Government, which clarified that SL 16-95 is still used by the institutes when assessing the financial feasibility of small hydropower projects, dated 26/11/2008 and 01/12/2008.

Moreover, the DOE have verified that in October 2006 the Ministry of Water Resources of the People's Republic of China have confirmed the validity of the SL16-95, including it into a list of the applicable evaluation standards (pls. see footnote 3 in PPs' response).
Further TÜV SÜD has observed that SL16-95, and hence the 10% benchmark, is still widely used in recent feasibility studies of hydropower projects in China.

It should be further clarified that the 8% benchmark which has been applied in case of other projects activities submitted for registration, and was chosen according to the specific condition of those projects, which did not allow the DOE to validate a 10% benchmark as the appropriate one to be used.
In particular in the case of project activity number 1875 (Sanchawan 32MW Hydro Power Project in Guizhou Province China), the 8% benchmark was chosen according to the installed capacity (32MW) and the location of the project which could hardly be considered as a rural area. These considerations lead to apply the "Interim Rules on Economic Assessment of Electrical Engineering Retrofit Project" (China Electric Power Press, 2003) indicating a benchmark of 8% as appropriate in that context.
In the case of project 2159 (Erbaqu Small Hydropower Project in Gansu Province) the benchmark was chosen according to the Preliminary Design Report which used as reference the "Interim Rules on Economic Assessment of Electrical Engineering Retrofit Project" (China Electric

Power Press, 2003) because of the project specifics in terms of costs and taking into consideration that it is a bundled hydropower station.
It is concluded that the applicability of the specific benchmark relies on the specificity of the project. As a consequence, the DOE confirms that for the proposed project activity 1991 the benchmark of 10% is still applicable and that the project meets the applicability criteria as mentioned according to the SL16-95.

Response by the Project Participants:

The project compares the IRR against the 10% benchmark (project IRR post tax) as per the "Economic Evaluation Code for Small Hydropower Projects (SL16-95)", which is applicable to hydropower stations located in rural areas with an installed capacity below 50MW. This document is part of the "Professional Standards of the People's Republic of China[1]" and was approved and published by the Ministry of Water Resources of the People's Republic of China in 1995.

Since then, the validity of this benchmark has not been repudiated in any way In fact, its applicability was confirmed by the Chinese Hydraulic Engineering Society (CHES) in 2002 in the "Bulletin of Valid Hydropower Technical Standards No 07 (2002)".[2] Additionally, the Ministry of Water Resources of the People's Republic of China confirms that this benchmark is still in effect in 2006[3]. The 10% benchmark is still ubiquitously applied by stakeholders of hydropower projects in rural areas with an installed capacity up to 50MW (e.g. design institutes, investors, governments in charge of approving projects) to evaluate the feasibility of these projects. In addition, China DNA's approval of CDM project activities with an IRR below this benchmark indicates it is still valid. Futhermore, It should be noted that other CDM hydro power projects from China located in rural areas and with installed capacities between 25 MW and 50 MW have been registered based on the same 10% benchmark.[4]

The project is located in a remote valley of a sparsely populated county at the border of the Qinghai-Tibet Plateau, within the Ganzi Tibetan Autonomous Prefecture in Sichuan Province. Kangding county, with an area of 11,422.75 km2 and a population of 96,687 people (1990) shows a very low population density of only 8.46 people per km2. Kangding's industry is not well developed and the town, from which the project site is 60 km away, mainly serves as a local administration for Ganzi Prefecture and small tourism center. Hence, the project is located in a rural area and has an installed capacity of 30MW, therefore, the benchmark of 10% derived from SL16-95 is applicable.

In addition, the fact that the "The Economic Evaluation Code for Small Hydropower Projects (SL16-95)" is still appropriate, is confirmed and reinforced by the fact that the Capacity Optimization Report of the proposed project activity, which is an officially approved document by Chinese authorities specifically mentions the benchmark on page 15.

Issue 2:

[1] http://www.cws.net.cn/guifan/bz/SL16-95/
[2] http://www.ches.com.cn/jishubiaozhun/001.htm
[3] http://www.mwr.gov.cn/tzgg/qt/20060926000000479251.aspx
[4] Following examples of CDM hydro power projects from China located in rural areas and with installed capacities between 25 MW and 50 MW have been registered (CDM ref. numbers): 1484, 1479, 1388, 1103, 791)

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The PP/DOE is requested to clarify how the reported values of annual electricity generation and power supply to grid are appropriate in the context of the underlying project activity.

Response by TÜV SÜD:

A value of 5,246 hours has been assumed in PDD according to the value as reported in Capacity Optimization Report (dated December 2005 and hereafter mentioned "COR"), providing an yearly power generation of 157,380 MWh. This amount corresponds to the power which the plant could potentially generate according to the total water availability throughout the year and the installed capacity of 30MW,

The net power which will be transmitted and sell to the local Kangding grid has been estimated taking into account an internal consumption of 0.3% and a further deduction of 20% from the remaining power. This lead to an estimated annual power supply to the grid of 125,526 MWh.

The high gap between the potential power generation and the annual electricity supplied to the grid according to a "deduction" of 20% was deeply investigated by the DOE throughout the assessment period. The figure of the "effective coefficient" equal to 80% was taken as a reference parameter from the COR (dated December 2005): this value is the result of the balance between the local absorption capability in the dry and rainy seasons, taking into consideration the demand for power in the two periods. In particular has been clarified that the value indicated throughout the Capacity Optimization Report of 80% mainly reflects the conditions of insufficient water availability during the dry season (October to April of each year) and the condition of "over the grid capability" available power during the flood season (from May to September of each year). The result is a production which changes significantly throughout the year and in particular between the dry and the flood season, therefore affecting the annual electricity which will feed the grid. The potential power production which has been estimated in the Capacity Optimization Report according to the hydrological conditions in terms of water availability, does therefore differ from the actual power which will be produced, because full load conditions will be rarely set during the plant operation throughout the year due to the lack of adsorption capability of the grid. In other words, during the flood season, a considerable hydropower potential, which in theory could allow the plant to reach 100% of the expected production, will be partially wasted due to the evidenced limits in the grid transmission and distribution system.

A reference regarding the applicability of the applied effective coefficient have been found in the document "Economic Evaluation Code for Small Hydropower Projects" (SL16-95)[5] which is still the reference standard for the hydropower projects feasibility evaluation. According to the document, the effective electricity delivered to the grid should be estimated taking into account the load that the grid is able to undertake and the type of hydropower stations in terms of power regulation ability. The Code also provide reference values for estimating the effective electricity delivered to the grid: in case of hydropower stations with no regulating ability, when the grid is not able to receive the entire power generated in rainy season and night, a range between 0.70 to 0.80 is considered as appropriate. It's furthermore confirmed that the proposed project activity does not have any regulating ability. To confirm that the grid is not able to receive all the power produced under full load conditions during the rainy season, has been requested to the Sichuan Kangding Power Grid Corporation to provide clarifications on the issue. According to the document[6] provided by the local grid company dated December 15th, 2008, it's confirmed that, based on the power balance in recent years, the average value for the effective electricity coefficient ranges between 70% to 80%.

It should be also noted that the Capacity Optimization Report (dated December 2005) has been issued in conformity with the evaluation code SL16-95. The estimation of the electricity deliv-

[5] Extract from the "Economic Evaluation Code fro Small Hydropower Projects (SL16-95)"
[6] Statement on Average Coefficient of Effective Electricity for Kangding Grid System

ered to the grid has been therefore accordingly done and the higher limit (0.8) of the suggested range was also used in the report. The applicability of this effective electricity coefficient of 0.8 was also suggested by the Investigation, Design and Planning Institute of the 10th Project Bureau of China Water Conservation and Hydropower Administration as evidenced with the document "Certification of the "Coefficient of Effective Electricity for Kangding Sandaoqiao Hydropower Station" issued on November 2005[7].
According to the documentation and the experience reached on site in assessing hydropower projects in China, the DOE further confirms that a similar discrepancy between the theoretical power deliverable to the grid and the effective power delivered is applicable to the specifications of the power plant (which does not have a regulation ability) and the grid conditions and related seasonal power adsorption ability as evidenced and confirmed by the local grid company.

Response by the Project Participants:
The project employs two turbines with a total installed capacity of 30 MW, and is expected to operate 5,246 hours per year, which corresponds to an average annual electricity generation of 157,380 MWh (design value). After deducting auxiliary power consumption and other losses due to technical constraints of the local grid, the effective power supplied to the grid is estimated to be 125,526 MWh per year.

The annual electricity generation and power supply to grid of the underlying project activity have been calculated in December 2005 by the Design and Planning Institute of the 10th Project Bureau of China Water Conservation and Hydropower Administration and Chengdu Yude Industry Co. Ltd. in the Capacity Optimization Report, which was approved by the local Development and Reform Commission and was submitted to DOE during validation.

The expected net electricity export to the grid (effective electricity generation) is calculated as described in the document "Economic Evaluation Code for Small Hydropower Projects (SL 16-95)", starting with the design electricity generation value and subtracting auxiliary power consumption as well as other losses described by the „average coefficient of effective electricity generation".

The annual design electricity generation value has been calculated based on the most accurate hydrological data available. The following is a short summary: The drainage area of Xiasuozigou river before the Sandaoqiao dam is 173.5 km^2. For climatic data, data from the nearest county seat Kangding was used, where sufficient historic climatic data has been recorded. During 1952-1991 (40 years), the average rainfall was 815.7 mm, of which 76.7% occured during May and September. Average amount of raining days was 178.7 with more than twenty raining days per month between May and December. Xiasuozigou river contains rain-, melting- and groundwater, with different proportions throughout the year. The average flow rate, calculated on the basis of measurements conducted at Kanding, is 5.44 m^3/s, which represents a total water flow of 172 mio m^3 per year. The water flow volume is preceived as relatively stable over the years with a deviation range between 0.7 and 1.36.

Based on the hydrological assessment and the available technology, the Capacity Optimization Report concludes that the optimal total capacity for the project is 30 MW, which corresponds to

[7] Certification of the Coefficient of Effective Electricity for Kangding Sandaoqiao Hydropower Station

an average annual electricity generation of 157,380 MWh (design value) based on an average operation time of 5,246 hours per year.

From the design electricity generation value of 157,380 MWh, 0.3% were deducted as auxiliary power consumption, which is based on the power plant design. The remaining electricity amount (156,907.86 MWh) is multiplied by the „average coefficient of effective electricity generation“, accounting for a series of factors, which describe the capability of the local grid to absorb the produced electricity. By the time the investment decision was made, it was advised by the Investigation, Design and Planning Institute of the 10th Project Bureau of China Water in 2005 to choose 80% as the applicable „average coefficient of effective electricity generation“, which can be seen from the document “Certification of the Coefficient of Effective Electricity”. This suggestion is in line with the “Economic Evaluation Code for Small Hydropower Projects (SL16-95)”, which provides default factors for different local grid situations. For projects where the grid is only able to take part of the electricity generated in the rainy season and during the night, a default factor within the range of 70 to 80% is applied.

The suitability of this range is confirmed by the Sichuan Kangding Power Grid Corporation (local grid power company) in the document “Statement on the Coefficient of Effective Electricity”, which states that the applicable “average coefficient of effective electricity generation” for the local grid system is 70~80% due to the limited capacity of the local grid. Concrete reasons for limited absorption capacity of the local grid are as follows:

- The structure of the Kangding grid (a sub grid of the Sichuan grid) is simple, the connection between Kangding grid and the greater grid is a simplex connection and it is common that the local grid transmission restricts the power generation from the power stations (especially during the rainy season). As a result, the effective power supplied to the grid cannot reach the design level.
- At present the grid construction is lagging behind the construction of the power station construction, Kangding grid cannot accept all the power generated from all the power stations within Kangding, as a matter of fact this situation will last for quite a long time.
- Newly constructed hydropower stations increase the power generation, however, the local industrial load is comparatively small, the surplus generated power is transmitted to the greater power grid. As the transmission line is long it leads to great distribution losses.

It should be noted that the choice of 80% is conservative for additionality assessment of the project since a value in the range of 70% would result in less electricity output and consequently a lower IRR.

Issue 3:

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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.

[EB 38 paragraph 54(c) states that:

> *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.]*

Response by TÜV SÜD:

The Capacity Optimization Report (dated December 2005) has been used in PDD as the reference document to perform the investment analysis. According to the timeline of the project as evidenced by the project participants and validated during the assessment the DOE confirms that the input values taken from the Capacity Optimization Report were valid at the time of the CDM decision. In particular this document have been considered as the only valid and reliable source as the implementation of the project fully relies on it and on its capacity adjustment up to 30MW.
The validity of the input values as in the Capacity Optimization Report has been checked by the DOE.
To further confirm and verify the appropriateness and validity of the input values as used in PDD to perform the investment analysis, the assessment team have reviewed each figure as follows:

Static Total Investment:
A figure of 162,248,000 Yuan RMB was used in PDD as estimated in the Capacity Optimization Report. This value has been considered reasonable considering the characteristics of the project, providing a unitary investment cost of about 5.61 Mio Yuan RMB/MW which is in line with the costs experienced with hydropower stations of similar size. The reasonability and conservativeness of the figure used for the Static Total Investment in PDD, receives further confirmation comparing it with the costs which have been actually undertaken by the project up to date.
Such a figure has been considered appropriate and even conservative if compared with the average value obtained by 22 hydropower stations currently under validation in China within the capacity range 25MW to 35MW; in particular, according to this internal statistics the DOE has obtained an average value of about 6.65 Mio Yuan RMB/MW which is remarkably higher than the figure estimated for the proposed project activity. This consideration and the experience reached by the assessment team in validation of CDM hydropower projects in China allows the DOE to further confirm the validity and conservativeness, under the CDM perspective, of the Static Total Investment as taken from the Capacity Optimization Report and used in the investment analysis.
Furthermore, even if the project is still not completed at the time of writing, according to the document “Statement regarding the total investment for Sichuan Kangding Sandaoqiao Hydropower Station” as issued August, 7th, 2008 by the Kangding Xiasuozi Basin River Sandaoqiao Hydropower Construction Supervising Department of Guangan Qujiang Hydropower Construc-

tion Supervising Co., Ltd. the costs undertaken by the project up to July 2008 have been about 128,000,000 Yuan RMB which are estimated to reach 178,000,000 Yuan RMB as soon as the plant will be completed on February 2009.

Annual utilization hours:
A value of 5,246 hours has been assumed in PDD according to the value as reported in the Capacity Optimization Report (issued on December 2005) which relies on a strong hydrological study, taking into consideration data from 1957 to 1991. The value of the annual utilization hours has been compared to the average value obtained by the analysis of more than 250 hydro power projects currently under validation. According to this DOE's internal statistics, the average annual utilization hours is 3,871, confirming that the proposed project estimated a reasonable and even conservative value. Furthermore, the genesis of this value has been evaluated by the DOE: the hydraulic regime of the Xiasuozigou river has been studied by the institute in charge to prepare the COR considering a consistent amount of historical flow data and water availability, between 1957 and 2002. The validation team has verified the section of the COR where the hydrological assessment is presented. The strong hydrological basis behind the study allows to state that the annual utilization hours have been consistently estimated and that no significant changes will occur in this operational parameter. The figure of the annual utilization hours has been furthermore compared with the value observed in many other large scale hydropower plants in China and it's confirmed as a reasonable and conservative value. The data assumed in the COR and in PDD has been therefore considered acceptable and consistent with the specifications of the project as evidenced during both the onsite audit and the subsequent additional review.

Grid Price:
A grid price of 0.207 Yuan RMB/kWh (with VAT) was used as input value for the investment analysis in PDD. The value was taken according to the Capacity Optimization Report issued on December 2005 which considered the same price as stated in the previous Feasibility Study Report (24MW) issued on August 2005. The confirmation that the price was in compliance the local regulation on prices has been provided by the local price bureau (Kangding County Pricing Bureau) on July 2005, stating that an average price of 0.21 Yuan RMB (with VAT) is in compliance with the local tariffs and that a similar price should have been used to conduct the financial analysis.
The proposed project activity is still not operational and still no power generation is in place at the time of writing. Anyway, the assessment team have verified that, according to a power generation invoice for a project connecting to the same grid in Sichuan Province, the price of the electricity delivered was about 0,199 Yuan RMB (including VAT) on December 19th, 2007. This lead to further consider the price used in the Capacity Optimization Report and by the PDD (0.207 Yuan RMB/kWh), as a reasonable and even conservative price.

Annual O&M Costs:
The annual operating costs of 5,249,100 Yuan RMB in the Capacity Optimization Report (December 2005) have been used to perform the investment analysis in PDD.
This figure was obtained in the Capacity Optimization Report as a result of a calculation which considers the parameters of payroll and welfare, cost of overhaul, cost of materials and other expenses, water charges and reservoir maintenance. The DOE have checked that the values behind these parameters were set to be in compliance with the local figures for the same. The transparency of the IRR calculation spreadsheet as requested by the DOE allowed to perform this check; according to the Capacity Optimization Report, the power station will have a fixed staff of 33 persons each of those will receive an average payroll of 17,220 Yuan RMB/year. The

number of employees of the hydropower station and the related payroll are consistent with the project specifications and local payroll respectively; furthermore, the DOE confirms that, according to the trend in salaries in China, an increase in the payroll is likely to occur throughout the next years.
The welfare fund of 14% have been also applied according to the chinese regulations. The cost of overhaul has been estimated according to a percentage of 1.50% of the total fixed asset value and the costs for the materials set to be 5 Yuan/kW; the remaining costs account for 24 Yuan/kW which also match with the local regulations. As a result of the calculation, the annual operating and maintenance costs account for about 3.2% of the static total investment which, according to the experience on this sector it's confirmed to be a reasonable and conservative value.
The DOE confirms that, according to these considerations, the annual O&M costs as stated by the PPs in the PDD have been estimated basing the calculation on provable parameters and reliable assumptions, which leave limited margins of uncertainty about the value used in the Capacity Optimization Report and transparently calculated by the PPs.

Response by the Project Participants:
At the time of investment decision, the Capacity Optimization Report for 30 MW was applicable. The values of the Capacity Optimization Report replaced those of the earlier Feasibility Study Report.
Consequently, the source of the values mentioned in the PDD and used in the IRR calculation for the proposed project is the Capacity Optimization Report. The main values are provided below. For the sake of consistency with the PDD, all values are provided in EUR based on an exchange rate of 1:10, which had been applied at the time of PDD writing and IRR calculation.

Installed capacity (MW)	30	Capacity Optimization Report
Annual Power supplied to the Grid (MWh)	125,526	Capacity Optimization Report
Static Total Investment (€)	16,224,800	Capacity Optimization Report
Loan	70%	Capacity Optimization Report
Rate of the Loan	6.12%	Capacity Optimization Report
Loan Repayment Period (Years)	15	Capacity Optimization Report
Estimated Grid Price (€/ kWh, with VAT)	0.0207	Capacity Optimization Report
Operation Period (years)	30	Capacity Optimization Report
VAT	17%	Capacity Optimization Report
Revenue from Electricity Sale (€/year)	2,598,390	Capacity Optimization Report
O&M Cost (€)	524,910	Capacity Optimization Report

DOE has confirmed that the values are valid by checking the Capacity Optimization Report and the Loan Agreement.

As further elaborated below, the main input values for the investment analysis are appropriate

and on the conservative side when compared to recent developments after the investment decision, which further strengthens the suitability of the applied values. Given the fact that the value of the annual power supplied to grid was explained in detail above and the fact that the loan and VAT figures are regarded as fixed and appropriate, the discussion below focuses on the static total investment figure, the grid price and the operational costs.

Static Total Investment

The operation start of this project will be postponed. According to the actual situation of the construction, it is estimated that the proposed project's construction will be completed and the project put in operation in February 2009. Until July 2008, the total investment was 12,800,000 € (128,000,000 RMB). When the whole construction is completed, the total investment for this project will have exceeded the planned investment, it is estimated that the total investment will reach 17,850,000 € (178,500,000 RMB), which is much more (plus 10%) than the initially expected 16,224,800 € (162,248,000 RMB) assumed for IRR calculation. The difference between the expected figure in 2005 and the revised figure of 17.85 Mio. EUR is linked to several unforeseen issues such as the large earthquake in Sichuan province in May 2008 as well as general construction challenges and delays.

The higher total investment has been confirmed by the Kangding Xiasuozi Basin River Sandaoqiao Hydropower Construction Supervising Department of Guangan Qujiang Hydropower Construction Supervising Co., Ltd. (see evidence „Statement Regarding the Total Investment for Sichuan Kangding").

Grid Price (Tariff)

The forecasted grid price of the project as per approved FSR and Capacity Optimization Report (which was the data source for the PDD) was 0.207 RMB/kWh (0.0207 €/ kWh) including VAT. This figure has been certified by the Kangding County Price Bureau in July 2005 (see evidence "Certification of Grid Price in Sandaoqiao CHN") to be 0.21 Yuan RMB/kWh (including VAT), which is close (plus 1.4%) to the grid price in the PDD. In China the grid price is established through strict regulation by the government rather than market mechanisms, so it is impossible to receive a significantly higher grid price than the one stipulated by the price bureau. As the grid price is related tightly to the national economy and livelihood of people, the government of China keeps the grid price as stable as possible. In the document published by local price bureau, the grid price of the project is 0.21 RMB/kWh including VAT during the operation period. For all subsequent years the grid price 0.21 RMB/kWh will most likely stay the same.

Operation and Maintenance (O&M) Cost

The O&M cost is calculated according to the parameters from the approved Capacity Optimization Report. The annual O&M cost includes overall cost, salaries, material prices, reservoir maintenance fee, and others. All these parameters are derived from the Capacity Optimization Report and are consistent with the applicable National Economic Evaluation Code for Small Hydropower Projects SL16-95.

Since the project has not been completed yet, it is impossible to provide actual O&M cost data. However, it is most likely that the cost is even higher than assumed during the investment decision. According to the applicable National Economic Evaluation Code for Small Hydropower Projects SL16-95, most of the values that flow into the O&M cost are fixed, but the salaries of employees may fluctuate.

In order to demonstrate that the input value of salaries is appropriate, the salary index fluctua-

tions in Sichuan Province has to be considered. As can be seen from the table below, the minimal increasing rate from 2002 to 2006 was 7.7% (Sichuan Province index). It is clear that the salaries are increasing rapidly (and can be expected to keep rising). Therefore the O&M cost in the IRR calculation is conservative.

Salary Index Fluctuations (Last Year=100, table displays fluctuations using always the previous year as reference)

Year	2002	2003	2004	2005	2006	Minimum rate
Salary	107.8	107.7	109.6	110.9	111.3	7.7%

Information source: China Statistics Year Book 2003-2007 (http://www.stats.gov.cn/tjsj/ndsj/)

Conclusion

From the analysis above it can be concluded that the values available at the investment decision as mentioned in the PDD are conservative or very close to the ex-post values. The positive influence from a possibly slightly higher grid price (plus 1.4%) is more than offset by the much higher investment (plus 10%) and the higher salaries (plus 7.7%). Hence, the real IRR of the project as per updated information is 6.97% as compared to the value of 7.88% calculated in the PDD.