

Mr. Rajesh Kumar Sethi Chair, CDM Executive Board UNFCCC

# Response to the request for review for the CDM project activity "Shanghai Baoshan Grid Connected Natural Gas Combined Cycle Power Plant Project " (Ref. no. 1381)

2008-03-10

Dear Mr. Sethi,

The DOE TÜV Rheinland Japan Ltd. was informed on 25 February 2008 that the CDM project "Shanghai Baoshan Grid Connected Natural Gas Combined Cycle Power Plant Project" (Ref. no. 1381) is under request for review because four requests for review have been received from members of the board.

All of these requests for review contain the same 2 issues. We would like to provide our response to the issues raised as follows:

#### Issue 1 raised:

The DOE should provide further details regarding how the assumptions used in the calculation of levelized electricity generation cost (EGC) and the IRR have been validated. Further clarification is required regarding how it has been validated that changes in key input values which result in an increase in the IRR beyond the benchmark are not likely to occur e.g. natural gas price, annual O&M cost and bus-bar tariff.

#### TUV's response:

#### (a) Levelized electricity generation cost (EGC)

The Validation Team has reviewed the approach adopted for the calculation of levelized electricity generation cost (EGC), and confirmed that it is carried out in accordance with Section 2 of the Approved baseline methodology of ACM0029/v01.1, and are based on the "Cost Estimation Methodology" under Appendix 5 of the "Projected Costs of Generating Electricity – 2005 Update" published by NEA, IEA and OECD<sup>1</sup>. It is therefore considered that the method used for the EGC calculations are acceptable.

The Validation Team has reviewed the sources of the input values used for the EGC calculations of proposed alternative baseline scenarios, namely the 600MW sub-critical and super-critical coal-fired power plants, and confirmed that they are based on the "Thermal Power Engineering Design Reference Cost Index"<sup>2</sup> (Annex 1a), which was issued by the State Power Corporation

<sup>&</sup>lt;sup>1</sup> "Projected Costs of Generating Electricity – 2005 Update", Nuclear Energy Agency (NEA), International Energy Agency (IEA) and Organization for Economic Co-operation and Development (OECD). (Source: <u>http://www.iea.org/textbase/nppdf/free/2005/ElecCost.pdf</u>)

<sup>&</sup>lt;sup>2</sup> "China Institute of Power Planning and Design, Thermal Power Engineering Design Reference Cost Index", 2005 Edition.



and is commonly used by the China Power Industry for cost estimation. The input value of investment cost for sub-critical coal-fired power plant is taken as 95% of that for the super-critical coal-fired power plant, i.e. 3,835 RMB/kW (based on 95% of 4,037 RMB/kW). This assumption is traceable in a paper titled "Optimising Analysis of the Parameters and Thermal System for Ultra Super-critical Plant Unit" (Annex 1b) and confirmed by the Validation Team to be valid.

The input values for the EGC calculation in this project were based on the Feasibility Study Report (FSR), see Annex 1c. The FSR was prepared by National Power Company China East Power Design Institute, an entity accredited by the Chinese Government for developing FSR's in China. The FSR was approved by the National Development and Reform Committee (NDRC) in 2005 for application; it can thus be concluded that the applied parameters are valid and plausible.

Furthermore, in order to confirm that the key input values used in the EGC comparison are representative and conservative, the Validation Team has reviewed the following elements of the EGC calculation:

$$EGC = \frac{\sum_{t} \left[ (I_t + M_t + F_t)(1+r)^{-t} \right]}{\sum_{t} \left[ E_t (1+r)^{-t} \right]}$$

- It: Capital expenditure in the year t.
- M<sub>t</sub>: Operation and maintenance expenditures in the year t.
- Ft: Fuel expenditure in the year t.
- Et: Electricity generation in the year t.
- r: Discount rate.

(i) I<sub>t</sub>: Capital expenditure in the year t. The investment cost of the proposed project is referenced to the FSR and is reported to be 2,961.4 RMB/kW. This value was verified by the validation team and found to be correctly calculated from the capital investment and installed power, respectively. The Validation Team has further reviewed the investment costs of super-critical plant in China<sup>3</sup>. The source shows that the specific investment costs (500 USD/kW, equivalent to 3,750 RMB/kW) is lower than the costs for the super-critical plant assumed in the PDD (4,037 RMB/kW), showing that the quoted investment costs for the alternatives are on the "conservative" side.

(ii) M<sub>t</sub>: Operation and maintenance expenditures in the year t.

The Validation Team has reviewed the sources of information for the input values for calculation of maintenance expenditures for the baseline alternatives, and confirmed that the sources are based on "Thermal Power Engineering Design Reference Cost Index" (Page 234). The input values for the project are based on the approved FSR and are confirmed to correspond to the "Thermal Power Engineering Design Reference Cost Index" (see Annex 1a).

(iii) F<sub>t</sub>: Fuel expenditure in the year t.

The Validation Team has reviewed the sources of information for the input values for calculation of fuel expenditures for the baseline alternatives, which consists of fuel consumption and fuel price, and confirmed that the sources are based on "Thermal Power Engineering Design Reference Cost

*<sup>3</sup>* Financing Capture Ready: Issuing Tradable Capture Option (Page 8). by LIANG Xi1, REINER David, GIBBINS Jon, LI Jia <u>http://www.hkie.org.hk/ICCC2007/docs/PDF/Oral%20Papers/L08.PDF</u>



Index" (Page 234) and the data published by the  $\overline{DNA^4}$  (Annex 1d). The input values for the fuel expenditures for the project (an expenditure of  $0.22m^3/kWh$  and fuel price of RMB  $1.35/m^3$ ) are based on the approved FSR and are confirmed by the Validation Team to be valid, as reported in the Validation Report. These quoted values are conservative as compared with the values presented in the "Thermal Power Engineering Design Reference Cost Index" (Page 234), which indicates a specific fuel consumption of  $0.244m^3/kWh$  and fuel prices of RMB  $1.3/m^3$  only.

(iv) E<sub>t</sub>: Electricity generation in the year t.

Furthermore, the Validation team reviewed the values for operating hours adopted in the PDD for the 600MW sub-critical and super-critical coal-fired power plants. In contrast to the project activity, the indicated annual operating hours (3,500 h/a) are not representative for these reference plants, which would typically be operated at ca. 5,000h/a. However, it is understood that the former value is selected for consistency with the project activity. It is also deemed conservative (i.e. 3,500 h/s/annum compared to 5,000 hrs/annum), because their specific generation cost would be even lower if the number of operating hours (and thus the electricity generation) increased. This is verified by the Validation Team as shown in the below table, where the operating hours are varied to 5,000 hrs/annum:

Item	Unit	Sub-Critical Coal-Fired Power Plant 2×600MW	Super-Critical Coal-Fired Power Plant 2×600MW
EGC (based on 3,500h operation hours)	RMB/KWh	0.2880	0.3004
EGC (based on 5,000h operation hours)	RMB/KWh	0.2431	0.2484
Cost reduced for operation of 5,000h	%	18.47%	20.93%

The above assumptions, including the sources of references, the validity of input values and the associated EGC calculations are assessed by the validation team and confirmed to be valid.

## (v) r: Discount rate.

The Validation Team has reviewed the EGC calculations worksheet and confirmed that a discount rate of 8% is adopted for the EGC calculations across the alternatives and the project itself. Based on the understanding that an IRR rate of 8% is accepted for the power industry in China (see below), the Validation Team thus accept the applied discount rate to be valid.

#### <u>(b) IRR</u>

The validation team has reviewed the source of the 8% benchmark applied in the PDD - Interim Rules on Economic Assessment of Electrical Engineering Retrofit Projects (Annex 1e), which is deemed an appropriate benchmark reference for the retrofit power projects and new power projects investment in China because of the high degree of relevance to the power industry. It has been commonly adopted for financial evaluation of power projects for the approved renewable power CDM projects in China. As highlighted in section 1.11 of the reference, the Interim Rules on Economic Assessment of Electrical Engineering Retrofit Projects clearly indicate that the

<sup>4</sup> Data source: "the Baseline Emission Factors of China Grids" Issued by the Chinese DNA, ,http://cdm.ccchina.gov.cn/web/main.asp?ColumnId=25"



economic benchmarks are regulated for the entire power industry. The validation team has also identified and validated the regulative document for the benchmarks, titled "*The Economic Assessment Method and Parameters for Capital Construction Project – version 3*" (see also Annex 1e), which provides the financial benchmark to the capital construction projects including the power industry in China. According to this reference, a benchmark of 10% (after tax) is quoted, which is higher than the 8% benchmark assumed in the "*Interim Rules on Economic Assessment of Electrical Engineering Retrofit Projects*". Based on the above reasons, the validation team hence accepts the 8% benchmark for the power industry as a generally accepted and conservative parameter.

Again, the input values for the project's IRR calculation is based on the FSR, where the FSR was prepared by National Power Company China East Power Design Institute., an accredited entity in China for developing FSR by the Chinese Government. With the approval of the FSR by the NDRC in 2005, it can thus conclude that the parameters applied are valid and plausible.

#### (c) Validation of changes in key input values in IRR calculations:

The validation team has examined the PDD and concluded that it has given due consideration to the parameters that are having a significant impact to the project finance, as explained below.

Factors determining the project income include:

- Annual electricity generation (which in turn depends on the annual operation hours);
- Electricity tariff
- Factors that will affect the expenses include:
  - Fixed investment costs
  - Annual operating costs, with major components of fuel and maintenance costs
  - Income tax (in accordance with relevant taxation law)
  - City construction and educational taxes (in accordance with relevant taxation law)

For the sensitivity analysis, those financial parameters having a degree of uncertainty (i.e. total investment, annual operating hours, annual O&M cost, tariff and natural gas price) have been selected and subjected to variations of +/-10% in the discussion. The selection of the +/-10% fluctuation for carrying out the sensitivity analysis is referable to the FSR which complies with the "Economic Assessment Method and Parameters of Construction Projects (version 3)", and is hence considered justifiable by the validation team.

The analysis results are presented in the PDD. The calculation has been reviewed by the validation team during validation and confirmed that the sensitivity analysis has been carried out in accordance with the approved FSR. The independent variation of the selected financial parameters in the sensitivity analysis has indicated that, even with a 10% increase in annual operating hours, or a 10% reduction in total investment and O&M cost, the IRR of the project is still below the benchmark IRR of 8%.

The project IRR is sensitive to the electricity tariff (with a 10% increasing in tariff the Project IRR would reach 8%). However, the tariff is strictly regulated by the Government and is therefore unlikely to be subject to significant variation.

#### Background information:

The process for setting the tariff is as follows: the project owner has to negotiate with the grid company and agree on a tariff. The Central government will then decide and approve the agreed tariff. Once the feed-in-tariff is defined, it will strictly be regulated by the government and can not



be changed by the project owner or the grid company without a new approval by the state authority. In addition, in order to curb the potential inflation with the recent rapid economic developments in China, it is noted from the announcement made by NDRC that the central government has come to a decision to proactively get involved into control and stabilize the national price level (including electricity tariff) in a steady and reasonable range by means of administrative measures, e.g. pricing strategy. According to a latest control measures announced by the State Council on 14<sup>th</sup> January 2008 regarding monitoring of the price control and management, the Vice-Premier (Mr. Zeng Peiyan) proclaims for freezing the charges of public affairs which include the electricity tariff, see Annex 1f<sup>5</sup>. Since the tariff is such a sensitive issue which is always strictly monitored and controlled by the central and local government, the validation team agreed with the argument that the electricity price is considered not likely to exceed 10% in the near future.

Similarly with a 10% reduction in natural gas price, the Project IRR could boost over 8%. However, it has been discussed in the Validation Report that while the FSR and IRR calculations assumed the cost for natural gas to be 1.35 RMB/m<sup>3</sup> (before tax), the actual gas supply agreement stipulated costs of 1.49 RMB/m<sup>3</sup> in 2005 (subject to renegotiations every year), see also Annex 1g<sup>6</sup> for an announcement made by the Shanghai City Price Bureau on adjustment of non-residential natural gas price. Besides, the validation team is able to search another recent announcement for adjustment of natural gas price made by the Shanghai City Price Bureau on 9<sup>th</sup> November 2007 (see Annex 1h) that the Shanghai government decided to raise the price of industrial-use natural gas by 0.4 RMB/m<sup>3</sup> of consumption effective from 10<sup>th</sup> November 2007, so as to suppress the over-accelerated industrial-use natural gas consumption and narrow the price difference between natural gas and other renewable energies. The documents can therefore support the argument that the natural gas price is commonly expected to increase further in future, rather than to decrease. The project IRR will thus reasonably remain below the benchmark of 8%.

The annual O&M costs, consisting of raw material consumption, labour cost, maintenance and repair expenses, are calculated in accordance with the FSR and consistent with parameters indicated in the "Thermal Power Engineering Design Reference Cost Index". The operating costs have been further reviewed during site interview with the project owner, where it was reported that the operational cost would be even higher than those predicted in the FSR due to increasing raw material prices and labour costs.

In addition, the validation team is able to confirm that the project proponent has entered into a Maintenance Service Contract with Siemens AG (i.e., the maintenance service provider) in order to ensure the expected performance result of the installed equipment (the signed contract has been validated during on-site visit). This results in an additional operational cost of 125 Million RMB per annum. The annual O&M cost is therefore deemed unlikely to become less than the assumed total value, particularly a decrease by 10% or more is not perceivable. The project IRR will hence stay below the 8% benchmark.

The validation team hence confirms that the IRR calculation performed is sound and reasonable, and, as revealed by the sensitivity analysis, the proposed project would not likely be subject to large fluctuations and variations. The prospective range of variation does not suggest that the benchmark IRR could be achieved without consideration of CDM revenues. The claim that the proposed project activity is financially unattractive is thus confirmed.

<sup>&</sup>lt;sup>5</sup> Press release on "Monitoring of price control & management", Central People's Government of P.R.China, http://www.gov.cn/ldhd/2008-01/14/content\_857704.htm

<sup>&</sup>lt;sup>6</sup> Adjustment on industrial NG price, Shanghai City Price Bureau, 13 November 2007

#### Issue 2 raised:



### Further clarification is required to demonstrate the prior consideration of the CDM before the start date of the project activity, in particular as the methodology AM0029 v1 was approved on 19 May 2006, after the start date of the project activity.

#### TUV's response:

The DOE shared the concerns raised by the members of the EB about consideration of CDM, and has carried out detailed verification of the evidences available to the DOE. These information and evidences include the following key information:

- (1) The PDD
- (2) CDM Workshop materials presented by the Green Capital Consulting Company, with potential projects include gas-fired power plant (15 December 2004) (Annex 2a, 2b).
- (3) Construction Contract showing the date of signing the contract (28 February 2005) (Annex 2c)
- (4) Letter of Approval of FSR (7 March 2005)
- (5) Construction Start by checking the date of construction start ceremony taken by the project proponent (8 April 2005) (Annex 2d)
- (6) Stakeholder interviews with project proponent and government officials (details as listed under the VR) and inspection of the true copies of the documents.

The results of the validation, including a comprehensive report on the project history with CDM consideration, has been duly reported in Page 8 of the submitted Validation Report (Ver. 3 of 7 Jan 2008). It is considered that the evidences have adequately demonstrated that the project proponent (China Huaneng Group – the mother company of Huaneng Shanghai Combined Cycle Power Co., Ltd.) has seriously considered the incentives from CDM from the project start.

The Huaneng Group has been widely recognised as one of the forerunners in the CDM developments in China, especially in wind power projects since 2005. Subsequently, Huaneng Group has successfully submitted the first wave of wind power projects for registration with UNFCCC in mid-2006. During on-site validation, the DOE acknowledged from the project proponent that they have learnt during the CDM Workshop in December 2004 about the potential CDM development in their on-list projects. The project proponent then profoundly studied the carbon assets for individual projects, including natural gas fired power generation, and considered them highly capable to meet all the CDM requirements. Rounds of detailed discussions had also been made thereafter between the project proponent's confidence on the project's CDM implementation. Based on this above risk assessment the project was deemed likely to be registered, and accordingly the project proponent decided to start off the project activity prior to receipt of either a positive validation opinion or notification of registration by the EB.

In addition to the information and evidences collected during site visit and provided to the DOE, the DOE has also carried out a search about the status of the project proponent, and found that a statement was made in December 2004 about the group's intention to make use of CDM as incentives to develop a range of renewable energy projects. This further confirms that the project proponent has seriously considered the incentives from the CDM. Sources of information:

http://www.co2-china.com/club/show.asp?id=806; (refer to Annex 2e)

Moreover, during validation, instead of accepting the start date of project construction (8 April 2005) as the project starting date, the Validation Team has determined that the date for signing the construction contract (28 February 2005) should be regarded as the project starting date, which is even earlier than the approval of the FSR (7 March 2005). Thus the Validation team confirms that



the CDM was seriously considered prior to the project start date.

The question of CDM consideration at the time of the project starting date was also raised during the internal quality review of the entire project documentation. As a result, the project history was clarified and credibly confirmed that potential benefits CDM have been considered before the start of real action in the project activity.

In summary, we understand the issues raised in the clarification requests and regret if the previous validation report did not reflect the discussions in sufficient detail. However, we hope that the input by the project participants and this explanation will find acceptance among the members of the Executive Board.

Yours sincerely

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