Mr. Hans Jürgen Stehr
Chair, CDM Executive Board
UNFCCC Secretariat
CDMinfo@unfccc.int

21 December 2007

Re: Request for Review "Beijing Taiyanggong CCGT Trigeneration project" (Ref. No. 1320)

Dear Mr Stehr,

Please find below the response of the project participants to the request for review for the above mentioned project, no. 1320.

We sincerely hope that the response below answers satisfactorily all of the issues raised but if you have any further questions or need further clarification, please do not hesitate to contact us. We hope that with this response, all issues have been addressed and the Board will approve this project for registration.

Yours sincerely,

Zhang Yandong Vice General Manager Beijing Taiyanggong Gas-fired Thermal Power Co. Ltd.	John Marlow Head of Environmental Financial Products Macquarie Bank Ltd.	Alan Ho Managing Director, China Camco International Ltd.

Issue 1. The PDD has applied investment analysis in order to demonstrate that project IRR (6.01 %) without CDM revenue do not exceed benchmark rate of return (8 %) and the project would have not happened in absence of the CDM benefits. However, further clarification is required on the IRR analysis, particularly on (a) the assumptions regarding natural gas prices and load hours and (b) the 20-year period of analysis.

(a) **Natural gas prices**: assuming all other parameters in the calculation remain constant, if the natural gas price increases then the IRR of the project will decrease. Similarly, if the natural gas price decreases, then this could have the effect of increasing the IRR of the project, potentially taking it above the benchmark. The price used in the PDD is that used in the FSR of the proposed project. Further, subsequent to submitting the PDD to the EB, a contract has been signed between the project owner and the gas supply company, and according to this contract, the gas purchase price is to be linked to standard local gas prices.. This has been verified and confirmed by the DOE. At the time of signing, this was the same price as that given in the PDD[1]. Following signing of the contact, gas prices for power generation in Beijing have risen further to 1.95 RMB/m^3 [2]. It is not plausible for us therefore to expect a decrease in natural gas prices in the future, for the following reasons:

- The price of natural gas in China is continuously rising and has been for a number of years. It is expected that such a trend will continue well into the future. For example, in September 2006 in Beijing the natural gas price increased, and in November 2007, the natural gas price increased

[1] http://www.bjpc.gov.cn/tztg/200608/t129243.htm.
[2] Beijing DRC Notice [2007]2154

nationwide[3].

- The long-term trend is that international gas prices are also continuously rising[4].
- The natural gas price in China is still lower than the international market price for natural gas. It is expected that China will gradually adopt the international market price as the domestic gas price in the future[5]. Logically, this means that the Chinese gas price will continue to increase.

Therefore, it is not plausible that in the future the project would be able to have a gas price lower than the price given in the PDD.

Load hours: According to the FSR of the proposed project, load hours will be 4528 hours each year. An increase in the load hours of the plant may lead to more power generation and might lead the IRR of the project to be higher than the benchmark. However, this scenario is not plausible, for the following reasons:

- For the proposed project, load hours are influenced by the heating and cooling demands of the area. In the Beijing area, the winter heating season runs for 4.5 months and the summer cooling season for 2 months[6]. As the heating and cooling seasons lasts for just over half the year, the load hours of the plant will correspond to this.
- Compared to the normal design of gas fired plants and other operational gas fired plants in China, the assumed load hours for the proposed project are relatively high. For example, according to the Thermal Power Engineering Design Reference Cost Index[7], the standard load hours for gas-fired plants should be 3500 hours per annum and this value was applied in the financial analysis in the PDDs for the Sulige Natural Gas plant[8] and Yuyao Natural Gas plant[9].
- Finally, the FSR approval by the Beijing Development and Reform Commission also states the amount of heat and power that the plant is approved to generate. This means that the predicted operation hours and amounts of heat and power generation as set out in the PDD are consistent with the project approvals issued by the relevant authorities, and shall not be changed without a specific reason and without further approval by the relevant authorities.

(b) **20 year period** for investment analysis: 20 years is the period that is widely applied in China for the investment analysis of power plants carried out by the Design Institutes who formulate the Feasibility Study Reports for this type of project. This is in accordance with the guidelines in the "the Methodology and Parameters for Financial Evaluation of Construction projects"[10].

However, the project owner would hope that the lifetime of the project will in practice be higher than 20 years, possibly up to 30 years, but this would require additional significant investment after 20 years to replace and refurbish the key components of the plant. Without an additional large investment to replace many of the components, it is unlikely that the project would be able to operate for more than 20 years. Therefore, in the feasibility study of such a project, regulations state that a 20 year lifetime should be used for the IRR calculation.

Furthermore, even assuming that this project would have a 30 year lifetime, without income from the CDM, the IRR of the project is still only 7.19%, well below the benchmark for such projects.

In conclusion, using 20 year lifetime for this project to calculate IRR is appropriate.

Issue 2. In addition, further clarification and justification is required regarding how DOE has assessed and validated (a) the assumptions in the FSR in particular regarding the lifetime of the project activity. Section C.1.2 of the PDD mentions lifetime of the project as 30 years, whereas IRR

---

[3] http://www.reuters.com/article/companyNewsAndPR/idUSPEK9283520071031
[4] http://www.eia.doe.gov/emeu/international/ngasprie.html
[5] Ni, C., China's Natural Gas Industry and Gas to Power Generation, Institute of Energy Economics, Japan (available at http://eneken.ieej.or.jp/en/data/pdf/397.pdf)
[6] Feasibility Study Report for the project
[7] China Institute of Power Planning and Design, 2005 edition, www.cepp.com.cn
[8] http://cdm.unfccc.int/Projects/DB/TUEV-SUED1184339707.46/view
[9] http://cdm.unfccc.int/Projects/DB/DNV-CUK1183455647.94/view
[10] 2nd edition, p62, section 5, paragraph 2

for the project has been calculated using 20 years as the operation period. (b) sensitivity analysis in the PDD state that changes in the gas price and electricity generation would strongly impact the IRR of the project. The DOE shall further clarify how it has validated that such variations are not possible.

Please see the response from the DOE. In addition, we would like to add the following clarification:

(a) 20 years was the period used for the investment analysis in the Feasibility Study Report carried out by Design Institute, Beijing Guodian Huabei Electric Power Engineering Company Ltd. The FSR was formulated by a government-accredited third party, assessed by designated independent experts and finally approved by Beijing Development and Reform Committee in October 2005. As explained in the response to issue 1, the project owner would hope for a lifetime of greater than 20 years but this would require additional investment to replace and refurbish key components. Therefore, in accordance with government guidelines, a 20 year lifetime is adopted for the financial analysis.

(b) The gas price in the PDD is that in the FSR of the project. A contract has also been signed between the project owner and the gas supply company and the gas price in this contract at the time of signing was the same as in the FSR. This gas price was also the standard gas price for the Beijing area at this point although subsequently gas prices have risen. The gas price in China has been rising in recent years and it is unlikely that the gas price will decrease in the future. Indeed it is expected to rise further as this has been the trend in China in recent years following international gas price trends. Finally, the gas price in China is regulated by the National and local Development and Reform Commissions in order to stabilise the price[11].

(c) Electricity generation (and, therefore, load hours) are, as discussed above, stated in the FSR for the project and correspond to the heating and cooling season in Beijing. Further, the gas supply contract signed between the project owner and Beijing Natural Gas Supply Company Ltd. limits the amount of natural gas that will be supplied to the project each year to the amount needed for the load hours as stated in the FSR.

Issue 3. The DOE shall further clarify why and by whom an IRR of 8% "is regarded as a benchmark for investment in fossil fuel power plants"

Please see the response from the DOE. In addition, we would like to add the following clarification:

The IRR benchmark, 8%, as applied in the PDD, is set by the Chinese government, and is an important indicator for the approval of the project by government. At the time of formulating the FSR for the project, the project IRR benchmark, as set by the relevant authorities in China for assessing new projects, was 8% according to the Interim Rules on Economic Assessment of Electrical Engineering Retrofit Projects issued by the State Power Corporation of China in 2003.

These Interim Rules are based on "the Methodology and Parameters for Financial Evaluation of Construction projects (2nd Edition)". 8% can be regarded therefore as a standard benchmark for fossil fuel power plants in China. Indeed, 8% is widely applied as a benchmark in power generation sector in China.

Further, the latest edition of the "the Methodology and Parameters for Financial Evaluation of Construction projects" (version 3, published in 2006) by the National Development and Reform Commission and Ministry of Construction confirms that the project IRR benchmark used for fossil fuel fired projects should be 8% but further states that a benchmark of 9% should be used for natural gas fired power plants. On this basis, the 8% value taken by the PDD is conservative.

Issue 4. The DOE shall further clarify why this project applies the benchmark for electrical engineering retrofit projects as the project activity "will comprise the installation of a 780MW natural gas fired combined cycle power generation system" which is a newly built gas fired combined cycle.

Please see the response from the DOE. In addition, we would like to add the following clarification:

[11] NDRC of PRC Decree 11, the Catalog priced by NDRC and Relevant Ministries State Council, July 4th, 2001

8% is widely applied as a benchmark in power generation sector in China. Paragraph 1.11 (page 2) of the Interim Rules states that the benchmark IRR for the electric power industry should be 8%, showing that the 8% benchmark is applicable to new build as well as retrofit projects.

Further, this benchmark and reference is used by other new build power generation projects in China that have been successfully registered with the CDM Executive Board.

Issue 5. The DOE shall further clarify why the IRR of 8% is acceptable as a benchmark if the Interim Rules used in the case were issued by the "former "State Power Corporation of China and which is the current status of that corporation.

Please see the response from the DOE. In addition, we would like to add the following clarification:

The State Power Corporation of China was responsible for the implementation of government policies and guidelines relating to power production, purchase and sales in China. Following re-structuring, the State Power Corporation ceased to exist and its functions relating to issuance of guidelines and rules (such as IRR benchmark setting) were transferred to the National Development and Reform Commission. Relevant policies and guidelines relating to the power sector were unchanged.

The Interim Rules issued by the State Power Corporation are still valid therefore for project assessment and approval and the Rules continue to be applied widely in the power generation sector in China. The 8% benchmark was re-confirmed in the Methodology and Parameters for Financial Evaluation of Construction projects" (version 3, published in 2006) published by the National Development and Reform Commission and Ministry of Construction. In summary, the IRR benchmark of 8% for power plants is widely used in China, in particular by the government in the consideration and approval of such projects.

Issue 6. The DOE shall further clarify why the sensitivity analysis does not include variation in prices of net electricity generated as this is variable is included in the revenue stream

Please see the response from the DOE. In addition, we would like to add the following clarification:

In the PDD, the power tariff given in the FSR was used in the IRR calculation. The sensitivity analysis does not include variation in electricity prices because in China the electricity tariff that a power plant can expect to achieve for the power that it produces is strictly regulated by government[12] and therefore once approved by government, the price is fixed and cannot be changed without further government approval. A power plant operator will negotiate a feed-in tariff with the Grid Company based on the operating costs and expected profit of the plant. Once the negotiated tariff has been approved by the Pricing Authority, the price is fixed and it is not possible to change unless the government regulates the change, for instance if the fuel price increases considerably[13]. At the time of writing this response, the tariff for this project is under negotiation and has not been confirmed.

Issue 7. Further justification is required on why the project activity is not a common practice.

The project cannot be considered a common practice because:

(a) This project activity is undertaking a high level of technical innovation (see response to question 9 below). It is the first of this type project in China i.e. a gas-fired plant that provides power, heating and cooling.

(b) As stated in the PDD, there are 3 other gas-fired plants in Beijing & Inner Mongolia of a similar scale to the project:

Location	Size	Details
Beijing	1 x 350MW	Jingfeng Beijing No. 3, Power only

[12] NDRC of PRC Decree 11, the Catalog priced by NDRC and Relevant Ministries State Council, July 4th, 2001
[13] Management Rules on Feed-in Tariff, No [2005].514, March 28, 2005

Beijing	2 x 250MW	Huadian Zhengchangzhuang, CHP
Inner Mongolia	2 x 150MW	Sulige, Power only

The Jingfeng, Zhengchangzhuang and Sulige plants are all also seeking additional finance through CDM registration. This demonstrates that all plants of a comparable size in the Beijing area and indeed the North China Power Grid area are facing similar financial barriers.

Issue 8. Further clarification is required on how the DOE validated the common practice analysis

Please see the response from the DOE.

Issue 9. Further justification is required regarding the technological risk mentioned in the PDD

According to AM0029, a barrier analysis cannot be carried out to demonstrate the additionality of the project. Therefore no technical risks were presented in the PDD, apart from Step 2 of section B.5 of the common practice analysis – although this did not affect the additionality of the project. However, it is predicted that there will be technical risks associated with the project These are detailed below:

- The project is using a custom designed steam turbine which is the first of that type in China.
- The core equipment of the project is imported as it is using GE's PG9351 gas turbines that have not been used extensively in China. No domestic manufacturer is producing similar turbines. There is, therefore, a lack of experience of installation, operation and maintenance of this type of turbine in China.
- Maintenance contracts and spare parts also have higher costs associated with them because of the expertise that is needed and the consequential exposures to foreign exchange given the equipment supplier is domiciled in the United States – increasing the financial risk associated with the project.
- Importing the GE gas turbines and transporting them to the centre of Beijing also presented technical obstacles to overcome – by scheduling freight access to the world's largest cargo plan for example.

Issue 10. The DOE shall further clarify if the construction of the newly built Shaanjing no. 2 line for the provision of natural gas does not create the conditions for a CCGT as a business as usual activity.

Please see the response from the DOE. In addition, we would like to add the following clarification::

There are a number of reasons why construction of CCGT cannot be regarded as a business as usual activity, even with the newly built Shaanjing No.2 line:

a) As demonstrated in the PDD, the IRR of the project is much less than the benchmark for fossil-fuel fired power generation projects in China, meaning that in the absence of CDM finance, this type of project would not be constructed.

b) As clarified in issue 9, this project activity is undertaking a high level of technical innovation and it is the first of this type of project in China i.e. a gas-fired plant that can provide power, heating and cooling. Therefore, it is not possible to create conditions for a CCGT to become a business as usual activity only by building a pipeline to supply more gas.

c) It is well known that China's power generation mix is dominated by coal, with natural gas being used to provide only a very small percentage of electricity (see DOE response to Issue 8). Further, this is situation is predicted to continue: according to the IEA World Energy Outlook 2007, considering the situation until 2030, coal will remain the dominant fuel in power generation in China[14].

d) Further, as discussed in the PDD, the total gas supply volume to Beijing from Shaanjing number 1 and number 2 lines is estimated to be 9.1 billion m^3 of natural gas each year. Of this, it is estimated that 3

[14] http://www.iea.org/Textbase/npsum/WEO2007SUM.pdf

billion m^3 will be supplied through the number 2 pipeline. The project, as estimated, will consume 730 million m^3 each year – this equates approx. 8% of the Beijing total gas supplied and 24% of that supplied by the number 2 pipeline.

The start of operation of the Shaanjing No. 2 line means that natural gas will be sufficiently available in the Beijing region for the project, a key applicability criteria for AM0029. However, it is highly unlikely that the increased supply of natural gas through the Shaanjing No. 2 pipeline will lead to a situation where there is excess natural gas in Beijing and supply is greater than demand and the project could be regarded as 'business as usual'. This is because nearly three quarters of natural gas in Beijing is used by residents and for communal heating boilers and historical trends show that the number of residential customers has increased by 250,000-300,000 households annually[15].

Further, even if supply of natural gas was greater than demand, the project is paying the standard price for natural gas in the Beijing area. As discussed in the response to Issue 1, the price of natural gas is regulated by the Chinese government. It is not plausible to expect a decrease in natural gas prices in the future which could lead to this project being a business as usual activity. Indeed since the Shaanjing No. 2 pipeline came into operation, there have been two further gas price rises in Beijing[16].

Issue 11. The DOE shall further clarify if during the process of consultations with local stakeholders the same stakeholders participated of the four different meetings, as there is a reference to a final unanimous support of the construction of the project, and why the number of participants in the survey changed over time.

Please see the response from the DOE. In addition, we would like to add the following clarification:

Three stakeholder meetings took place during the course of making the Environmental Impact Assessment Report. The EIA was conducted by Guodian North Power Engineering (Beijing) Co. Ltd. in accordance with China's rules and was approved by the Beijing Environmental Protection Bureau in June 2005.

Attendance at these meetings was open and voluntary. Those stakeholders who wanted their views recorded were invited to fill out a questionnaire, which the majority (but not all) did. The stakeholders raised concerns about air pollution and noise associated with the construction and operation of the project. In response to these comments and to control the noise associated with the development and operation of the project, the project owner is investing 186.32million RMB (equivalent to 5.76% of the total capital investment) in measures to reduce noise from the site in order to meet the target noise level of 55dB in the daytime and 48dB at night.

In addition, it was understood that some of these problems were raised because the local residents did not fully understand the differences between a CCGT plant using natural gas and a traditional coal-fired power station. The project owner therefore, by hosting these consultation meetings, explained to the stakeholders the key features of this project and the benefits of the project e.g. improvement of local air pollution.

Despite these consultation meetings having already been carried out in accordance with host party rules and the project owner undertaking measures to mitigate the main concerns of local residents, it was believed that it was prudent to undertake another consultation as the project participant believed it was necessary to have a specific consultation for the CDM project. This took place in October 2006. Again, an open invitation to the meeting was issued and stakeholders were invited to record their comments in a questionnaire. Evidence of how comments were invited were presented to the DOE. This meeting showed unanimous support for the project, particularly given the mitigating measures that TYG has undertaken as well as the perceived benefits of the project at that time.

In summary, therefore, as participation in all meetings and completion of questionnaires was voluntary, it was not possible to ensure that the same group of stakeholders participated in all meetings. In addition, this meant that the number of stakeholders participating in the meeting changed over time. However, the project participants are satisfied that, as all meetings were carried out in accordance with Host Party rules and/ or CDM procedures, that all stakeholders have been properly and fully consulted.

---

[15] http://www.unep.org/sport_env/Documents/BeijingReport07/chapter7.pdf

[16] http://www.bjpc.gov.cn/tztg/200608/t129243.htm and Beijing DRC Notice [2007]2154

Issue 12. Approved methodology AM0029, version 01 has been applied to prepare the PDD. As per the methodology baseline scenario should be identified as the most economical plausible alternative scenario. Based on financial analysis of levelised cost, construction of a new 2x600 MW sub critical coal fired power plant has been selected as the plausible baseline scenario. As specified in the methodology baseline emission factor should be selected as the lowest value of following three options (a) Build Margin (b) Combined Margin (c) Emission factor of technology and fuel identified as the baseline scenario. Calculations in the PDD assume that option (c) gives the lowest value 0.8731 tCO2/Mwh. However further clarification is required on following points:
a. The PDD has included assumptions and parameters to calculate the levelised cost of electricity production. Further justification is required on how DOE has validated assumptions about various parameters of FSR.
b. How DOE has validated the coal prices mentioned in Table 5 on page 12 of the PDD which has been used in the levelized cost analysis. PDD mentions that this has been taken from FSR of Shanxi Zhongshan.
c. Further clarification is required on how the DOE has validated the assumptions on the various parameters for the levelized cost analysis including coal and gas prices and currency exchange rate.

Please see the response from the DOE. In addition, we would like to add the following clarification:

(a) The parameters in the levelised Cost Calculation for CCGT are taken from the Feasibility Study Report for the project prepared by Beijing Guodian Huabei Electric Power Engineering Company Ltd., an independent third-party to the project. The FSR was approved by Beijing DRC in October 2006.

(b) The coal price of 210 RMB/tonne used in the PDD was taken from the FSR and coal supply contracts of the Shanxi Zh**a**ngshan power project (note the original PDD contained a typing error). This can be seen as a typical coal price for the North China Power Grid area (Beijing, Tianjin, Hebei, Shandong, Shanxi and Inner Mongolia) as, according to the FSR of the project, the majority of the power supplied to the Beijing area comes from Shanxi, Hebei and Inner Mongolia provinces.

Further, according a notice from the National Development and Reform Commission of China on the operation trends of the coal industry in 2005-06, the average coal price for power generation was 212.75 RMB/ tonne[17].

(c) As explained above, the parameters in the levelised Cost Calculation for CCGT are taken from the Feasibility Study Report for the project. For the sub-critical coal plant (2 x 300MW), sub-critical coal plant (2 x 600MW) and super-critical coal plant (2 x 600MW) the parameters were taken from China Institute of Power Planning and Design, Thermal Power Engineering Design Reference Cost Index, 2005 edition. This is the standard reference used by power plant operators and investors for assessing the financial feasibility of construction of new fossil fuel fired power plants.

Gas price: The price used in the PDD is that used in the FSR of the proposed project. This price is 1.55RMB/m^3, including tax (this equates to 1.35RMB/m^3 once VAT at 13% has been removed). See also the response to issue 1.

Coal price: for the levelised cost analysis in the PDD, the coal price is taken from Shanxi Zhangshan Power Company Limited Expansion Project Feasibility Study Report. As explained above, this can be seen as a typical coal price for the North China Power Grid area and for coal prices for power generation in China.

Exchange rate: no exchange rate was used in the levelised cost calculation – all figures were given in RMB.

Issue 13. In addition, the DOE shall further clarify how they have verified the statistics published by the Chinese DNA regarding thermal power plants, that are used to determine the levelized cost analysis and whether the DNA is the only source of official statistics.

[17] Http://www.ndrc.gov.cn/jjxsfx/t20060317_126320.htm

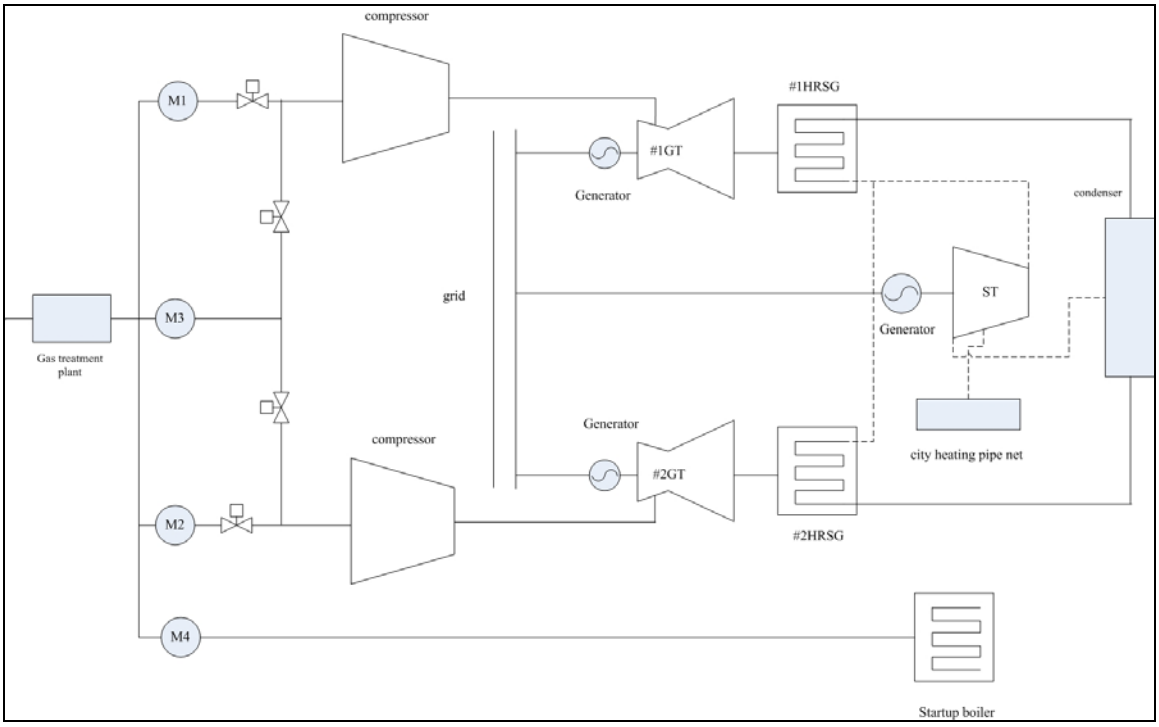
According to the China DNA, of the new thermal power plants built between 2000-2005, 21% of new units were 600MW, 60% of new units were 300MW and above and the remainder had a unit capacity of less than 300MW per unit. Data used by the DNA is derived from other official sources such as the China Energy Year Book and China Electrical Power Year Book. The China DNA operates under the auspices of the National Development and Reform Committee of China, the body responsible for many aspects of national economic and social development in China, including energy policy and planning. Statistics from the China DNA can therefore be regarded as reliable.

Issue 14. The monitoring plan should specify the means of determining the natural gas and diesel consumption.

- **Gas consumption monitoring:** Gas consumption will be measured using gas flow meters. These will be maintained and calibrated regularly according to Chinese regulations and standards. As detailed in annex 4 of the PDD, there are four meters monitoring gas consumption: meters 1 and 2 measuring gas to each compressor and a meter 3 as a back-up. Meter 4 measures gas sent to the start-up boiler. Gas consumption will therefore be calculated by:

  $$\mathbf{FC_{Gas} = M1 + M2 + M4}$$

  M3 will act as a back-up in case of failure of M1 or M2. As a further back-up, sales receipts of gas supplied by the gas company will be used. The gas meters will automatically compensate for changes in temperature and pressure of the natural gas so that FC_{gas} is given at normal temperature and pressure.



- **Diesel consumption monitoring:** A volume flow meter will be installed on the main fuel supply line and measure the volume of diesel consumed in litres by the diesel gensets. This will be converted to the mass of diesel consumed using the standard density of diesel (0.85 kg/litre), giving FC_{diesel}. The flow meter will maintained and calibrated according to Chinese regulations and standards. As a back-up, sales receipts from the diesel supply company will be used.

- As described in Annex 4 of the PDD, regular meter readings will be taken and these readings checked with the back-up sales receipts. Any discrepancies will be reported to the General Manager. Finally

readings will be stored in the CDM management information system, in accordance with the company's management procedures.

Please see also the revised PDD.