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Request for Review

Dear Sirs,

Please find below the response to the review formulated for the CDM project with the title "*Dalian Tuchengzi Wind Power Project 30 MW*" with the registration number 2209. In case you have any further inquiries please let us know as we kindly assist you.

Yours sincerely,

Cuiyun Zhang
Carbon Management Service

Enclosures

Annex: the Wind Power Generation (assessment reference for on-grid eletricity)

Industrie Service

Response to the CDM Executive Board

Issue 1

Further clarification is required on how the TÜV SÜD has validated the appropriateness of additional costs in line with the requirements of EB 38 paragraph 54(b), as the first PDD for GSC (1 December 2007) considered a higher IRR and did not considered the supplementary FSR (elaborated in August 2007).

Response from the Project Participant

The owner of the proposed project Dalian Tuchengzi Wind Farm had provided the data of wind source measured at height of 50m to the Liaoning Electric Power Survey & Design Institute for compiling FSR. And the experts of Liaoning Electric Power Survey & Design Institute considered that the annual electricity generation could be increased with 5.2% while the hub height at 60m by theoretical calculations. Therefore, the experts of Liaoning Electric Power Survey & Design Institute suggested constructing the hub with 60m high for the proposed project[1]. Thereafter the financial values in the FSR are based on data with the hub height of 60m.
As a matter of fact, there isn't a model of wind turbine which the hub height is 60m in the series of WD49-750[2] in the process of linking up with Dalian Tuchengzi Wind Power Co., Ltd. after the FSR had been finished. The designers of Liaoning Electric Power Survey & Design Institute had given a supplemental FSR of the hub height 50m immediately. The staff of CDM Office Liaoning Province had neglected the supplementary FSR and had still adopted those financial data in the FSR in the process of compiling the PDD, and so resulted in the first PDD for GSC (1 December 2007) considered a higher IRR and did not consider the supplementary FSR (elaborated in August 2007). Therefore, the owner of the proposed project Dalian Tuchengzi Wind Farm had to ask staff of CDM Office Liaoning Province to correct the relevant data according to the supplementary FSR (elaborated in August 2007) when the TÜV SÜD found it out during on-the-spot audit.

Thereafter the relevant financial values were revised in the updated PDD on the basis of the supplementary FSR.

Response by TÜV SÜD

EB 38 paragraph 54 (b):

The values used in the PDD and associated annexes are fully consistent with the FSR, and where inconsistencies occur the TÜV SÜD should validate the appropriateness of the values.

According to the EB guidelines, input values were assessed very carefully for the proposed project. The values in the first PDD for GSC were referred the data from FSR, which was developed in August 2007 by Liaoning Electric Power Survey & Design Institute, an independent

1 This information is in the page 86 in FSR of the proposed project.
2 http://www.chinawindey.com/Products.asp?TypeID=08

third party qualified by the Chinese Government. In this version, 60m hub height was adopted. Correspondingly more electricity was generated due to the richer wind resources, which caused to higher IRR. Meanwhile, the supplementary FSR was supplied by the same institute as an optional scenario with 50m high hub. During on-site validation, it was found 50m high hub was applied. So the evaluation was based on the actual situation with 50m high hub. Obviously the IRR value is reduced from 7.74% to 6.96% in the updated PDD caused by lower electricity generation, which was originated due to the difference between different wind resources from different hub heights. The validation team has compared these two documents and could confirm that besides the annual power generation, there are no other values were different in IRR calculation between FSR and supplementary FSR.

Issue 2

The TÜV SÜD 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 further explanation of the reported values of annual electricity generation and electricity supply to grid.

Response from the Project Participant

The guidance of EB 38 paragraph 54(c) demonstrates that the input values from the FSR should be confirmed to be valid and applicable at the time of the investment decision by crosschecking or in other appropriate manners on the basis of its specific local and sectoral expertise. All input values used in the financial analysis of this project are taken from the supplementary FSR that was approved by Dalian Development and Reform Commission. A feasibility study report (FSR) in China is required to be developed by a third party, accredited by the government. Therefore, the values can be regarded plausible and trustworthy. Among all the values four are the key ones as below:

1) Investment on Fixed Assets

The investment on the fixed assets of 244.49 million RMB applied in PDD comes from supplementary FSR, which mainly include several components like the cost on purchasing and installation of the wind-turbines, the cost on the construction, the cost related to the on-site sub-step station, the cost of land purchasing and etc. Particularly the investment on the main equipments of turbines generally contributes around 65%[3] of the total Investment on Fixed Asset (67.28% for this project). Recently the investment for wind power generation is 8000-10000 RMB/kW[4] in China, and in the proposed project the investment per kW is 8150 RMB. Additionally, the value from supplementary FSR could be cross-checked by the actual cost on the main components for its validity and applicability. The cost constituting most of the investment on fixed assets are summarized as below:

[3] Preliminary study of wind power project investment and power price, Qingyuan Zhang, Ruiqing Liu, 2006
[4] http://cppcc.people.com.cn/GB/34961/45560/45565/3262150.html

Term	Value of Cost (RMB)	Percent of Total Investment on Fixed Assets shown in FSR (%)
Wind Turbine Equipments and services Purchasing	164,490,700[5]	67.28
Main Construction	30,018,677.7[6]	12.28
Total	194,509,377.7	79.56

2) Annual O&M cost

In PDD Annual O&M Cost comes from supplementary FSR and is 6.982 Million RMB annually, which is 4.24% of the cost of the wind turbine for the proposed project. The O&M cost of wind farm normally equals to 3%-5% of the cost of the wind turbine[7]. The IRR is 7.28% when the annual O&M cost decreases by more than 10%. The IRR will reach the benchmark 8% when the annual O&M cost decreases by more than 29.4%. The annual O&M cost consist of five parts, materials, wage and welfare, overhaul fund, insurance and other expense in the supplementary FSR[8]. The material fee, wage and other fees from FSR are fixed during operational life. The overhaul fund is deducted from 1.5% to 2% of the static total investment for the proposed project each year in the operational life according to the document <The provisional regulation for the economical estimation of technique reform of power industrial project > issued by the State Energy Department[9]. The insurance expense will decrease along with the time in operational life. The wage and welfare, overhaul fund are the two main parts of the annual O&M cost. Both of them contain from 75.9% to 84.9% for all the annual O&M cost in the operational life. The cost of wage and welfare is increasing in recent years[10]. Therefore the O&M cost of the project is impossible to decrease.

3) The Feed-In-Tariff

The feed-in tariff being anticipated in supplementary FSR of the proposed project is 0.60 RMB / kWh (including VAT). In China the feed-in tariff wind power project is determined by the government within the same grid should enjoy the same tariff and it can be stable. According to the documents issued by NDRC (FAGAIJIAGE[2007]No.3303) [11] and (FAGAIJIAGE [2008]No.1876)[12], the approved tariff of wind power projects in Liaoning Province in 2007 and 2008 is 0.61 RMB/ kWh (including VAT) before the operation hours reaching to 30000 h , after that the tariff reduces to the local average electricity price. The feed-in tariff would be lower than 0.61 RMB/ kWh (including VAT) actually for the wind farms in Liaoning Province during the 20 years of operation life. The IRR would be 7.18% for the proposed project even if the feed-in tariff is 0.61 RMB/ kWh (including VAT), which is lower than the benchmark IRR. So the feed-in

[5] The price comes from the contract of wind power turbine WD-750kW
[6] The price comes from seven of the construction contracts, which cover most of the main work on the construction like the construction of the power plant, foundations of wind turbines and etc.
[7] http://www.p5w.net/newfortune/fxs/baogao/dlsb/200709/P020070929554327034210.pdf
[8] Table of estimation for total cost
[9] http://www.fsou.com/redirect/index.asp?url=http://vip.chinalawinfo.com/newlaw2002/slc/slc.asp?db=chl&gid=24745
[10] http://news.xinhuanet.com/fortune/2008-01/18/content_7445014.htm
[11] http://www.ndrc.gov.cn/zcfb/zcfbtz/2007tongzhi/t20080218_193193.htm
[12] http://www.ndrc.gov.cn/zcfb/zcfbtz/2008tongzhi/t20080813_230718.htm

tariff 0.60 RMB / kWh (including VAT) being anticipated in supplementary FSR of the proposed project is conservative.

4) Annual electricity generation and electricity supply to grid

The operational hours of Dalian Tuchengzi Wind Power Project 30 MW is estimated to be 2233 hours per year. In China, the operational hours of wind power plant are 2000-2400 hours per year[13] generally. This value is mainly influenced by the turbine availability, grid availability and the wind speed. For the Dalian Tuchengzi Wind Power Project 30 MW, it is assumed in the PDD and supplementary FSR that the turbine availability and grid availability is maximized. The annual power supply in the supplementary FSR was calculated on basis of the wind speed data from the on-site wind data measurements from July 1st of 2005 to June 30th of 2006 and with reference of the historical wind speeds between 1977 and 2005 measured by Meteorological Station in Wafangdian City. The annual power supply of the wind turbines are assumed same for the whole project life time in the supplementary FSR and the PDD. But the actual sales of electricity of wind power project are usually less than the estimation from the supplementary FSR[14]. So, the operational hours of Dalian Tuchengzi Wind Power Project 30 MW are optimistic values.

The annual electricity generation of the proposed projected in the supplementary FSR is a theoretical value calculated on the basis of the frequency curve of wind velocity and the power curve of wind power generating unit under the normal condition. And the electricity supplied to the grid should be a value considering the corrections of following aspects:

i. The utilization rate of the wind turbine unit;
ii. The wear and tear of leaves;
iii. The loss of transmission line & own consumption;
iv. The influence of controlling and turbulent flow;
v. Guarantee the power curve.

These 5 aspects above referred to the second paragraph of <Wind Power Generation>[15] which was published by China Electric Power Press in 2003. The estimation for the loss of each aspect was taken as following:

i. The utilization rate of the wind turbine unit is 95% (loss of 5%);
ii. A loss of 2% from the wear and tear of leaves. It is because the wear & tear of the vanes cause a higher roughness on surface of the vanes and diminish pneumatic performance. Thus the power generating quantity becomes lower as well.
iii. The loss of 4% caused by transmission line & own consumption;
iv. A deal of 2 % comes from the influence of controlling and turbulent flow. Here the control means that controlling of the status of the wind turbine unit following the variation of the wind direction and speed. In practice, the control leads a electricity loss.
v. 5% to guarantee the power curve. The turbine producer has guaranteed that the power curve measured in practice will reach 95% of the standard power curve, The power

[13] http://cppcc.people.com.cn/GB/34961/45560/45565/3262150.html
[14] <Implementation on Review and Appraisal of Chinese Renewable Energy Law> compiled by Institute of Energy of Chinese National Development and Reform Commission http://www.efchina.org/csepupfiles/report/200762245523267.84008610380704.pdf/RE%20Law%20Implementation%20Review_070408%20CN.pdf
[15] <Wind Power Generation> , China Electric Power Press, 2003

curve has been confirmed by the Lloyd Company German16. Therefore, a loss of 5% is reasonable.

In general speaking the electricity supply to grid has a loss around 20% compare with the theoretical electricity generation of wind turbine in different model.[17]

Thus loss 18% for the electricity supply to grid comparing with the theoretical electricity generation of wind turbine in the supplementary FSR is suitable.

Response by TÜV SÜD

EB 38 paragraph 54(c) guidance:

"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 supplementary Feasibility Study Report (FSR) was developed in August 2007 by Liaoning Electric Power Survey & Design Institute, which is a qualified third party. And its approval was released on 9 December 2007 by Dalian Development and Reform Committee. Hence, TÜV SÜD is strongly convinced that applied input values (total static investment, net electricity to the Grid, tariffs and O&M costs) from supplementary FSR for IRR calculation is appropriate in the context of the project activity. And all the values have been cross-checked as follows:

1. Investment on Fixed Assets

The specific investment for wind power generation is 8 to 10 million RMB/MW in China according to the statistics from the Chinese New Energy[18]. The value of the proposed project is 8.15 million RMB/MW among the range. So the assumption is deemed reasonable.

In addition, TÜV SÜD has cross-checked the contract of wind power turbine WD-750kW and seven construction contracts. According to the detailed statement, these main expenses for the project have been around 0.26 million RMB more than the estimation in supplementary FSR, in which those cost reached 183 million RMB. Thus TÜV SÜD confirmed the total static investment applied in supplementary FSR was credible and conservative.

2. Annual O&M cost

The estimation of annual O&M cost was appropriate and conservative in supplementary FSR.

During the validation assessment, TÜV SÜD compared annual O&M cost in supplementary FSR with actual costs which already took place. The main constituent, employee wages & welfare were compared with the Compensation and Benefit List. The actual cost was slightly higher than the estimation in supplementary FSR, 1566 RMB more with actual value.

[16] The power curve comes from the contract of wind power turbine WD-750kW
[17] http://www.360doc.com/content/080110/11/25463_960535.html
[18] http://www.newenergy.org.cn/

3. The Feed-In-Tariff

The Feed-in tariff estimated in supplementary FSR was 0.60 RMB/kWh (including VAT). In China, the feed-in tariff of wind power projects is determined by the government within the same grid. According to the approval of the feed-in tariff for wind farm project issued by NDRC in 2007 and 2008, the feed-in tariff is determined maximum as 0.61 RMB/kWh (including VAT) in Liaoning Province. Additionally, this tariff is only applicable for the wind farm projects for which operational hours are within 30,000 hours. Later on the wind farm projects will be applied the average feed-in tariff of local power grid. The feed-in tariff for wind farm is supported by Chinese government, so it is generally much higher than the average tariff which considered the parts of fossil-fuel power. So the feed-in tariff for wind project will be lower than 0.61 RMB/kWh (including VAT) after 30,000 hours operational time. Even though 0.61 RMB/kWh (including VAT) is applied for the proposed project, the IRR will be 7.18%, which is still lower than the benchmark. So the feed-in tariff of 0.60 RMB/kWh (including VAT) assumed in supplementary FSR is deemed plausible.

4. Annual electricity generation and electricity supply to grid

The electricity generation value in supplementary FSR is the product of installed capacity and the designed operational hours for the proposed project. The installed capacity has been verified by cross-checking the *supply contract of Dalian Tuchengzi 40×750 kW wind generator units*. The designed operational hours of the proposed project in supplementary FSR was estimated based on the wind speed data from the on-site wind data measurements from July 1st 2005 to June 30th 2006 and with reference of the historical wind speeds between 1977 and 2005 measured by Wafangdian City Meteorological Station. This supplementary FSR was developed by Liaoning Electric Power Survey & Design Institute, which is fully experienced with wind project survey and accredited with grade A by the Chinese Government. The supplementary FSR was approved by the local DRC on 9 November 2007. So the operational hours of Dalian Tuchengzi Wind Power Project 30 MW accordingly estimated as 2233 hours are reasonable. All electricity self-consuming and losses were assessed and correctly deducted from annual electricity generation. TÜV SÜD refers to the expert opinions during the validation, and details are presented as following.

The wind technology and power generation estimation was represented by the specialists, Mr. Wang Chengxi and Mr. Zhang Yuan, in *the Wind Power Generation*, published by China Electric Power Press in 2003. The original reference document will be supplied together with the response. According to the reference, it is mentioned that the net electricity to the grid should be corrected with following five aspects.

a) Operating factor of wind turbine gensets

   The availability of the wind turbine gensets is around 95% due to the malfunction, overhaul and grid power cut. In the proposed project, the loss was estimated as 5%.

b) Blade loss from contamination

   Blade surface roughness will be higher if the blades are polluted. Correspondingly worse aerodynamic characteristics cause lower power generations. Due to the reason,

generally contamination coefficient is set as 3%. A loss of 2% was estimated for the proposed wind project.

c) Plant electrical consumption and line loss

According to the experience from operational wind farms, the loss for this part is normally estimated as 3% to 5%. The loss of 4% caused by transmission line & own consumption was calculated for the proposed project.

d) Loss due to control and turbulence

Controlling in the actual operation must be taken according to the changes of wind speed and direction. The real-time adjustment will have 5% loss by the effect of turbulence. 2% loss came from the influence of controlling and turbulent flow was adopted for the proposed project.

e) Air density corrections

Wind power density is directly proportional to air density, so the actual power curve could be revised with elasticity coefficient. Here

Elasticity coefficient = average air density (project location) / standard air density,

where standard air density is 1.225kg/m^3.

In the proposed project, 5% loss was taken from the standard power curve, which was certified by WINDTEST Kaiser-Wilhelm-Koog GmbH, the daughter firm of Germanischer Lloyd AG offering the full range of turbine measurement services.

So 18% gap between the electricity supplied to the grid and the theoretical electricity generated is reasonable. All in all, TÜV SÜD confirmed the net electricity generation applied in the IRR calculation was realistic.