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CDM Executive Board

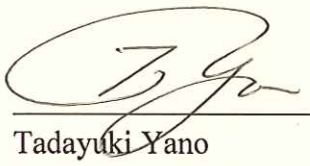
Clarification on Request for Review for "Energy efficiency improvements of Pucheng Power Plant through retrofitting turbines in China" (Ref.4667)

Dear Honorable Members of the CDM Executive Board,

This is referring to the above-mentioned Request for Review.
Please find our response to the request for review for the above mentioned project No. 4667.

If you have any questions, please do not hesitate to contact us.

Yours sincerely,



Tadayuki Yano
Senior Executive
Japan Quality Assurance Organization

Initial Response to Request for Review issued by EB for "Energy efficiency improvements of Pucheng Power Plant through retrofitting turbines in China" (Ref. 4667)

1. The DOE is requested to further substantiate: (a) the technological barrier and how the CDM has helped it to overcome the barrier; and (b) the first-of-its-kind argument, in particular, to justify the criteria applied to limit to "300 MW class power plants" and to clarify if there have been retrofitting projects in any of the power plants connected to North West power grid; if so, what the uniqueness of the project activity is. In doing so, please refer to VVM v1.2 paragraph 117.

DOE's response

1.(a) substantiation of the technological barrier and how the CDM has helped it to overcome the barrier

The basic barrier is economical barrier as stated in Step 3 Investment analysis of Section B.5 of the PDD, but the following technological barriers should be also taken into consideration.

- The technological barrier

  - Project-specific technological barrier

    The two turbines (No.1 and No.2 units) concerned were manufactured by General Turbine, Inc. (Manufacturer in Bucharest, Romania) and delivered from Romania to China as consideration of loan. These two turbines have been in commercial operation since 1996 and 1998, respectively. However, the critical information such as drawing for detailed design of the turbines, except for the information necessary for the maintenance and inspection, was not available at that time from Romania to China Huadian Corporation which is the parent company of Shaanxi Huadian Pucheng Power Generation Co., Ltd (hereinafter referred to as Project company). As a result, they had to newly remake a precise drawing upon retrofitting by themselves.

  - Technological barrier upon retrofitting turbines

    There existed the technological difficulties upon the retrofitting of the

relevant turbines because there had not been any retrofitting experiences on 57units of 300MW-class turbine connected to North West Power Grid (Refer to 1 (b) below).

The thermal efficiency of steam turbines is directly determined by the optimization of steam flow path, i.e., the performance of rotating blades and stator vanes of turbines, which needs the use of the most advanced technology to implement the retrofitting of turbines.

The remake of precise drawing based on the accurate measurement of the relevant parts of turbines and high-precision processing technology are essential for the implementation of turbine retrofitting. Therefore, there existed a high technological barrier for the turbine retrofitting, taking the level of such technologies in China at that time into consideration.

- Role of CDM to overcome the technological barrier

Mitsubishi Research Institute, Inc. (hereinafter referred to as MRI), consultant of the project activity, visited China Huadian Corporation in Beijing in December 2005, and made approach about the improvement of low-efficiency steam turbines by the CDM scheme. As described in the validation report, prior to the consultation by MRI, the Feasibility Study Report (hereinafter referred to as FSR) of the turbine retrofit project was prepared by Northwest Electric Power Research Institute in February 2005 because Project company had already recognized the low efficiency of the two turbines. As the result of technical feasibility analysis in case of using domestic and foreign technologies, the FSR concluded that only the technology of Alstom (a foreign technology) could be recommended because Alstom was the developer of the turbine concerned and also had advanced, matured and credible technology for turbine retrofitting. However, Project company hesitated to put the retrofitting into action due to the following reasons:

- The risk of retrofitting fault which leads to lower efficiency than estimated, due to the technological barriers mentioned above,
- The higher estimated cost for the retrofitting with the Alstom's technology compared to other suppliers'.

With the explanation by the experts on the side of MRI and by introducing some examples of small-scale turbine (less than 200MW) retrofitting with

high-precision processing technology in China through the technical collaboration between Hitachi Co., Ltd. and Dongfang Turbine Co., Ltd., China Huadian Corporation was convinced of the feasibility of the turbine retrofitting plan. The plan was approved by China Huadian Corporation on 27 March 2006, and then the decision of implementation of the project was made by Project company on 12 May 2006. Under technological circumstances in China at that time, the technology-sharing agreement between Dongfang Turbine Co., Ltd. (China) and Hitachi Co., Ltd (Japan) greatly contributed to the solution of the technological barriers which the Project company had faced

This case is a good example which has eliminated the high risk of technological/economical barriers through the introduction of one of the most advanced Japanese technologies and CDM scheme in the retrofitting of turbines which requires high-precision processing technology.

Thus JQA has confirmed that the consultation from the MRI helped Project company to overcome the technological barriers and to minimize the financial risk due to the technological failure in the turbine retrofitting project. It can be confirmed that the CDM incentive was a decisive factor for the PPs to invest on the turbine retrofitting project.

The PPs' consideration in the PDD that no alternative scenarios are eliminated by the technological barrier because of the rapid technological development in China through the technological cooperation with developed countries is deemed conservative.

1.(b) substantiation of the first-of-its-kind argument

- Justification of the criteria applied to limit to "300 MW class power plants"

The reduction of CO_2 emissions and the promotion of energy savings were one of the key policies in the 11th Five Year Plan (2006-2010) in China. The installation of large-scale power plants, the abolition of old small-scale (less than 200MW) and low-efficiency power plants and improvement of power generation efficiency have been strongly promoted in the field of power industry. Table 1 shows that as of 2009, the medium sized 200-400MW class power plant has highest proportion in the composition ratio, followed by a large class of more than 400MW (Appendix 1). Most of the large-scale

power plants with high efficiency have been introduced during the last ten years, meanwhile the medium-sized plants were mostly introduced in the 1980s and many of them were low in efficiency. Hence, the efficiency improvement of 300MW class turbine is an important issue to promote energy saving in the energy sector of China. From the above technological background in China, the criteria applied to limit to "300 MW class power plants" is deemed reasonable.

Table 1 Capacity and ratio of coal-fired power plant in China

Year	Total capacity of coal-fired power plant (MW)	Capacity of electricity generation unit (MW)		
		0–200 MW class	200–400 MW class	400–1000 MW class
2000	235,402	103,507 (43.6 %)	111,955 (47.2 %)	19,940 (8.4 %)
2009	631,065	154,976 (23.8 %)	251,977 (38.7 %)	224,112 (34.3 %)

- Retrofitting project in NWPG

JQA has confirmed through the interview with the officials of Shaanxi Development and Reform Committee and the review of a list of 57 units of 300MW-class power plants in North West Power Grid provided by the PP that none of turbines is retrofitted not only in Shaanxi Province but in NWPG. The list presents the result of the investigation by Northwest Electric Power Research Institute (changed the name to Shaanxi Electric Power Research Institute in December 2006) which produced the FSR of the project activity.

Furthermore, JQA has interviewed two experts in China about the retrofitting of turbine as follows.

- Interview with Dr. Li Bao-Qing[1], Vice President of FDPT

[1] Position: Deputy Technology Department Manager, Research Department Manager.
Academy: Master and PhD degrees in School of Material Science and Engineering, Tianjin University between 1996 and 2002.
Major research: Computational Structural Mechanics and Materials Technology and Application. He conducted as a Chief Technical Engineer and Officer who has taken charge for designing of turbine capacity of 300MW.
His accomplishments effectively facilitate the Chinese turbine manufacture and production industry's evolution, particularly in the conception and methodology of design.

He has extensively familiar with the turbine retrofitting project in China with technical information.

According to his comments, the retrofitting projects of 300MW-class turbine have started from around 2005 and more than fifty turbine retrofitting projects are currently completed in China. It seems that the proposed project is the first case in the retrofitting of 300MW-class turbine in NWPG.

- Interview with Professor Xu Hong[2]

According to his comments, retrofitting turbine projects were mainly implemented by Dongfang Steam Turbine Factory, Harbin Steam Turbine Factory, Shanghai Steam Turbine Factory, Beijing Full Three Dimension Power Engineering Co.,Ltd. (FTDPE), and Beijing Full Four Dimension Power Tech.Co.,Ltd. (FDPT), etc. Therefore, JQA conducted telephone survey against Dongfang Steam Turbine Factory, Harbin Steam Turbine Factory, Shanghai Steam Turbine Factory and web survey against FTDPE and the FDPT.

As a result of the telephone survey, the former three companies answered as follows:

- Dongfang Steam Turbine Factory: No retrofitting turbine projects in NWPG except the proposed project activity were conducted. It was evidenced by the list of retrofitting turbine project of the company (Appendix 2).
- Harbin Steam Turbine Factory: No retrofitting turbine projects in NWPG were conducted. It was evidenced by the list of retrofitting turbine project of the company (Appendix 3).
- Shanghai Steam Turbine Factory: No retrofitting projects of turbines which were manufactured by other companies were conducted.

As a result of the web survey, the following results are obtained through the list of retrofitting projects:

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[2] Position: Dean of the School of Energy, Power and Mechanical Engineering of North China Electric Power University (NCEPU), the senior member of Chinese Society for Electrical Engineering (CSEE) and the committee member of National Standardization Technical Committee of Turbine (NSTCT).
Major research: Theoretical and experimental study on the intensity of power generation equipment, damage characterization and detection techniques of high-temperature component, and energy saving of thermal power plant.

- FTDPE[3]: No retrofitting turbine projects in NWPG were conducted.
- FDPT[4]: No retrofitting turbine projects in NWPG were conducted.

Through the interview with the experts and the government officials, the review of the list prepared by the independent third party and telephone and web surveys, JQA could not find any retrofitting projects connected to NWPG except this project, and concludes that no retrofitting turbine projects were implemented in NWPG at the time of decision making to proceed with the CDM project activity and hence the project was “first-of-its-kind”.

[3] Retrofitting project list of FTDPE: http://www.bf3d.com.cn/ShowInfo.asp?id=122&pid=136
[4] Retrofitting project list of FDPT: http://www.fulldipower.com.cn/case01.asp

2. The DOE is requested to further explain how it has validated: (a) the assumption made in the investment analysis that the net power export to the grid remains unchanged as reasonable as the project activity increases the installed capacity by 60 MW (from 660 to 720 MW); (b) the baseline and project activity power output, providing details such as the operating hours of the plant; and (c) whether there is any increase in the power export; if so please include this parameter in the sensitivity analysis as per VVM v1.2, paragraph 111.e and EB 51 Annex 58 paragraph 17.

DOE's response

JQA checked the historical performance data of the power plant for the purpose of assessing if the net power supply to the grid remains unchanged before and after the implementation of the project activity.

Net electricity supply to the grid and operating hours of the power plant in 2006-2011 are summarized in Figure 1 and Figure 2, respectively (Appendix 4).

(Unit: MWh)

Phase	Turbine	2006	2007	2008	2009	2010	2011	
							Annual estimate using half-year data	(half year: Jan-Jun)
I (Project)	No.1	1,360,024	1,414,918	1,595,788	558,496	1,631,390	1,269,924	(634,962)
	No.2	1,710,194	1,685,454	1,814,276	834,052	1,245,309	1,601,072	(800,536)
	Total	3,070,218	3,100,372	3,410,064	1,392,548	2,876,699	2,870,996	(1,435,498)

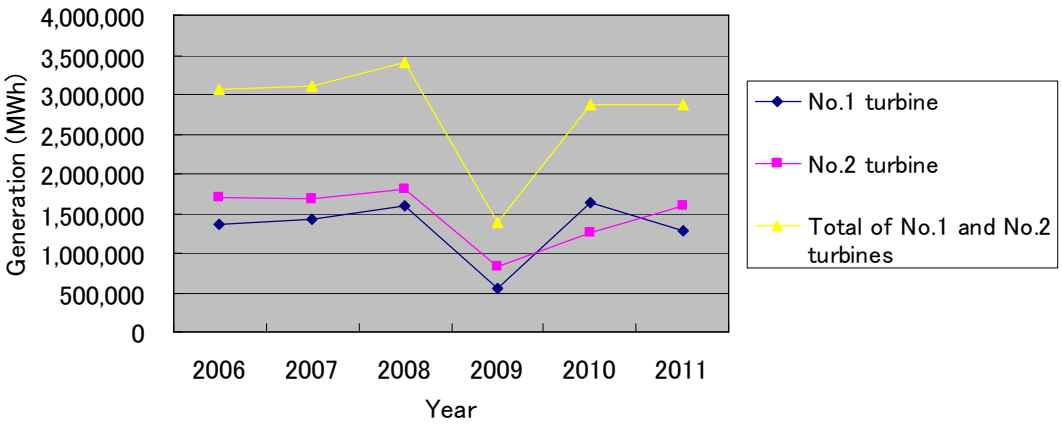

Figure 1. Net electricity supply to the grid before and after retrofitting of turbine

(Unit: hr)

Phase	Turbine	2006	2007	2008	2009	2010	2011	
							Annual estimate using half-year data	(half year: Jan-Jun)
I (Project)	No.1	6517.70	6535.05	7165.78	2755.17	7248.40	5,705	(2,852.57)
	No.2	8059.05	7790.41	8299.26	3716.46	5928.26	7,066	(3,533.18)
	Avg.	7,288	7,163	7,733	3,236	6,588	6,386	(3,192.88)

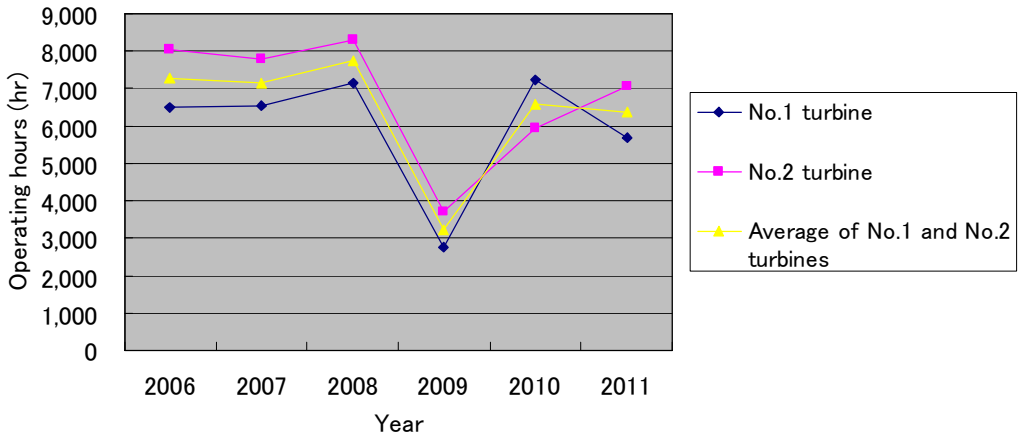

Figure 2. Operating hours before and after retrofitting of turbine

It should be noted that the annual values in 2011 are re-calculated based on the actual data from January to June. The results of net electricity supply to the grid and operating hours are found to be at the same level before and after the retrofitting. The data of net electricity and operating hours in 2009 were smaller than those in other years, due to the retrofitting process of turbines.

Meanwhile, it is explained in the validation report that the amount of power remains unchanged before and after the project based on the agreement with the Grid (PPA). In the PPA and the Notification (only 2009) (Appendix 5), the amount of electricity supply to the Grid by Project company including this project (Phase I) are determined as shown in Table 2, but the amount of electricity supply from this project alone is not specified. JQA calculated the amount of power supply from this project (Phase I), based on the generation capacity of each Phase, to assess if the electricity supply from the project had been increased after the retrofitting of the project turbines. The calculated amount of electricity supply from the project in 2010 has become smaller compared to those before retrofitting (2006-2008). As

described in the PDD, it can be confirmed that the contracted quantity would not be increased by the project activity.

Table 2　Electricity supplied to the grid determined by the PPA

(Unit: GWh)

Phase	Turbine	2006	2007	2008	2009	2010
I	No.1,2	6,072	6,072	5,495	4,103	3,828
II	No.3,4					
III	No.5,6	-	-	-	2,622	3,727
Total		6,072	6,072	5,495	6,725	7,555
Phase I (estimated using capacity ratio)		3,036	3,036	2,748	2,052	2,088

Phase I (the proposed CDM project activity): 330MW×2 (until 2009), 360MW×2 (from 2010)

Phase II: 330MW×2

Phase III: 660MW×2 (Commercial operation was started in 2009)

From the above, the PP's assumption used for the investment analysis that the net power supply to the grid would not increase in spite of the increase of 60MW in installed capacity (660MW⇒720MW) is justified.　Therefore, the net power supply to the grid is not considered as a parameter of sensitivity analysis in the PDD.

3. The DOE is requested to explain how it has validated the assumptions in the emission reduction calculations; in particular, the net power export to the grid to remain unchanged after the project implementation while the installed capacity is increased from 660 MW to 720 MW according to the page 5 of the PDD. In doing so, please refer to VVM v1.2 paragraph 91 and AM0062 v1 page 8. Further, in case there is an increase in the power exported to the grid, the DOE is requested to explain why the provisions under equation 1 (option a) the methodology is not considered.

DOE's response

As stated in the DOE's response to Review Comment 2, it is proven that the net power supply to the grid remains unchanged before and after the implementation of the project activity.

Hence, JQA concludes that the application of Equation 3 (Case c) of AM 0062 in the emission reductions calculation is valid.

List of Appendices

Appendix 1	Dr. Li Bao-Qing, Full Dimension Power Tech. Co., Ltd.: “Energy saving and environmental technology in the coal-fired power generation, and business matching of operation and maintenance technology”, Japan-China Renovation Workshop 2011, 23-24 Feb. 2011.
Appendix 2	List of retrofitting turbine project of Dongfang Steam Turbine Factory.
Appendix 3	List of retrofitting turbine project of Harbin Steam Turbine Factory.
Appendix 4	Monthly operation record of Pucheng Plant from 2006 to Jun. 2011
Appendix 5	Power Purchase Agreements in 2006, 2007, 2008 and 2010 Notification on Electric Power Purchase Plan for the year 2009 issued by Shaanxi Electric Power Company