CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 03 - in effect as of: 28 July 2006

CONTENTS

SECTION A. General description of project activity

A.1. Title of the project activity:

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Title: 65MW Dagushan hydropower Project in China

This version of document: 05

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A.2. Description of the project activity:

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The Dagushan Hydropower Project (hereinafter referred as “DHP” or “the project”), a run-of-river hydropower project, is located in Su’nan Yugu Autonomous County and about 102 km far from Zhangye City in Gansu Province, China. The proposed project is a new built project which is constructed and operated by Gansu Zhangye Dagushan Hydropower Co.Ltd.

The scenario existing prior to the start of the implementation of the proposed project:

The proposed project is located in Gansu province and covered by Northwest Power Grid (NWPG) which is mainly dominated by fossil fuel power plants. Prior to the start of the implementation of the proposed project, the local electricity is supplied by the NWPG and the installed capacity of the fossil-fuel fired power plants in year 2004-2006 in NWPG was 59.74%, 61.44%, 64.39%.of total capacity. In view of the facility and practicality of technology in China, in nearly future, the dependence on thermal power for energy demand of NWPG will be continuing.

The project scenario:

This project is a run-of-river hydropower project utilizing nature hydro energy in Heihe River, the total installed capacity is 65MW and is expected to supply annually 195.15GWh[1] electricity to the Northwest Power Grid of China (NWPG). The designed operation life of the project is 30 years. The main construction of the project consists of diversion weir, 7.536km tunnel, penstock, high pressure pipelines, power station and 110kV transfer station. Please also refer to section A.4.3 for detailed project technical information.

The project will be connected to the Northwest Power Grid (NWPG) through Gansu Power Grid; the spatial extent of the project boundary includes the project site and the electricity system (NWPG) which the proposed project activity is connected to. As per guidance published by China DNA (national development and reform committee), the Northwest Region Power Grid consists of Shaanxi Grid, Gansu Grid, Qinghai Grid, Ningxia Grid and Xinjiang Grid). The reservoir of the project is located in the deep gorge, the increased submerged area was measured to be 147300 m^2 and the power density is calculated as 441W/m^2 caused by the project; According to methodology ACM0002, the project emissions were neglected.

The baseline scenario:

The baseline scenario is the same as it existing prior to the start of the implementation of the proposed project.

Generated electricity by the proposed project will displace part of the electricity generated by the

[1]Feasibility Study Report of Gansu Zhangye Heihe Dagushan Hydropower project,1-39

Northwest power grid, therefore the emission reduction will be achieved, and the estimated annual GHG emission reductions are 170,015 tCO2e.

The construction and operation of the proposed project will bring prominent environmental and social benefit, and contribute to region sustainable development through following aspects:

- To act as a direct supplement to power grid capacity, and alleviate regional shortage of electricity in a sense;
- Compared with fossil fuel fired plants, the project does not release pollutants into the air, such as sulphur dioxide, nitrogen oxide and particulates, nor does it emit residuals that can give harmful impacts on soil, water etc;
- To create new job opportunities for the local people during the project construction and operation.

A.3. Project participants:

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Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
P.R. China (host country)	•Private entity: Gansu Zhangye Dagushan Hydropower Co.Ltd.	No
United Kingdom	EcoSecurities International Ltd	No

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

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A.4.1.1. Host Party(ies):

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P.R. China

A.4.1.2. Region/State/Province etc.:

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Gansu Province

A.4.1.3. City/Town/Community etc:

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Su'nan Yugu Autonomous County, Zhangye City

A.4.1.4. Detail of physical location, including information allowing the unique identification of this project activity (maximum one page):

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This project activity is located in the middle of the upper steam of the Heihe River, within the territory of Su'nan Yugu Autonomous County of Gansu Province, approximately 102 km far from Zhangye City. The geographical coordinates of the project are east longitude of 100°01′29″and north altitude of 38°37′21″, as shown in figure 1.

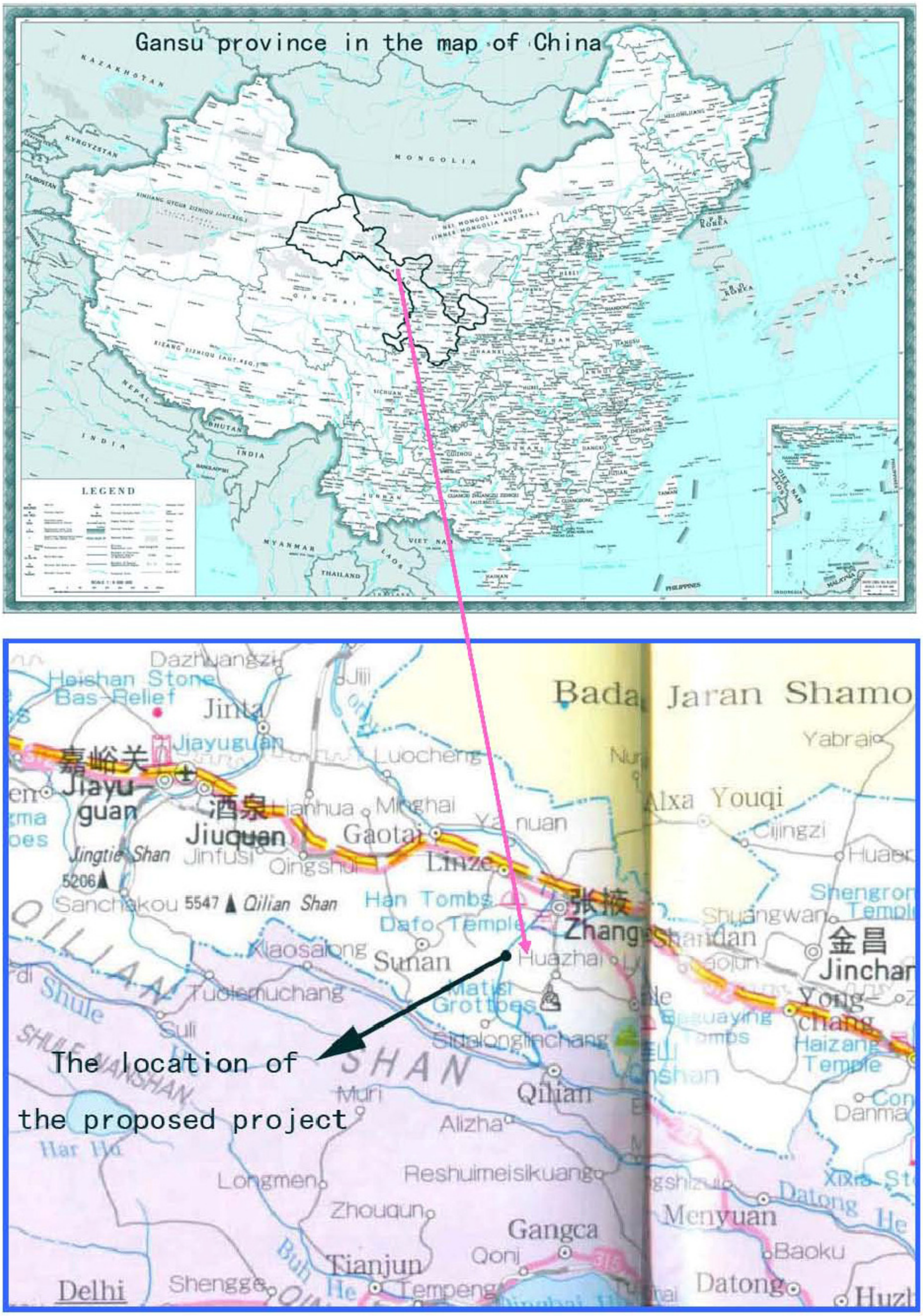

Fig.1. Location of Dagushan Hydropower Project

A.4.2. Category(ies) of project activity:

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The proposed project falls into: Category 1, energy industries (renewable sources), the project activity is grid-connected renewable power generation.

A.4.3. Technology to be employed by the project activity:

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Scenario existing prior to the implementation of the proposed project:
The location of the proposed project is covered by the NWPG. The total installed capacity of the NWPG and installed capacities by fossil fuels power, hydropower, nuclear power, wind power and others, in 2006 is showed as follows(References: China Electric Power Yearbook 2007):

Item	Unit	Total	Share in total capacity
Thermal power	MW	29627	67.11%
Hydro power	MW	14074	31.88%
Nuclear power	MW	0	0.00%
Wind power and others	MW	445	1.01%
Total	MW	44146	100.00%

It can be concluded that the NWPG is mainly dominated by the fossil-fuel fired power plants.

Information of the proposed project

This project is a run-of-river hydropower project, the total installed capacity is 65MW served by two 26 MW generators and one 13MW generator. The designed operation life of the project is 30 years.

The main construction of the project consists of a diversion weir, a tunnel, a penstock, high pressure pipelines, a power station and a transfer station. Through the penstock, the water head is formed taking advantage of the natural height drop through tunnel, which then enters into the pressure adjustment well. The hydraulic pressure of the water is increased through high pressure pipeline, and then the water flows into the turbines and drives the generator to produce electricity. Finally, the voltage of the generated electricity is increased to 330 kV and the electricity is delivered to the NWPG.

The information on key equipments as follows:

Table 1 Summary of key equipments in the proposed project[2]

Equipment	Parameter	Unit	Amount
Turbine	Units(large/small)	-	3（2*large/1*small）
	Model(large/small)	-	HL（257）-LJ-225/ HL（257）-LJ-160
	Rated Header	m	73
	Rated Flow(large/small)	m^3/s	40/21
	Rated Rotation Speed(large/small)	r/min	300/428.6
	Rated Power(large/small)	MW	27.3/13.6
	Annual operation time	h	3094
Generator	Model(large/small)	-	SF-J26-20/4800/SF-J13-14/3400

[2] Purchase Contract of Turbines and Generators（DGS－SB—01）.

	Rated Power	MW	26/13
	Rated Voltage	kV	10.5
	Rated Rotation Speed	r/min	300/428.6

All equipments are supplied domestically and no technology transfer to the host country is occurred.

According to FSR, the increased submerged area was measured to be 147300m^2 and the power density is calculated as 441W/m^2. According to methodology ACM0002, the project emissions from the reservoir may be neglected.

Baseline scenario of the proposed project

The baseline scenario is the same as the scenario existing prior to the start of implementation of the project activity.

A.4.4. Estimated amount of emission reductions over the chosen crediting period:

The annual estimated amount of emission reductions of the proposed project are 170,015 tCO_2e and the total reductions are 1,190,103 tCO_2e in the first crediting period (2010-2016).

Years	**Annual estimation of emission reductions in tonnes of CO_2 e**
01/01/2010-31/12/2010	170,015
01/01/2011-31/12/2011	170,015
01/01/2012-31/12/2012	170,015
01/01/2013-31/12/2013	170,015
01/01/2014-31/12/2014	170,015
01/01/2015-31/12/2015	170,015
01/01/2016-31/12/2016	170,015
Total estimated reductions (tonnes of CO_2e)	1,190,103
Total number of crediting years	7
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	170,015

A.4.5. Public funding of the project activity:

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No public funding from the annex 1 country is involved in this project activity.

SECTION B. Application of a baseline and monitoring methodology:

B.1. Title and reference of the approved baseline and monitoring methodology applied to the project activity:

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Version 10 of the approved methodology ACM0002 “Consolidated methodology for grid-connected electricity generation from renewable source” and “Consolidated monitoring methodology for grid-connected electricity generation from renewable source” were adopted.

http://cdm.unfccc.int/UserManagement/FileStorage/NF9EDAOV5K382HW0JR14GS7XYQUMCP .

Version 05.2 of "Tool for the Demonstration and Assessment of Additionality" are used. For more information, please refer to the following website:

http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v5.2.pdf

Tool to calculate the emission factor for an electricity system version 02.

http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v2.pdf

B.2. Justification of the choice of the methodology and why it is applicable to the project activity:

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ACM0002 (Version 10) is applicable to this project for the following reasons:

- This project activity is new built grid-connected (connected to Northwest China Power Grid through Gansu Provincial Grid) hydro power project;
- This project activity does not involve switching from fossil fuels to renewable energy at the project site;
- The Northwest China Power Grid is identified as project boundary of which information on the characteristics is publicly available;
- The proposed project includes a reservoir which has a flooded area of 147300m^2 and the power density is calculated as 441W/m^2, which is greater than 4 W/m^2.

To conclude, ACM0002 (Version 10) is applicable to this project activity.

B.3. Description of how the sources and gases included in the project boundary:

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	Source	Gas	Included ?	Justification / Explanation
Baseline	Electricity supplied by NWPG	CO_2	Yes	Main emission source and the only gas identified in the baseline methodology
		CH_4	No	Excluded for simplification, it is conservative
		N_2O	No	Excluded for simplification, it is conservative
Project Activity	Proposed Project	CO_2	No	Zero-emissions grid-connected electricity generation from renewable energy
		CH_4	No	the project is run-of-river hydropower plant, and the power density is more than 10 W/m^2
		N_2O	No	Zero-emissions grid-connected electricity generation from renewable energy

Referring to the descriptions in the baseline methodology ACM0002 "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" (Version 10), the spatial extent of the project boundary includes the project site and the electricity system which applies to the proposed project activity-Northwest Region Power Grid(including Shaanxi Grid, Gansu Grid, Qinghai Grid, Ningxia Grid and Xinjiang Grid). Flow diagram of the proposed project boundary is showed in fig 2.

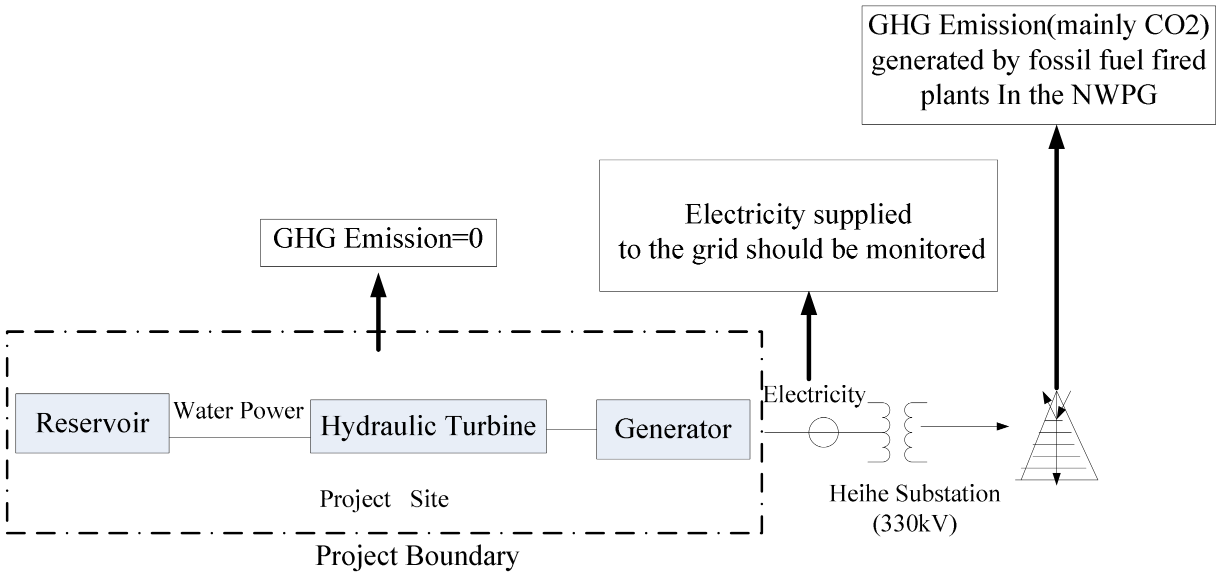

Fig2 Flow diagram of the proposed project boundary

B.4. Description of how the baseline scenario is identified and description of the identified baseline scenario:

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According to ACM0002 v10, if the project activity is the installation of a new grid-connected renewable power plant/ unit, the baseline is the following:

Electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in the "Tool to calculate the emission factor for an electricity system" (version 02).

The NWPG only possesses 24.71% of its total electricity generation that come from renewable energy sources in 2006, 27.44% in 2005,22.46% in 2004, 19.34% in 2003 and 23.76% in 2002 . Hence, the low operating cost/must run sources is much less than 50% of the total grid generation. Consequently, Simple OM method is selected to calculate the Operating Margin emission factor of the proposed project.

According to ACM0002, baseline emissions are equal to the power generated by the project that is delivered to the Northwest China Power Grid, multiplied by the baseline emission factor. The baseline emission factor (EF_y) is calculated as a Combined Margin (CM), which consists of the weighted average of Operating Margin (OM) emission factor and Build Margin (BM) factor. An ex-ante 3 years data vintage for the Northwest China Power Grid is used. The key parameters used for emission reductions calculation are as follow:

Parameter	Unit	Value
EF_{OM}	tCO_2e/MWh	1.1225
EF_{BM}	tCO_2e/MWh	0.6199
EF_y	tCO_2e/MWh	0.8712

The emission reductions calculations are specified in Section 6 and Annex 3.

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM project activity (assessment and demonstration of additionality):

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The additionality of the proposed project activity is demonstrated and assessed using the latest version of the "Tool for the demonstration and assessment of additionality" (version 05.2), as following steps:

Step1. Identification of alternatives to the project activity consistent with current laws and regulations

Sub-step 1a. Define alternatives to the project activity:

4 possible alternatives to the proposed project activity were identified as followings:

1) This project activity is undertaken not as a CDM project activity;
2) Construct a fossil fuel-fired power plant with equivalent annual power supply
3) Construct a power plant using other renewable energy with equivalent annual power supply
4) Equivalent annual electricity supplied by Northwest China Power Grid ;

Besides hydro, solar pV, geothermal, biomass and wind are the possible grid-connected renewable energy technologies that could be applied in the NWPG. Due to the technology development status and the high cost for power generation, solar pV[3], geothermal[4], biomass of the similar installed capacity as the proposed project are alternatives far from being attractive investment in the grid in China. Only wind power projects have the investment return rate that can compete over that of hydropower projects in China. However, DHP is on the Heihe River with the rich water resource. Therefore, there is no suitable geographic condition to develop the wind farm at the project site[5]. So the alternative 3 is not feasible as an alternative scenario.

Sub-step 1b. Enforcement of applicable laws and regulations:

Alternative 2) is not in compliance with applicable legal and regulatory requirements. According to Chinese regulations, coal-fired power plants of less than 135MW are prohibited for construction in the areas covered by the large grids such as provincial grids[6] and fuel-fired power plants with installed capacity less than 100 MW is strictly restricted for construction[7]. In general, the annual operation hours for a fossil fuel-fired power plant are greater than that of a hydropower plant. Therefore the capacity of a fossil fuel-fired power plant to generate equivalent electricity is less than 65MW, the possible alternative of building a similar scale fossil fuel-fired power plant conflicts with these regulations, it is also not a realistic alternative.

[3] Source: Page 54, *China Solar PV Report 2007*, China Environment Science Press. The cost of solar PV is USD 0.5/kWh, which is around RMB 3.7/kWh.

[4] Source: Page 6 of *Overview of Chinese Renewable Energy Development*, NDRC/GEF/Word Bank China Renewable Energy Development Project, May 2004. Geothermal technology is still in demonstration stage in China

[5] China wind power report 2008, Page 22.

[6] General Office of the State Council [Decree No. 2002-6]: Notice on Strictly Prohibiting the Construction of Coal-fired Power Plants with Installed Capacity of 135 MW or Below

[7] Temporary Stipulation of Construction & Management of Small Scale Fuel-fired Generators, August, 1997

All alternatives in sub-step 1a except alternative 2) are consistent with China's relevant laws and regulations.

Step 2. Investment analysis

It will be demonstrated by following sub-steps that the proposed project activity is the economically or financially less attractive than other alternatives without the revenue from the sale of certified emission reductions (CERs).

Sub-step 2a. Determine appropriate analysis method

In "Tools for the demonstration and assessment of additionality" (V05.2), three options are given for the investment analysis: the simple cost analysis, the investment comparison analysis and the benchmark analysis.

The simple cost analysis is not applicable for the proposed project because the project activity will produce economic benefit (from electricity sale) other than CERs income. The investment comparison analysis is also not applicable for the proposed project because the other possible alternative 4) is not a specific investment choice. The benchmark analysis is thus used for investment analysis, and the Financial Internal Return Rate (FIRR) for total investment is used to analyze whether this project activity is financially feasible or not.

Sub-step 2b – Option III. Apply benchmark analysis

The project faces a barrier to implementation due to the poor returns on investment. To illustrate this, we performed a benchmark analysis in which calculate the Internal Rate of Return (IRR) of the project and compare this with a benchmark stated in the *Interim Rules on Economic Assessment of Electrical Engineering Retrofit Projects*[8], issued by the State Power Corporation of China. This publication provides an 8% Internal Rate of Return (IRR) benchmark as a guideline for investments in the power sector. The IRR is defined as a project IRR based on cash in and outflows only, and does not take into account the source of financing.

Sub-step 2c. Calculation and comparison of financial indicators.

The tariff which can be available for the proposed project owner when they made the CDM consideration is based on the document of "Notice on regulating the price conflict of NWPG and related issues form NDRC [9], so the tariff of 0.227 RMB Yuan per kWh was adopted by the proposed project. Main parameters for the calculation of FIRR were derived from the FSR of the proposed project, as table 2 shows. The FIRR of the proposed project is 5.28%, which is lower than the benchmark rate of 8%, so the DHP is financially unattractive. But if it be registered as a CDM project successfully, the economic indicators will be improved taking the incomes from CERs into account. Based on the expecting carbon price of 100 RMB Yuan/ tCO_2, considering the incomes from CERs sells in the whole renewable crediting period, The FIRR of DHP will rise to 8.27% and the proposed project is economically practical.

Table 2 Main Parameters for the Calculation of Financial Indicators

Item	Unit	Value	comments
Capacity	MW	65	Feasibility Study
Generated electricity	MWh/year	201,140	Feasibility Study

[8] *Interim Rules on Economic Assessment of Electric Engineering Retrofit Projects (Ref no.: GuoDian Fa [2002](263))*

[9] Notice on regulating the price conflict of NWPG and related issues form NDRC(No. fagaijiage[2004]1125)

Supplied electricity	MWh/year	195,150	Feasibility Study
Static total investment	Million RMB Yuan	434.24	Feasibility Study
Annual O&M cost	Million RMB Yuan	8.42	Feasibility Study
Electricity Tariff (including VAT)	RMB Yuan/kWh	0.227	Documents from Price Bureau in Gansu Province
Value Added Tax (VAT)	%	17	Feasibility Study
Income Tax	%	33	Feasibility Study
Additional tax on city building and education	%	3	Feasibility Study
Depreciation rate	%	4.5	Feasibility Study
Expected CERs Price	RMB Yuan / tCO_2	100	Estimation
CERs Crediting Period	Year	7×3	Selected

Table 3 Financial Indicators of DHP with and without Income from CDM

Financial indicators	**Without income from CDM**	**Benchmark rate**	**With income from CDM**
FIRR	**5.28%**	**8%**	**8.27%**

Sub-step 2d. Sensitivity analysis

Four parameters are considered in the following sensitivity analysis:

- Static total investment.
- Annual O&M Cost
- Power generation
- Tariff

Assuming the above three factors vary in the range of -10%-+10%, the FIRR of the proposed project (without the income from CERs sales) varies to different extents, as shown in fig.3.

Table 4 Sensitivity test for the proposed project

Range Parameter	-10.0%	-5.0%	0.0%	5.0%	10.0%
Static total investment	6.11%	5.68%	5.28%	4.91%	4.57%
Annual O&M Cost	5.37%	5.32%	5.28%	5.22%	5.16%
Power Generation	4.45%	4.87%	5.28%	5.68%	6.07%
Tariff	4.45%	4.87%	5.28%	5.68%	6.07%

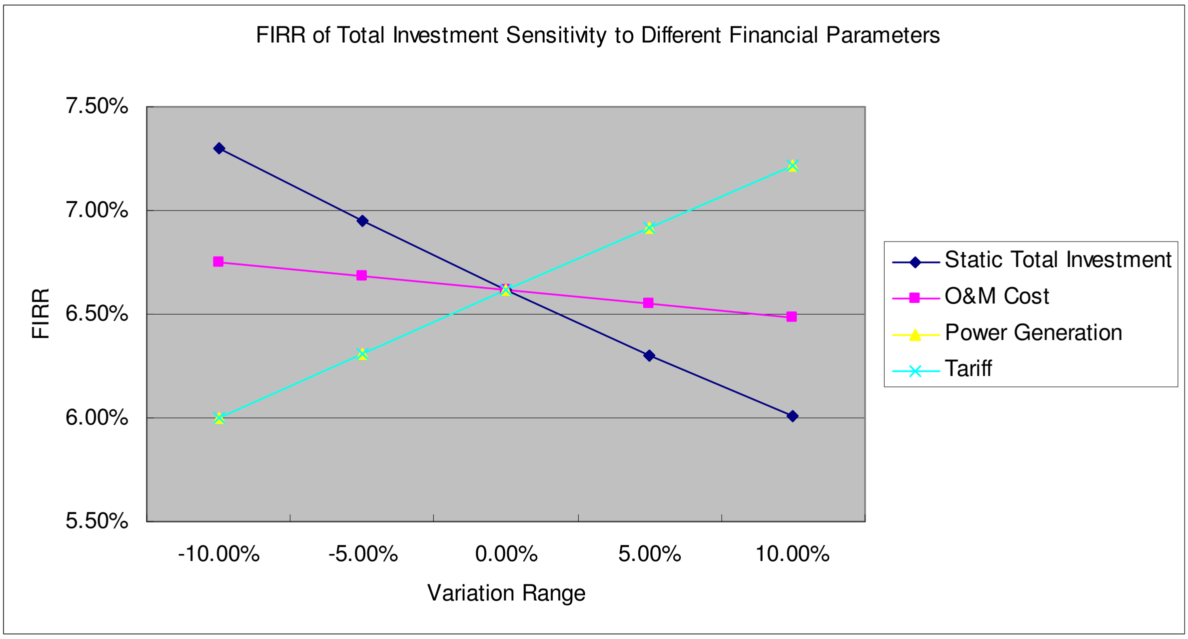

Figure3 Sensitivity analysis of the proposed project (without CERs revenues)

As shown in Table 4 and Figure 3, the annual O&M cost has relative less impact on the project FIRR, and thus be regarded as an insensitive factor. As the chosen parameters vary within the reasonable range, the project FIRR would not reach the benchmark rate. To conclude, that the construction of the DHP is financially viable on the premise of considering the CERs revenue.

To cross-check the conclusion obtained from above analysis process, the possibility of the critical factors lead to project FIRR exceeding the benchmark FIRR is discussed individually as follows:

Table 5 Variations of parameters to make the project FIRR reach the benchmark (8%)

Parameters	Variations
Total investment	-20%
Power Generation	+37.5%
Tariff	+37.5%

Total investment

From the sensitivity analysis result, it could be seen that the project FIRR is almost equal to the benchmark FIRR when the total investment drops by 20%. However, it is unlikely to decline by 20%. Since the project is proposed to be in operation in Sep. 2007, and the main contracts such as purchasing contract of turbines and generators, project construction and installation contracts were already signed, the actual investment of the project reached at 449.52 million RMB by the end of 2008, accounted for 95% of estimated investment cost (464.10 million RMB). Therefore, the total investment of the proposed project is impossible to be decreased by over 20% to exceed benchmark.

Power Generation

Since the annual output was calculated based on long-term flow date (30 years) and the installed capacity (65MW) of the project was approved by local government and will be fixed during the crediting period, it can be concluded that the estimated annual power generation is deemed to the credible and conservative, the great deviation in the annual power generation is unlikely during the crediting period. The input value from the FSR was valid and applicable at the time of the investment decision.

Tariff

In table 5, it is clear indicated that the project FIRR is sensitive to the Feed-in-Tariff: when it increases as 37.5%, the FIRR will achieve the benchmark 8%. The actual approved tariff is 0.227 RMB/kWh (including 17% VAT) for the FSR of the proposed project is approved by Gansu Development and Reform Committee in July, 2007. As well known, the tariff is strictly regulated and controlled by relevant authorities in China, also as per the national financial assessment regulation "Economical Assessment and Parameters for Construction Project, 3rd edition", the fixed tariff should be used for project financial analysis and will be justified in the sensitivity analysis. In the region (Gansu province) the tariff from the year 1996 to 2004 was fixed to be 0.16 RMB/kWh (including 6% VAT), and increased to 0.227 RMB/kWh (including 17% VAT) in year 2005 and year 2008. The average annual increase rate of the tariff after VAT for the hydropower project is calculated as 2.37% during the past twelve years. Therefore, it can be concluded that the increase of tariff 37.5% is not likely.

After above sensitive analysis, FIRR of the project is difficult to reach the benchmark 8% without CERs revenue, which supports the conclusion that the proposed project is unlikely to be financially attractive. Therefore, the proposed project is not the baseline scenario, it's additional.

Step 4. Common practice analysis

Sub-step 4a. Analyze other activities similar to the proposed project activity:

According to the Tool for the Demonstration and Assessment of Additionality, projects are considered "similar" in case they are located in the "same county/region", are of "similar scale", and "take place in a comparable environment with respect to regulatory framework, investment climate, access to technology, access to financing, etc". Therefore, the limit of common practice was determined based on following aspects:

- ✓ The hydropower projects constructed since 2002: A reform of unbundling for power generation and supply has been implemented in China's electric power sector since 2002[10]. After the reform, not only the national or provincial electric power companies but also the private entities were allowed to invest on hydropower projects.

- ✓ The hydropower projects located within Gansu province: Gansu province has around 45.5 ten thousand km^2 of geographical area which is even comparatively and considerably larger than many countries. Second, the policies and regulations are made normally province basis in China. Therefore, Gansu province is defined as the region of the common practice.

- ✓ The hydropower projects with capacity from 50-300MW: According to the state power industry standards of China11, hydropower can be classified into three types: small scale (with an installed capacity less than 50MW), middle-scale (with an installed capacity between 50 and 300MW), large-scale (with an installed capacity greater than 300MW). The proposed project belongs to middle-scale hydropower referring this classification. Small-scale hydro Power (SHP) has different invest environment and tax policy with the projects above 50 MW[12], so similar projects was chose as having the capacity between 50MW to 300MW.

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[10] Notice of National Council Issued about the Power System of Organization Reform Programme(National issued [2002]NO. 5)

[11] Standard for Classification and Flood Control of Water Resources and Hydroelectric Project (SL252-2000)

[12] http://www.aseanenergy.info/News/34001134.htm

A research was performed based on the public information of "China Water Resources Yearbook 2006" and other public available information sources. Hydro power plants with installed capacity between 50MW and 300 MW and constructed in Gansu Province since 2002 were presented in table6:

Table 6 Hydropower plants between 50MW-300MW in Gansu province constructed since 2002

No.	Project name	Location	Basion	Installed capacity (MW)	Construction time	Remark*
1.	Xiaogushan	Sunan county of Gansu Province	Heihe	102	2003.10	Developed under CDM
2	Longshou II	Ganzhou District of Gansu Province	Heihe	157	2002	
3	Hanpingzui	Wen county of Gansu Province	Bailongjiang	72	2005	Developed under CDM
4	Chaijiaxia	county of Gansu Province	Huanghe	96	2006	Developed under CDM
5	Jiulongxia	Diebu county of Gansu Province	Bailongjiang	81	2007.12	Developed under CDM
6	Qilinsi	Wen county of Gansu Province	Bailongjiang	111	2007	Developed under CDM
7	Haidianxia	Lintao county of Gansu Province	taohe	60	2005	Developed under CDM
8	Dalahe	Zhouqu county of Gansu Province	Bailongjiang	52.5	2003	Developed under CDM
9	Erlongshan	Sunan county of Gansu Province	Heihe	50.5	2004.11	Developed under CDM
10	Tiecheng	Yongdeng County of Lanzhou City	Datonghe	51.5	2005	Developed under CDM
11	Sandaowan	Sunan county of Gansu Province	Heihe	112	2004	Developed under CDM

Data source:
1. http://cdm.unfccc.int/Projects/DB/DNV-CUK1156319853.39/view
2. China Water Resources Yearbook 2006, P577
http://www.zdlsdfh.cn/member.asp?EID=80
3. http://www.gansudaily.com.cn/20030123/2/2003123A00281001.htm
4.http://www.sasac.gov.cn/n1180/n1226/n2410/n314274/6028416.html
5. http://www.xinhuanet.com/chinanews/2007-12/10/content_11893699.htm
6. http://www.sasac.gov.cn/n1180/n1226/n2410/n314274/1465409.html
7. http://www.cnki.com.cn/Article/CJFDTotal-GSSJ200704017.htm
8. http://www.chinaccm.com/38/3802/380201/news/20030721/094821.asp
9.http://cdm.unfccc.int/Projects/DB/JCI1145495919.5/view
10. http://www.ydjcdj.gov.cn/E_ReadNews.asp?NewsID=2943
11˙ http://cdm.unfccc.int/Projects/DB/DNV-CUK1185438063.19/view
* http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File2342.pdf

Of the 11 hydropower stations listed in Table 6, 10 are applying for CDM status or have been developed under CDM to overcome barriers they are facing. The only remaining project is Longshou II hydropower project which located in the downstream of the proposed project.

Sub-step 4b. Discuss any similar options that accruing

There are essential distinctions between the proposed project and Longshou II hydropower project:

➢ Operation hours: The annual operation hours of DHP is 3094h, which is significantly less than that of the Longshou II hydropower project (4290h/year[13]). Annual operational hour of a hydropower plant in China evaluated from the annual power generation divided by its installed capacity is an index that represents the availability of the water potential for power generation including seasonal change. Therefore, the Longshou II hydropower plant can enjoy better water potential availability than DHP that leads financially efficient operation.

- The investment per unit capacity: The investment per unit capacity of Longshou II hydropower project is 6253RMB Yuan/ kW, which is less than that of proposed project (7140RMB Yuan/ kWh).
- The investment per unit power generation: The investment per unit power generation of Longshou II hydropower project is 1.86 RMB Yuan/ kWh, which is less than that of proposed project (2.31 RMB Yuan/ kWh).

From the above analyses we can concluded that the proposed project has poorer financial indicators and isn't attractive to investors, when without the financial support from CDM.

Furthermore, comparing with the other registered CDM hydropower projects (Xiaogushan[14], Erlongshan[15] and Sandaowan[16]) which located in the same rive, the proposed project has even lower operation time and higher investment per unit power generation (The operation time of these three CDM project are 3900h, 3444h and 3574h, and investment costs per unit power generation of these three CDM project are 1.63 Yuan/kWh, 1.92 Yuan/kWh, and 1.73Yuan/kWh). Thus the proposed project without CDM revenue is not a common practice.

CDM prior Consideration

Due to the poor financial indicators (FIRR) which was indicated in the project financial assessment report, the project owner decided to develop the project as CDM activity. And with the potential benefit from CDM revenue, the project was finally approved by the local authority, the investment and construction were started consequently.

Timeline of the CDM prior consideration and continue actions

Time	Key events	Remark
09 Mar. 2006	Project financial pre-assessment	The pre-assessment was finalized by qualified 3rd party
Mar 12. 2006	1st directorate Meeting for developing the proposed project as CDM project	Based on poor financial indicator, the management decided to apply CDM to overcome investment barriers
Aug, 2006	Feasibility Study Report (FSR) developed	The revenue of CDM was considered in the FSR and the FIRR with CDM was calculated out as 8.27% correspondingly
Oct 26th---27th. 2006	CDM training	Asia Carbon Expo at Beijing world hotel
Dec 2006	Environment Impact Assessment(EIA)	

[13] Yearbook of China Water Resources, 2006. P 577

[14] http://cdm.unfccc.int/Projects/DB/DNV-CUK1156319853.39/view

[15] http://cdm.unfccc.int/Projects/DB/JCI1145495919.5/view

[16] http://cdm.unfccc.int/Projects/DB/DNV-CUK1185438063.19/view

Mar 19. 2007	EIA was approved by local authority	
Apr 20. 2007	The bank agreed to provide loan with the CDM consideration[17]	The bank loan was approved with premise of CDM
Apr 23. 2007	CDM Consultation contract was signed	
May 16. 2007	Hydro turbines purchasing agreement signed	The date was defined as project starting date which is the earliest date of project real action taken
June 4 . 2007	Project Financial Feasibility was assessed by Asia Development Bank considering the potential CDM revenue	CDM was seriously considered during the bank loan assessment
July 12. 2007	FSR approved by Gansu Development and Reform Committee	CDM revenue was considered in approved FSR
16 July. 2007	2nd directorate Meeting	Status of CDM development was reviewed
July 18. 2007	Tunnel construction signed	
Nov 16. 2007	The start of Construction[18]	Construction was permitted by local authority
Nov 5. 2007	Power house construction signed	
Mar 4. 2008	Asia Development Band (ADB) loan approved	CDM was regarded as the premise to get the approval
Mar.29—31. 2008	CDM training	Trained by China DNA at Chongqing
Apr 17.2008	Applying for China DNA approval	
Apr 29. 2008	Validation contract	
July 30th,2008	Emission Reduction Purchasing Agreement (ERPA) Signed	
July 30. 2008	China LOA	
July,2008	Validation commission	The PDD was published for global stakeholder consultation[19]

According to the timelines, it can be concluded that CDM was seriously considered before the starting of the project activity, and played a key role during the implementation.

B.6. Emission reductions:

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B.6.1. Explanation of methodological choices:

The emission reduction by the project is calculated according to approved consolidated methodology ACM0002（Version 10）. The equation is showed below:

[17] Comments on the loan assessment of Dagushan hydropower project. Released by China Industrial and Commercial Bank Zhangye Branch No. 196 [2007]

[18] Construction was permitted by Gansu Construction Department，No. 620102200711160106

[19] http://cdm.unfccc.int/Projects/Validation/DB/BF44C3HT7I3O9O37WJ5FWXL53VAQYD/view.html

$$ER_y = BE_y - PE_y$$

Where:

ER_y is the emission reductions in year y (t CO_2 e/yr)

BE_y is baseline emissions in year y (t CO_2 e/yr)

PE_y is project emissions in year y (t CO_2 e/yr)

Following procedures are applied to the proposed project activity to calculate BE_y and PE_y :

1. Calculation baseline emissions (BE_y) [20]

According to ACM0002 (version 10), baseline emissions include only CO_2 emission from electricity generation in fossil fuel fired power plants that are displaced due to the project activity, calculated as follows:

$$BE_y = EG_{PJ,y} \times EF_{grid,CM,y}$$

Where:

BE_y = Baseline emission in year y (t CO_2 e/yr)

$EG_{PJ,y}$ = Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year y (MWh/yr).

$EF_{grid,CM,y}$ = Combined margin CO_2 emission factor for grid connected power generation in year y calculated using the latest version of the "Tool to calculate the emission factor for an electricity system" (version 02).

Following steps are applied to calculate the baseline emissions:

(1) Calculation of $EG_{PJ,y}$

Because the project activity is the installation of a new grid-connected renewable power plant at a site where no renewable power plant was operated prior to the implementation of the project activity, the project belongs to (a), Greenfield plants, so

$$EG_{PJ,y} = EG_{facility,y}$$

Where,

$EG_{facility,y}$ = Quantity of net electricity generation supplied by the project plant to the grid in year y (MWh/yr)

(2) Calculation of $EF_{grid,CM,y}$

According to the "Tool to calculate the emission factor for an electricity system" version 02, the calculation of $EF_{grid,CM,y}$ comprises following steps:

Step 1. Identify the relevant electricity systems.

Step 2. Chose whether to include off-grid power plants in the project electricity system (optional)

Step 3. Select a method to determine the operating margin (OM)

Step 4. Calculate the operating margin emission factor according to the selected method.

Step 5. Identify the group of power units to be included in the build margin (BM).

Step 6. Calculate the build margin emission factor.

Step 7. Calculate the combined margin (CM) emissions factor.

Detailed calculation procedures are as follows:

- ***Step1: Identify the relevant electricity systems***

[20] The calculation of the baseline emission factor are referred to "*Notice on the determination of emission factors of China regional power grids in 2008*" at http://cdm.ccchina.gov.cn, which accords with the *"Tool to calculate to the emission factor for an electricity system"* approved by CDM EB.

The project is located in Gansu Province of northwest China. According to the definition of China's DNA on China's regional power grid[21], the relevant power system is Northwest Power Grid (NWPG), which includes Shanxi Power Grid, Gansu Power Grid, Qinghai Power Grid, Ningxia Power Grid and Xinjiang Power Grid.

- ***Step 2: Chose whether to include off-grid power plants in the project electricity system (optional)***

It can be chose between the following two options to calculate the operating margin and build margin emission factor:

Option I: Only grid power plants are included in the calculation.
Option II: Both grid power plants and off-grid power plants are included in the calculation.

In China, off-grid power generation is not significant. So Option I is chosen.

- ***Step 3: Select a method to determine the operating margin (OM)***

The calculation of the operation margin emission factor ($EF_{grid,\ OM,\ y}$) is based on one of the following methods:

(a) Simple OM, or
(b) Simple adjusted OM, or
(c) Dispatch data analysis OM, or
(d) Average OM
For method (a): This method can only be used where low-cost/must run resources constitute less than 50% of total grid generation in: 1) average of the five most recent years, or 2) based on long-term average for hydroelectricity production. For the most recent 5 years, low-cost/must run resources constitute less than 50% of total generation of NWPG (showed in table 8[22]). So this method should be applicable to calculate $EF_{grid,\ OM,\ y}$.

Table 8 the Proportion of Low-cost/Must Run Resources in NWPG

Years / Energy Source	2002	2003	2004	2005	2006
Total Power Generation (GWh)	99,592	115,625	142,612	184562	198,491
Total Low-cost/must run resources (Hydro)	23,645	22,330	31,145	42801	47,817
Total Low-cost/must run resources (Others)	18	34	484	7852	1,237
The Proportion of Low-cost/Must Run Resources in NWPG（%）	23.76	19.34	22.46	27.44	24.71

For method (b): This method needs the annual load duration curve of the grid. As the detailed hourly load data in China are not publicly available, it is unfeasible to apply this method.
For method (c): This method should be the first methodological choice according to ACM0002. But dispatch data information is not publicly available in China. So this method is excluded.
For method (d): This method can only be used when low-cost/must run resources constitute more

[21] http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/2008/200887164119674.pdf

[22] China Electric Power Yearbook2003, 2004, 2005, 2006, 2007

than 50% of total grid generation. As described in method (a), this method is unsuitable.

So only method (a), that is simple OM, is applicable to calculate $EF_{grid,\ OM,\ y}$.

In this PDD, ex ante option is selected to calculate the emission factor, that is a 3-year generation-weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation, without requirement to monitor and recalculate the emissions factor during the crediting period.

- ***Step 4: Calculating the operating margin(OM) emission factor according to the selected method***

The OM emission factor is calculated as the generation-weighted average CO_2 emission per unit net electricity generation (t CO_2/MWh) of all generating power plants serving the system, not including low cost/must run power plants/units. It may be calculated:

- Option A: Based on the net electricity generation and a CO2 emission factor of each power unit, or
- Option B: Based on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system.

Because the data on fuel consumption and net electricity generation of each power plant/unit is not available in China, and nuclear and renewable power generation are considered as low-cost/must-run power sources and the quantity of electricity supplied to the grid by these sources is known, Option B is chosen to calculate the operation margin emission factor.

Option B: Calculation based on total fuel consumption and electricity generation of the system.

The simple OM emission factor is calculated based on the net electricity supplied to the grid by all power plants serving NWPG, not including low-cost/must-run power plants/units, and based on the fuel type(s) and total fuel consumption of NWPG, as follows:

$$EF_{grid,OM_{simple},y} = \frac{\sum_i FC_{i,y} \times NCV_{i,y} \times EF_{CO_2,i,y}}{EG_y}$$

Where:

$EF_{grid,OM_{simple},y}$ = Simple operating margin CO_2 emission factor in year y (t CO_2/MWh)

$FC_{i,y}$ = Amount of fossil fuel type *i* consumed in the project electricity system in year y (mass or volume unit)

$NCV_{i,y}$ = Net calorific value (energy content) of fossil fuel type *i* in year y (GJ/mass or volume unit)

$EF_{CO2,i,y}$ = CO_2 emission factor of fossil fuel type *i* in year y (t CO_2/GJ)

EG_y = Net electricity generated and delivered to the grid by all power sources serving the system, not including low–cost/must-run power plants/units, in year y (MWh)

i = All fossil fuel types combusted in power sources in the project electricity system in year y

y = The three most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation.

The details of the calculations are provided in Annex 3. For each of the most recent years for which data are available (2004, 2005, and 2006), first determine the emissions, then the total electricity generation. Then determine the Simple Operating Margin Emissions Factor as the total emissions over these three years divided by the total generation over the same period.

The Simple OM emission factor is calculated ex-ante as a 3-year average (2004-2006): $EF_{grid,OM_{simple},y}$ **=1.1225tCO_2/MWh** (see Annex 3 for details).

- ***Step5: Identify the group of power units to be included in the build margin***

According to the Tool, the sample group of power units *m* used to calculate the build margin consists of either:

(a) The set of five power units that have been built most recently, or

(b) The set of power capacity additions in the electricity system that comprise 20% of the system generation (in MWh), and that have been built most recently.

However, the data of power units is considered commercial confidences in China, and is not available to the public. According to the EB's guidance on DNV deviation request "Request for clarification on use of approved methodology AM0005 for several projects in China", the CDM EB suggested that the project participants use the following alternative solutions in absence of data:

- Use of capacity additions during last 1-3 years for estimating the build margin emission factor for grid electricity, or

- Use the efficiency level of the best technology commercially available in the provincial/regional, or national grid of China, as a conservative proxy, for each fuel type in estimating the fuel consumption to estimate the build margin (BM).

Although the request for deviation was related to AM0005, the deviation is also clearly applicable to ACM0002 for the following reasons:

- AM0005 was valid from 14th April 2004 to 2th March 2006 and after this period, it was replaced by ACM0002.
- The calculation procedures of OM and BM are the same as that described in AM0005.

For the statistics of China Electric Power Yearbook in year 2005, 2006 and 2007, the capacity additions in NWPG during 2004-2006 represents a value that is 24.44% of the total installed capacity in 2006, which make up the build margin. The procedure for determining the power plants that make up the group is shown in Annex 3.

The Tool offers two options for data vintage:

Option 1: For the first crediting period, calculate the build margin emission factor ex-ante based on the most recent information available on units already built for sample group m at the time of CDM-PDD submission to the DOE for validation. For the second crediting period, the build margin emission factor should be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to the DOE. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used. This option does not require monitoring the emission factor during the crediting period.

Option 2: For the first crediting period, the build margin emission factor shall be updated annually, ex-post, including those units built up to the year of registration of the project activity or, if information up to the year of registration is not yet available, including those units built up to the latest year for which information is available. For the second crediting period, the build margin emissions factor shall be calculated ex-ante, as described in option 1 above. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used.

Project participants have chosen Option 1.

- ***Step 6 Calculate the build margin emission factor***

According to the tool, the build margin emissions factor is the generation-weighted average emission factor (t CO_2/MWh) of all power units *m* during the most recent year y for which power generation data is available, calculated as follows:

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}}$$

Where:

$EF_{grid,BM,y}$ = Build margin CO_2 emission factor in year *y* (t CO_2/MWh)

$EG_{m,y}$ = Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh)

$EF_{EL,m,y}$ = CO_2 emission factor of power unit m in year y (t CO_2/MWh)

m = Power units included in the build margin

y = Most recent historical year for which power generation data is available

The CO_2 emission factor of each power unit *m* ($EF_{EL,m,y}$) should be determined as per the guidance in step 4 (a) for the simple OM, using options A1, A2, using for y the most recent historical year for which power generation data is available, and using for *m* the power units included in the build margin. In this PDD, Option A.2 is applied.
According to Option A.2, the emission factor of each power unit *m* should be determined based on the CO_2 emission factor of the fuel used and the efficiency of the power unit, as follows:

$$EF_{EL,m,y} = \frac{EF_{CO_2,m,i,y} \cdot 3.6}{\eta_{m,y}}$$

Where:

$EF_{EL,m,y}$ = CO_2 emission factor of power unit *m* in year y (t CO_2/MWh);

$EF_{CO_2,m,i,y}$ = Average CO_2 emission factor of fuel type *i* used in power unit *m* in year *y* (t CO_2/GJ);

$\eta_{m,y}$ = Average net energy conversion efficiency of power unit *m* in year *y* (ration);

m = All power units serving the grid in year y except low-cost/must-run power units

y = the three most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (ex ant option).

Because it is not possible to distinguish power capacities of coal-fired, oil-fired and gas-fired power plants from fossil fuel-fired thermal power capacity in the current statistical data, the calculation of the emission factor and $EF_{grid,BM,y}$ can be shown the following alternative sub-steps, where the methods are referenced to the "Notice on the determination of emission factors of regional power grids[23]" by Chinese's DNA.

Sub-step 6a *Calculate the respective ratios of CO_2 emissions from coal, oil and gas combustion for power generation in the whole emissions from fossil fuel-based thermal power generation*

The data can be calculated as per the fuel consumptions in China Energy Statistical Yearbook 2007 for which data are available at the time of PDD submission:

$$\lambda_{Coal,y} = \frac{\sum_{i \in Coal,y} FC_{i,y} \times NCV_{i,y} \times EF_{CO_2,i,y}}{\sum_{i,j} FC_{i,y} \times NCV_{i,y} \times EF_{CO_2,i,y}}$$

$$\lambda_{Oil,y} = \frac{\sum_{i \in Oil,y} FC_{i,y} \times NCV_{i,y} \times EF_{CO_2,i,y}}{\sum_{i,y} FC_{i,y} \times NCV_{i,y} \times EF_{CO_2,i,y}}$$

$$\lambda_{Gas,y} = \frac{\sum_{i \in Gas,y} FC_{i,y} \times NCV_{i,y} \times EF_{CO_2,i,y}}{\sum_{i,y} F_{i,y} \times NCV_{i,y} \times EF_{CO_2,i,y}}$$

Where:

$FC_{i,y}$ = Amount of fossil fuel type *i* consumed in the project electricity system in year y (mass or volume unit)

$NCV_{i,y}$ = Net calorific value (energy content) of fossil fuel type *i* in year y (GJ/mass or volume unit)

$EF_{CO2,i,y}$ = CO_2 emission factor of fossil fuel type *i* in year *y* (t CO_2/GJ)
Coal, Oil and *Gas* = The fuel categories, respectively solids fuels, liquid fuels, and gas fuels.

Sub-step6b *Calculate the emission factor of fossil fuel-based thermal power generation*

$$EF_{Thermal} = \lambda_{Coal} \times EF_{Coal,adv} + \lambda_{Oil} \times EF_{Oil,adv} + \lambda_{Gas} \times EF_{Gas,adv}$$

Where:

Where:

$EF_{Coal,adv}$, $EF_{Oil,adv}$ and $EF_{Gas,adv}$ are the emission factor proxies of efficiency level of the most advanced coal-fired, oil-fired and gas-fired power generation technology commercially available in China.

With reference to the "Notice on the determination of emission factors of regional power grids" by Chinese CDM DNA, the weighted average fuel consumption for power generation of 30 sets of 600 MW sub-critical coal-fired power generators built in 2006 (329.94gce/kWh) and the 200 MW oil/gas based combined cycle power generators (252gce/kWh) are taken as the efficiency level of the best technology commercially available in China, which correspond to the supply efficiency 37.28% and48.81%[24].

Based on the formulae above, the emission factor of thermal power plants in the Build Margin is calculated as following(see Annex 3 for details):

$$EF_{Thermal} = \lambda_{Coal} \times EF_{Coal,adv} + \lambda_{Oil} \times EF_{Oil,adv} + \lambda_{Gas} \times EF_{Gas,adv}$$

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[23] http://cdm.ccchina.gov.cn/web/NewsInfo.asp?NewsId=2184

[24]http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/2008/20081231101111351.pdf

=98.49%×0.9135 + 0.11%×0.5706 + 1.41%× 0.4137= 0.9062 (tCO_2/MWh).

***Sub-step 6c** Calculate the BM emission Factor*

$$EF_{grid,BM,y} = \frac{CAP_{Thermal}}{CAP_{Total}} \times EF_{Thermal}$$

Where: CAP_{Total} is the total capacity additions, $CAP_{Thermal}$ is the capacity added of thermal power.

Based on the formulae above in Step6, the BM Emission Factor of NWPG is calculated *ex-ante* as the value 0.6199 tCO_2/MWh [25](see Annex 3 for details).

- ***Step 7 Calculate the combined margin emission factor***

The combined margin emissions factor is given by:

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times w_{OM} + EF_{grid,BM,y} \times w_{BM} \qquad \text{(Tool Eq. 13)}$$

Where:

$EF_{grid,CM,y}$ = Combined margin CO_2 emission factor in year y (tCO_2/MWh)

$EF_{grid,OM,y}$ = Operating margin CO_2 emission factor in year y (tCO_2/MWh)

w_{OM} = Weighting of operating margin emissions factor (%)

$EF_{grid,BM,y}$ = Build margin CO_2 emission factor in year y (tCO_2/MWh)

w_{BM} = Weighting of build margin emissions factor (%)

As indicated in the Tool, 0.5 of default value is used for w_{OM} and w_{BM} in this hydropower project during the first crediting period. Using these values and the values of Operating Margin and Build Margin emission factors, the Combined Margin Emission Factor can be calculated as 0.8712 tCO_2MWh.

2. Calculate the project emissions (PE_y)

The project is a newly built diversion type hydropower plant with low dam, which resulted in a new reservoir. The estimated surface area is 147300m^2 when the reservoir is full and the calculated power density is 441 W/m^2, which is great larger than 10W/m^2. So the project emission PE_y = 0. The power density of the project activity is calculated as follows:

$$PD = \frac{Cap_{PJ} - Cap_{BL}}{A_{PJ} - A_{BL}} = (65\times10^6\text{-}0) / (147300\text{-}0) = 441 \text{ (W/m}^2\text{)}$$

Where:
PD = Power density of the project activity, in W/m^2
Cap_{PJ} = Installed capacity of the hydro power plant after the implementation of the project activity (W)
Cap_{BL} = Installed capacity of the hydro power plant before the implementation of the project activity (W). For new hydro power plants, this value is zero.
A_{PJ} = Area of the reservoir measured in the surface of the water, after the implementation of the project activity, when the reservoir is full (m^2).

[25] There are two edition emission factor published by DNA in year 2008， the first edition emission factor(0.8770tCO_2/ MWh) was wrong and be corrected by DNA in later published emission factor(0.8712tCO_2/ MWh).

A_{BL} = Area of the reservoir measured in the surface of the water, before the implementation of the project activity, when the reservoir is full (m^2). For new reservoirs, this value is zero.

B.6.2. Data and parameters that are available at validation:

Data and parameters are adopted to calculate ex-ante the emission factor that are available when validation is undertaken, they are not monitored throughout the crediting period but are determined only once and thus remains fixed throughout the crediting period. These data and parameters also characterize the connected grid by the proposed project, including installed capacity, generation, consumption ratio by the thermal plants, fuel consumption amount, net calorific value, oxidation factor, CO_2 emission factor, the efficiency level of the best technology commercially available etc

Data / Parameter:	$FC_{,j,y}$
Data unit:	Mt, Mm^3
Description:	the amount of fuel *i* (in a mass or volume unit) consumed by relevant power sources j in year(s) *y*
Source of data used:	China Energy Statistical Yearbook (2005~2007)
Value applied:	See Annex 3 for details
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official released statistic; publicly accessible and reliable data source
Any comment:	Accurate

Data / Parameter:	NCV_i
Data unit:	*TJ/ mass or volume unit of a fuel*
Description:	the net calorific value (energy content) per mass or volume unit of a fuel *i*
Source of data used:	China Energy Statistical Yearbook (2006)
Value applied:	See Annex 3 for details
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official released statistic; publicly accessible and reliable data source
Any comment:	Reasonable

Data / Parameter:	$OXID_i$
Data unit:	%
Description:	The oxidation factor of the fuel i
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2: Energy(Introduction, Table 1-4)
Value applied:	See Annex 3 for details
Justification of the choice of data or description of	IPCC default value

measurement methods and procedures actually applied :	
Any comment:	Reasonable

Data / Parameter:	***$EF_{CO2,i}$***
Data unit:	tCO_2e/TJ
Description:	the CO_2 emission factor per unit of energy of the fuel *i*
Source of data used:	*IPCC Guidelines for National Greenhouse Gas Inventories 2006*
Value applied:	see Annex3 for details
Justification of the choice of data or description of measurement methods and procedures actually applied :	National data not available, so IPCC default values are used.
Any comment:	Reasonable

Data / Parameter:	$G_{j,y}$
Data unit:	MWh
Description:	the amount of electricity generation by source *j* in year *y*
Source of data used:	China Electric Power Yearbook (2005~2007)
Value applied:	See Annex 3 for details
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official statistical data
Any comment:	Accurate

Data / Parameter:	$e_{j,y}$
Data unit:	%
Description:	station service power consumption rate of source *j* in year *y*
Source of data used:	See Annex 3 for details
Value applied:	China Energy Statistical Yearbook (2005~2007)
Justification of the choice of data or description of measurement methods	Official statistical data

and procedures actually applied :	
Any comment:	Reasonable

Data / Parameter:	$EF_{coal,adv}$
Data unit:	tCO_2e/MWh
Description:	Emission factor of most advanced coal-fired power technology that is commercially available
Source of data used:	Notice on the determination of emission factors of regional power grids by Chinese CDM DNA
Value applied:	0.9135
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official statistics of state power authority
Any comment:	Reasonable

Data / Parameter:	$EF_{oil,adv}$
Data unit:	tCO_2e/MWh
Description:	Emission factor of most advanced oil-fired power technology that is commercially available
Source of data used:	Notice on the determination of emission factors of regional power grids by Chinese CDM DNA
Value applied:	0.5706
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official statistics of state power authority
Any comment:	Reasonable

Data / Parameter:	$EF_{gas,adv}$
Data unit:	tCO_2e/MWh
Description:	Emission factor of most advanced gas-fired power technology that is commercially available
Source of data used:	Notice on the determination of emission factors of regional power grids by Chinese CDM DNA
Value applied:	0.4137
Justification of the	Official statistics of state power authority

choice of data or description of measurement methods and procedures actually applied :	
Any comment:	Reasonable

Data / Parameter:	CAP_{Toal}
Data unit:	MW
Description:	The total capacity additions in NWPG during 2004-2006
Source of data used:	China Energy Statistical Yearbook (2005~2007)
Value applied:	See Annex 3 for details
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official statistical data
Any comment:	Accurate

Data / Parameter:	$CAP_{Thermal}$
Data unit:	MW
Description:	the thermal capacity additions in NWPG during 2004-2006
Source of data used:	China Energy Statistical Yearbook (2005~2007)
Value applied:	See Annex 3 for details
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official statistical data
Any comment:	Accurate

Data / Parameter:	CAP_{BL}
Data unit:	W
Description:	Installed capacity of the hydro power plant before the implementation of the project activity. For new hydro power plants, this value is zero.
Source of data used:	Project site
Value applied:	zero
Justification of the choice of data or description of measurement methods	

and procedures actually applied :	
Any comment:	

Data / Parameter:	A_{BL}
Data unit:	m^2
Description:	Area of the reservoir measured in the surface of the water, before the implementation of the project activity, when the reservoir is full (m2). For new reservoirs, this value is zero.
Source of data used:	Project site
Value applied:	zero
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

B.6.3. Ex-ante calculation of emission reductions:

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As described in B.6, the emission reductions of the proposed project are calculated as follows:

Baseline Emissions

Application of the formulae presented in Section B to the baseline data presented in Annex 3 yields the following results:

EF_{OM} =1.1225 tCO_2/ MWh

EF_{BM} =0.6199 tCO_2/ MWh

According to the calculation result above, the combined ex-ante baseline emission factor of the project is 0.8712 tCO_2/ MWh. The calculation equation is as follows:

EF_y ＝1.1225×0.5+0.6199×0.5=0.8712tCO_2/ MWh

According to methodology ACM0002（Version 10）, the estimated annual emission reduction by the project activity during the first crediting period is calculated as follows:

$$ER_y = BE_y - PE_y = EG_{PJ,y} \times EF_{grid,CM,y} - PE_y = EG_{facility,y} \times EF_{grid,CM,y} - PE_y$$

$$=195{,}150\text{MWh} \times 0.8712\ tCO_2/\text{MWh} - 0 = 170{,}015\ tCO_2$$

B.6.4. Summary of the ex-ante estimation of emission reductions:

>>

Year	Estimation of Project activity	Estimation of baseline emission (tonnes of CO_2 e)	Estimation of leakage (tonnes of CO_2e)	Estimation of Emission reductions

	Emission (tonnes of CO_2e)			(tonnes of CO_2 e)
01/01/2010-31/12/2010	0	170,015	0	170,015
01/01/2011-31/12/2011	0	170,015	0	170,015
01/01/2012-31/12/2012	0	170,015	0	170,015
01/01/2013-31/12/2013	0	170,015	0	170,015
01/01/2014-31/12/2014	0	170,015	0	170,015
01/01/2015-31/12/2015	0	170,015	0	170,015
01/01/2016-31/12/2016	0	170,015	0	170,015
Total (t CO_2e)	0	1,190,103	0	1,190,103

B.7. Application of the monitoring methodology and description of the monitoring plan:

>>

B.7.1. Data and parameters monitored:

Data / Parameter:	$EG_{facility,y}$
Data unit:	MWh/yr
Description:	Quantity of net electricity generation supplied by the project plant/unit to the grid in year *y*. $EG_{facility,y}$ is the difference between annual exported electricity ($EG_{g,y}$) and imported electricity ($EG_{a,y}$) of the project.
Source of data:	Project site
Measurement procedures(if any):	Refer to B.7.2. Description of the monitoring plan
Monitoring frequency:	Measured continuously and recorded on a monthly basis.
QA/QC procedures to be applied:	The meters will be calibrated according to the relevant national standard and regulations; Power supplied to the grid will be recorded by both the project owner and the grid company, and cross checked by sales invoices.
Any comment:	

Data / Parameter:	$PR_{g,y}$
Data unit:	MWh
Description:	Electricity imported from auxiliary power line
Source of data:	Directly measured by meter
Measurement procedures(if any):	The power imported from auxiliary power line, and will be measured by M5(showed as fig3 in section **B.7.2**).
Monitoring	Measured continuously and recorded on a monthly basis.

frequency:	
QA/QC procedures to be applied:	M5 with accuracy of 0.5s and will be calibrated according to the relevant national standard and regulations.
Any comment:	Refer to B.7.2. Description of the monitoring plan

Data / Parameter:	CAP_{PJ}
Data unit:	W
Description:	Installed capacity of the hydro power plant after the implementation of the project activity.
Source of data:	Project site
Measurement procedures(if any):	Determine the installed capacity based on recognized standards.
Monitoring frequency:	Yearly
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	A_{PJ}
Data unit:	m^2
Description:	Area of the reservoir measured in the surface of the water, after the implementation of the project activity, when the reservoir is full.
Source of data:	Calculated based on the design schematics and area maps.
Measurement procedures(if any):	The surface area will be calculated using the design schematics and area maps. Photographs of the reservoir at several key locations will be taken when the project becomes operational to check whether the actual reservoir does not deviate substantially for the design.
Monitoring frequency:	Yearly
QA/QC procedures to be applied:	Project direct emission is excluded because the project's power density is 441W/m^2 which is much higher than 10 W/m^2. Further QA/QC procedures are therefore not considered necessary.
Any comment:	The measurement will be carried out by the third authorized party.

B.7.2. Description of the monitoring plan:

1. Purpose of the monitoring procedure

An overall monitoring procedure will be applied to the proposed project. The aim of monitoring procedure is to make sure that the net generated electricity monitored and evaluated during the project activity operation period is completed, consistent, and precise.

2. CDM monitoring team

The DHP entity will set up a CDM team/committee comprising of persons from relevant departments, which will be responsible for monitoring of all the parameters mentioned in this section. The CDM team also comprises of a special group of operators who are assigned the responsibility of monitoring different parameters and record. On a weekly basis, the monitoring reports are checked and discussed by the seniors CDM team members/managers. In case of any irregularity observed by any of the CDM team member, it is informed to the concerned person for necessary actions.

This monitoring plan will be implemented by professional staff authorized by the project sponsor.

3. Data to be monitored

Given the emission factor is ex-ante calculated and according to the ACM0002, the annual electricity delivered to the grid by the proposed project will be monitored. Since the baseline emission factor is calculated ex-ante, the main data to be monitored is:

- Annual net electricity supplied to the NWPG by the proposed project ($EG_{faciltiy,y}$)
- Electricity imported from the grid ($PR_{g,y}$)
- Surface area of the reservoir at full level (A_{PJ})
- Installed capacity of the hydro power plant (CAP_{PJ})

4. Meter Installation

The electricity supply will be metered by the grid company and the project entity. An agreement will be signed between the project owner and the grid company that defines the metering arrangements and the required quality control procedures to ensure accuracy.

The power generated by the proposed project will be transmitted to Heihe Substation(330kV) together with the electricity of Erlongshan Hydropower Station (CDM project, located in the upper reaches of the proposed project), and then to Gansu Grid and finally to NWPG.

The simple diagram of grid connection is as figure 3.

Eleven meters will be required, of which:

Meter M3, M4 (0.2S,bi-directional): Owned by the grid company. M3 and M4 will be installed at the input of Heihe Substation(330kV) of the Grid Company, measures the net power supplied to the grid by the DHP and Erlongshan Hydropower station (M3+M4).

Md1, Md2 and Md3 (0.5S ,single-direction)**:** located at generators of DHP, employed to measure generated electricity by DHP.

Me1, Me2 and Me3 (0.5S, single-direction)**:** located at generators of Erlongshan Hydropower station, employed to measure generated electricity by Erlongshan Hydropower station.

According to Power Purchasing Agreement, the electricity supplied to the grid by the proposed project will be calculated and invoiced as:

$$\left[(M3+M4)\right]\times\left[\frac{EG_{DHP,generated,y}}{\left(EG_{DHP,generated,y}+EG_{Erlongshan,generated,y}\right)}\right]$$

Where:

$EG_{DHP,\ generated,\ y}$ is employed to measure the electricity generated by DHP and calculated as:

$EG_{DHP,\ generated,\ y}$ =Md1+ Md2+ Md3;

$EG_{Erlongshan,\ generated,\ y}$ is employed to measure the electricity generated by Erlongshan Hydropower station and calculated as:

$EG_{Erlongshan,\ generated,\ y}$ = Me1+ Me2+ Me3;

If it is in trouble, the meter **M1 and M2** (0.2S , backup meter, bi-direction) at the power plant booster station(110kV) of DHP are employed to calculate the electricity supplied by the project as (M1+M2). In emergency, 35kV power lines from LongquI hydropower Station will be used to transmit electricity to the project. M5 (0.5S, single-direction) will be employed to measure the electricity from other hydropower station; it will be deducted to calculate the net power supplied to the grid by the project.
The net electricity supplied to the grid by the proposed project will be calculated as:

$$\left[(M3+M4)\right]\times\left[\frac{EG_{DHP,generated,y}}{\left(EG_{DHP,generated,y}+EG_{Erlongshan,generated,y}\right)}\right]-M5$$

In case of malfunction of main meters, the calculation will be (M1+M2)-M5. There is a minor transmission loss from M1 and M2 to M3 and M4, and the transmission losses (according to historical transmission loss rate) will be taken into account in any situation where the backup meter data is used in CDM calculation.

Monitoring of reservoir surface area

The project entity will monitor the surface area of the reservoir by collecting photographic evidence of the surface level when the project becomes operational. This photographic evidence will be compared with the design reservoir dimensions to confirm whether or not the actual surface area substantially deviates from the design surface area.

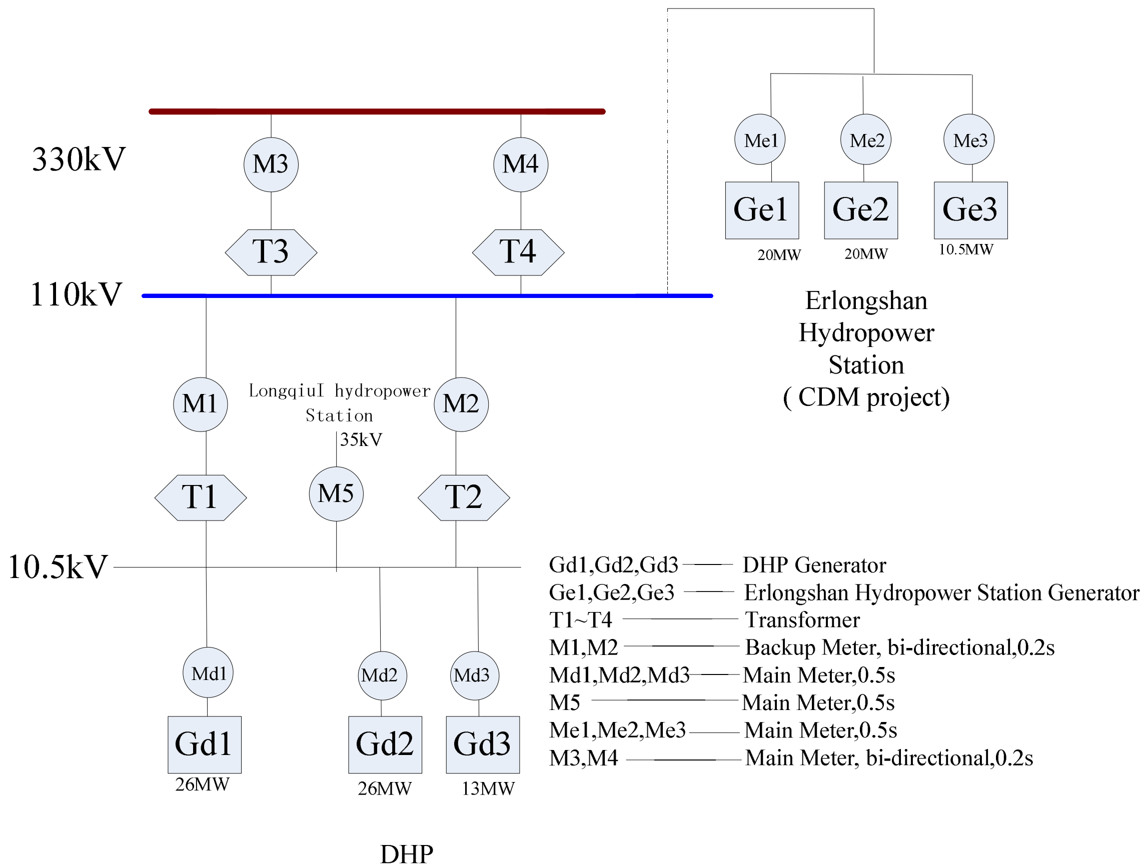

Fig.3 Principal Diagram of the meter positions

5. Quality control

The project owner and the grid corporation will sign an agreement to develop a set of quality control

procedures regarding measurement and calibration so as to maintain the accuracy of the measurement. The electric meters should be examined and undergo regular field calibration according the relevant standards and regulations of the power industry so as to ensure the sophistication of the meters. After the examination, the meters should be sealed. The lift of the seals requires the presence of both the project owner and the grid corporation. One party must not lift the seals or fiddle with the meters without the presence of the other party.
All the meters installed shall be tested by a qualified metering verification institution commissioned jointly by the project owner and the grid corporation within 10 days after:
(a) Detection of a difference larger than the allowable error in the readings of both meters;
(b) The repair of all or part of meter caused by the failure of one or more parts to operated in accordance with the specifications.

6. Data Management System

This provides information on record keeping of the data collected during monitoring. Record keeping is the most important exercise in relation to the monitoring process. Without accurate and efficient record keeping, emission reductions of the proposed project cannot be verified. The data will be measured hourly, record monthly and archived electronically, in addition monthly data also will be printed in paper for a backup.

At the end of each month the monitoring data needs to be filed electronically. The electronic files need to have CD back-up or print-out. The project developer needs to keep electricity sale and purchase invoices.
All written documentation such as maps, drawings, the EIA and the Feasibility study, should be stored and should be available to the verifier so that the reliability of the information may be checked. In order to make it easy for the verifier to retrieve the documentation and information in relation to the project emission reduction verification, the project developer should provide a document register. The document management system will be developed to ensure adequate document control for CDM purposes.
The dedicated CDM Manager of the project developer is responsible for checking the data (according to a formal procedure) and CDM Manager will be responsible for managing the collection, storage and archive of all data and records. A procedure will be developed to manage the CDM record keeping arrangements. All the data shall be kept until two years after the end of credit period.

B.8. Date of completion of the application of the baseline study and monitoring methodology and the name of the responsible person(s)/entity(ies)

>>

The application of baseline study and monitoring methodology was completed on 04/02/2010 by Ying Wang

Orgnization: S.D.F (Beijing) consulting co. Ltd.
Address: No. 39, Landianchan south road, Haidian district, Beijing
Tel/fax: ＋86-10-88859362 0936-8225763
The entity is not one of the Project Participants

SECTION C. Duration of the project activity / Crediting period

C.1. Duration of the project activity:

C.1.1. Starting date of the project activity:

>>

16/05/2007 (Hydro turbines purchasing agreement signed)

C.1.2. Expected operational lifetime of the project activity:

>>

30 years

C.2. Choice of the crediting period and related information:

>>

The proposed project activity would select a renewable crediting period as detailed in C.2.1.

C.2.1. Renewable crediting period

>>

C.2.1.1. Starting date of the first crediting period:

>>

01/01/2010 or the registration date, whichever is later.

C.2.1.2. Length of the first crediting period:

>>

7 years

C.2.2. Fixed crediting period:

>>

Not applicable

C.2.2.1. Starting date:

>>

C.2.2.2. Length:

>>

SECTION D. Environmental impacts

D.1. Documentation on the analysis of the environmental impacts, including transboundary impacts:

>>

The project entity had entrusted Gansu Academy of Environmental Science to assess the environmental impacts of the DHP, finally Gansu Provincial Environmental Protection Agency approved the environmental impact assessment (EIA) of DHP in form of official document (approved file NO. [2007]22), that shows the proposed project in accordance with the claim to environment protection by the host party.

Major conclusions of the approved EIA report are summarized as follows:

1. Ecosystem impact

This project will have little impact on vegetation and bio diversity since there's very sparse vegetation on the riverside mountains located by the project. After project construction, the rehabilitation of vegetation will be conducted on the project site, which will improve the vegetation further. Furthermore, the plant species in the construction site are common species existing in extensive areas and will move near areas during the construction period with little negative impact.

The upstream view will be altered as a result of the project. The diversion reroutes water away from the traditional route taken by the river. Although water is returned to the river after being diverted, the downstream water level is intermittently affected by the project. In order to protect the ecology system, the project developer will ensure that minimum ecological waters flows will be maintained ($4.43m^3/s$), according to the EIA[26], therefore the negative impacts are not considered to be significant.

2. Wastewater

In order to protect the Heihe River from being polluted, the wastewater is not allowed to be discharged into the river directly. During the operation period, the waste water, mainly sanitary waste from the plant staffs, will be treated by an integrated sewage disposal equipment of 10 cubic meters to meet the standard of GB8978-1996, and then will be used for irrigation purpose in the project site.

3. Solid waste

During the construction period, the solid waste includes the engineering waste residue and the domestic garbage. The engineering waste residue will be disposed in dumping sites. And the domestic garbage will be collected and carried to designed dumpsites regularly for disposal.

4. Noise

Noise is mainly caused by the machines and vehicles during construction period. The construction personnel will take precautionary measures during the construction to avoid the negative impacts from noise. Furthermore, the proposed construction site is located in deep gorge with seldom residents resulting in no quarrels of "disturbing of sweet dreams. Hence the noise impact of the proposed project is insignificant.

5. Impact on Qilianshan Natural Reserve

The project is located in the experimental zone of Qilianshan Natural Reserve (QNR). The natural reserve area is classified into core, buffer and experimental zones according to the nature characteristics. In the core and buffer zone any kind of exploitation is prohibited, while in the experimental zone, production and living areas activities are allowed. The project area is not the habitat of wild animals, so through rationally designing and carrying out construction activities, the adverse impact on the wild animals will be very little.

6. Reduce the pollution resulting from coal-fired consumption

When the project is put into operation, the electricity displacement will reduce 77.7 kilo tons of coal consumption, 17.7 tons of CO emission, 3.69 kilo tons of SO_2 emission and 680 tons of NO_x emission, which not only mitigate the local shortage pressure of coal and water, and also improve the local environment quality.

In a word, the proposed project is a renewable energy project and will reduce both GHG emissions and local environmental pollutants caused by coal combustion. The project is a run-of-river hydropower plant flooding no soil or farmland and causing no migration. The project will have positive impact on local environment.

D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

>>

Construction and operation of the DHP will not result in any significant environmental impacts.

[26] EIA report of Dagushan hydropower project, 54

SECTION E. Stakeholders' comments

>>

E.1. Brief description how comments by local stakeholders have been invited and compiled:

>>

The comments from local stakeholders on the proposed project reflected are described in the following three aspects: Format, Major investigated issues and Investigated stakeholders scope.

1. Format

100 questionnaires were distributed in October 2006, and by the end of December 2006, all of the distributed questionnaires had been returned, and the return rate is 100%.

Furthermore, "Notice on Environment Impact of Dagushan Hydropower Project" had been done in the co-ordination office to collect the stakeholders' comments on the project.

2. Major investigated issues

(1) Key environmental problems currently existing in the project construction area

(2) Main impacts on the local environment of the proposed project activity

(3) Contribution of the project to local economic development

(4) Necessity of the proposed project activity

(5) Major impacts of the project on local public living quality

(6) Recommendations on the construction of the project and environmental protection in the construction area

3. Investigated stakeholders scope

The investigated stakeholders include herdsman, forestry authority staff, residents, students, teachers, technicians, environmentalists and governmental officials in Su'nan county and Zhangye city. In order to receive the all-sided stakeholders' options to the proposed project, the investigation had taken full account into the public advice of different ages, civilizations and occupations.

Table 6 statistics results of investigated stakeholders

Items \ Results		Amount	Proportion (%)
Amount of investigated stakeholders	Male	76	76
	Female	24	24
	Total	100	100
Age	<25	6	6
	25-45	28	28
	46-55	50	50
	>55	16	16
Education	Junior middle school or below	52	52
	Senior middle school	14	14
	College or above	34	34
Occupation	workers	24	24
	Peasants and herdsmen	31	31
	Technicians	5	5
	Residents	11	11

	Students and teachers	21	21
	Representatives to the people's congress and people's political consultative conference	5	5
	Environmentalists and others	3	3

E.2. Summary of the comments received:

>>

Comments from the questionnaires are summarized below：
The major public concerns regarding this project are landscape destroy (36%) and noise pollution (28%); regarding the attitude towards the project, 98% support it and only one person object (the attitude of another person is indifferent). The objection reason is that they worry about the possible negative impact on the local eco-environment. Most of the stakeholders think that it should be scientific design, make effort to protect the eco-environment and make full use of the hydro energy resource.

It is the general opinion that the Dagushan hydropower plant is a feasible project depends on viewpoints from experts and officials. The location of the dam was designed aright based on the character of local environment. When the proposed project is put into practice, it will have very positive social, economical and environmental benefits. To minimum the negative impact on ecological ecosystem, water resources and atmospheric environment, the proposed project was designed scientifically and managed strictly.

E.3. Report on how due account was taken of any comments received:

>>

The project owner will pay much attention to the comments and suggestions of stakeholders and will put all of the measures listed in the EIA into effect during construction and operation to protect the local environment.

And the rehabilitation of vegetation will be conducted to mitigate landscape degradation. Meanwhile, vibration reduction and sound insulation measures will be carried out to protect construction workers. As for the 2% stakeholders who worry about the possible negative impact on the local eco-environment, the project owner has take effort to make them understand the little impact on the eco-environment as the EIA conclusion. The project owner will also keep regular communication with the public regarding the construction and operation of this project.

At the same time, according to the stakeholders' requirements, 2 stakeholders among them have been selected and assigned to be the volunteer supervisor of environment protection, who will supervise the environment issue during the construction and operation period at any time.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Project Entity

Organization:	Gansu Zhangye Dagushan Hydropower Co.Ltd.
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Department:	
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Direct FAX:	
Direct tel:	
Personal E-Mail:	cdm@ecosecurities.com

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

>>

No public funding is involved in this project activity.

Annex 3

BASELINE INFORMATION

Step 1. Calculate the Simple Operating Margin emission factor ($EF_{OM,y}$)

According to the "Tool to calculate the emission factor for an electricity system" version 2, the calculation Steps of baseline emissions can be described below.

Step 1. Identify the relevant electricity systems

The project is located in Gansu Province in northwest China. The appropriate power system is the Northwest Power Grid (NWPG), including Shaanxi, Gansu, Qinghai, Ningxia and Xinjiang provinces.

Step 2: Chose whether to include off-grid power plants in the project electricity system (optional)

It can be chose between the following two options to calculate the operating margin and build margin emission factor:
Option I: Only grid power plants are included in the calculation.
Option II: Both grid power plants and off-grid power plants are included in the calculation.
In China, off-grid power generation is not significant. So Option I is chose.

Step 3. Select a method to determine the operating margin (OM)
Several options are provided in the Tool for determining the Operating Margin. The Simple Operating Margin can be used here, since low cost/must run resources account for substantially less than 50% of the total generation.

Within the Simple OM Option, the ex-ante option is chosen, where, according to the Tool, "A 3-year generation-weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation, without requirement to monitor and recalculate the emissions factor during the crediting period".

Step 4. Calculate the operating margin emission factor according to the selected method

According to the Tool Eq.5 and descriptions of B.6 in this document, the following tables (A.1~A.7) calculate the simple OM emission factor of NWPG as per data on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system. For each of the most recent years for which data are available (2004, 2005, and 2006), The Simple Operating Margin Emissions Factor is determined as the total emissions over these three years divided by the total generation over the same period.

Table A.1 Calculation of emissions of NWPG in 2004

Fuel Type	Unit	Shannxi	Gansu	Qinghai	Ningxia	Xinjiang	Subtotal	Carbon content (tc/TJ)	Oxidation Factor (%)	Average low caloric value (MJ/ton,km^3)	CO_2 emissions(tCO_2)
		A	B	C	D	E	F=A+B+C+D +E	G	H	I	J=G*H*I*F*44/12/1000(Volume Unit) J=G*H*I*F*44/12/10000(Mass Unit)
Raw coal	10^4ton	2428.7	1595.9	322.8	1270.1	1240.9	**6858.4**	25.8	100	20908	135,652,074
Cleaned coal	10^4ton						**0**	25.8	100	26344	0
Other washed coal	10^4ton				102.64	10.5	**113.14**	25.8	100	8363	895,096
Coke	10^4ton	0.78					**0.78**	29.2	100	28435	23,747
Coke over gas	100Mm^3		0.3				**0.3**	12.1	100	16726	22,262
Other coal gas	100Mm^3	0.74	1.26				**2**	12.1	100	5227	46,381
Crude oil	10^4ton	0.01				0.06	**0.07**	20	100	41816	2,147
Gasoline	10^4ton	0.02					**0.02**	18.9	100	43070	597
Diesel oil	10^4ton	2.16	0.36		0.05	0.41	**2.98**	20.2	100	42652	94,141
Fuel oil	10^4ton	0.01	0.69			0.3	**1**	21.1	100	41816	32,352
LPG	10^4ton						**0**	17.2	100	50179	0
Refinery gas	10^4ton					3.26	**3.26**	15.7	100	46055	86,430
Natural gas	100Mm^3	1.61	0.59			6.27	**8.47**	15.3	100	38931	1,849,873
Other petroleum products	10^4ton						**0**	20	100	38369	0
Other coking products	10^4ton						**0**	25.8	100	28435	0
Other energy	10^4tce		6.17			3.46	**9.63**	0	100	0	0
Total											138,705,098
Data source： China Energy Statistical Yearbook 2005											

Table A.2 Thermal power generation of NWPG in 2004

Province	**Thermal power generation (MWh)**	**Auxiliary power consumption rate (%)**	**Electricity delivered to the grid (MWh)**
Shannxi	44439000	7.5	41,106,075
Gansu	33242000	6.21	31,177,672
Qinghai	6208000	7.96	5,713,843
Ningxia	25298000	5.45	23,919,259
Xinjiang	22752000	9.07	20,688,394
Total			122,605,243
Data source: China Electric Power Yearbook 2005			

Table A.3 Calculation of emissions of NWPG in 2005

Fuel Type	Unit	Shannxi	Gansu	Qinghai	Ningxia	Xinjiang	Subtotal	Carbon content (tc/TJ)	Oxidation Factor (%)	Average low caloric value (MJ/ton,km^3)	CO_2 emissions(tCO_2e)
		A	B	C	D	E	F=A+B+C +D+E	G	H	I	J=G*H*I*F*44/12/1000(Volume Unit) J=G*H*I*F*44/12/10000(Mass Unit)
Raw coal	10^4ton	2461.28	1597	345.1	1467.7	1358.09	**7229.17**	25.8	100	20908	142,985,522
Cleaned coal	10^4ton	16.22					**16.22**	25.8	100	26344	404,225
Other washed coal	10^4ton	35.56			101.95	10.2	**147.71**	25.8	100	8363	1,168,593
Coke	10^4ton	3.23					**3.23**	29.2	100	28435	98,335
Coke over gas	100Mm^3						**0**	12.1	100	16726	0
Other coal gas	100Mm^3						**0**	12.1	100	5227	0
Crude oil	10^4ton					0.18	**0.18**	20	100	41816	5,520
Gasoline	10^4ton	0.02				0.01	**0.03**	18.9	100	43070	895
Diesel oil	10^4ton	2.24	0.46	0.06		0.5	**3.26**	20.2	100	42652	102,986
Fuel oil	10^4ton	0.01	0.57			0.25	**0.83**	21.1	100	41816	26,852
LPG	10^4ton						**0**	17.2	100	50179	0
Refinery gas	10^4ton					7.71	**7.71**	15.7	100	46055	204,410
Natural gas	100Mm^3	1.46	0.52	1.33		7.81	**11.12**	15.3	100	38931	2,428,640
Other petroleum products	10^4ton						**0**	20	100	38369	0
Other coking products	10^4ton						**0**	25.8	100	28435	0
Other energy	10^4tce	8.24	1.3				**9.54**	0	100	0	0
Total											147,425,979
Data source： China Energy Statistical Yearbook 2006											

Table A.4 Electricity generation of NWPG from the thermal power in 2005

Province	Electricity generation (MWh)	Station service power consumption rate (%)	Electricity delivered to the grid (MWh)
Shannxi	41100000	7.16	38,157,240
Gansu	33106000	4.23	31,705,616
Qinghai	5500000	2.69	5,352,050
Ningxia	27643000	5.73	26,059,056
Xinjiang	26560000	8.8	24,222,720
Total			125,496,682
Data source: China Electric Power Yearbook 2006			

Table A.5 Calculation of emissions of NWPG in 2006

Fuel Type	Unit	Shannxi	Gansu	Qinghai	Ningxia	Xinjiang	Subtotal	Carbon content (tc/TJ)	Oxidation Factor (%)	Average low caloric value (MJ/ton,km^3)	CO_2 emissions(tCO_2e)
		A	B	C	D	E	F=A+B+C+D+E	G	H	I	J=G*H*I*F*44/12/1000(Volume Unit) J=G*H*I*F*44/12/10000(Mass Unit)
Raw coal	10^4ton	2834.44	1660.92	421.86	1833.72	1547.69	**8298.63**	25.8	100	20908	164138337.2
Cleaned coal	10^4ton						**0**	25.8	100	26344	0
Other washed coal	10^4ton				112.7	8.45	**121.15**	25.8	100	8363	958465.8677
Coke	10^4ton				0.01		**0.01**	29.2	100	28435	304.4440667
Coke over gas	100Mm^3	0.2				0.08	**0.28**	12.1	100	16726	20778.15227
Other coal gas	100Mm^3	0.1					**0.1**	12.1	100	5227	2319.045667
Crude oil	10^4ton					0.02	**0.02**	20	100	41816	613.3013333
Gasoline	10^4ton	0.01					**0.01**	18.9	100	43070	298.4751
Diesel oil	10^4ton	1.14	0.24	0.61		1.25	**3.24**	20.2	100	42652	102354.5635
Fuel oil	10^4ton		0.6			0.11	**0.71**	21.1	100	41816	22969.66819
LPG	10^4ton						**0**	17.2	100	50179	0
Refinery gas	10^4ton						**0**	15.7	100	46055	0
Natural gas	100Mm^3	1.59	0.56	1.06		7.49	**10.7**	15.3	100	38931	2336911.137
Other petroleum products	10^4ton						**0**	20	100	38369	0
Other coking products	10^4ton	1.86					**1.86**	25.8	100	28435	50033.0886
Other energy	10^4tce	33.57	8.81			2.2	**44.58**	0	100	0	0
Total										小计	167633385

Data source： China Energy Statistical Yearbook 2007

Table A.6 Electricity generation of NWPG from the thermal power in 2006

Province	Electricity generation (MWh)	Station service power consumption rate (%)	Electricity delivered to the grid (MWh)
Shannxi	54482000	6.97	50684605
Gansu	35738000	4.29	34204840
Qinghai	7204000	2.57	7018857.2
Ningxia	36731000		36731000

Xinjiang	29901000	8.02	27502940
Total			156142241

Data source: China Electric Power Yearbook 2007

The emissions and electricity generation for each of these three years (2004, 2005, and 2006) are summarized in Table A.7 below. The Operating Margin Emission Factor is given by the total emissions over this three-year period divided by the total generation, also shown in Table A.7.

Table A.7 Calculation of simple OM emission factor of NWPG

	Total emissions （tCO_2e）	**Electricity generation (MWh)**	**Weighted average OM (tCO_2/MWh)**
	A	B	C=A/B
2004	**138705098.5**	**122605242.6**	
2005	**147425979.4**	**125496682.3**	
2006	**167633385**	**156142241.4**	
Total			**1.122500955**

<u>Step 5. Identify the groups of power units to be included in the build margin</u>

According to the EB's guidance on DNV deviation request "Request for clarification on use of approved methodology AM0005 for several projects in China", the capacity additions during last 1-3 years that make up 20% of the system is chosen here, since these power plants add up to much more than the last five power plants built. The procedure for determining the capacity additions that make up the group is shown below. Table A.8 lists the installed capacity as of 2006, the most recent data available. Total installed capacity in 2006: 44100MW, 20% of installed capacity which is 8820 MW.

Table A.8 Installed capacity of NWPG in 2006

	Unit	**Shanxi**	**Gansu**	**Qinghai**	**Ningxia**	**Xinjiang**	**Total**
Thermal power	MW	9723	6448	1517	6002	5937	29627
Hydro power	MW	2165	4291	5423	429	1766	14074
Nuclear power	MW	0	0	0	0	0	0
Wind power and others	MW	46	199	0	11	189	445
Total	MW	11934	10938	6940	6442	7892	44146

Data source: China Electric Power Yearbook 2007

Total installed capacity in 2005: 37981.9MW (see Table A.9). Capacity additions from 2005 to 2006 are 6,164.1 MW, which is less than 20% of installed capacity in 2006. Therefore the calculations need to include capacity additions before 2005. Total installed capacity in 2004 was 33358.7 MW as shown in

Table A.10. Capacity additions from 2004 to 2006 is 10,787.3 MW, which is more than 20% of installed capacity of 2006, so that capacity additions from 2004 to 2006 make up the build margin, as shown in Table A.11.

Table A.9 Installed capacity of NWPG in 2005

	Unit	Shanxi	Gansu	Qinghai	Ningxia	Xinjiang	Total
Thermal power	MW	9132.1	5715	886.8	4577	5051.7	25362.6
Hydro power	MW	1578	4036.2	4825	428.5	1352.1	12219.8
Nuclear power	MW	0	0	0	0	0	0
Wind power and others	MW	46	109.1	0	112.2	132.2	399.5
Total	MW	10756.1	9860.3	5711.8	5117.7	6536	37981.9

Data source: China Electric Power Yearbook 2006.

Table A.10 Installed capacity of NWPG in 2004

	Unit	Shanxi	Gansu	Qinghai	Ningxia	Xinjiang	Total
Thermal power	MW	7640.4	4975.6	889.8	3782	4959.7	22247.5
Hydro power	MW	1876.5	3566.1	4053.4	366.2	973	10835.2
Nuclear power	MW	0	0	0	0	0	0
Wind power and others	MW	0	138.2	0	42.5	95.3	276
Total	MW	9516.9	8679.9	4943.2	4190.7	6028	33358.7

Data source: China Electric Power Yearbook 2005.

Table A.11The group of power plants in the Build Margin of NWPG

	Installed capacity in 2004 (MW)	Installed capacity in 2005 (MW)	Installed capacity in 2006 (MW)	Capacity additions from 2004 to 2006 (MW)	Share in total capacity additions
	A	B	C	D=C-A	E
Thermal power	22247.5	25362.6	29627	7379.5	**68.41%**
Hydro power	10835.2	12219.8	14074	3238.8	**30.02%**
Nuclear power	0	0	0	0	**0.00%**
Wind power and others	276	399.5	445	169	**1.57%**
Total	33358.7	37981.9	44146	10787.3	**100.00%**
Share in installed capacity of 2006	75.56%	86.04%	100.00%		

http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/2008/20081231101111351.pdf

<u>Step 6. Calculate the build margin emission factor</u>

Sub-step 6a *Calculate the respective ratios of CO_2 emissions from coal, oil and gas combustion for power generation in the whole emissions from fossil fuel-based thermal power generation*

Table A.12 Calculation of emissions from solid, liquid and gas fuels combusted for power generation

Fuel Type	Unit	Shannxi	Gansu	Qinghai	Ningxia	Xinjiang	Subtotal	Carbon content (tc/TJ)	Oxidation Factor (%)	Average low caloric value (MJ/ton,km^3)	CO_2 emissions (tCO_2)
		A	B	C	D	E	F=A+B+C+D+E	G	H	I	J=G*H*I*F*44/12/1000(Volume Unit) J=G*H*I*F*44/12/10000(Mass Unit)
Raw coal	10^4ton	2834.44	1660.92	421.86	1833.72	1547.69	**8298.63**	25.8	1	20908	164138337.2
Cleaned coal	10^4ton							25.8	1	26344	0
Other washed coal	10^4ton				112.7	8.45	**121.15**	25.8	1	8363	958465.8677
Coke	10^4ton				0.01		**0.01**	29.2	1	28435	304.4440667
Sub-total											165097107.5
Crude oil	10^4ton					0.02	**0.02**	20	1	41816	613.3013333
Gasoline	10^4ton	0.01					**0.01**	18.9	1	43070	298.4751
Kerosene	10^4ton							19.6	1	43070	0
Diesel oil	10^4ton	1.14	0.24	0.61		1.25	**3.24**	20.2	1	42652	102354.5635
Fuel oil	10^4ton		0.6			0.11	**0.71**	21.1	1	41816	22969.66819
Other petroleum products	10^4ton							20	1	38369	0
Other coking products	10^4ton	1.86					**1.86**	25.8	1	28435	50033.0886
Sub-total											176269.0967
Natural gas	100Mm^3	15.9	5.6	10.6		74.9	**107**	15.3	1	38931	2336911.137
Coke over gas	100Mm^3	2				0.8	**2.8**	12.1	1	16726	20778.15227
Other coal gas	100Mm^3	1					**1**	12.1	1	5227	2319.045667
LPG	10^4ton	0						17.2	1	50179	0
Refinery gas	10^4ton	0						15.7	1	46055	0
Sub-total											2360008.335
Total											167633385

Data sources： China Energy Statistical Yearbook 2007

Based on the Table A.12 above, different fuels are used in the proportions shown in Table A.13 below.

Table A.13 Share of different fossil fuels in the total CO2 emissions from thermal power plants of NWPG

Item	Value
λ_{Coal}	98.49%
λ_{Oil}	0.11%
λ_{Gas}	1.41%

Sub-step 6b: *Calculate the emission factor of fossil fuel-based thermal power generation*

Table A.14 Emission factor of coal-fired plants, gas-fired plants and oil-fired plants in NWPG

Type of power plant	**Variable**	**Efficiency A**	**Carbon content (tc/TJ) B**	**Oxidation factor (%) C**	**Emission factor (tCO_2/MWh) D=(3.6/A/1000)*B*C*44/12**
Coal-fired	$EF_{Coal,adv}$	37.28%	25.8	100%	0.913519313
Oil-fired	$EF_{Oil,adv}$	48.81%	21.1	100%	0.570620774
Gas-fired	$EF_{Gas,adv}$	48.81%	15.3	100%	0.413767671
		Announcement on baseline emission factor of Chinese grids (updated on August 17th, 2008) http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/2008/20081231101111351.pdf	2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2 Energy: p. 1.23-1.24	2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2 Energy: p. 1.23-1.24	

Therefore, the Emission Factor of thermal power plants in the Build Margin is determined as the weighted average of emissions factors for each fuel, using data shown in Tables A.13 and A.14. $EF_{Thermal} == \lambda_{Coal} \times EF_{Coal,adv} + \lambda_{Oil} \times EF_{Oil,adv} + \lambda_{Gas} \times EF_{Gas,adv}$ =98.49%×0.9135 + 0.11%×0.5706 + 1.41%× 0.4137= 0.9062 (tCO_2/MWh).

Sub-step 6c: *Calculate the BM mission Factor*

As the value from the last column of Table A.11, 60.99% of the build margin capacity addition was thermal, the remainder being renewable (zero emissions). Since the average emissions factor for thermal power plants in this grid is 0.9409 (tCO_2/MWh), the Build Margin Emission Factor can be determined as follows.

$EF_{grid,BM,y}$ **= 0.9062*68.41% = 0.6199(tCO_2/MWh).**

<u>Step 7. Calculate the combined margin emissions factor</u>

The Combined Margin Emission Factor can be calculated as shown in Table A.15.

Table A.15 Baseline Emission Factor of the NWPG

A	*Operating Margin Emission Factor (tCO_2/MWh)*	1.1225
B	*Build Margin Emission Factor (tCO_2/MWh)*	0.6199
C	***Combined Margin Emission Factor (C=0.5*A+0.5*B) (tCO_2/MWh)***	**0.8712**

Annex 4

MONITORING PLAN

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No Additional information.

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