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

CONTENTS

Annexes

SECTION A. General description of project activity

A.1 Title of the project activity:

>>
Baxianyuan 27 MW Hydropower Project
Version number of the document: 07
Date: 07/01/2008

A.2. Description of the project activity:

>>
The Baxianyuan 27 MW Hydropower Project (hereafter referred to as the Project) is sited on the main stream of the Xushui River within Yang County, Hanzhong City, Shaanxi Province, P.R.China. It is a two cascade diversion type run-of-river hydropower plant with 27 MW of installed capacity.

Water diversion utilizing cemented masonry gravity-arch dam in conjunction with pressure tunnel is adopted by the Project, in which water is diverted to the power house to generate electricity, and all the electricity generated will be delivered to the Shaanxi Power Grid via a 110 kV outlet circuit.

The Project will not only supply renewable electricity to grid, but also contribute to sustainable development of the local community, the host country and the world by means of:

- reducing greenhouse gas emissions compared to a business-as-usual scenario;
- stimulating economy development of least developed area in China[1] and promoting nation solidarity and establishment of harmony society;
- reducing the emission of other pollutants resulting from the power generation industry in China, compared to a business-as-usual scenario[2];
- creating local employment opportunities during the project construction and operation period.

A.3. Project participants:

>>
Participants to the project activity are the following:

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)	Yangxian Longsheng Hydropower Development Co., Ltd. of Shaanxi Province (Project owner)	No
The Netherlands	Energy Systems International B.V.	No

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

1 http://www.yangxian.gov.cn/ZwdtDetail.asp?id=195
2 *Environmental Cost Analysis of Power Plant*, Lu Hua, Zhou Hao, Environmental Protection, 2004.4.

A.4.1.1. Host Party(ies):

>>

The Host Country is the People's Republic of China.

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

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Shaanxi Province

A.4.1.3. City/Town/Community etc:

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Huayang Town, Yang County, Hanzhong 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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The Project is sited on the main stream of the Xushui River within Huayang Town, Yang County, Hanzhong City, Shaanxi Province, P.R.China.

The dam of the first cascade is sited 0.5 km downstream to the Tianxing Village and the power house of the first cascade is sited on the upstream to the Pingduhe River embouchure. Power house of the first cascade has geographical coordinates with north latitude of 33°39′48″ and east longitude of 107°21′30″.

The dam of the second cascade is sited within the Qingxi Village and the power house of the second cascade is sited on the downstream to the inter connection point of the main stream of the Xushui River and the Qingxi River. Power house of the second cascade has geographical coordinates with north latitude of 33°37′37″ and east longitude of 107°19′39″.

Figure 1 shows the location of the Project.

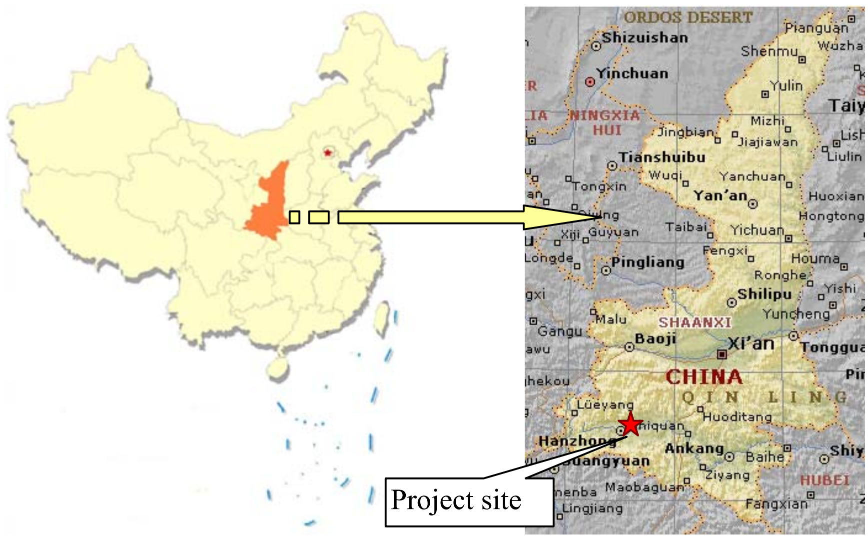

Figure 1. Location of the Project

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

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The Project is a power generation activity using renewable hydro energy that falls within sectoral scope 1: energy industries.

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

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The total installed capacity of the Project is 27 MW. It is estimated that the feed-in electricity to the Shaanxi Power Grid is approximately 94.51 GWh per year.

For the first cascade of the Project, the installed capacity is 15 MW with 91.6 Mu of flooding area[3]. Therefore power density of the first cascade of the Project is about 246 W/m^2. Three sets of 5 MW Fancies turbine and associated generators which are made in China will be installed in the Project. The maximum height of the cemented masonry gravity-arch dam is 39.5 m. The main pressure steel pipe is 140 m long with an internal diameter of 2.5 m. The first cascade of the Project is designed to deliver discharge flow of 27 m^3/s with 67 m of water head.

For the second cascade of the Project, the installed capacity is 12 MW with 68.7 Mu of flooding area[4]. Therefore power density of the second cascade of the Project is about 262 W/m^2. Three sets of 4 MW Fancies turbine and associated generators which are made in China will be installed in the Project. The maximum height of the cemented masonry gravity-arch dam is 42.0 m. The main pressure steel pipe is 82 m long with an internal diameter of 3.0 m. The second cascade of the Project is designed to deliver discharge flow of 39.2 m^3/s with 36 m of water head.

Technology employed by the Project is listed in the *Renewable Energy Industry Development Guidance Catalogue* issued Nov. 29 2005 by the National Development and Reform Commissions. It is also belongs to renewable energy which is one of the priority areas for CDM projects in China defined in the *Measures for Operation and Management of Clean Development Mechanism Projects in China*. The Project involves no technology transfer from abroad. The Fancies turbine is spiral-cased water turbine suitable for water head of 20~200 m, due to better flow pattern in spiral case, the Fancies turbine can obtain higher efficiency than other kind of water turbines[5].

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

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It is expected that the Project activities will generate emission reductions for about 79,483 tCO_2e per year over the first 7-year renewable crediting period from 01/05/2008 to 30/04/2015.

3 Table of techno-economic indicators in FSR, calculated with 1 Mu=667m^2.
4 Table of techno-economic indicators in FSR, calculated with 1 Mu=667m^2.
5 http://www.industrychina.net/product/product_info_dzsb.asp

Years	Annual estimation of emission reductions in tonnes of CO_2e
May to December, 2008	52,989
2009	79,483
2010	79,483
2011	79,483
2012	79,483
2013	79,483
2014	79,483
January to April, 2015	26,494
Total estimated reductions (tonnes of CO_2e)	**556,381**
Total number of crediting years	**7**
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	**79,483**

A.4.5. Public funding of the project activity:

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There is no public funding from Annex I Parties for this Project.

SECTION B. Application of a baseline methodology

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

>>
ACM0002.ver 06 – "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" and "Consolidated monitoring methodology for grid-connected electricity generation from renewable sources".

The *Tool for the Demonstration and Assessment of Additionality* ver 03.

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

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Hydropower generation technology is a renewable electricity generation technology which displaces fossil fuel-fired power generation technology to supply electricity to the grid. Therefore the Project applies the consolidated baseline methodology ACM0002 approved by CDM EB to determine the project baseline and calculate GHG emission reductions achieved by hydropower generation.

The Project meets all applicability conditions of the consolidated baseline methodology ACM0002 as follows:

1） The Project involves the electricity capacity additions from run-of-river hydropower plant and power density of Project is 246 W/m^2 for the first cascade and 262 W/m^2 for the second cascade, which is higher than 4 W/m^2.
2） The Project does not involve switching from fossil fuels to renewable energy at the site of the project activity.
3） The geographic and system boundaries for the Northwest China Grid can be clearly identified and information on the characteristics of the Northwest China Grid is available[6].

According to the consolidated baseline methodology ACM0002, the consolidated baseline methodology ACM0002 is applied in compliance with the consolidated monitoring methodology ACM0002, the additionality of the Project is demonstrated and assessed by using the *Tool for the Demonstration and Assessment of Additionality* approved by CDM EB.

Data and information used in the PDD of the Project are mainly from the *Feasibility Study Report* of the Project and the *Notification on Determining Baseline Emission Factor of China's Grid* issued by China's DNA on December 15th, 2006 on http://cdm.ccchina.gov.cn.

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

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As per the baseline methodology ACM0002 (ver 06), the delineation of grid boundaries as provided by the DNA of the host country is used.
Electricity generated by the Project will be delivered to the Shaanxi Power Grid. With reference to the *Notification on Determining Baseline Emission Factor of China's Grid*, the boundary of the electricity

6 Detailed information of the grid in China can be obtained from the China Electric Power Yearbook (published annually), the China Energy Statistical Yearbook (published annually after 2003) and the Notification on Determining Baseline Emission Factor of China's Grid made publicly available on the website of China's DNA (http://cdm.ccchina.gov.cn/) on December 15th, 2006.

system is defined as the Northwest China Grid for Shaanxi Power Grid is an integral part of the Northwest China Grid. The Northwest China Grid is composed of Shaanxi Power Grid, Gansu Power Grid, Qinghai Power Grid, Ningxia Power Grid and Xinjiang Power Grid.

The spatial extent of the project boundary includes the project site and all power plants connected physically to the Northwest China Grid that the CDM project power plant is connected to and power flows within the grid system without any significant transmission constrains.

	Source	Gas	Included?	Justification/Explanation
Baseline	Electricity generation of those fossil fuel-fired power plants connected into the Northwest China Grid.	CO_2	Yes	Main emission sources.
		CH_4	No	Excluded for simplification. This is conservative.
		N_2O	No	Excluded for simplification. This is conservative.
Project activity	Project emission	CO_2	No	Power density of Project is 246 W/m^2 for the first cascade and 262 W/m^2 for the second cascade, both higher than 10 W/m^2, therefore the project emissions should not be considered as per ACM0002.
		CH_4	No	
		N_2O	No	

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

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The baseline scenario of the Project is identified and demonstrated by using the Step 1 and Step 2 of the *Tool for the Demonstration and Assessment of Additionality* approved by CDM EB, details please refer to Section B.5. According to analysis of Step 1 and Step 2, the baseline scenario of the Project is the provision of equivalent amount of annual electricity supply by the Northwest China Grid; even the variation range of the uncertain factors reach 10%, the IRR of total investment of the Project could not reach the benchmark and the additionality of the Project would not be influenced.

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 Project is demonstrated and assessed by using the *Tool for the Demonstration and Assessment of Additionality* approved by CDM EB.

To solve the investment barrier faced by the Project and guarantee its successful implementation, the project owner decided to start CDM development process of the Project on 09/03/2005. Later, the project owner signed a CDM consultation agreement with Beijing Haohua Jianghe International Water Conservancy Consultation Co., Ltd on 06/06/2005. Then the construction work of the Project began on 11/06/2005.

Step 1. Identification of alternatives to the project activity consistent with current laws and regulations

The objective of the Step 1 is to define realistic and credible alternatives to the project activity(s) that can be (part of) the baseline scenario through the following sub-steps:

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

Plausible and credible alternatives available to the Project that provide outputs or services comparable to the proposed CDM project activity include:
Alternative I: Construction of a fuel-fired power plant with equivalent amount of annual electricity generation;
Alternative II: The Project not undertaken as a CDM project activity;
Alternative III: Construction of a power plant using other sources of renewable energy with equivalent amount of annual electricity generation; and
Alternative IV: Provision of an equivalent amount of annual power output by the grid into which the Project is connected.

The average wind speed of the project site is only 1.3 m/s, which is not viable for wind power project[7]. In China, biomass power generation technology is still in the demonstration phase and can bring only poor economic benefits, which can not be operated without support from the national policies[8]. Since there exist no economically exploitable wind or biomass resources with a commensurate scale within the area of the Project. Alternative III is not feasible.

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

For Alternative I, considering the same annual electricity generation, the alternative baseline scenario for the Project should be a fuel-fired power plant with installed capacity lower than 27 MW. Further, as the Project is a grid-connected hydropower generation project, the alternative baseline scenario must be a grid-connected fuel-fired power generation project. However, according to China's regulations, construction of coal-fired power plants with the installed capacity lower than 135 MW is prohibited in the areas which can be covered by large grids such as provincial grids[9], and the fossil fuel-fired power units[10] with the capacity lower than 100 MW are strictly limited for installation [11]. For these reasons, the possible alternative baseline scenario of building a fuel-fired power plant with an installed capacity lower than 27 MW conflicts with China's current regulations. Therefore, Alternative I is not feasible.

For Alternative II, the Project not undertaken as a CDM project activity satisfies China's regulations.

For Alternative IV, the installed capacity of the Northwest China Grid for both the existing power plants and the power plants to be built in a foreseeable future satisfies China's regulations, which is also economically feasible.

Therefore Alternative II and Alternative IV are analyzed in Step 2 as potential baseline alternatives.

Step 2. Investment Analysis

7 Feasibility study report of the Project.
8 *Tentative Management Measures for Price and Sharing of Expenses for Electricity Generation from Renewable Energy*, Document No. NDRC Energy[2006]13.
9 *Notice on Strictly Prohibiting the Installation of Fuel-fired Generators with the Capacity of 135 MW or Below* issued by the General Office of the State Council, decree no. 2002-6.
10 Fuel-fired power plants covers oil based power plants and natural gas based power plants with reference to the *Statistics Report System of National Electricity Industry* issued by China Electricity Council, referred http://www.cec.org.cn/4-6/tongji3/xiazai/download/shengchan2005.xls.
11 *Interim Rules on the Installation and Management of Small-scale Fuel-fired Generators* (issued in Aug., 1997).

The purpose of this step is to determine whether the project activity is economically or financially less attractive than Alternative IV without an additional revenue/funding, possibly from the sale of certified emission reductions (CERs). The investment analysis was conducted in the following steps:

Sub-step 2a. Determine appropriate analysis method

The *Tool for the Demonstration and Assessment of Additionality* suggests three analysis methods which are simple cost analysis (Option I), investment comparison analysis (Option II) and benchmark analysis (Option III). Since the Project will earn revenues not only from the CERs sales but also from electricity sales, the simple cost analysis method is not appropriate. Investment comparison analysis method is only applicable to projects whose alternatives are similar investment projects. The Alternative IV of the Project is the Northwest China Grid rather than new investment projects. Therefore Option II is not appropriate. The Project will use benchmark analysis method (Option III) based on the consideration that benchmark IRR of the power sector is available.

Sub-step 2b. Benchmark Analysis Method (Option III)

According to the *Economic Evaluation Code for Small Hydropower Projects* issued by the Ministry of Water Resources in 1995 (Document No. SL16-95), the financial benchmark rate of return (after tax) adopted by the Project is 10% for the IRR of total investment. On the basis of above benchmark, calculation and comparison of financial indicators are carried out in sub-step 2c.

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

(1) Basic parameters for calculation of financial indicators

According to the Feasibility Study Report, basic parameters for calculation of financial indicators of the Project are summarized in Table 1.

Table 1. Financial parameters for calculation of IRR of total investment of the Project

Series	Item	Value	Remark
	general description		
1	installed capacity	27	MW
2	feed-in electricity	94.51	GWh
3	construction period	3	year
4	operation period	30	year
5	bus-bar tariff (including VAT)	0.27[12]	RMB/kWh
	investment plan		
	total investment	23084	10000RMB
1	value of fixed assets	23030	10000RMB
2	fluid capital	54	10000RMB
	tax		
1	VAT	6.00%[13]	
2	income tax	33%	tax free for the first 3 years

12 Notice on Revising the Bus-bar Tariff within Shaanxi Grid by Shaanxi Bureau of Commodity Price (SHAANJIAJIAFA[2005]100)
13 Notice on Revising the Rate of Value-Added Tax on Agricultural Product and Exemption for Some Projects (CAISHUI[1994]004)

			after the project is put into operation, 16.5% for the following 5 years, 33% for the years afterwards
3	urban maintenance and construction tax	5%	
4	surtax for education	3%	
	cost		
1	rate for maintenance fee	1.0%	
2	insurance premium rate	0.25%	
3	Staff	40	person
4	Salary	1.8	10000RMB/year
5	rate of employee welfare, labor and protection fund, housing fund, education fund, labor union fund	41%	
6	reservoir maintenance fee	0.001	RMB/kWh
7	valid electricity	9692	10000kWh
8	auxiliary electricity consumption rate	0.5%	
9	materials cost	5	RMB/kW
10	other cost	24	RMB/kW
11	depreciation rate of station	4.5%	
12	depreciation rate of transmission auxiliaries	4.0%	
13	operation cost rate of transmission auxiliaries	4.0%	

(2) Comparison of the financial benchmark of IRR for the Project

In accordance with the benchmark analysis (Option III), if the financial indicators (such as IRR) of a project are lower than the benchmark, the project is not considered as financially attractive. Based on the data above, without CERs sales revenues, the IRR of total investment of the Project is 5.54%, which is lower than the benchmark (10%). The cash flow table of total investment is attached in Annex 5, and the detailed IRR calculation process has been provided in the IRR calculation excel table as an attachment submitted along with the PDD. The Project is not financially attractive.

Sub-step 2d. Sensitivity analysis

For the project, following financial parameters were taken as uncertain factors for sensitive analysis of financial attractiveness:

- Total investment
- Annual O&M cost
- Annual electricity output
- Bus-bar tariff (not including VAT)

The impacts of total investment, annual O&M cost, annual electricity output and bus-bar tariff of the Project on IRR of total investment were analyzed. The results of sensitive analysis of four indicators of the Project are shown in Table 2 and Figure 2.

Table 2. IRR of total investment sensitivity to different financial parameters of the Project

(without CERs sales revenues)

Range / Parameter	-10%	0	+10%
Total investment (%)	6.51	5.54	4.72
Annual O&M cost (%)	5.74	5.54	5.34
Annual electricity output (%)	4.56	5.54	6.49
Bus-bar tariff (%)	4.56	5.54	6.49

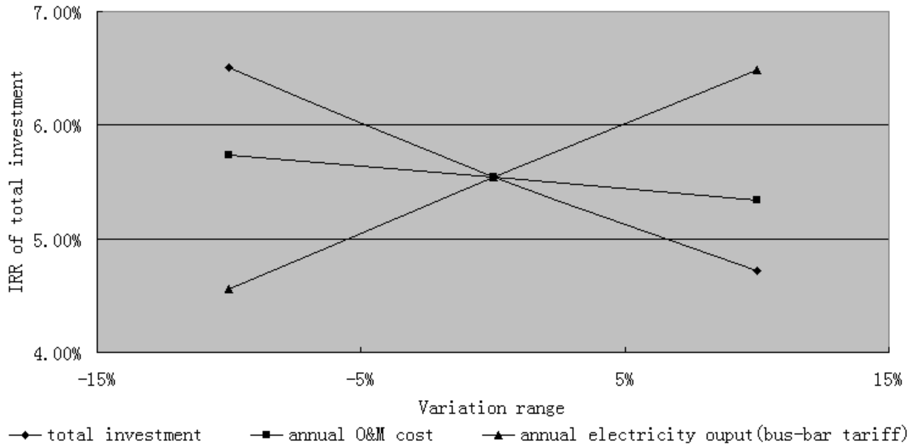

Figure 2. IRR of total investment sensitivity to different financial parameters of the Project
(without CERs sales revenues)

As shown in the sensitivity analysis, even the variation range of the uncertain factors reaches 10%, the IRR of total investment of the Project could not reach the benchmark and the additionality of the Project would not be influenced.

Based on the Investment Analysis above, the Project is not financially attractive without consideration of CERs sales revenues. Alternative II is not feasible thus not baseline scenario.

In conclusion, the practical and feasible baseline scenario is Alternative IV, the provision of equivalent amount of annual electricity supply by the grid into which the Project is connected. Therefore the baseline scenario of the Project is the provision of equivalent amount of annual electricity supply by the Northwest China Grid.

Step 4 Common practice analysis

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

According to Annual of China's Water Power (volume 6-9), Yearbook of China Water Resources (edition 2004 and 2005), Yearbook of Shaanxi Water Resources (2002-2004) and the investigation result conducted by the PDD developers, Existing hydropower projects in Shaanxi Province with a commensurate scale to the Project are listed in Table 3.

Table 3. Existing hydropower projects in Shaanxi Province with a commensurate scale to the Project

Project Name	Installed capacity (MW)

Linhekou Hydropower Project	72
Shiquan Hydropower Addition Project	90
Erlang Dam Step Hydropower Project	50
Shimen Hydropower Project	41.2
Shitouhe Hydropower Project	49.5
Auxiliary Hydropower Project of Dongfanghong Transferring Wei River for Irrigation Project	25
Heihe Hydropower Project	20

Sub-step 4b. Discuss any similar options that are occurring:

Existing hydropower projects of Shaanxi Province with a commensurate scale to the Project are analyzed as follows:
· Linhekou Hydropower Project adopts incompletely yearly regulation reservoir[14];
· Shiquan Hydropower Addition Project is constructed based on the existing hydropower project, with an investment of 3333.3 RMB per kW[15], less than 40% of the Project (8550 RMB per kW);
· Erlang Dam Step Hydropower Project is composed of Tianshengqiao Hydropower Project (12MW), Erlang Dam Hydropower Project (25MW) and Wolongtai Hydropower Project (13MW). This project is a complex project involving transferring more than 0.2 billion m^3 water from Jialing River to Han River, which is one of the key projects listed in the Eighth Five Year Plan of Shaanxi Province and one of the 20 projects most important to Shaanxi's development.[16]
· Shimen Hydropower Project adopts multi-year regulation reservoir;[17]
· Shitouhe Hydropower Project is an auxiliary project to Shitouhe Reservoir, which is featured by incomplete yearly regulation[18], and the dam of Shitouhe Reservoir is the highest earth fill dam constructed in China[19];
· Auxiliary Hydropower Project of Dongfanghong Transferring Wei River for Irrigation Project was put into operation in 1970[20], far earlier than the time when the Project is put into operation;
· Heihe Hydropower Project is an auxiliary project to Heihe Jinpen Reservoir, featured by incomplete yearly regulation[21];

Existing hydropower projects in Shaanxi Province with a commensurate scale to the Project possess incomparable advantages over the Project in respect of regulation characteristics, investment per kW, construction time, investment environment and so on; whose existence will not have influence on the additionality of the Project.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

14 Yearbook of Shanxi Water Resources (2002-2004) P242-243.
15 Annual of China's Water Power (volume 6) (data of 1998-2000)P219.
16 http://www.chinawater.com.cn/newscenter/df/shx/t20060724_184381.htm, http://www.sx-sigc.com/web-sitey/right?id=33&col=%B5%E7%C1%A6%CF%E0%B9%D8&on=right
17 http://www.hwcc.com.cn/newsdisplay/newsdisplay.asp?Id=40548
18 http://www.shuigong.com/papers/others/20060125/paper16040.shtml
19 Annual of China's Water Power (volume 8), P914
20 http://zhidao.baidu.com/question/11298801.html
21 http://www.cws.net.cn/zmslgc/ArticleView.asp?ArticleID=No&ClassID=1689

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The consolidated methodology ACM0002 is applied in the context of the Project in the following five steps:
- First, calculate the baseline GHG emissions;
- Second, calculate the project GHG emissions;
- Third, calculate the project leakage;
- Fourth, calculate the emission reductions.

I. Calculate the baseline GHG emissions

Baseline emission factors of operating margin ($EF_{OM,y}$) and build margin ($EF_{BM,y}$) were determined ex ante. The baseline emission factor (EF_y) is calculated as a combined margin (CM) of $EF_{OM,y}$ and $EF_{BM,y}$, according to the following three steps:

STEP 1. Calculate the Operating Margin Emission Factor(s) ($EF_{OM,y}$) based on one of the four following methods:
(a) Simple OM, or
(b) Simple adjusted OM, or
(c) Dispatch data analysis OM, or
(d) Average OM.
Each method is analyzed as below.

Method (a) Simple OM

The simple OM method only can be used when low-cost/must run resources constitute less than 50% of total grid generation 1) in the recent five years, or 2) by taking into account long-term normal for hydroelectricity generation. Among the total electricity generations of the Northwest China Grid which the Project is connected into, the amount of low-cost/must run resources accounts for about 30% in 2000, 25% in 2001, 23% in 2002, 19% in 2003 and 22% in 2004[22], all less than 50%. Thus, the method (a) Simple OM can be used to calculate the baseline emission factor of operating margin ($EF_{OM,y}$) for the Project.

Method (b) Simple adjusted OM

The application of simple adjusted OM method requires annual load duration curve of the grid. The power sector in China is in a transitional period of "separating the plant operation from the grid operation", resulting in the detailed data of dispatch and fuel consumption are often taken as confidential business information by the grid company and the power plants. Therefore those data are not publicly available. In most cases, it is difficult for the CDM projects in China to adopt Method (b) for the calculation of the baseline emission factor of operating margin ($EF_{OM,y}$). Similarly, the Project can not adopt Method (b) for the calculation of the baseline emission factor of operating margin ($EF_{OM,y}$) due to unavailability of the dispatch data of the Northwest China Grid.

Method (c) Dispatch data analysis OM

22 *China Electric Power Yearbook*, 2001~2005 edition. See Annex 3 for details.

Dispatch data analysis OM method should be the first choice if the dispatch data are available, because the method can truly reflect the substitutable relationship between the amount of electricity output from power plants of the baseline grid and that from the Project activity and the emission reductions generated. However, Method (c) cannot be adopted for the Project because of unavailability of the dispatch data of the Northwest China Grid, similar reason as method (b).

Method (d) Average OM

Method (d) can only be used when 1) low-cost/must run resources constitute more than 50% of total grid generation and 2) detailed data required by applying method (b) and method (c) is unavailable. Among the total electricity generations of the Northwest China Grid which the Project is connected into, the amount of low-cost/must run resources accounts for about 30% in 2000, 25% in 2001, 23% in 2002, 19% in 2003 and 22% in 2004, all less than 50%, therefore method (d) cannot be applied to the Project.

In conclusion, Method (a) Simple OM is the only reasonable and feasible method among the four methods for the calculation of the operating margin emission factor(s) ($EF_{OM,y}$) of the Project.

In accordance with the consolidated baseline methodology ACM0002, the Simple OM emission factor ($EF_{OM,simple,y}$) is calculated ex ante. The formula of $EF_{OM,simple,y}$ calculation is

$$EF_{OM,simple,y} = \frac{\sum_{i,j} F_{i,j,y} \cdot COEF_{i,j}}{\sum_{j} GEN_{j,y}} \qquad (1)$$

where:

$F_{i,j,y}$ is the amount of fuel i (in a mass or volume unit) consumed by province j in year(s) y,

$COEF_{i,j,y}$ is the CO_2 emission coefficient of fuel i (tCO_2/mass or volume unit of the fuel), taking into account the carbon content of the fuels (coal, oil and gas) used by province j and the percent oxidation of the fuel in year(s) y, and

$GEN_{j,y}$ is the electricity (MWh) delivered to the grid by province j.

The CO_2 emission coefficient $COEF_i$ is then obtained from equation (2) as

$$COEF_i = NCV_i \cdot EF_{CO2,i} \cdot OXID_i \qquad (2)$$

where:

NCV_i is the net calorific value (energy content) per mass or volume unit of fuel i,

$OXID_i$ is the oxidation factor of the fuel i, and

$EF_{CO2,i}$ is the CO_2 emission factor per unit of energy of the fuel i.

The data on electricity generation and auxiliary power consumption are obtained from the *China Electric Power Yearbook* from 1998 to 2005 (published annually). The data on different fuel consumptions for power generation and the net caloric values of the fuels are obtained from the *China Energy Statistical Yearbook* from 2000 to 2005 (published annually after 2003). The emission factors and oxidation factors of the fuels adopted are obtained from Table 1-2 and Table 1-4 of the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories: Workbook.*

With reference to the *Notification on Determining Baseline Emission Factor of China's Grid*, the Simple OM emission factor ($EF_{OM,y}$) of the Northwest China Grid is calculated as 1.0329 tCO_2e/MWh (see Annex 3 for details).

STEP 2. Calculate the Build Margin Emission Factor ($EF_{BM,y}$**)** according to the consolidated baseline methodology ACM0002 using equation (3):

$$EF_{BM,y} = \frac{\sum_{i,m} F_{i,m,y} \cdot COEF_{i,m}}{\sum_{m} GEN_{m,y}} \qquad (3)$$

where:

$F_{i,m,y}$ is the amount of fuel i (tCe) consumed by relevant power source m in year(s) y,

$COEF_{i,m,y}$ is the CO_2 emission coefficient of fuel i (tCO_2/tCe), taking into account the carbon content of the fuels (coal, oil and gas) used by relevant power source m and the percent oxidation of the fuel in year(s) y, and

$GEN_{m,y}$ is the electricity (MWh) delivered to the grid by source m.

Option 1, calculate the Build Margin emission factor ($EF_{BM,y}$) ex-ante based on the most recent information available on plants already built for sample group m at the time of PDD submission was selected for the Project.

According to the consolidated baseline methodology ACM0002, the sample group m consists of either (1) the five power plants that have been built most recently, or (2) the power plant capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently. It is suggested that the sample group that comprises the larger annual generation should be used.

Consider of data availability, CDM EB accepts the following deviation in application of methodology AM0005[23]:
1) Use of capacity additions during the last 1~3 years for estimating the build margin emission factor for grid electricity.
2) Use of weights estimated using installed capacity in place of annual electricity generation.

And it is suggested to use the efficiency level of the best technology commercially available in the provincial/regional or national grid of China, as a conservative proxy.

Since methodology AM0005 has been replaced by and incorporated into the consolidated methodology ACM0002, the deviation above is also applicable to the consolidated methodology ACM0002. Therefore for the Project: First, calculate the share of different power generation technology in recent capacity additions. Second, calculate the weight for capacity additions of each power generation technology. And finally calculate the emission factor use the efficiency level of the best technology commercially available in China.

Since data of installed capacities can not be separated to coal based, oil based and gas based at present, BM is calculated with following steps and formula:

23 Http://cdm.unfccc.int/Projects/Deviations.

Step a. Calculate the power generation emissions for solid, liquid and gas fuel and each share of total emissions based on the *Energy Balance Table* of the most recent year.

$$\lambda_{Coal} = \frac{\sum\limits_{i \in COAL,j} F_{i,j,y} \times COEF_{i,j}}{\sum\limits_{i,j} F_{i,j,y} \times COEF_{i,j}} \tag{4}$$

$$\lambda_{Oil} = \frac{\sum\limits_{i \in OIL,j} F_{i,j,y} \times COEF_{i,j}}{\sum\limits_{i,j} F_{i,j,y} \times COEF_{i,j}} \tag{5}$$

$$\lambda_{Gas} = \frac{\sum\limits_{i \in GAS,j} F_{i,j,y} \times COEF_{i,j}}{\sum\limits_{i,j} F_{i,j,y} \times COEF_{i,j}} \tag{6}$$

where:

$F_{i,j,y}$ is the amount of fuel i (in a mass or volume unit) consumed by province j in year(s) y,

$COEF_{i,j,y}$ is the CO_2 emission coefficient of fuel i (tCO_2/tCe), taking into account the carbon content of the fuels (coal, oil and gas) used by province j and the percent oxidation of the fuel in year(s) y, and

COAL, OIL and GAS are footnote group for solid fuels, liquid fuels and gas fuels.

Step b. Calculate emission factor for thermal power of the grid based on the result of Step a and the efficiency level of the best technology commercially available in China.

$$EF_{Thermal} = \lambda_{Coal} \times EF_{Coal,Adv} + \lambda_{Oil} \times EF_{Oil,Adv} + \lambda_{Gas} \times EF_{Gas,Adv} \tag{7}$$

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

Step c. Calculate BM of the grid based on the result of Step b and the share of thermal power of recent 20% capacity additions.

$$EF_{BM,y} = \frac{CAP_{Thermal}}{CAP_{Total}} \times EF_{Thermal} \tag{8}$$

Where CAP_{Total} is total capacity additions while $CAP_{Thermal}$ is capacity additions of thermal power.

The data on different fuel consumptions for power generation and the net caloric values of the fuels are obtained from the *China Energy Statistical Yearbook* from 2000 to 2005 (published annually after 2003). The emission factors and oxidation factors of the fuels adopted are obtained from Table 1-2 and Table 1-4 of the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories: Workbook*.

With reference to the *Notification on Determining Baseline Emission Factor of China's Grid*, the weighted average fuel consumption for power generation of 11 sets of 600 MW sub-critical coal-fired power generators built in 2004 (336.66 gCe/kWh) and the 200 MW oil/gas based combined cycle power generators (268.13 gCe/kWh) are taken as the efficiency level of the best technology commercially available in China.

With reference to the *Notification on Determining Baseline Emission Factor of China's Grid*, the build margin emission factor ($EF_{BM,y}$) of the Northwest China Grid is calculated ex ante as 0.6491 tCO_2e/MWh (see Annex 3 for details).

STEP3. Calculate the baseline emission factor (EF_y)

Based on the consolidated baseline methodology ACM0002, the baseline emission factor (EF_y) is calculated as the weighted average of the operating margin emission factor ($EF_{OM,y}$) and the build margin emission factor ($EF_{BM,y}$), as

$$EF_y = w_{OM} \cdot EF_{OM,y} + w_{BM} \cdot EF_{BM,y} \qquad (9)$$

According to the consolidated baseline methodology ACM0002, both the weight w_{OM} and the weight w_{BM} take 0.5 as default. Therefore the combined baseline emission factor EF_y=0.5×1.0329+0.5×0.6491=0.8410 (tCO_2e/MWh).

Baseline emissions

Baseline emissions are calculated with combined baseline emission factor and the electricity delivered to the grid by the project as follows:

$$BE_y = EG_y \times EF_y \qquad (10)$$

II. Calculate the project GHG emissions

The Project is a run-of-river hydropower plant that the project emissions should not be considered as per ACM0002, i.e. $PE_y = 0$ tCO_2e.

III. Calculate the project leakage GHG emissions

According to the consolidated baseline methodology ACM0002, the main indirect emissions potentially giving rise to leakage in the context of electric sector projects result from activities such as power plant construction, fuel handling (mining, processing, and transportation), and land inundation (for hydroelectric projects). The project developer does not need to consider such indirect emissions when applying the methodology. Therefore the Project can take no account of such leakages, $L_y = 0$ tCO_2e.

IV. Calculate the emission reductions

The project activity will generate GHG emission reductions by avoiding CO_2 emissions from electricity generation by fossil fuel power plants. The emission reduction (ER_y) during a given year y is calculated as follows:

$$ER_y = BE_y - PE_y - L_y \qquad (11)$$

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

Data / Parameter:	$EF_{OM,y}$
Data unit:	tCO_2e/MWh
Description:	The OM emission factor
Source of data used:	*Notification on Determining Baseline Emission Factor of China's Grid*
Value applied:	1.0329
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data obtained from the *Notification on Determining Baseline Emission Factor of China's Grid* made publicly available by China's DNA is reliable.
Any comment:	-

Data / Parameter:	$EF_{BM,y}$
Data unit:	tCO_2e/MWh
Description:	The BM emission factor
Source of data used:	*Notification on Determining Baseline Emission Factor of China's Grid*
Value applied:	0.6491
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data obtained from the *Notification on Determining Baseline Emission Factor of China's Grid* made publicly available by China's DNA is reliable.
Any comment:	-

B.6.3 Ex-ante calculation of emission reductions:

>>

I. Estimated anthropogenic emissions by sources of greenhouse gases of the baseline:

According to the *Feasibility Study Report* of the Project, the annual power generation is estimated to be 94.51 GWh. According to the *Notification on Determining Baseline Emission Factor of China's Grid*, the baseline emission factor for the Project is 0.8410 tCO_2e/MWh and the annual baseline emission of the Project is 79,483 tCO_2e.

II. Estimated project activity emissions:

The Project is a run-of-river hydropower plant that the project emissions should not be considered as per ACM0002, i.e. $PE_y = 0$ tCO_2e.

III. Estimated project leakage emissions:

As above ACM0002, the leakage of the Project is not considered, i.e. L_y =0 tCO_2e.

IV. Estimated emission reductions

As per formula (11), the annual emission reductions of the Project are 79,483 tCO_2e.

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

>>

It is expected that the Project activities will generate emission reductions for about 79,483 tCO_2e per year over the first 7-year renewable crediting period from 01/05/2008 to 30/04/2015.

Year	Estimation of project activity emissions (tonnes of CO_2e)	Estimation of baseline emissions (tonnes of CO_2e)	Estimation of leakage (tonnes of CO_2e)	Estimation of overall emission reductions (tonnes of CO_2e)
May to December, 2008	0	52,989	0	52,989
2009	0	79,483	0	79,483
2010	0	79,483	0	79,483
2011	0	79,483	0	79,483
2012	0	79,483	0	79,483
2013	0	79,483	0	79,483
2014	0	79,483	0	79,483
January to April, 2015	0	26,494	0	26,494
Total (tCO_2e)	**0**	**556,381**	**0**	**556,381**

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

B.7.1 Data and parameters monitored:

Data / Parameter:	EG_y
Data unit:	MWh
Description:	Electricity delivered by the Project to the grid in year y
Source of data to be used:	Monitoring online
Value of data applied for the purpose of calculating expected emission reductions in section B.5	94,510 MWh
Description of measurement methods and procedures to be applied:	Continuously measurement by ammeters and monthly recording by the project owner
QA/QC procedures to be applied:	Sales receipts/records to the grid are used to ensure the consistency.
Any comment:	-

B.7.2 Description of the monitoring plan:

>>

1. Monitoring system organization chart

The monitoring system organization chart is shown in Figure 3, in which the authority and responsibility of project management are defined.

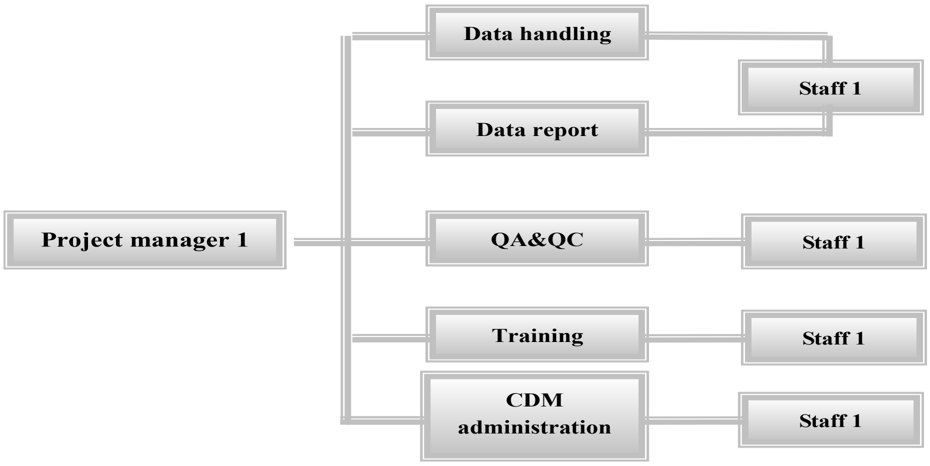

Figure 3 monitoring system flowchart of the Project for CDM

2. Monitoring of the Electricity Delivered to the Northwest China Grid by the Project

Baseline emission factor of the Project is determined ex ante. Therefore the electricity delivered by the Project to the Northwest China Grid is defined as the key data to be monitored. The monitoring plan is drafted to focus on monitoring the electricity delivered by the Project to the Northwest China Grid.

The electricity delivered by the Project to the Northwest China Grid will be monitored through metering equipment at the substation (interconnection facility connecting the Project to the grid). And the data should be cross-checked against relevant electricity sales receipts and/or records.

The project owner will ensure that the meter readings be readily available for DOE's verification.

3. Data Management System

Specific staff will be appointed by the project owner to take the overall responsibility for monitoring of greenhouse gas emission reductions and keeping all the data and information for emission reductions verification.

4. Calibration of Meters & Metering

Calibration of Meters & Metering should be implemented according to national standards and rules. And all the records should be documented and maintained by the project owner for DOE's verification.

5. Quality Assurance and Quality Control

The quality assurance and quality control procedures for recording, maintaining and archiving data shall be improved as part of this CDM project activity according to CDM EB rules and real practice in terms of the need for verification of the emission reductions on an annual basis according to this PDD.

6. Verification

It is expected that the verification of emission reductions generated from the Project will be done annually.

Detailed monitoring plan is described in Annex 4 to provide adequate information.

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 the baseline study and monitoring methodology of the Project was completed on 23/07/2007 by below parties:

Name/Origination	Project participate Yes/No
Dr. Zheng Zhaoning, Ms. Pan Tao Mobile: 0086-13911049424	No
Millennium Capital Services 1202 Jinbao Office Building, 89 Jinbao Street, Dongcheng District, Beijing 100005, P.R.China Tel: +86 (10) 8522 1916 Fax: +86 (10) 8522 1906	No

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:

>>
11/06/2005

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

>>
30y-0m

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

C.2.1. Renewable crediting period

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

>>
01/05/2008

C.2.1.2. Length of the first crediting period:

>>
7y-0m

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>
Not applicable.

C.2.2.2. Length:

>>
Not applicable.

SECTION D. Environmental impacts

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

>>
According to the *Feasibility Study Report* of the Project, environmental impacts possibly caused by the Project and corresponding measures adopted by the project owner are analyzed as follows:

Land use
The Project will permanently take up 1.7 Mu of forestland. And 160.3 Mu of land will be inundated by the Project, entailing resettlement of two families (involving 8 people). The project owner will make compensations according to the *Land Administration Law of the People's Republic of China* and relevant regulations. Migrants will be resettled in the area closest to their land occupied by the Project or in the area of the same town.

Air pollution and noise
Waste gas, dust and noise generated by the excavation and construction facilities during the construction of the Project will have certain impacts on the air environment and acoustical environment of the construction area. Measures to reduce the above impacts will be taken, including installing vibration dampening and sound insulation equipment, providing mouth masks for the workers and avoiding generating sudden noises during rest time. Air pollution and noise generated by the Project involve a small area affected and a short time period, which will be eliminated with the completion of the project construction.

Waste water
Waste water generated by production and living activities will result during construction and operation of the Project. Major pollutants of production waste water are suspending particles, which are innoxious, and after removing the suspending particles by means of sedimentation tank, the waste water can be recycled. Residential waste water will be discharged delivered to specific collection pool.

Solid waste
Waste solid and discarded soil generated during the construction will be recycled, and those which can not be recycled will be sent to the spoil area for treatment. Residential garbage generated during the construction and operation will be collected and treated.

Ecological impact
Vegetation damaged in the process of earth excavation and backfill will be resumed by means of secondary tillage or revegetation upon completion of the project construction. The accumulation of silt in front of the dam after completion of the project can improve the water quality of the lower reaches and in the meantime increase the output of fishery in front of the dam.

Production and residential water
After completion of the Project, cleaner water with high quality can be provided to meet the production and residential need in the neighborhood, which is conducive to the development of agriculture and livestock husbandry of the area.

In summary, the Project will not have significant impacts on the 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:

>>
Impacts are not considered significant.

SECTION E. Stakeholders' comments

>>

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

>>
The stakeholders' comments on the implementation of the Project have been collected twice.

In July 2005, Shaanxi Water Engineering Exploring and Planning Research Institute conducted a survey on the local residents possibly impacted by the Project as a part of the *Environment Impact Assessment Report* (hereafter referred to as the EIA report). The survey was conducted in form of questionnaire.

From March to April 2006, the project owner introduced the hydropower plant to the residents nearby the project site, and then published comment invitation letters on villages' billboards for 15 business days to invite public comments..

E.2. Summary of the comments received:

>>
Both of the survey results indicate that all the interviewees agreed that the implementation of the Project has no significant environmental impact and will be beneficial to the local economic development. The comments are summarized as follows.

Survey carried out in July 2005

For the totally 100 questionnaires distributed to the stakeholders, 99 pieces returned. The basic information of the respondents is illustrated in Table 4.

Table 4. Basic Information of the Respondents

Education		
Education	**No.**	**Percentage (%)**
Colledge and above	11	11.1
Senior High school	10	10.1
Junior High school	36	36.4
Elementary school	42	42.4

Age		
Age	**No.**	**Percentage (%)**
50 and above	4	4.0
40~50	41	41.4
30~40	37	37.4
20~30	17	17.2

It can be seen that the respondents are adequately representative in terms of age and educational level, and their attitudes towards the impacts of the Project can be a comprehensive reflection of the attitudes of the residents possibly impacted by the Project. According to the 99 questionnaires received:

- 99 respondents (100%) support the implementation of the Project.
- 99 respondents (100%) consider that the implementation of the Project will benefit the local economic development.
- 99 respondents (100%) consider that the implementation of the Project will has no significant impact on environment.

Survey carried out from March to April 2006

Comments were collected 15 days after sent out. We know from the outcome of this survey that people all agree that the Project will actively decrease environment pollution and mitigate local environmental quality. In addition, the construction of the Project will renovate the local grid system, promote the development of other industries, and partly allieviate local employment pressure. All the stakeholders support the Project.

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

>>

No negative comments received during two surveys regarding the implementation of the Project. We know from the results of surveys that stakeholders of the Project generally understand and support the construction of the Project. Based on the comments received from the stakeholders, there has been no necessity to modify the Project in the aspect of design, construction and operation.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no public funding from Annex I Parties for this Project.

Annex 3

BASELINE INFORMATION

The following tables summarise the numerical results calculated from the equations listed in the consolidated baseline methodology ACM0002 for grid-connected electricity generation from renewable sources. The information provided by the tables includes data, data sources and the underlying computations.

Table A1. Calculation of simple OM emission factor of the Northwest China Grid in 2002

Energy	Unit	Shaanxi A	Gansu B	Qinghai C	Ningxia D	Xinjiang E	Total F=A+B+C+D+E	Emission factor (tC/TJ) G	Oxidation Rate (%) H	NCV (MJ/t or 1000m^3) I	Emission[24] (tCO_2e) J
Raw coal	10^4t	1607.5	1156.02	278.66	0.00	981.75	4023.93	25.8	98	20908	77997399.05
Cleaned coal	10^4t	0.00	0.91	0.00	0.00	0.00	0.91	25.8	98	26344	22224.92592
Coke oven gas	10^8m^3	0.00	0.04	0.00	0.00	0.00	0.04	13	99.5	16726	3173.145213
Other gas	10^8m^3	0.00	0.08	0.00	0.00	0.00	0.08	13	99.5	5227	1983.263187
Diesel	10^4t	1.96	0.00	0.00	0.00	1.12	3.08	20.2	99	42652	96327.017
Fuel oil	10^4t	0.00	1.7	0.00	0.00	1.27	2.97	21.1	99	41816	95123.54277
Natural gas	10^8m^3	0.00	0.53	0.00	0.00	2.33	2.86	15.3	99.5	38931	621509.161
Total emission of the Northwest China Grid (tCO_2e)						78837740.11					
Fossil power generation of the Northwest China Grid (MWh)						86084777.9					
OM emission factor of the Northwest China Grid (tCO_2e/MWh)						0.9158					

Data sources: China Energy Statistical Yearbook (2000-2002), China Electric Power Yearbook 2003.

24 If the unit of the fuel is 10^4 t, then J=F×G×H×I×44/12/10^4; if the unit of the fuel is 10^8 m^3, then J=F×G×H×I×44/12/10^3. The same about the calculation of J in Table A3 and Table A5.

Table A2. Electricity generation of the Northwest China Grid in 2002

	Electricity generation (MWh)	Auxiliary power consumption (%)	Electricity delivered to the grid (MWh)
Shaanxi	31941000	7.87	29427243
Gansu	23504000	6.83	21898677
Qinghai	4980000	8.4	4561680
Ningxia	15505000	6.54	14490973
Xinjiang	17498000	10.24	15706205
Total			86084778

Data source: China Electric Power Yearbook 2003.

Table A3. Calculation of simple OM emission factor of the Northwest China Grid in 2003

Energy	Unit	Shaanxi A	Gansu B	Qinghai C	Ningxia D	Xinjiang E	Total F=A+B+C+D+E	Emission factor (tC/TJ) G	Oxidation Rate (%) H	NCV (MJ/t or 1000m^3) I	Emission (tCO_2e) J
Raw coal	10^4t	2002.26	1479.62	330.67	682	1065.75	5560.3	25.8	98	20908	107777455.9
Other washed coal	10^4t	0.00	0.00	0.00	27	3.64	30.64	25.8	98	8363	237557.13
Coke oven gas	10^8m^3	0.00	1.54	0.00	0.00	0.00	1.54	13	99.5	16726	122166.0907
Other gas	10^8m^3	0.00	0.12	0.00	0.00	0.00	0.12	13	99.5	5227	2974.89478
Diesel	10^4t	3.12	0.00	0.00	0.04	0.4	3.56	20.2	99	42652	111339.0197
Fuel oil	10^4t	0.00	1.19	0.00	0.00	1.02	2.21	21.1	99	41816	70782.16482
Refinery gas	10^4t	0.00	0.00	0.00	0.00	3.48	3.48	18.2	99.5	46055	106419.6754
Natural gas	10^8m^3	0.1	0.54	0.00	0.00	5.95	6.59	15.3	99.5	38931	1432078.801
Total emission of the Northwest China Grid (tCO_2e)						109860773.6					
Fossil power generation of the Northwest China Grid (MWh)						105651775.3					
OM emission factor of the Northwest China Grid (tCO_2e/MWh)						1.0398					

Data sources: China Energy Statistical Yearbook 2004.

Table A4. Electricity generation of the Northwest China Grid in 2003

	Electricity generation (MWh)	Auxiliary power consumption (%)	Electricity delivered to the grid (MWh)
Shaanxi	38144000	6.94	35496806
Gansu	29494000	6.35	27621131
Qinghai	6446000	4.5	6155930
Ningxia	19175000	5.25	18168313
Xinjiang	19834000	8.19	18209595
Total			105651775

Data source: China Electric Power Yearbook 2004.

Table A5. Calculation of simple OM emission factor of the Northwest China Grid in 2004

Energy	Unit	Shaanxi A	Gansu B	Qinghai C	Ningxia D	Xinjiang E	Total F=A+B+C+D+E	Emission factor (tC/TJ) G	Oxidation Rate (%) H	NCV (MJ/t or 1000m^3) I	Emission (tCO_2e) J
Raw coal	10^4t	2428.7	1595.9	322.8	1270.1	1240.9	6858.4	25.8	98	20908	132939032.6
Other washed coal	10^4t	0.00	0.00	0.00	102.64	10.5	113.14	25.8	98	8363	877193.6583
Coke	10^4t	0.78	0.00	0.00	0.00	0.00	0.78	29.5	98	28435	23510.79731
Coke oven gas	10^8m^3	0.00	0.3	0.00	0.00	0.00	0.3	13	99.5	16726	23798.5891
Other gas	10^8m^3	0.74	1.26	0.00	0.00	0.00	2	13	99.5	5227	49581.57967
Crude oil	10^4t	0.01	0.00	0.00	0.00	0.06	0.07	20	99	41816	2125.08912
Gasoline	10^4t	0.02	0.00	0.00	0.00	0.00	0.02	18.9	99	43070	590.980698
Diesel	10^4t	2.16	0.36	0.00	0.05	0.41	2.98	20.2	99	42652	93199.51645
Fuel oil	10^4t	0.01	0.69	0.00	0.00	0.3	1	21.1	99	41816	32028.12888
Refinery gas	10^4t	0.00	0.00	0.00	0.00	3.26	3.26	18.2	99.5	46055	99691.99474
Natural gas	10^8m^3	1.61	0.59	0.00	0.00	6.27	8.47	15.3	99.5	38931	1840623.284
Total emission of the Northwest China Grid (tCO_2e)						135981376.3					
Fossil power generation of the Northwest China Grid (MWh)						122605242.6					
OM emission factor of the Northwest China Grid (tCO_2e/MWh)						1.1091					

Data sources: China Energy Statistical Yearbook 2005.

Table A6. Electricity generation of the Northwest China Grid in 2004

	Electricity generation (MWh)	Auxiliary power consumption (%)	Electricity delivered to the grid (MWh)
Shaanxi	44439000	7.5	41106075
Gansu	33242000	6.21	31177672
Qinghai	6208000	7.96	5713843.2
Ningxia	25298000	5.45	23919259
Xinjiang	22752000	9.07	20688394
Total			122605243

Data source: China Electric Power Yearbook 2005.

Table A7. Data and result of Step a.

Energy	Unit	Shaanxi A	Gansu B	Qinghai C	Ningxia D	Xinjiang E	Total F=A+B+C+D+E	Emission factor (tC/TJ) G	Oxidation Rate H	NCV (MJ/t or 1000m^3) I	Emission (tCO_2e) J
Raw coal	10^4t	2428.70	1595.90	322.80	1270.10	1240.90	6858.4	25.80	0.98	20908	132,939,033
Other washed coal	10^4t	0	0	0	102.64	10.50	113.14	25.80	0.98	8363	877,194
Coke	10^4t	0.78	0	0	0	0	0.78	29.50	0.98	28435	23,511
Sub-total											**133,839,737**
Crude oil	10^4t	0.01	0	0	0	0.06	0.07	20.00	0.99	41816	2,125
Gasoline	10^4t	0.02	0	0	0	0	0.02	18.90	0.99	43070	591
Diesel	10^4t	2.16	0.36	0	0.05	0.41	2.98	20.20	0.99	42652	93,200
Fuel oil	10^4t	0.01	0.69	0	0	0.30	1	21.10	0.99	41816	32,028
Sub-total											**127,944**
Natural gas	10^7m^3	16.1	5.9	0	0	62.7	84.7	15.30	0.995	38931	1,840,623
Coke oven gas	10^7m^3	0	3.0	0	0	0	3	13.00	0.995	16726	23,799
Other gas	10^7m^3	7.4	12.6	0	0	0	20	13.00	0.995	5227	49,582
Refinery gas	10^4t	0	0	0	0	3.26	3.26	18.20	0.995	46055	99,692
Sub-total											**2,013,695**
Total											**135,981,376**

Data sources: China Energy Statistical Yearbook 2005.

Calculate with data provided in Table A7 and formula (4)~(6), the value for λ_{Coal} is 98.43%, the value for λ_{Oil} is 0.09% and the value for λ_{Gas} is 1.48%. Therefore $EF_{Thermal} = \lambda_{Coal} \times EF_{Coal,Adv} + \lambda_{Oil} \times EF_{Oil,Adv} + \lambda_{Gas} \times EF_{Gas,Adv}$ =0.9062 tCO_2e/MWh.

Table A8. Installed capacity of the Northwest China Grid in 2004

	Shaanxi	**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
Wind power and Other (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 A9. Installed capacity of the Northwest China Grid in 2002

	Shaanxi	**Gansu**	**Qinghai**	**Ningxia**	**Xinjiang**	**Total**
Thermal power (MW)	6735.4	3881.8	803.8	2386	3949.9	17756.9
Hydro power (MW)	1462.3	3238.6	3206.3	307.9	984.8	9199.9
Wind power and Other (MW)	0	8.4	0	0	96.7	105.1
Total (MW)	8197.7	7128.8	4010	2693.9	5031.4	27061.8

Data source: China Electric Power Yearbook 2003.

Table A10. Installed capacity of the Northwest China Grid in 2001

	Shaanxi	**Gansu**	**Qinghai**	**Ningxia**	**Xinjiang**	**Total**
Thermal power (MW)	6302.4	3874.8	766.8	2046	3804.9	16794.9
Hydro power (MW)	1450.7	3118.3	3127.4	307.9	868.1	8872.4
Wind power and Other (MW)	0	8.4	0	0	70.6	79
Total (MW)	7753.1	7001.5	3894.1	2353.9	4743.6	25746.2

Data source: China Electric Power Yearbook 2002.

Table A11. Calculation of BM emission factor of the Northwest China Grid

	Installed capacity in 2001 (MW) A	Installed capacity in 2002 (MW) B	Installed capacity in 2004 (MW) C	Capacity additions from 2001 to 2004 (MW) D=C-A	Share in total capacity additions
Thermal power	16794.9	17756.9	22247.5	5452.6	71.63%
Hydro power	8872.4	9199.9	10835.2	1962.8	25.78%
Wind power and Other	79	105.1	276	197	2.59%
Total	25746.3	27061.9	33358.7	7612.4	100.00%
Share in total installed capacity of 2004	77.18%	81.12%	100%		

$EF_{BM,y}$ =0.9062×71.63%=0.6491tCO_2e/MWh.

Annex 4

MONITORING INFORMATION

Introduction

Monitoring plan determines the target distribution and time arrangement of monitoring, to ensure the true, maintainable and measurable GHGs of CDM project can be monitored, recorded and reported. This is the key procedure to determine the CERs. According to monitoring plan, monitoring system should be reliable, conservative and comprehensive, this system should have the function of data evaluation, measurement, collection and monitoring, meanwhile providing true, reliable and conservative CERs monitoring and calculation process & result to DOE when doing the project verification. This procedure will ensure the authenticity of CERs from CO2 reduction to the CERs buyers.

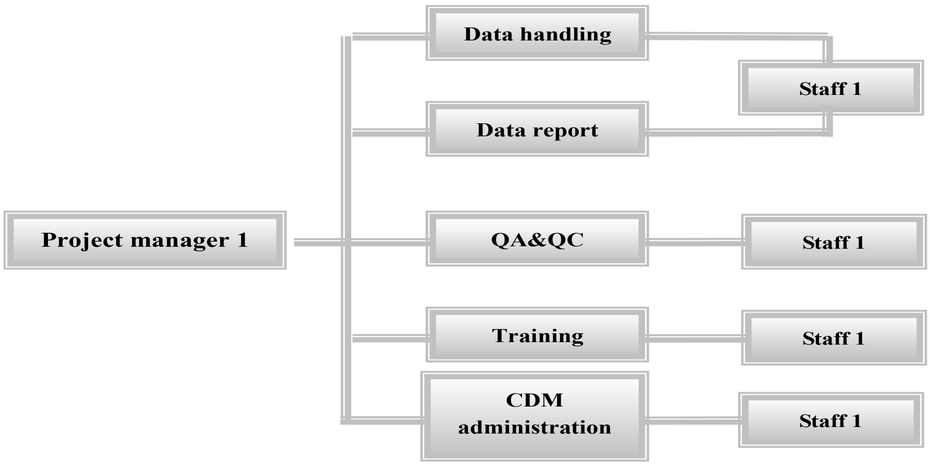
The staffs who are responsible for monitoring should strictly follow the monitoring plan. They should effectively and truly report the project CERs.

Project integrated management

The monitoring plan of Baxianyuan 27MW Hydro Power Project will be executed by the project owner, meanwhile guided by MCS, and verified by DOE. To ensure the smooth implementation of the monitoring plan, the project owner established clear monitoring system.

The monitoring system organization chart is shown in figure 1.The project manager supervises the whole monitoring activities and management. The staff of CDM administration department is responsible for CDM registration, verification and coordination with other departments about CDM affairs.

Figure 1 monitoring system flowchart of the proposed project for CDM



1. Monitored data

The electricity delivered by the Project to the China Northwest Power Grid is defined as the key data to be monitored. The monitoring plan is drafted to focus on monitoring the electricity delivered by the Project to the China Northwest Power Grid.

2. Installation of meters

Project net electricity generation will be monitored through the use of on site metering equipment at the substation. The main metering system equipment will be owned, operated and maintained by Hanzhong Electricity Bureau, which belongs to Shaanxi Electric Power Company.
The backup metering system equipment will be owned, operated and maintained by the project owner. Both meters will be read on-site in the power station house. Both grid company and plant operator have the right to read either meter. Both meters record on memory the accumulated kilowatt-hours. The results from the main meter will be supplied by Hanzhong Electricity Bureau to the project owner on a monthly basis.

3. QA & QC

QA&QC, including data monitoring, maintenance and storage, will be modified according to operation status and verification requirement.

1) Calibration
The main meter is owned and operated by the Hanzhong Electricity Bureau. The Bureau will conduct the maintenance and calibration work according to the relevant national standard. The meter will be calibrated by a professional institute at least annually so that the main meter shall have sufficient accuracy. The calibration records can be maintained by the proposed project owner for verification.

The backup meter is owned and operated by the project owner. The project owner will also conduct the maintenance and calibration work according to the relevant national standard. The meter will be calibrated by a professional institute at least annually so that the backup meter shall have sufficient accuracy. The calibration records can be maintained by the proposed project owner for verification.

2）Emergency

There are no GHG emissions when the electricity generation system stops working.

Should any previous months reading of the Main Meter be inaccurate by more than the allowable error, or otherwise functioned improperly, the grid-connected electricity generated by the proposed project shall be determined by:

- First, by reading Backup Meter, unless a test by either party reveals it is inaccurate;
- If the backup system is not with acceptable limits of accuracy or is otherwise performing improperly the proposed project owner and the Hanzhong Electricity Bureau shall jointly prepare an estimate of the correct reading; and
- If the project owner and the Hanzhong Electricity Bureau fail to agree the estimate of the correct reading, then the matter will be referred for arbitration.

The quality assurance and quality control procedures for recording, maintaining and archiving data shall be improved as part of this CDM project activity according to CDM EB rules and real practice in terms of the need for verification of the emission reductions on an annual basis according to this PDD.

4. Calculation of emission reductions

Emission reduction of the project is calculated by Millennium Capital Services, as the consultant of the Project. To ensure the transparence and conservative, an excel table is used for calculation, with all relative data and calculate process provided. Meanwhile, sources of default values are provided for DOE verification.

Emission reduction of the project is calculated by project assistant from Millennium Capital Services. To ensure its conservativeness and accuracy, the calculation process is also double checked and saved by project manager from Millennium Capital Services.

5. Data management systems

Data management systems are used to keep monitoring data. It is the key step in monitoring process. The emission reductions cannot be verified, if the monitoring data is not kept well.

The original data and the final results, as well as all the information and relative data are kept electronically and in paper, and are listed by document name, content summary for check and other use. Reference and website address are also provided for DOE verification.

All relative documents are kept by the monitoring group and at least have 1 copy.

Documents required in monitoring and verification is listed in Table 3.

Table 3 Documents required in monitoring and verification

I.D. No.	Document Title	Main Content	Source
F-1	PDD, including the electronic spreadsheets and supporting documentation (assumptions, estimations, measurement, etc)	Calculation procedure of emission reduction and monitoring items	the project owner, or directly download from UNFCCC website
F-2	Monitoring Quality Control and Quality Assurance Report	Equipments and national and industry standards	the project owner
F-3	The report on qualifications of the persons responsible for the monitoring and calculation	Major, the title of a technical post, working experience and etc.	the project owner
F-4	The report on monitoring and checking of the electricity delivered by the Project to the grid	Record based on monthly meter reading and electricity sales receipts/records	the project owner
F-5	Record on maintenance and calibration of metering equipment	Reasons for maintenance and calibration and the precision after maintenance and calibration	the project owner
F-6	Monitoring report	CO_2 emission reduction calculation	Project owner and Millennium Capital Services
F-7	Letter of confirmation on F-2 to F-6	Confirmation of monitoring and calculation data and procedure from F-2 to F-6	Project owner and Millennium Capital Services
F-8	Project Management Record (including data collection and management system)	Comprehensive and true reflection of the management and the operation of the Project	the project owner

6. Personnel training

The monitoring plan need to be executed by qualified professionals, thus the project owner will train the relevant personnel before the project operation.

The training will make sure the relevant personnel to master the necessary mechanical, electric and installing knowledge, know well the working principle and the fundamental structure of wind power generator, understand the reasons of common malfunction and the corresponding solving methods, expertly use the automatic monitoring system and understand the request of CDM on the monitoring system.

Project owner will organize professional training periodically to improve the professional skill of the operators after the project operation.

The fresh employees have to receive training on relevant CDM knowledge, monitoring requirements of CDM projects and project operation skills.

If personnel alternation happens, the worker taking over should be ensured to receive the same training.

In summary, the monitoring plan of the project will be executed by the project owner, under the supervision of the project consultant, Millennium Capital Services, according to detail requirements from EB on monitoring, validation and verification to ensure the emission reduction can be monitored, recorded and reported accurately.

7. Verification of monitoring results

Verification of monitoring results is a necessary part of all CDM projects. The main purpose of verification is to verify the achievement of GHG reduction independently. The verification of emission reductions generated from the Project will be done annually.

The main steps of verification are listed as below:

- The project owner signs agreement with the DOE that conducts the verification, and stick to the verification schedule according to the request of the buyer and CDM EB in the crediting period. The project owner will make the preparation in advance and support the verifiers and relevant personnel to achieve the verification work in high quality and efficiently.
- The project owner will offer the complete information according to DOE's request before and during the verification process. The consultant of the project, Millennium Capital Services, will make inner inspection together with the project owner every year before the DOE verification.
- The project owner will inform its employees to cooperate with the DOE verifiers to finish the visit and to faithfully answer all questions raised by the verifiers about emission reductions.

The consultant of the project, Millennium Capital Services, as the contactor of DOE verification, will be in charge of revising the monitoring plan according to the verification content every year.

8. Efficiency evaluation

To assess whether the project can reach the anticipative efficiency on the Feasibility Study Report, the project owner, together with the project consultant, Millennium Capital Services, evaluate the electricity delivered to the grid, project power generation and power generation of each turbine in the end of every year.
The evaluation results will be stored by both parties.

Annex 5

CASH FLOW TABLE OF TOTAL INVESTMENT

Series	Item	Construction			Operation period													
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
1	cash inflow	0	0	0	2407	2407	2407	2407	2407	2407	2407	2407	2407	2407	2407	2407	2407	2407
1.1	sale revenue of power generation	0	0	0	2407	2407	2407	2407	2407	2407	2407	2407	2407	2407	2407	2407	2407	2407
1.2	recovery of residue value of the fixed assets	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.3	recovery of fluid capital	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	cash outflow	446	1350	511	501	501	501	562	574	586	599	612	751	777	789	789	789	789
2.1	value of fixed assets	4465	13502	5063	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.2	fluid capital	0	0	54	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.3	operating cost	0	0	0	490	490	490	490	490	490	490	490	490	490	490	490	490	490
2.4	sales tax and extra charges	0	0	0	12	12	12	12	12	12	12	12	12	12	12	12	12	12
2.5	income tax	0	0	0	0	0	0	61	73	85	98	111	249	275	288	288	288	288
3	net cash flow	446	1350	511	1906	1906	1906	1845	1833	1821	1808	1795	1657	1631	1618	1618	1618	1618

(Continued)

Series	Item	Operation period															
		18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
1	cash inflow	2407	2407	2407	2407	2407	2407	2407	2407	2407	2407	2407	2407	2407	2407	2407	2461
1.1	sale revenue of power generation	2407	2407	2407	2407	2407	2407	2407	2407	2407	2407	2407	2407	2407	2407	2407	2407
1.2	recovery of residue value of the fixed assets	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.3	recovery of fluid capital	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	54
2	cash outflow	789	789	789	789	789	789	789	789	1046	1119	1119	1130	1130	1130	1130	1130
2.1	value of fixed assets	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.2	fluid capital	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.3	operating cost	490	490	490	490	490	490	490	490	490	490	490	490	490	490	490	490
2.4	sales tax and extra charges	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
2.5	income tax	288	288	288	288	288	288	288	288	544	618	618	628	628	628	628	628
3	net cash flow	1618	1618	1618	1618	1618	1618	1618	1618	1362	1288	1288	1278	1278	1278	1278	1332

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