CLEAN DEVELOPMENT MECHANISM

PROJECT DESIGN DOCUMENT FORM (CDM-SSC-PDD)
Version 03 - in effect as of: 22 December 2006

CONTENTS

Annexes

Revision history of this document

Version Number	Date	Description and reason of revision
01	21 January 2003	Initial adoption
02	8 July 2005	• The Board agreed to revise the CDM SSC PDD to reflect guidance and clarifications provided by the Board since version 01 of this document. • As a consequence, the guidelines for completing CDM SSC PDD have been revised accordingly to version 2. The latest version can be found at <http://cdm.unfccc.int/Reference/Documents>.
03	22 December 2006	• The Board agreed to revise the CDM project design document for small-scale activities (CDM-SSC-PDD), taking into account CDM-PDD and CDM-NM.

SECTION A. General description of small scale project activity

A.1. Title of the small scale project activity:

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Project Title: Waste Coke Oven Gas Recovery and Reconstruction of Kilns in Loudi WUJO Industrial Co., Ltd.

PDD Version: Version 6

PDD completion date: 15th Jan 2013

A.2. Description of the small scale project activity:

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(1) The purpose of the Loudi WUJO COG project activity

(a) The project owner is Loudi WUJO Industrial Co., Ltd. (hereafter referred as WUJO). Prior to the implementation of the proposed project, 2 sets of glass furnaces, 4 sets of Lehres, 2 sets of processing lines, 1 boiler and 5 enamel converters were installed at the project site. Prior to the project implementation, these facilities used coal gas as the fuel to generate thermal energy through 3 water coal gas furnaces and 3 mixed coal gas furnaces, which will be removed in the proposed project. In the project scenario, the coal gas is replaced by coke oven gas supplied by the two sets of coke ovens at the nearby Lianyuan City HUIYUAN Gas Co., Ltd (a branch of Hunan Wujo Light Industry & Chemicals Group Co. Ltd). The two coke ovens at Lianyuan City HUIYUAN Gas Co., Ltd each produce 400,000t of coke annually and generate 437.5Nm^3 of coke oven gas per tonne produced[1]. Therefore, Lianyuan City HUIYUAN Gas Co., Ltd releases about 3.5×10^8 Nm^3 of Coke Oven Gas (800,000*437.5) annually as a byproduct of coke production, which is released into the atmosphere after incineration.

(b) The proposed small scale project is a waste coke oven gas (COG) recovery project via reconstruction of existing kilns at WUJO, which is located in Shimen Industrial Park, Maotang town, Lianyuan, Hunan province. It plans to reconstruct existing kilns (including glass furnaces, Lehres, processing lines，boiler and enamel converters), in order to recover the COG from HUIYUAN as fuel of these kilns. The proposed project will utilise 71,880,480Nm^3 of COG gas per year, which is 20.5% of the total COG produced at HUIYUAN. At the same time, a gas pipeline with a length of 27 km from HUIYUAN to WUJO will be built to transport the gas to the proposed project.

(c) In absence of the proposed project, the COG will be released into the atmosphere after incineration[2] (which is demonstrated through 'Paragraph 5. (h) Option iv) Process plant manufacturer's original specifications' as per the applicability conditions of the methodology). These facilities use coal gas as the fuel to generate thermal energy. The historic fuel consumption of these facilities in the latest three years before the implementation of the proposed project was 122,142,559 / 121,266,614 / 120,326,700 Nm^3 (fuel consumption is coal gas，data from 2005 to 2007). The boundary of the proposed project activity includes:

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1 *'COG discharging explanation'* issued by Lianyuan Economic Bureau on 5th February 2008.

2 '*The main equipments technical specifications'* issued by Loudi WUJO Industrial Co., Ltd. on 1st March 2009

According to the methodology, there are 4 options to prove the COG status in the absence of the project activity: (i) direct measurement, (ii) energy balance, (iii) energy bills or (iv) process plant. In the project, Option 4 (manufacturer's original specification/information, schemes and diagrams from the construction of the facility could be used as an estimate of quantity and energy content of waste gas/heat produced for rated plant capacity/per unit of product produced.) is chosen. According to *The main equipments technical specifications'*, there are two coke ovens in Huiyuan coking plant, each of which has a COG production capacity of 175,000,000 Nm^3 per year. Therefore, the COG production capacity of two coke ovens together is 350,000,000 Nm^3 per year. The production capacity of these ovens is not affected by the project activity, and the above coke oven gas is released into the atmosphere after incineration in the baseline.

coke ovens in HUIYUAN, glass furnaces, Lehres, processing lines, boiler, enamel converters and other auxiliary facilities in WUJO. In absence of the project, these thermal energy generators will consume coal gas as fuel, and COG of HUIYUAN will be released into the atmosphere after incineration. This is same as the baseline scenario.

(2) Loudi WUJO COG project activity reduces GHG emissions

The project owner completed the FSR of the proposed project in Feb. 2008, and the project was started in Nov. 2008 with a signed purchasing contract for the main equipments. In the project, 7.19×10^7 Nm3 of COG is planed to be recovered as fuel to generate thermal energy. Because of the utilization of waste energy (COG), the project activity reduces greenhouse gas emission. The emission reduction is estimated to be 57,461 tCO_2e per year by the fuel switch. Total emission reduction of 574,609 tCO_2e will be produced in a fixed crediting period of 10 years.

(3) In addition to reducing emissions of greenhouse gases, the project will also promote the local sustainable development in following aspects:

- To improve local air quality and water quality resources – the project will reduce emissions of CO_2, SO_2, NO_x and particulate matter and will minimise wastewater contamination in the local water resources. Therefore, the proposed project activity provides significant benefit to the local environment by reducing the air emissions pollution and wastewater contamination from the coke oven plant operations.
- To improve the fuel structure, saving non-renewable resources, thus contributing to national sustainable development.
- To create about 30 new jobs and provide relevant training opportunities for employees and promote local economic development.

A.3. Project participants:

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Table A-1 Project Participants Information

Name of Party involved ((host) indicates a host Party)	Private and/or public entities, project participants (as applicable)	Kindly indicate if the Party involved whishes to be considered as project participant (Yes/No)
People´s Republic of China (host)	Loudi WUJO Industrial Co., Ltd.	No
United Kingdom of Great Britain and Northern Ireland	Originate Carbon Ltd.	No

A.4. Technical description of the small scale project activity:

A.4.1. Location of the small scale project activity:

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A.4.1.1. Host Party(ies):

>>
People´s Republic of China

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

>>
Hunan Province

A.4.1.3. City/Town/Community etc:

>>
Shimen Industrial Park, Lianyuan, Loudi City

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

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Figure A.1 below shows the location of the proposed project site. The proposed project is located in Maotang town, Lianyuan County, Loudi City, Hunan Province, P. R. China. The proposed site is 23 km from the urban district of Lianyuan. The geographical coordinates of the site in decimal degrees are 27.7631° North; 111.7458° East. The map below shows the location of the proposed construction site.

Figure A.1 location of the proposed small scale project activity

A.4.2. Type and category(ies) and technology/measure of the small-scale project activity:

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According to Appendix B of the simplified modalities and procedures for the small-scale CDM project activities, the proposed project belongs to:
Type III: Other type of project
Section: III-Q waste energy recovery

The original technology used coal gas burnt furnaces to heat up glass and roughcast enamel. 3 sets of water coal gas furnace and 3 sets of mixed coal gas furnace were established to provide fuel for these furnaces. These coal gas ovens are inefficient and produce high levels of pollution. To improve energy efficiency and reduce pollution, the project owner plans to reconstruct these facilities, as well as establish a gas pipeline from WUJO to HUIYUAN, so as to recover the waste coke oven gas (COG) as fuel.

Parameters such as the burning mechanism, quantity of smoke in furnace, length of the blaze in COG-fired furnace are different from coal gas-fired furnaces. Furnaces need to be reconstructed to meet the requirements of COG burning. Reconstruction involves the reduction of the length of the furnace and assistant furnace, improvement of the structure of the clarifier, improvement of the thermal storage room with new material, reduction of heat loss in the furnace, increasing the height of the throat, improving the anti-corrosion of the assistant furnace and so on.

To ensure the continuous and stable supply of COG, a gas transportation system needs to be built. The gas transportation system includes a gas pipeline with length of 27km and a set of gas regulation cabinets.

The process of the project is as follows:

COG is burnt in two glass furnaces, in which raw materials are heated and melted into liquid for producing glass. A roughcast of the flask is produced in the melting shop and is then annealed. Qualified roughcasts are made into vacuum flasks after cutting, drawing, obturating, silvering, and vacuuming.

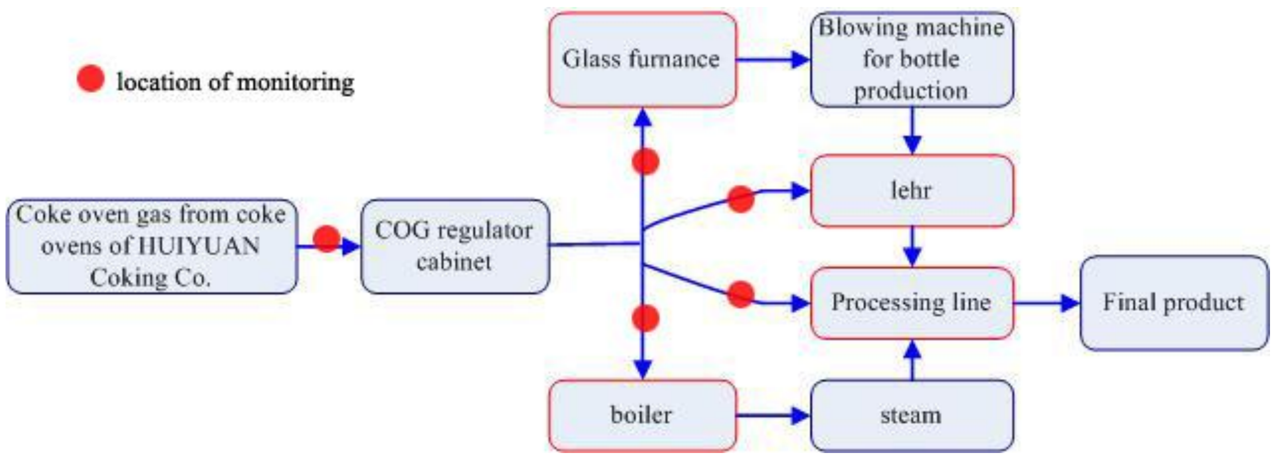

Figure A.2 Process of the project and location of monitoring

New COG-fired furnaces will be installed for ensure the safety and efficiency. Table A.3 and A.2 give the technical parameters of the main project equipment before and after the implementation of the project activity. *Option (a)* of the "Tool to determine the remaining lifetime of equipment", detailed in EB 50, Annex 15 (16th October 2009), has been used to define the remaining lifetime of project equipment. *Option (a)* uses the difference between the Technical Lifetime and Operation Time[3] to calculate the Remaining Lifetime.

Table A.2 Technical parameters of main equipments (before implement of project activity)

I.D.	Name of equipment	Quantity	Main technical parameters	
1	63-hole WKD43D coke oven	2	Designed annual yield of coke:	400,000 tonnes
			COG yield per unit of coke:	437.5Nm3/t
			Designed annual yield of COG:	175,000,000 Nm3
			Total annual yield of COG of 2 coke ovens:	350,000,000 Nm3
			Technical Lifetime:	20 yr
			Remaining lifetime:	14yr
2	Water coal gas furnace	3	Designed annual yield of water coal gas:	2800-3200Nm3/h
			Furnace diameter:	2400mm
			Ash pan revolution speed:	0-2r/h

[3] Refer to the document *'Lifetime proof for main equipment'* issued by Hunan Province Loudi City Quality and Technical Inspection Bureau on the 1st November 2009, for all evidence of Technical and Operation Lifetime given in Table A.3 and A.2.

			Technical Lifetime	20 years
			Year Installed	2005
			Remaining Lifetime	13 years
	Mixed coal gas furnace	3	Model:	GC-3
			Designed annual yield of mixed coal gas:	5000-6000Nm3/h
			Furnace diameter:	3000 mm
			Ash pan revolution speed:	0.232-2.571 r/h
			Technical Lifetime	20
			Year Installed	2005
			Remaining Lifetime	13 years
3	$45m^2$ glass furnace	1	Output of glass solution:	77—80t/d
			Area:	45m2
			Furnace pressure:	20kPa
			Suitable motor parameters:	YZ160M-6 5KW
			Fuel type:	Coal gas
			Energy efficiency:	89%
			Lifetime:	15 yr
4	$56m^2$ glass furnace	1	Output of glass solution:	75—78t/d
			Area:	56 m2
			Fuel type:	Coal gas
			Suitable motor parameters:	YZ160M-6 5.5KW
			Furnace pressure:	20kPa
			Energy efficiency:	89%
			Lifetime:	15 yr
5	6 ton Coal Burnt Boiler	1	Model:	SHFx6-1.25-LIZ
			Output of steam:	6t/h

<table>
<tr><td rowspan="6"></td><td rowspan="6"></td><td rowspan="6"></td><td colspan="2">Temperature:</td><td>194℃</td></tr>
<tr><td colspan="2">Pressure:</td><td>1.25MPa</td></tr>
<tr><td colspan="2">Energy efficiency:</td><td>89%</td></tr>
<tr><td colspan="2">Technical Lifetime</td><td>25 years</td></tr>
<tr><td colspan="2">Year Installed</td><td>2000</td></tr>
<tr><td colspan="2">Remaining Lifetime:</td><td>13 yr</td></tr>
<tr><td rowspan="9">6</td><td rowspan="9">Lehre</td><td rowspan="5">2</td><td colspan="2">Width of net:</td><td>1800mm/2050mm</td></tr>
<tr><td colspan="2">Length of net:</td><td>37m</td></tr>
<tr><td colspan="2">Suitable motor parameters:</td><td>YCTL180-4A,4KW</td></tr>
<tr><td colspan="2">Energy efficiency:</td><td>88%</td></tr>
<tr><td colspan="2">Lifetime:</td><td>20yr</td></tr>
<tr><td rowspan="4">2</td><td colspan="2">Width of net:</td><td>2600mm</td></tr>
<tr><td colspan="2">Suitable motor parameters:</td><td>YCTL180-4A,5.5KW</td></tr>
<tr><td colspan="2">Energy efficiency:</td><td>88%</td></tr>
<tr><td colspan="2">Lifetime:</td><td>20yr</td></tr>
<tr><td rowspan="7">7</td><td rowspan="7">Processing line</td><td rowspan="7">2</td><td rowspan="5">Including:</td><td>1. Capping machine</td><td>PTZTF2L-3.2L-42
FK3.2-41
FK2-41</td></tr>
<tr><td>2. Cut small opening machine
Cut big opening machine
Cut big bottom machine</td><td></td></tr>
<tr><td>3. Drying machine</td><td>C series</td></tr>
<tr><td rowspan="2">4. End-pulling machine</td><td>WL-K-2</td></tr>
<tr><td>2L</td></tr>
<tr><td colspan="2">Lifetime:</td><td>20yr</td></tr>
<tr><td colspan="2">Energy efficiency:</td><td>82%</td></tr>
<tr><td rowspan="2">8</td><td rowspan="2">Enamel converter</td><td rowspan="2">3</td><td colspan="2">Diameter of switcher</td><td>Φ3600</td></tr>
<tr><td colspan="2">Length×width×height of heating zone/m</td><td>17×0.72×0.782</td></tr>
</table>

			The chain length of Firing furnace/m	40
			Temperature of heating zone	820-880℃
			Production capacity (Kg/h)	2200-3000
			Lifetime:	20 yr
			Energy efficiency:	82%
		1	Diameter of switcher	Φ2700
			Length×width×height of heating zone/m	17×0.62×0.782
			The chain length of Firing furnace/m	40
			Temperature of heating zone	820-880℃
			Production capacity (Kg/h)	2500-2600
			Lifetime:	20 yr
			Energy efficiency:	82%
		1	Length×width×height of heating zone /m	3×1.6×0.4
			Temperature of heating zone	820-880℃
			Production capacity (Kg/h)	1250-1300
			Lifetime:	20 yr
			Energy efficiency:	82%

Table A.3 Technical parameters of main equipments (after implement of project activity)

I.D.	Name of equipment	Quantity	Main technical parameters	
1	COG compressor	1	Model:	L93WD/L84WD
			Outlet pressure/ temperature:	30Kpa/40^{O}C
			Voltage:	10kV/380V
			Medium:	COG
			Flow rate:	315m3/min
			Technical Lifetime:	15 years
			Year Installed:	2009

			Remaining Lifetime:	12 yr
2	45m^2 glass furnace	1	Output of glass solution:	77-80t/d
			Area:	45m2
			Fuel type:	COG
			Suitable motor parameters:	YZ160M-6 5KW
			Furnace pressure:	20kPa
			Energy efficiency:	93%
			Technical Lifetime:	25 years
			Year Installed:	2000
			Remaining Lifetime:	13 yr
3	56m^2 glass furnace	1	Output of glass solution:	75-78t/d
			Area:	56 m2
			Fuel type:	COG
			Suitable motor parameters:	YZ160M-6 5.5KW
			Furnace pressure:	20kPa
			Energy efficiency:	93%
			Technical Lifetime:	25 Years
			Year Installed:	2001
			Remaining Lifetime:	14 yr
4	6 ton COG burnt boiler	1	Model:	SZL6-1.25-WIIAI
			Yield of steam:	6t/h
			Temperature:	194℃
			Pressure:	1.25MPa
			Energy efficiency:	92%
			Technical Lifetime:	20
			Year Installed:	2009
			Remaining Lifetime:	17 yr
5	Lehre	2	Width of net:	1800mm/2050mm
			Length of net:	37m

			Suitable motor parameters:		YCTL180-4A, 4KW
			Fuel type:		Coke Oven Gas
			Energy efficiency:		94%
			Technical Lifetime:		24 years
			Year Installed:		2004
			Remaining Lifetime:		16yr
		2	Width of net:		2600mm
			Suitable motor parameters:		YCTL180-4A, 5.5KW
			Fuel type:		Coke Oven Gas
			Energy efficiency:		94%
			Technical Lifetime:		24 years
			Year Installed:		2004
			Remaining Lifetime:		16yr
6	Processing line	2	Including :	1. Capping machine	PTZTF2L-3.2L-42 FK3.2-41 FK2-41
				2. Cut small opening machine Cut big opening machine Cut big bottom machine	
				3. Drying machine	C series
				4. End-pulling machine	WL-K-2
					2L
			Fuel type:		COG
			Technical Lifetime:		20 years
			Year Installed:		2004
			Remaining Lifetime:		12 yr
			Energy efficiency:		82%
7	20,000m^3 gas cabinet	1	Volume:		20,000 m^3
			Medium:		COG

		1	Technical Lifetime:	20 years
			Year Installed:	2009
			Remaining Lifetime:	17 yr
8	Enamel converter	3	Diameter of switcher	Φ3600
			Length×width×height of heating zone /m	17×0.72×0.782
			The chain length of Firing furnace/m	40
			Temperature of heating zone	820-880℃
			Production capacity (Kg/h)	2200-3000
			Fuel type:	COG
			Technical Lifetime:	20 years
			Year Installed:	2004
			Remaining Lifetime:	12 yr
			Energy efficiency:	82%
		1	Diameter of switcher	Φ2700
			Length×width×height of heating zone /m	17×0.62×0.782
			The chain length of Firing furnace/m	40
			Temperature of heating zone	820-880℃
			Production capacity (Kg/h)	2500-2600
			Fuel type:	COG
			Technical Lifetime:	20 years
			Year Installed:	2004
			Remaining Lifetime:	12 yr
			Energy efficiency:	82%
		1	Length×width×height of heating zone (m^3)	3×1.6×0.4
			Temperature of heating zone	820-880℃
			Production capacity (Kg/h)	1250-1300

			Fuel type:	COG
			Technical Lifetime:	20 years
			Year Installed:	2004
			Remaining Lifetime:	12 yr
			Energy efficiency:	82%

Table A.4 Component analysis of coke oven gas (COG)[4]

Component	CH_4	C_mH_n	CO	H_2	H_2O	N_2	CO_2	O_2
Content (%)	25.40	2.44	6.07	56.7	2.22	4.41	2.15	0.59
Low calorific value (MJ/Nm^3)	17.60							

The proposed project utilises 'mixed coal gas' and 'water coal gas' prior to the implementation of the project. They are defined as:

- Water Coal Gas – the mixture of carbon monoxide and hydrogen, generated by heating coal and water vapour
- Mixed Coal Gas – created using air and water as a gasifying agent, and reacting with the heating coal and generating gas

Collectively these are referred to as 'coal gas' in the PDD although their properties are each given in the tables below.

Table A.4 Component analysis of water coal gas[5]

Component	H_2	CO	CO_2	N_2	CH_4	O_2
Content (%)	47-52	35-40	5-7	2-6	0.3-0.6	0.1-0.2
Low calorific value (MJ/Nm^3)	6.2802 - 8.3736					

Table A.4 Component analysis of mixed coal gas[6]

Component	H_2	CO	CO_2	N_2	CH_4	O_2
Content (%)	11-15	24-30	3-7	47-54	0.5-0.7	0.1-0.3
Low calorific value (MJ/Nm^3)	5.02416 – 5.44284					

There is no technology transfer because all technology and equipments involved in the proposed project are

[4] '*COG discharging explanation'* issued by Lianyuan Economic Bureau on 5th February 2008
[5] *'Coal gas components'* issued by Baidu Encyclopedia on 3rd June 2010
[6] *'Coal gas components'* issued by Baidu Encyclopedia on 3rd June 2010

domestic.

A.4.3. Estimated amount of emission reductions over the chosen crediting period:

>>
Anthropogenic emissions of GHGs are to be reduced because of the switch in fuel from coal to coke oven gas. The estimated emission reduction is **57,461** tCO_2e per year, and the total emission reduction arising from the project activity in a fixed crediting period of 10 years (from 1st October, 2012 to the 30th September 2022) is **574,609** tCO_2e. The detailed calculation of emission reduction will be given in Section B6.4

Table A.5 Estimated Emissions Reductions Over crediting period

Years	Annual estimation of emission reductions in (tCO_2e)
01/10/2012 – 31/12/2012	***14,365***
2013	***57,461***
2014	***57,461***
2015	***57,461***
2016	***57,461***
2017	***57,461***
2018	***57,461***
2019	***57,461***
2020	***57,461***
2021	***57,461***
01/01/2022 – 30/09/2022	***43,096***
Total estimated reductions (tones of CO_2e)	***574,609***
Total number of crediting years	***10***
Annual average over the crediting period of estimated reductions (tones of CO_2e)	***57,461***

A.4.4. Public funding of the small scale project activity:

>>

No public funding is provided for this project.

A.4.5. Confirmation that the small-scale project activity is not a bundled component of a large scale project activity:

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According to *Appendix C to the simplified modalities and procedures for the small-scale CDM project*

activities, the proposed small scale project activity cannot be considered debundled component of a large scale project activity, if there is no other project for which the following condition is satisfied:

1. With the same project participants;

2. Employs the same technology and belongs to a same section;

3. Has been registered as a CDM project within recent two years, or in procedure of CDM project registering;

4. The shortest distance between the boundary of the proposed small scale project activity and the large scale project is not less than 1 kilometer.

Because there is no such project, it can be confirmed that the proposed small scale project activity is not a debundled component of a large 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 small-scale project activity:

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The proposed project applies the "Waste energy recovery (gas/heat/pressure) Project" methodology **(**AMS-III.Q. Ver. 04, EB61**)**, which is available on the UNFCCC website as follows:
http://cdm.unfccc.int/methodologies/DB/3U6PNM2D6CSPAS1GKQ9BTM63RDTRRP
CDM Executive Board: Baseline and monitoring methodology AMS-III.Q, Version: 03, EB 51, Waste energy recovery (gas/heat/pressure) Project, dated 04 December 2009;
CDM Executive Board: Baseline and monitoring methodology AMS-III.Q version: 4.0, EB 60, Waste energy recovery (gas/heat/pressure) projects, dated 15 April, 2011;
CDM Executive Board: Guidance for request for deviation titled "Application of AM0005 and AMS-I.D in China", dated 7 October 2005: http://cdm.unfccc.int/Projects/deviations/87512
CDM Executive Board: Tool to determine the remaining lifetime of equipment, detailed in EB 50, Annex 15 dated 16 October 2009

B.2. Justification of the choice of the project category:

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The methodology AMS-III.Q (version 04) is for project activities that utilize waste gas and/or waste heat (henceforth referred to as waste gas/heat) at existing facilities as an energy source for:

- Cogeneration; or
- Generation of electricity; or
- Direct use as process heat source; or
- For generation of heat in element process (e.g. steam, hot water, hot oil, hot air);
- For generation of mechanical energy

AMS-III.Q (ver. 4) is also applicable to project activities that use waste pressure to generate electricity.

The objective of the proposed project activity is to utilize waste coke oven gas (COG) at existing facilities as an energy source for generation of heat in an elemental process. Waste COG will be used as the fuel for the kilns including: glass furnaces; Lehres; processing lines， boilers and enamel converters to generate thermal energy. Thus it could primarily be considered that the methodology is applicable to the proposed project activity.

In accordance with the items of applicability condition of methodology AMS-III.Q (ver. 4), the description of relevant situation of the proposed project and corresponding conclusions are showing as follows:

Table B-1 The applicably of the methodology

No.	Methodology AMS-III.Q (version 4)	Project situation
1	The category is for project activities that utilize waste gas and/or waste heat at existing facilities[1] as an energy source for: (a) Cogeneration; or (b) Generation of electricity; or (c) Direct use as process heat; or	(d) Generation of heat in elemental process (e.g. steam, hot water, hot oil, hot air): The objective of the proposed project activity

	(d) Generation of heat in elemental process (e.g. steam, hot water, hot oil, hot air); or (e) Generation of mechanical energy	is to utilize waste coke oven gas (COG) at existing facilities as an energy source for the generation of heat in elemental processes including: glass furnaces, Lehres, processing lines, boilers and enamel converters.
2	The category is also applicable to project activities that use waste pressure to generate electricity at existing facilities.	This project is not for electricity generation.
3	The recovery of waste gas/heat/pressure should be a new initiative (no waste gas/heat/pressure was recovered from the project activity source prior to the implementation of the project activity).	The project activity is a new initiative
4	Measures are limited to those that result in emission reductions of less than or equal to 60 kt CO2 equivalent annually.	The emission reduction is 57,461 t CO_2e/yr, which is less then 60 kt CO_2e/yr (Further details are provided in Part B6). This is consistent with the Methodology AMS-III.Q (version 4).
5	The category is applicable under the following conditions: a) The energy produced with the recovered waste gas/heat or waste pressure should be measurable; b) Energy generated in the project activity may be used within the industrial facility or exported to other industrial facilities (included in the project boundary); c) Electricity generated in the project activity may be exported to the grid or used for captive purposes. However, the methodology is not applicable to projects where the waste gas/heat recovery project is implemented in a single-cycle power plant (e.g., gas turbine or diesel generator) where heat generated on site is not utilizable for any other purposes on-site except to generate power. The projects recovering waste energy from such power plants for the purpose of generation of heat only can apply this methodology; d) For a project activity which recovers waste gas/heat/pressure for power generation from multiple sources (e.g. kiln and single-cycle power plant), this methodology can be used in combination with AMS-III.AL provided that: (i) Within the project activity it is possible to distinguish two distinct waste energy sources such that: • Waste energy source-I (e.g. kiln) belongs to such waste heat sources which are eligible under AMS-III.Q;	a) The energy produced with the recovered waste COG will be measured according to the monitoring plan described in Part B.7.2. b) The proposed project will use the energy generated by utilization of waste COG in the kilns only and within the project boundary, which is consistent with the Methodology AMS-III.Q (version 4). c) This project does not include electricity generation. The proposed project recovers waste COG for the purpose of generation heat in the kilns. d) This project is not for power generation.

	• Waste energy source-II (e.g. single-cycle power unit) belongs to such waste heat sources which are eligible under AMS-III.AL; (ii) It is possible, for each waste energy source, to determine the baseline according to the specific methodology referred to; (iii) It is possible to objectively allocate the electricity produced in the project activity to each waste energy source, by means of one of the following methods: • Through separate measurements of the electricity produced by utilizing waste energy from each waste energy source; or • Through separate measurements of the energy content of the waste energy carrying medium (WECM) streams used for electricity production; or • Through separate measurements of the energy content of the waste energy streams that are associated with each waste energy source and used for electricity production or for the WECM generation in a common waste heat recovery system (e.g. if steam is generated by waste heat from a kiln and waste heat from an internal combustion engine in a common waste heat recovery boiler);	
	e) The emission reductions are claimed by the generator of energy using waste energy;	e) The emission reductions are claimed by Loudi WUJO Industrial Co., Ltd., the generator of thermal energy using waste energy (COG).
	f) In cases where the energy is exported to other facilities (included in the project boundary), the following are required; (i) All historical information from the recipient plants; (ii) An official agreement exists between the owners of the project energy generation plant (henceforth referred to as generator, unless specified otherwise) with the recipient plant(s) that the emission reductions would not be claimed by the recipient plant(s) for using a zero-emission energy source;	f) All of the energy generated by waste COG in the project is used by the project owner itself. There is no energy exported to other facilities.
	g) For those facilities and recipients included in the project boundary, that prior to implementation of the project activity (current situation) generated energy on-site (sources of energy in the baseline), the credits can be claimed for minimum of the following time periods: (i) The remaining lifetime of equipment	g) The credits will be claimed in a fixed crediting period of 10 years (from 1st February 2012 to 31st January 2022) as previously shown in Section A.4.3.

	currently being used; and (ii) Crediting period. h) The waste gas/heat or waste pressure utilized in the project activity would have been flared or released into the atmosphere in the absence of the project activity. This shall be proven by one of the following options: (i) Direct measurements, (ii) Energy balance, (iii) Energy bills, (iv) Process plant manufacturer's original specifications	h) In the project, Option (iv) is selected to demonstrate the COG status in the absence of the project activity. Direct measurement of COG was not made prior to the project's implementation, and there is no evidence in the form of Energy bills as the waste gas was released to the atmosphere. Similarly, a historical energy balance is not available for the separate facility generating the waste gas used in the project. Therefore, manufacturer's original specification/ information, schemes and diagrams from the construction of the facility are used to estimate the quantity and energy content of waste gas/heat produced at the plant and to calculate the capacity/per unit of product produced. There are in total two coke ovens in the Huiyuan coking plant, the COG production capacity of each coke oven is 175,000,000 Nm^3, COG production capacity of the two coke ovens is 350,000,000 Nm^3. In absence of the project (baseline), the COG was released into the atmosphere after incineration[7].
6	For the purpose of this category waste energy is defined as: a by-product gas/heat/pressure from machines and industrial processes having potential to provide usable energy, for which it can be demonstrated that it was wasted. For example gas flared or released into the atmosphere, the heat or pressure not recovered (therefore wasted). Gases that have intrinsic value in a spot market as energy carrier or chemical (e.g. natural gas, hydrogen, liquefied petroleum gas, or their substitutes) are not eligible under this category.	Prior to the implementation of the project activity, COG was released to the atmosphere following incineration. The proposed project will use the heat by utilization of waste COG in the kilns.

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

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[7] '*the main equipments technical specifications*' issued by Loudi WUJO Industrial Co., Ltd. (PP) on 1st Mar 2009.

According to the methodology AMS-III.Q (Ver. 04), the physical and spatial extent of the Project Boundary includes the industrial facility where waste energy (COG) is generated, the facilities where the COG is used and other assistant equipments involved for the COG recovery. Therefore, the Project boundary (as shown in Figure B.1 and Table B.2 below) includes coke ovens in HUIYUAN, glass furnaces, Lehres, processing lines, boiler, enamel converter and other auxiliary facilities in WUJO and a set of gas pipes with a length of 27 km from HUIYUAN to WUJO

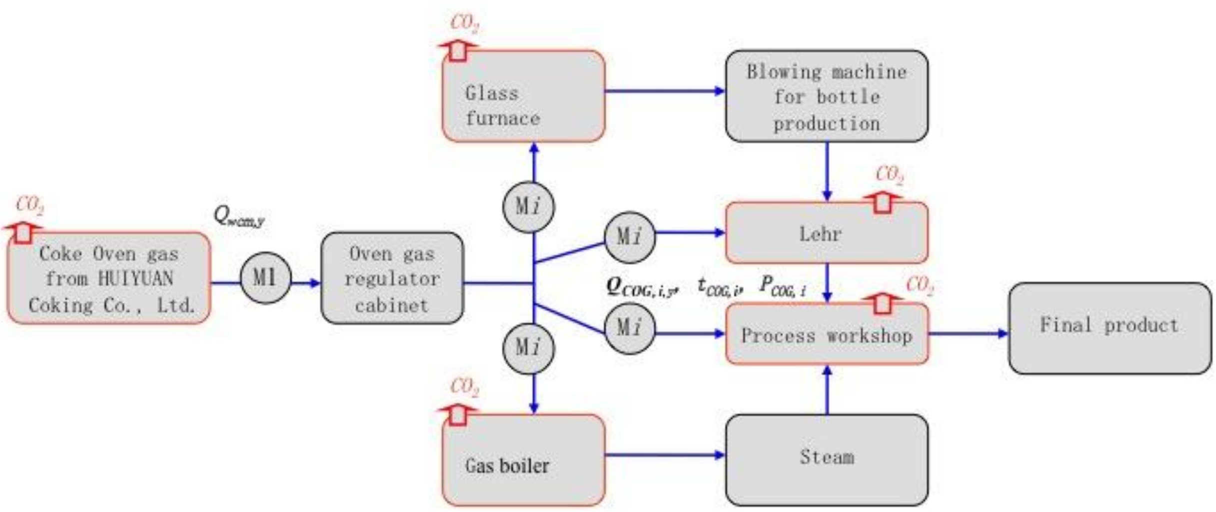

Figure B.1 GHGs emission source in the boundary of the project

Table B.2 Sources and gases in project boundary

	Source	Gas	Include?	Justification / Explanation
Baseline	Fossil fuel consumption for thermal energy generation	CO_2	Include	Main emission sources
		CH_4	Exclude	Minor source, exclusion for simplified, that is conservative.
		N_2O	Exclude	
	Baseline emissions from the flaring process (if any)	CO_2	Exclude	Because there is no historic data, excluded for simplification. This is conservative.
		CH_4	Exclude	
		N_2O	Exclude	

Project activity	Supplemental fossil fuel consumption at the project plant	CO_2	Exclude	The project does not need supplemental fossil fuel.
		CH_4	Exclude	
		N_2O	Exclude	
	Supplemental electricity consumption	CO_2	Exclude	The project does not need supplemental electricity.
		CH_4	Exclude	
		N_2O	Exclude	
	Project emissions from cleaning of gas	CO_2	Exclude	The project does not include such process.
		CH_4	Exclude	
		N_2O	Exclude	
	Project emissions due to the combustion of the waste COG	CO_2	Excluded	Excluded. Because in absence of the project, the COG is released into the atmosphere after incineration.
		CH_4	Excluded	Excluded for simplification. This is conservative.
		N_2O	Excluded	Excluded for simplification. This is conservative.

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

>>
The following procedure from the methodology (paragraph 8) will be used in the calculation of the baseline.

In the situation where the electricity is obtained from a specific existing power plant or from the grid, mechanical energy is obtained by electric motors and heat from a fossil fuel based element process (e.g. steam boiler, hot water generator, hot air generator, hot oil generator), baseline emissions can be calculated as follows:

(a) Baseline emissions from electricity ($BE_{elec,y}$) generated by waste energy

(b) Baseline emissions from electricity ($BE_{Elec,y}$) to provide mechanical energy generated by waste energy

(c) Baseline emissions to provide thermal energy generated by waste energy

In absence of the proposed project, the COG will be released into the atmosphere after incineration. The kilns and furnaces use coal gas as the fuel to generate thermal energy with 3 sets of water coal gas furnace and 3 sets of mixed coal gas furnace. No electricity and no mechanical energy will be generated and no cogeneration plant exists in this project. Therefore, (a) and (b) are not possible baseline scenarios for this project. Option (c) is selected as the baseline scenario.

1. Baseline scenario
The baseline scenario of the proposed project activity is that: in absence of the proposed project, about 3.5×10^8 Nm^3 COG produced by two coke ovens was released to atmosphere after incineration[8]. Glass furnaces, Lehre, boiler, processing line and enamel converter use coal gas as the fuel to generate thermal energy with 3 sets of water coal gas furnace and 3 sets of mixed coal gas furnace.

[8] 'The main equipments technical specifications' issued by Loudi WUJO Industrial Co., Ltd. on 1st March 2009

According to the ASM-III.Q (Ver. 04), the historical information (detailed records) on the use of fossil fuels and plant output (e.g heat, electricity etc) from the last three years must be included in the baseline calculations. In the last three years before the implementation of the proposed project activity, the coal gas consumption was 122,142,559 / 121,266,614 / 120,326,700 Nm^3 (from 2005 to 2007)[9].

The emissions from incineration in the baseline have not been considered the calculation of emissions reductions due to the lack of historical data regarding the volume and concentration of COG. No supporting fuel is needed for the incineration of coke oven gas.

By not considering the emissions from the incineration of gas, the baseline emissions are understated. This follows the principle of conservativeness, and creates a corresponding reduction in the claimed Emissions Reductions of the project.

2. Project scenario

The kilns and furnaces need to be reconstructed in order to switch from coal gas to COG utilization. 3 sets of water coal gas furnaces and 3 sets of mixed coal gas furnaces will be removed. COG recovery from HUIYUAN will be utilized as the fuel for these kilns.

When the project is implemented, coal gas is no longer produced. The original coal gas equipment has been removed, so the usage of coal gas no longer occurs after retrofitting.

Neither the PP nor Lianyuan City Huiyuan Gas Co., Ltd. have found any other suitable ways of utilizing the remaining 278,000,000Nm^3 of COG produced. Therefore, it is released into the atmosphere after incineration. The emissions from doing so are negligible, and are excluded from the baseline and project emissions calculations.

The COG consumed by the project activity is transported to the project site by an enclosed pipeline, not by transport vehicles. Therefore there are no direct emissions involved in its transportation.

According to methodology, there is guidance or consideration made in project emissions or leakage emissions for emissions from waste energy transport. Therefore, any emissions from the pipeline are not included in the emissions reduction calculation.

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):

>>

Taking into consideration that CDM revenue can reduce the economic barriers faced by the project participant, a feasibility study was carried out in Feb. 2008. This feasibility study takes into account the development of the project as a CDM project.

Table B.3 - Key events about CDM

Date	Key Event	Evidence

9 FSR and '*Coal and coal gas consumption records (from 2005 to 2007)*' issued by Loudi WUJO Industrial Co., Ltd. on 31st December 2007.

1st Feb. 2008	Completion of Feasibility Study Report	Feasibility Study Report
18th Apr. 2008	Board made decision to develop the project into CDM.	Resolution of Board of Directors
7th May 2008	Completed FSR and received the approval of Hunan committee of Economic.	FSR approval
5th May 2008	Approval of Environmental Impact Assessment	EIA approval
3rd Nov. 2008	Starting time of the proposed project	*'Kiln Construction Contract' issued by Lianyuan City Huiyuan Gas Co., Ltd and Loudi Wujo Industrial Co. Ltd, on 3/11/2008.*
16th Oct. 2008	Signed a consulting contract with B-road Investment Co. Ltd to develop CDM project.	Consulting contract signed.
1st Dec. 2008	Carried out with the buyers to negotiate the sale of the CERs.	PIN document，E-mail record
27th Apr. 2009	Notification of CDM intent approval submitted to DNA of China	CDM Notification form
Oct. 2009	Signed ERPA with CERs purchaser.	ERPA
16th Nov. 2009	Prior consideration of CDM was confirmed by UNFCCC Secretariat	UNFCCC website
1st Apr. 2010	It is expected to be put into operation	Building program
May, 2010	NDRC Letter of Approval received	NDRC LoA
16th Sept. 2010	UK Letter of Approval received	UK LoA

Assessment and demonstration of additionality

According to Attachment A and Appendix B of the simplified modalities and procedures for small scale CDM project activities, project participants shall provide an explanation to show that the project would not have occurred anyway due to at least one of the following barriers:

- Investment barrier
- Technical barrier
- Barrier due to prevailing practice
- Other barriers

As per the following, the project faces significant investment barriers;

1. Investment barriers

According to "Tool for the demonstration and assessment of additionality", three means of analysis are proposed; the simple cost analysis (Option I), the investment comparison analysis (Option II), or the benchmark analysis (Option III).

Considering that the project activity is approved as CDM by the EB, the benefit would be composed of two parts: (1) CERs revenue; (2) Savings due to not having to purchase coal and generate coal gas. The simple cost analysis (Option I) is not applicable.

Investment comparison analysis requires comparing the IRR in different investment conditions. But the baseline condition of the project is providing energy by coal gas, and the project is to recover COG to replace the coal gas, which will lead to emission reduction. No comparison of different investment conditions exists in the project. The investment comparison analysis (Option II) is not applicable.

Therefore, the benchmark analysis (Option III) has been used for the demonstration and assessment of additionality in this PDD because it can clearly show the logic behind the investment decision-making for the proposed project activity.

According to the Economic Evaluation Methods and Parameters of Construction Project (Version 3) issued by the National Development and Reform Commission of the P. R. China in July 3rd, 2006, the financial benchmark Internal Rate of Return before tax (IRR) of total investment for Chinese Light Industry projects is 13%. Thus, the benchmark analysis is applicable to this project. If the IRR is lower than the benchmark, it is considered that the proposed project has no financial attractiveness, and therefore meets additionally standards.

The main assumptions for the investment analysis are shown in Table B.4 below:

Table B.4 Basic parameter in the FSR

Parameter	Value		Data Source
Coke Oven gas consumption, with proposed project (Nm^3)	71,880,480		FSR: Page 16, Table 9
Coal gas consumption, before proposed project (Nm^3)	120,326,700		FSR: Page 13, Table 5
Units cost of coal gas production, calculated by coal consumed (RMB/Nm^3)	0.20		FSR: Page 55, Chapter 11.1 and '*coal gas material balance calculation and cost analysis*'issued by China Machinery International Engineering Design and research Institute (FSR issuer) in May 2009.
Construction Time (yr)	1		FSR: Page 55, Chapter 11
Operation period (yr)	10		
Total investment (RMB)	48,293,000		
Own capital (RMB)	48,293,000		
Loan (RMB)	0		
O&M cost (RMB)	Pipe operation and maintenance cost	2,920,000	FSR: Page 55-62, Chapter 11.2.3
	COG collection and transportation cost	10,780,000	
	Repair Costs	452,900	
	Asset Insurance Cost	107,600	

	Total O&M cost	**14,260,500**	
Value-added tax (%)	17 %		FSR, Page 60 and Government tax regulation
Maintenance costs of urban construction (%)	7 %		
Education tax (%)	3 %		
Income tax (%)	25 %		
Expected CER price	8.2		n/a
CER credit period (yr)	10		n/a
Fixed asset depreciation periods (yr)	10		FSR: Page 54
Residual value rate of fixed assets (%)	5		

Through the above calculation, the before tax IRR of the proposed project without CDM income is 5.38%, which is lower than the before tax benchmark IRR of 13% used for the glass manufacturing industry[10]. The main products of the Loudi WUJO Industrial CO. Ltd, which is a branch of Hunan WUJO Light Industry & Chemicals Group Co. Ltd /2/, are vacuum flask and ceramic products, therefore benchmark IRR of the glass manufacturing industry was chosen. It can be considered that without the CER revenue the project has no financial attractiveness to be carried out. However, the IRR is expected to increase to 18.38% with CER revenue (CER price: 8.2 euro/tCO_2e, Exchange rate: 10 Chinese Dollar/1 euro, Crediting period: 10 years). Therefore, the CERs revenue will significantly improve the financial situation and commercial feasibility of the project, as well as will provide investors with relatively high returns.

Justification of Project Revenue:
Project revenue is generated through the saved cost of purchasing coal and creating coal gas. The estimates of project revenue have been based on the data given in the FSR and reproduced in the table above.

The main coal gas consumption equipments include: 45m^2 glass furnace, 56m^2 glass furnace, COG-burnt boiler, Lehre, Processing line, Enamel converter. There are 3 sets of water coal gas furnace and 3 sets of mixed coal gas furnace, which use coal as fuel and provide coal gas for the equipments prior to the project.

As the project owner uses raw coal to create the coal gas burnt in the boilers at the facility, the coal gas production is dependent on the quantity of coal. The project assumes a Coal Gas price of 0.2/RMB/Nm^3, which includes the costs of producing coal gas from the purchased coal. The '*Coal gas price calculation evidence'* issued by the China Machinery International Engineering Design and Research Institute in May 2009, shows how the coal gas price is calculated.

In the estimation of the coal gas price, a coal price of 270RMB/t (exclu. VAT) is conservatively estimated. This is conservative as the forgone costs of purchasing coal and creating coal gas represents the income of the project and thus it is prudent to cautiously overestimate income in the financial analysis. In reality, the '*coal purchase invoices*' issued to the PP show that the coal price is on average 206RMB/t (inc. VAT). Therefore, the coal price estimate used in the Coal Gas price calculation is conservative. The second key

10 As explained in the FSR (p.8) the main products of the PP are vacuum flasks and ceramic products. Therefore the project will adopt the benchmark of the glass manufacturing industry.

aspect of the coal gas price calculation is water usage. As the coal gas usage is fixed, the amount of water required is also fixed. To ensure conservatism, a water price of 1.755RMB/t is assumed in the calculation. The '*Loudi water price evidence*' issued by the Hunan Provincial Government Pricing Bureau specifies that the price of industrial usage water is 1.32RMB/t. Therefore the usage of 1.755RMB/t in the coal gas price estimation is both reasonable and conservative.

Justification of O&M Costs:

As seen in the table below, the O&M costs are comprised of three factors, Repair Cost, Insurance and the Pipe operation cost (cost of purchase and transport of COG and Pipe Maintenance). These are shown in the table below, further justification is given underneath.

Cost	Cost per year (10,000 RMB)	Reference
Repair cost	45.29	FSR (p.55)
Wage	0.00	n/a
Insurance	10.76	FSR (p.55)
Low value consumables	0.00	n/a
Pipe operation cost *The sum of:* *COG Collection and Transport* *Pipe Operation and Maintenance Costs*	1370.0 *1078* *292*	FSR (p.55)
Interest	0.00	n/a
Total O&M cost	1426.05	FSR (p.55)

Repair Rate and Insurance costs:

The Repair costs of the project are calculated as 1% of the static investment per year. This is an extremely conservative choice of repair rate when considered with other projects using the same methodology. The table below gives the repair rate used in other recently registered projects using AMS-III.Q.

Project Number	Project Name	Repair Rate
5224	Zhonglian 4.5MW Waste Heat Power Generation Project in Hebei Province	4%
4208	Jiangxi Nanfang Cement Low Temperature Waste Heat Power Generation Project	1.5%
3564	Sichuan LiwanBusen Cement Waste Heat Recovery for Power Generation Project	4%
3832	Liaoning Chaoyang Waste Gas Recovery for Electricity Generation	2.5%
n/a	Proposed Project	1%

Additionally, it should be noted that the Repair cost and Insurance only contribute only 1% and 0.25% of total O&M costs. Even when both these costs are omitted from the financial analysis, the benchmark only reaches 7.33%, which is still beneath the industry benchmark of 13%.

Wages, Low value consumables and Management Costs:

As the project only involves a retrofit (to change the fuel source) of existing equipment, there is no need for

additional employees or management resources following the implementation of the project activity. Therefore, these costs are given a value of 0. For the same reason, no cost is allocated to the purchase of low value consumables (i.e. staff safety gear, travel expense etc.). This is conservative.

Pipe Operation Cost:
The primary factor in the project's O&M cost is the COG transportation and pipeline maintenance. Purified COG is transported to the project site via a 27km pipeline (The specification of pipeline is L245*D426*10mm and L245*D529*10mm). The transportation fee is 0.17 RMB/Nm3 (with VAT) or 0.15 RMB/Nm^3 (without VAT), this price is inclusive of the costs of purification.

Based on the FSR (p.56);
- Pipeline maintenance cost: 2.92 million RMB/year[11]
- COG collection and transport cost (including purification): 10.78 million RMB/year

Based on FSR (p.55):
After retrofitting, the consumption volume of COG is: 71,880,480Nm^3

Based on the '*COG supply agreement'* (p.1), the COG cost is: 0.17 RMB/Nm3, or 0.17/1.17 = 0.15 RMB/Nm^3 (before VAT)

Therefore, COG usage cost is: 0.15RMB/Nm3 * 71,880,480 = 10.78 million RMB/year

Please also refer to the *'COG invoice 1*' & '*COG invoice 2'* as evidence of COG price being 0.15RMB/Nm^3

2. Sensitivity analysis

The sensitivity analysis is used to show whether the conclusion regarding the financial attractiveness is robust to reasonable variations in the critical assumptions. For the project, four parameters are selected as sensitive factors to check out the financial attractiveness, the sensitivity analysis is shown in Table B.5 below:

- Total investment
- Operation cost
- Quantity of coal gas consumption
- Units cost of coal gas

Table B.5 (1) - Sensitivity analysis (without CDM)

Index \ Change rate	-10.00%	-5.00%	0.00%	5.00%	10.00%
Total investment	3.52%	4.42%	5.38%	6.42%	7.56%
O/M cost	0.79%	3.14%	5.38%	7.52%	9.59%
Coal gas consumption	11.26%	8.40%	5.38%	2.17%	-1.29%
Coal gas price	11.26%	8.40%	5.38%	2.17%	-1.29%

[11] '*Coke Oven Gas Supply Agreement'* issued by Lianyuan City Huiyuan Gas Co., Ltd and the PO on 8th December 2008.

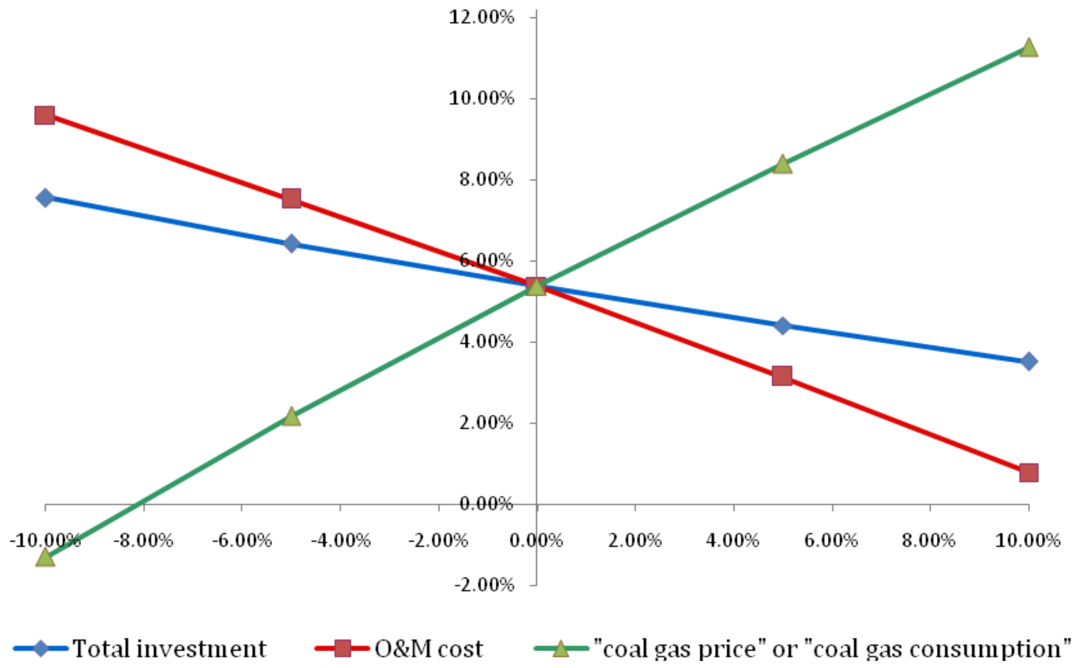

Figure B.2 Sensitivity analysis

Even considering the most optimistic conditions in each scenario, the equity IRRs of the Project activity are still below the before tax benchmark IRR of 13%, which confirms the fact that the Project activity is unlikely to be financially attractive and the successful implementation is dependent on CDM assistance. Therefore the project activity can be considered additional.

If the IRR of the project reach benchmark, the relevant indicators should be:

Table B.5 (2) - Change rate of indicators while IRR reach benchmark 13%

Indicator	Total investment	O&M cost	Coal Gas Amount	Coal gas price
Change range of indicator	-28.94%	-18.61%	13.13%	13.13%
IRR reaches to benchmark	13%	13%	13%	13%

Total investment:

The total project investment was estimated in the FSR and is in line with relevant national and local standards regarding engineering construction and equipments purchasing. According to the official statistics

issued by National Bureau of Statistics of China, the fixed investment price has increased 1.60%, 1.50% and 3.90% in 2005, 2006 and 2007[12,13,14], and the average annual increased rate is 2.33%, this trend will not change much in the future. Therefore, it is very impossible to decrease the total static investment to the threshold value of -28.94%% due to the price increasing of the raw material and wages and the difficulties of kiln reconstruction. In fact, the actual contracted amount for project investment was greater than expected and totaled 48,500,000 Yuan which is evidenced by the '*kiln reconstruction contract'* (29.5 million RMB) and the '*pipe construction contract'* (19 million RMB).

O&M cost:
The O&M expenses are estimated in the FSR finalized by Central Mechanical International Engineering Design Institute, a qualified organization. The major components for the O&M include: pipe maintenance 292.00 Yuan; COG cost of collection and transportation 1078.00 Yuan. According to the same above official statistics as above, the raw material, fuel and power have increased 8.3%, 6.0% and 4.4% in 2005, 2006 and 2007, and the average annual increased rate is 5.9%; the worker salary has increased by 12.8%, 12.7% and 13.6 % (excluding inflation) in 2005, 2006 and 2007 15,16,17, and the average annual increasing rate is 13.03%, accordingly, the pipe maintenance cost and COG cost of collection and transportation is very likely to be increased. Therefore, it is very impossible to decrease the O&M to the threshold value of -18.61%.

Coal gas price and annual coal gas consumption:
These two parameters are directly related (i.e. cost of coal gas = volume * price) and so a variation in either of these parameters will result in identical variation to the project IRR.

The main coal gas consumption equipments include: 45m^2 glass furnace, 56m^2 glass furnace, COG-burnt boiler, Lehre, Processing line, Enamel converter. There are 3 sets of water coal gas furnace and 3 sets of mixed coal gas furnace, which use coal as fuel and provide coal gas for the equipments. The equipments production capacity, heat efficiency and demand for coal gas will not change, as a result, the total coal gas consumption cannot increase by 13.13%.

Based on the conservative estimations of the factors underpinning the calculation of the coal gas price, the use of 0.2 RMB/Nm^3 in the financial analysis is considered reasonable. Furthermore, Loudi city is a main coal-mining zone in Hunan province and in China. So the coal price is comparatively low in China and is not likely to increase.

Therefore, it is very impossible to increase the coal gas price to the threshold value of 13.13%.

As demonstrated above, the project activity is additional and it is unlikely to be considered economically attractive without CDM. In conclusion, without CERs, the proposed Project Activity will lack financial attraction and couldn't become the baseline scenario; therefore, the Project is additional.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

[12] http://www.stats.gov.cn/tjgb/ndtjgb/qgndtjgb/t20060227_402307796.htm
[13] http://www.stats.gov.cn/tjgb/ndtjgb/qgndtjgb/t20070228_402387821.htm
[14] http://www.stats.gov.cn/tjgb/ndtjgb/qgndtjgb/t20080228_402464933.htm
[15] http://www.stats.gov.cn/tjgb/qttjgb/qgqttjgb/t20060609_402329458.htm
[16] http://www.stats.gov.cn/tjgb/qttjgb/qgqttjgb/t20070518_402405314.htm
[17] http://www.stats.gov.cn/tjgb/qttjgb/qgqttjgb/t20080521_402481634.htm

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According to methodology AMS-III.Q (ver. 4), the emission reduction of the project is calculated as follows:

B.6.1.1 Calculation of baseline emissions（BE_y）

Baseline emissions:

The objective of the proposed project activity is to utilize waste coke oven gas (COG) as an energy source at an existing facility for the generation of heat through an elemental process. Waste COG will be used as the fuel to generate thermal energy for the kilns including: glass furnaces; Lehres; processing lines, boilers and enamel converters.

Baseline emissions to provide thermal energy generated by waste energy ($BE_{Ther,y}$);

$$BE_{Ther,y} = f_{cap} * f_{wcm} * \sum_i \sum_j (HG_{j,y} + MG_{i,j,y,tur} / \eta_{mech,tur}) * EF_{heat,j,y}$$

Where:

$BE_{Ther,y}$	Baseline emissions from thermal energy (as steam) during the year *y* in tons of CO_2
$HG_{j,y}$	Net quantity of heat (enthalpy) supplied to the recipient plant *j* by the project activity during the year *y* in TJ (In case of steam this is expressed as the difference in energy contents between the steam supplied to the recipient plant and the feed water to the boiler. The enthalpy of feed water to the boiler takes into account the enthalpy of condensate returned to the boiler (if any) and any other waste heat recovery (including economiser, blow down heat recovery etc.). It should be noted that no additional fuel outside the boiler or hot water/oil generator should be fired to heat the feed water/oil. In case of hot water/oil generator this is expressed as the difference in energy content between the hot water/oil supplied to and returned by the recipient plant(s) to the element process of cogeneration plants). This includes steam supplied to recipients that may be used for generating mechanical energy
f_{cap}	Capping factor to exclude increased waste energy utilization in the project year y due to increased level of activity of the plant, relative to the level of activity in the base years before project start. The ratio is 1 if the waste energy generated in project year *y* is same or less than that generated in base years. f_{cap} shall be estimated according to the corresponding section of ACM0012 .Consolidated baseline methodology for GHG emission reductions from waste energy recovery projects.
f_{wcm}	Fraction of total heat generated by the project activity electricity using waste energy. This fraction is 1 if the heat generation is purely from use of waste energy. If the element process providing heat uses both waste and fossil fuels, this factor is estimated using equation (7) or (9)
$EF_{heat,j,y}$	The CO_2 emission factor of the element process supplying heat that would have supplied the recipient plant *j* in the absence of the project activity, expressed in tCO_2/TJ and calculated as per equation (5) below
$MG_{i,j,y,tur}$	Mechanical energy generated and supplied to the recipient *j*, which in the absence of the project activity would receive power from a steam turbine *i*, driven by steam generated in a fossil fuel boiler (TJ)
$\eta_{mech,tur}$	The efficiency of the baseline equipment (steam turbine) that would provide mechanical power in the absence of the project activity

Calculation of f_{wcm} **:**

All of the thermal energy is generated by recovered COG, so $f_{wcm} = 1$

Calculation of f_{cap} :

ACM0012 provides three methods to calculate f_{cap}, which are as follows:

Method 1: Where the historical data on energy released by the waste energy carrying medium is available, the baseline emissions are capped at the maximum quantity of waste energy released into the atmosphere under normal operation conditions in the three years previous to the project activity.

Method 2: The manufacturer's data for the industrial facility shall be used to estimate the amount of waste energy the industrial facility generates per unit of product manufactured by the process that generates waste energy (either the product of the departmental process or the product of the entire plant, whichever is more justifiable and accurate). In the case that any modification is carried out by the project proponent, or in the case that the manufacturer's data is not available for an assessment, this should be carried out by an independent qualified/certified external expert such as a chartered engineer. This should be based on a conservative quantity of waste energy generated by a plant per unit of product manufactured by the process generating waste energy. The value arrived at, based on above sources of data, shall be used to estimate the baseline cap (f_{cap}).

Method 3: In some cases, it may not be possible to measure the waste energy (heat, sensible heat, heat of reaction, heat of combustion etc.), enthalpy or pressure content of WECM. Therefore there is no historic data available for these cases. These cases may be one of following two types.

> ***Case 1:*** The energy is recovered from WECM and converted into final output energy through waste heat recovery equipment. For such cases, f_{cap} should be the ratio of maximum theoretical energy recoverable (using the project activity waste heat recovery equipment) and the actual energy recovered under the project activity (using direct measurement). For estimating the theoretical recoverable energy, the manufacturer's specifications can be used. Alternatively, technical assessment can be conducted by an independent qualified/certified external expert, such as a chartered engineer.
>
> ***Case 2:*** The energy is recovered from WECM by intermediate energy recovery equipment, using an intermediate source. For example, an intermediate source used to carry energy from the primary WECM may include sources, such as water, oil or air, to extract waste energy entrapped in chemicals (heat of reaction) or solids (sensible heat). This intermediate energy source is finally used to generate the output energy in the final waste heat recovery equipment. For these cases, f_{cap} is the ratio of maximum theoretical intermediate energy recoverable (from intermediate waste heat recovery equipment) to actual intermediate energy recovered under the project activity (using direct measurement). For estimating the theoretical energy, manufacturer's specifications can be used. Alternatively, technical assessment can be carried out by an independent qualified/certified external expert, such as a chartered engineer.

In the proposed project activity, if COG is recovered and directly utilized as a fuel of industrial facilities, and there is no detailed historic record of COG, **Method 2** is employed to calculate f_{cap} .

$$f_{cap} = \frac{Q_{WCM,BL}}{Q_{WCM,y}}$$

$$Q_{WCM,BL} = Q_{BL,product} \times q_{wcm,product}$$

Where,

$Q_{WCM,BL}$	Quantity of waste energy generated prior to the start of the project activity (Nm^3)
$Q_{WCM,y}$	Quantity of WECM (COG) used for energy generation in year *y* (Nm^3)
$Q_{BL,product}$	Production associated with the relevant waste energy generation as it occurs in the baseline scenario. The minimum of the following two figures should be used: (1) average annual historical production data from start-up of the plant (if the plant's operational history is less than three years) or (2) the most relevant manufacture's data for normal operating conditions. In case of new facilities or where data is not available the manufacture's data for normal operating conditions shall be used. (Nm^3)
$q_{wcm,product}$	Amount of waste energy (COG) per unit of product generated by the process (that generates waste energy) in the industrial facility (Nm^3/t)

The calculated value of f_{cap} is used when it is less than 1, if the calculated value of f_{cap} is more than 1, then $f_{cap} = 1$.

The annual yield of the two coke ovens is 800,000 tonnes. According to the equipment literature provided by the manufacturer of coke ovens, amount of waste energy (COG) per unit of product generated by the process is 437.5 Nm3/t。

$$Q_{WCM,BL} = 800,000 \times 437.5 = 350,000,000 \quad (Nm^3)$$

$Q_{WCM,y}$: the value can be obtained from the measurement of COG by flow meter in the monitoring process. So f_{cap} is assumed to be 1 in ex-ante calculation of emission reductions, and can be adjusted in ex post calculation according to the $Q_{WCM,y}$ in monitoring.

Calculation of $MG_{i,j,y,tur}$

There is no mechanical energy generated and supplied to the recipient *j*, which in the absence of the project activity, so the $MG_{i,j,y,tur} = 0$. Therefore the baseline emissions calculation becomes:

$$BE_{Ther,y} = f_{cap} * f_{wcm} * \sum_i \sum_j HG_{j,y} * EF_{heat,j,y}$$

Calculation of $EF_{heat,j,y}$

$$EF_{heat,j,y} = \sum_i ws_{i,j} \frac{EF_{CO2,i,j}}{\eta_{EP,i,j}} \quad \textbf{(1)}$$

Where:

$EF_{CO2,i,j}$	The CO_2 emission factor per unit of energy of the baseline fuel used in i^{th} element process used by recipient *j*, in tCO_2/TJ, in absence of the project activity
$\eta_{EP,i,j}$	Efficiency of the i^{th} element process that would have been supplied heat to j^{th} recipient in the absence of the project activity
$ws_{i,j}$	Fraction of total heat that is used by the recipient *j* in the project that in the absence of the project activity would have been supplied by the i^{th} boiler

In the absence of the project activity, all the heat that is used by the recipient in the project that have been supplied by the water coal gas boiler, so the $ws_{i,j}$ = 1

The water coal gas is the only fuel used in the baseline scenario, and according to the default value in IPCC 2006, the CO_2 emission factor per unit of energy of the baseline fuel is 44.4 tCO_2/TJ.

Efficiency of the element process ($\eta_{EP,i,j}$) shall be one of the following:

(a) Assume a constant efficiency of the element process and determine the efficiency, as a conservative approach, for optimal operation conditions i.e. design fuel, optimal load, optimal oxygen content in flue gases, adequate fuel conditioning (temperature, viscosity, moisture, size/mesh etc.), representative or favourable ambient conditions (ambient temperature and humidity); or

(b) Highest of the efficiency values provided by two or more manufacturers for element process with specifications similar to that which would have been required to supply the recipient with heat that it receives from the project activity; or

(c) Maximum efficiency of 100%.

The constant efficiency of the each element process *i* is determines by Option (a). The is estimated assuming optimal operation conditions, i.e. design fuel, optimal load, optimal oxygen content in flue gases, adequate fuel conditioning (temperature, viscosity, moisture, size/mesh etc.). The baseline conditions used have been provided by the project participant and are given in the table below.

The energy efficiency for the 5 different element processes[18]

Elemental process	Efficiency
The Glass furnaces	0.89
Processing lines	0.82
Boiler	0.89
Lehres	0.88
Enamel converter	0.82

B.6.1.2 Project emissions (PE_y)

As defined by the methodology, project emissions include emissions due to combustion of auxiliary fuel to supplement waste gas and emissions due to consumption of electricity by the project activity.

If the waste gas contains carbon monoxide or hydrocarbons, other than methane, and the waste gas is vented to the atmosphere in the baseline situation, project emissions have to include CO_2 emissions due to the combustion of the waste gas.

Waste COG gas is vented to the atmosphere only after incineration, and as there is no supplemental fossil fuel and electricity consumption in the proposed project activity, COG of HUIYUAN will be released into the atmosphere after incineration in the absence of the proposed project. Therefore, according to the methodology AMS-III.Q (ver. 4), emissions due to the combustion of the waste COG is excluded.

Therefore, project emissions are 0.

[18] 'The main equipments technical specifications' issued by Loudi WUJO Industrial Co., Ltd. on 1st March 2009

$$PE_y = 0$$

B.6.1.3 Leakage emission(LE_y):

If equipment to be used in the project activity is currently being utilised elsewhere and is transferred from outside the boundary to the project activity, leakage is to be considered.

Because equipment currently being utilized is NOT transferred from outside the boundary to the project activity, leakage emission is 0.

$$LE_y = 0$$

B.6.1.4 Emission reduction

The emission reduction achieved by the project activity will be calculated as the difference between the baseline emissions and the project emissions.

$$ER_y = BE_y - PE_y - LE_y$$

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

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Some data and parameters are not monitored throughout the crediting period but are fixed and remained unchanged throughout the crediting period. They are available when validation is undertaken. These data and parameters are summarized in TableB.6.

Table B.6 Data and parameters those are available at validation

Data / Parameter	$\eta_{EP,i,j}$
Data unit	----
Description	Baseline efficiency of the element process/captive power plant/ cogeneration plant/mechanical energy conversion equipment
Source of data used	Manufacturers data
Value applied	Glass furnaces: ***0.89*** Processing line: ***0.82*** Boiler: ***0.89*** Lehre: ***0.88*** Enamel converter :***0.82***[19]
Justification of the choice of data or description of measurement methods and procedures actually applied	Manufacturers data is applicable.
Any comment	----

[19] 'The main equipments technical specifications' issued by Loudi WUJO Industrial Co., Ltd. on 1st March 2009

Data / Parameter	$Q_{BL,product}$
Data unit	t
Description	Annual yield of coke prior to the start of the proposed project activity.
Source of data used	Manufacturers data
Value applied	***800,000***
Justification of the choice of data or description of measurement methods and procedures actually applied	Manufacturers data is applicable.
Any comment	----

Data / Parameter	$q_{wcm,BL}$
Data unit	Nm^3/t
Description	Amount of waste energy (COG) per unit of product generated by the process (that generates waste energy) in the industrial facility
Source of data used	Manufacturers data
Value applied	***437.5***
Justification of the choice of data or description of measurement methods and procedures actually applied	Manufacturers data is applicable.
Any comment	----

Data / Parameter	$EF_{CO_2,coalgas}$
Data unit	tCO_2e/TJ
Description	Emission factor of baseline fuel (coal gas)
Source of data used	Default value in IPCC2006
Value applied	***44.4***
Justification of the choice of data or description of measurement methods and procedures actually applied	Default value in IPCC 2006 is applicable.
Any comment	----

Data / Parameter	f_{wcm}

Data unit	%
Description	Fraction of total heat generated by the project activity electricity using waste energy. This fraction is 1 if the heat generation is purely from use of waste energy.
Source of data used	FSR
Value applied	100
Justification of the choice of data or description of measurement methods and procedures actually applied	All of the thermal energy is generated by recovered COG, so $f_{wcm} = 1$
Any comment	----

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

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Ex-ante calculation is employed in this PDD, the actual value of parameters need to be monitored will be subjected to the monitored value.

The proposed project activity is reconstruction of kilns. These kilns are semi-opening systems and the temperature inside is very high (more than 1000℃)[20]. Furthermore, the output temperature and pressure of the heat fluctuates significantly making it impossible to install monitoring equipment. To deal with this the Central Mechanical International Engineering Design Institute (FSR developer) developed the following equation to accurately define the heat output of the project[21]. Using the volume of COG, the NCV of COG and the efficiency of the retrofitted equipment, the net quantity of heat supplied to the recipient facility can be determined. Using this equation, the baseline emissions are calculated as follows

$$HG_{i,y} = Q_{COG,i.y} \times NCV_{COG} \times \eta_{PJ,i}$$

Where:

$Q_{COG,i,y}$	Quantity of COG consumed by the i[th] equipment in year y (Nm^3);
NCV_{COG}	Net calorific value of coke oven gas (TJ/Nm^3);
$\eta_{PJ,i}$	Efficiency of the i[th] equipment in project acitivty (%);

Table B.7 Value of parameter for ex-ante calculation

ID	Parameter	Unit	Value		Data source
1	Quantity of COG		Total:	71,880,480	“*main equipments*

[20] ‘*Kiln temperature evidence’* issued by China International Engineering Design and research Institute in May 2010
[21] ‘Clarification of heat supply equation’ issued by Central Mechanical International Engineering Design Institute on 17[th] June 2008.

	recovered per year $Q_{COG,y}$	Nm^3	2 sets of Glass furnaces: 27,008,580 2 sets of Processing lines: 30,129,761 1 Boiler: 1,743,024 4 sets of Lehres: 5,558,080 5 Enamel converters: 7,441,036	*technical specifications*" issued by Loudi WUJO Industrial Co., Ltd on 1st Mar. 2009.
2	Net calorific value of COG NCV_{COG}	GJ/Nm^3	***0.01760***	"*COG discharging explanation"* issued by Lianyuan Economic Bureau on 5th February 2008.
3	Emission factor of coal gas $EF_{CO_2,coalgas,y}$	tCO_2e/TJ	***44.4***	IPCC 2006
4	Amount of COG per unit of product generated by the coke oven $q_{wcm,product}$	Nm^3/t	***437.5***	"*COG discharging explanation"* issued by Lianyuan Economic Bureau on 5th February 2008.
5	Yield of coke ovens in baseline situation $Q_{BL,product}$	t	***800,000***	*"COG discharging explaination"* issued by Lianyuan Economic Bureau on 5/2/2008.
6	Efficiency of the ith thermal energy generation facility in baseline situation $\eta_{BL,i}$	----	Glass furnaces: ***0.89*** Processing lines: ***0.82*** Boiler: ***0.89*** Lehres: ***0.88*** Enamel converter***0.82***[22]	*"main equipments technical specifications*" issued by Loudi WUJO Industrial Co., Ltd on 1st Mar. 2009
7	Efficiency of the ith thermal energy generation facility in project activity $\eta_{PJ,i}$	----	Glass furnaces: ***0.93*** Processing lines: ***0.82*** Boiler: ***0.92*** Lehres: ***0.94*** Enamel converter***0.82***[23]	*"main equipments technical specifications*" issued by Loudi WUJO Industrial Co., Ltd on 1st Mar. 2009

[22] 'The main equipments technical specifications' issued by Loudi WUJO Industrial Co., Ltd. on 1st March 2009

[23] 'The main equipments technical specifications' issued by Loudi WUJO Industrial Co., Ltd. on 1st March 2009

1, in order to reduce environmental pollution and reduce the energy consumption, the glass furnaces, Lehres, processing lines, boiler and enamel converters has been reconstructed to use COG to replace coal gas. The reconstruction of the kilns include reconstruction of key equipment, reconstruction of fuel entering equipment and combustion system reconstruction. After reconstruction , the heat supply effect of the kilns has been improved.

2. In *the main equipments technical specifications, kiln testing report and FSR,* value of the PLF (heat efficiency) are all the same, So the PLF adopted is suitable.

3 The ER calculation use this PLF (heat efficiency) is reasonable, in the post-ER calculation, PLF must be adjusted according to the practical testing data.

8	Fraction of total heat generated by the project activity using waste energy f_{wcm}	----	***1***	When the project is finished, the coke gas is used for fuel. There is no other auxiliary fuel. So f_{wcm} is 1.
9	Capping factor to exclude increased waste energy utilization in the project year y due to increased level of activity of the plant f_{cap}	----	***1***	***fcap*** is assumed to be 1 in ex-ante calculation of emission reductions, and can be adjusted in ex post calculation according to the $Q_{WCM,y}$ in monitoring.

According to the ER calculation sheet, the Baseline emission：

BE_y = 57,461 tCO_2e

Project emission：

$PE_y = 0$ tCO_2e

Leakage emission：

$LE_y = 0$ tCO_2e

Emission reduction:

ER_y = BE_y = 57,461 tCO_2e

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

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Table B.8 Estimation of project activity emission reductions

Year	Baseline emission (tCO_2e)	Project emission (tCO_2e)	Leakage emission (tCO_2e)	Emission reduction (tCO_2e)
01/10/2012 – 31/12/2012	***14,365***	***0***	***0***	***14,365***
2013	***57,461***	***0***	***0***	***57,461***
2014	***57,461***	***0***	***0***	***57,461***
2015	***57,461***	***0***	***0***	***57,461***

2016	***57,461***	***0***	***0***	***57,461***
2017	***57,461***	***0***	***0***	***57,461***
2018	***57,461***	***0***	***0***	***57,461***
2019	***57,461***	***0***	***0***	***57,461***
2020	***57,461***	***0***	***0***	***57,461***
2021	***57,461***	***0***	***0***	***57,461***
01/01/2022 – 30/9/2022	***43,096***	***0***	***0***	***43,096***
Total (tCO_2e)	***574,609***	***0***	***0***	***574,609***

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

B.7.1. Data and parameters monitored:

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According to AMS-III.Q (ver. 4), data and parameters to be monitored in the project activity are as follows:

Table B.9 - Data and Parameters to be monitored

Data / Parameter:	$p_{COG,i}$
Data unit	MPa
Description	Pressure of COG in the entrance of equipment i
Source of data to be used	Actual data will be obtained through on-site measurement.
Value of data	0.3MPa
Description of measurement methods and procedures to be applied:	Continuously measured by gas flow gauge and monthly read and recorded by the project owner.
QA/QC procedures to be applied	The regular calibration and management of the meters will accord to the National standards and regulations, the DOE will verify it.
Any comment	Use to discount the COG to the same state as baseline situation.

Data / Parameter:	$t_{COG,i}$
Data unit	℃
Description	Temperature of COG in the entrance of equipment i
Source of data to be used	Actual data will be obtained through on-site measurement.
Value of data	40℃
Description of measurement methods and procedures to be applied:	Continuously measured by gas flow gauge and monthly read and recorded by the project owner.

QA/QC procedures to be applied	The regular calibration and management of the meters will accord to the National standards and regulations, the DOE will verify it.
Any comment	Use to discount the COG to the same state as baseline situation.

Data / Parameter:	$\eta_{PJ,i}$
Data unit	
Description	Energy efficiency of equipment i in project activity.
Source of data to be used	Manufacturers data verified at issuance
Value of data	Glass furnaces: ***0.93*** Processing lines: ***0.82*** Boiler: ***0.92*** Lehres: ***0.94*** Enamel converter： ***0.82***[24]
Description of measurement methods and procedures to be applied:	Annually measured by external qualified energy efficiency testing institute.
QA/QC procedures to be applied	----
Any comment	The values applied here will be re-examined in the verification process.

Data / Parameter:	$Q_{COG,i,y}$
Data unit	Nm^3
Description	Quantity of COG consumed by the ith equipment in year y
Source of data to be used	On-site measurement
Value of data	Glass furnaces 27,008,580 Processing lines: 30,129,761 Boiler: 1,743,024 Lehres: 5,558,080 Enamel converter 7,441,036[25]
Description of measurement methods and procedures to be applied:	Continuously measured by gas flow gauge and monthly read and recorded by the project owner.
QA/QC procedures to be applied	The regular calibration and management of the meters will accord to the National standards and regulations, the DOE will verify it.
Any comment	The values applied here will be re-examined in the verification process.

Data / Parameter:	NCV_{COG}
Data unit	TJ/Nm^3
Description	Net calorific value of COG

[24] Reference for energy efficiency figures in table 3,6,5,7 in “*main equipments technical specifications*” issued by Loudi WUJO Industrial Co., Ltd on 1st Mar. 2009
[25] Page 17 of the FSR

Source of data to be used	The NCV is determined based on laboratory results. Laboratory can be either under control of project participants or external recognized laboratory.
Value of data	0.0176 TJ/Nm3
Description of measurement methods and procedures to be applied:	Monthly. If it can be established that the NCV of COG does not change much, the frequency will be reduced to once in six months. At least twice a year
QA/QC procedures to be applied	Instruments used for collection of sample and measurement of NCV of COG should have proper calibration done. Sampling and testing procedure should be defined in case the NCV is determined by COG generators.
Any comment	----

Data / Parameter:	$Q_{WCM,y}$
Data unit	Nm^3/yr
Description	Quantity of WECM (COG) recovered for energy generation in year *y*
Source of data to be used	On-site measurement
Value of data	71,880,480
Description of measurement methods and procedures to be applied:	Continuously measured by gas flow gauge and monthly read and recorded by the project owner.
QA/QC procedures to be applied	The regular calibration and management of the meters will accord to the National standards and regulations, the DOE will verify it.
Any comment	----

B.7.2. Description of the monitoring plan:

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The project owner is the maker and user of this monitoring plan and will be responsible for this monitoring plan. The project owner must maintain credible, transparent, and adequate data estimations, measurement, collection, and tracking systems to maintain the information required for an audit of the emission reduction project. These records and monitoring systems are needed to allow the selected DOE to verify project performance as part of the verification and certification process. This process also reinforces that CO_2 reductions are real and credible to the buyers of the Certified Emissions Reductions (CERs).

1. Data and parameters need to be monitored:

According to the monitoring methodology of ASM-III-Q, the following parameters will be monitored:

- $Q_{wcm,y}$ (Amount of WECM (COG) recovered in year ***y***);
- $Q_{COG,i,y}$ (coke oven gas consumed by equipment ***i*** in year y);
- NCV_{COG} (Net calorific value of project fuel, coke oven gas);
- $\eta_{PJ,i}$ (Energy efficiency of equipment i in project activity)
- $t_{COG,i}$ (temperature of coke oven gas supplied to equipment ***i***); and

- $P_{COG,i}$ (pressure of coke oven gas supplied to equipment ***i***).

2. Operational and Management Structure for Monitoring

Loudi WUJO Industrial Co. Ltd. is regarded as the implementer of this project, so the project entity will be in charge of constituting and carrying out this monitoring plan. A specialized CDM management team will be formed by project entity; the structure of it is shown by Figure B-3.

The general manager of the project entity will take charge of the monitoring management of the proposed project. The general manager will appoint a CDM Project Manager, who will be in charge of routine management of the monitoring plan, accomplishing the monitoring report. The monitoring personnel of the specialized organization will record monitoring data and archive them according to requirement of monitoring plan; the verifier will be in charge of checking and verifying the data. The Finance department and Production department will assist with verification data collection.

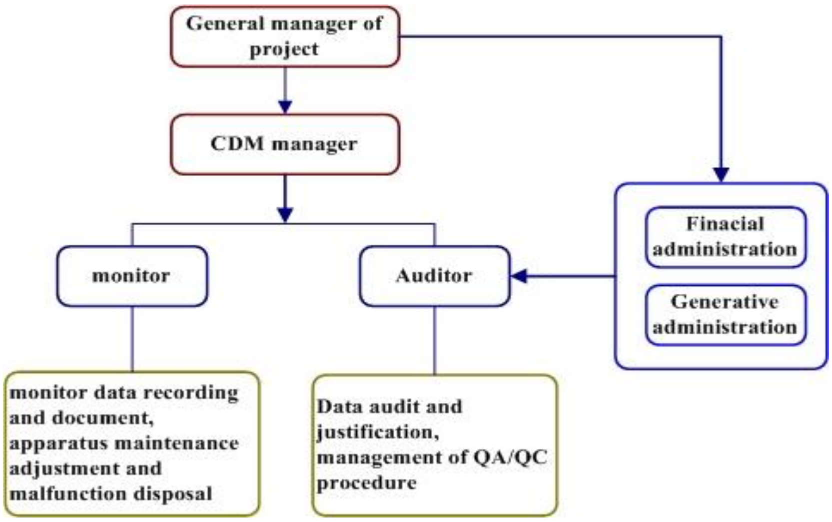

Figure B.3 - Operation and management structure

3. Installation of the monitoring meters

The diagram of location of all related meters is shown in Figure B.4 below:

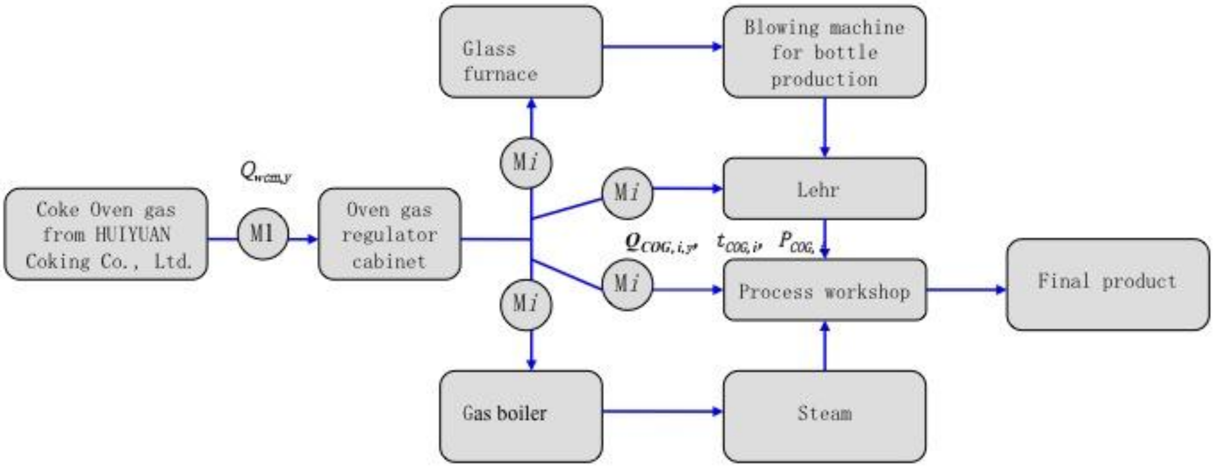

Figure B.4 - Location of meters and parameters monitored

- *Monitoring of $Q_{wcm,y}$ (amount of WECM (COG) recovered in year* ***y****)*

The flow of waste gas (COG) is monitored by flow meter which is installed in the main pipe, the value is accumulated annually. The pressure and temperature is measured at the same time.

- *Monitoring of $Q_{COG,i,y}$ (coke oven gas consumed by equipment* ***i*** *in year y)*

The compressed COG is transported to gas-consumed equipments. The flow is monitored by a flow meter at the gas inlet of each equipment.

- *Monitoring of temperature and pressure of COG*

The temperature and pressure of COG are monitored by the barometers and thermometers which are installed in the pipeline.

- *Monitoring of NCV_{COG} (net calorific value of COG)*

The net calorific value of COG is measured according to relevant national standards[26] by qualified laboratory with calibrated equipment. The sampling location of COG is the same as $Q_{COG,i,y}$ in monitoring location, so that it can ensure that the composition and quality of sample is the same as the ones of COG used by gas-consumed equipments. In addition, the net calorific value is compared with default values published by the IPCC.

- *Monitoring of* $\eta_{PJ,i}$ *(Energy efficiency of equipment i in project activity)*

The energy efficiency of equipment i in project activity is annually measured by independent qualified energy efficiency testing institute.

4. Precision and calibration of ammeters

The precision level of equipment installed in the project meets the standard listed in Table B.10, and they need to be calibrated regularly according to the equipment instructions and national standards. The evidence should be reviewed and archived after the calibration.

Table B.10 Precision and location of monitor instruments

Instrument	Location	Parameter monitored	Precision
Flow meter	Main pipe of COG collection	$Q_{wcm,y}$,	±0.35%
Flow temperature and pressure meter	At the COG gas input of each equipment	$Q_{COG,i,y}$, $t_{COG,i}$, $P_{COG,i}$	±0.35%
Analysis equipments	Qualified laboratory	NCV_{COG}	GB standard
Analysis equipments	Qualified testing institute	$\eta_{PJ,i}$	GB standard

For each parameter, two meters are installed. The first is responsible for taking primary measurements, whilst the second acts as a failsafe. If the primary meter is broken, the other can substitute in its place. To be conservative, the emission reductions during the period of equipment maintenance or replacement are not included in the total volume of emission reductions. A designated national organization will be responsible for equipment maintenance and calibration.

If any of the following situations happens, the equipment must be repaired and calibrated within 10 days after happening;

- Two sets of equipment readings exceed the permitted error margin.
- Any malfunction of equipment components.

The gas flow gauges for measurement in the Project are equipped in line with the standard of *Gas Flux Measurement in Closed Pipes – Turbine Flow Meter* (GB/T 18940-2003).

5. Data management

- Electronic data and documents, including readings from meters connected to the computer central control system, kept at a special computer, and will be regularly copied and archived via optical discs and storage tapes.
- Written data and documents, including receipts for cross-checking of data, will be copied and

[26] *Determination of calorific value of city gas* (GB/T 12206-1990)

archived with an explanation of the department or company. All paper-based information will be stored by the project owner and kept at least one electronic copy. Specific staff will be appointed by the project owner to take the overall responsibility for keeping the original copy

- Data recording, maintaining and archiving will be implemented in line with the *Quality Management System Standards* (GB/T-1 19001).

Internal verifier is responsible for checking and verifying the data regularly. The CDM Project Manager is responsible for checking the data management regularly (once a month). All the data collected as part of monitoring will be kept at least for two years after the end of the last crediting period.

6. Quality control and quality assurance (QA/QC programme)

The reliability of monitoring system is determined by precision and quality of measuring meter. The meters shall be purchased from professional manufacturers with national metering certificates and QA qualified pass. The meter shall be calibrated by qualified metering instrument institutions (at least once a year), so as to assure the precision and steadiness of the metering results.

The general manager shall be in responsible for arranging monitoring plans and staff, checking the monitoring reports. All the monitoring data shall be saved and archived properly; all the data shall be reserved for at least two years after the end of the crediting period.

All the monitoring data shall be saved and archived properly. All the data shall be reserved for at least two years after the end of the crediting period.

The project entity will ask DOE for advice in this process.

7. Monitoring report

Annual or a monthly monitoring results and emission reductions result shall be summarized into a monitoring report by the CDM Project Manager. This report should include COG consumption data of the Project, the waste energy used by the Project Activity as well as records of meters' calibration and maintenance. A verification application shall be submitted to a DOE for CERs certification.

The monitoring report will contain a summary of the monitoring plan in that particular year, and will describe the implementation of the monitoring plan. It should also present the relevant results and data, and calculate emission reductions for the period. It also includes:

- Quality assurance reports for the monitoring equipment;
- Calibration reports for the monitoring equipment (including relevant standards and regulations);
- Any maintenance and repair of monitoring equipment;
- Any other information relevant to the monitoring plan.

8. Preparation for DOE verification

A verification service agreement specific to the DOE should be signed with an agreed timeframe set by the EB for carrying out verification activities, while taking into account the buyer's schedule. The project owner will make the arrangements for the verification and will prepare for the audit and verification process to the best of their abilities.

The project owner will facilitate the verification process through provision of all required information to the DOE, before, during and, in the event of queries, after the verification.

The project owner will fully cooperate with the DOE and instruct its staff and managers to be available for interviews and respond honestly to all questions from the DOE.

The project owner should designate a CDM responsible person for the overall responsibility for the monitoring and verification process and act as the contact point for the DOE.

Besides the monitoring reports, other documents will be prepared by the project owner for verification by the DOE including, but not limited to:

- PDD (registration version), including the electronic spreadsheets and supporting documentation (assumptions, estimations, measurement, etc);
- Report on Project Management Record (including the data collection and management system).

The monitoring plan is the task and schedule for a series of monitoring work. The plan could be amended according to the actual implementation of the monitoring plan and the requirements of DOE so as to ensure the credible, transparent and conservative monitoring course of emission reduction.

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)

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Completion date of the application of Baseline and Monitoring Methodology was on April 13th, 2010.

Name of person determining the baseline and monitoring: HU Zhiwei/**B-road(International) Investment Management Co. Ltd.** (CDM project manager)

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Teams and Entity:

DENG Kuihuan - **B-road(International) Investment Management Co. Ltd.**

WU Ehui - **B-road(International) Investment Management Co. Ltd.**

HU Zhiwei - **B-road(International) Investment Management Co. Ltd.**

PENG Canhua - **Loudi WUJO Industrial Co., Ltd.**

B-road(International) Investment Management Co. Ltd. and HU Zhiwei are not project participants.

Loudi WUJO Industrial Co., Ltd. **is project participant.**

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:

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3/11/2008 (Starting date of project, equipment purchase/reconstruction contract signed)

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

>>

11 years (including construction period 1 year)

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

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C.2.1. Renewable crediting period

>>

Not applicable

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

>>

Not applicable

C.2.1.2. Length of the first crediting period:

>>

Not applicable

C.2.2. Fixed crediting period:

>>

Fixed crediting period of this project is 10 years

C.2.2.1. Starting date:

>>

01/10/2012 or the date of registration whichever is earlier.

C.2.2.2. Length:

>>

10 years.

SECTION D. Environmental impacts

D.1. Documentation on the analysis of the environmental impacts, including trans-boundary impacts:

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In accordance with the relevant provisions and decree of environmental protection in China, The owner of the proposed project has completed the environmental impact assessment of Fuel Switch from Coal to COG in WUJO Industrial Co., Ltd. The Environmental Protection Bureau of Hunan Province issued the approval of the project in May, 2008 (Hunan Environmental Registration Form [2008] №70).

The project may impact on the environment as follows：

Air pollution

The main emission of the process is waste gas from COG combustion. Because of the fuel switch from coal to COG, the content of SO_2, NO_x and solid particles will be reduced after the project is implemented. After dust removal, smoke dust concentration is 89.1 mg/Nm^3, SO_2 concentration is 113.8 mg/Nm^3, the waste gas is discharged to air by a chimney of 25-meters-high. This is in accordance with the standard of *Boiler emission standards for air pollutants* (GB13271-2001).

Waste water

After the fuel switch, the quantity of waste water will be reduced and the concentration of contamination will be much lower. The waste water discharged after the project is implemented is in accordance with the II standard of *waste water comprehensive discharge quality standards*(GB8978-1996). Therefore, this project will minimize surface water and groundwater contamination.

Noise

The acoustic environment near the project site will be affected during the period of construction. The affected scope is limited to the construction area of the project site. The following measures will be taken to mitigate the noise pollution： reasonable operation hours will be applied to project construction, high-noise construction equipments will not be run simultaneously; operation of high-noise construction equipment will not be operated at night. This will reduce the impact of construction noise on the surrounding area during the period of construction.

During the period of operation, low-noise equipment will be chosen for the production process. Noise enclosures will be fitted around high noise source such as fans and air intake, double insulation of engine room, so the overall sound pressure level of 50 meters away will be smaller than 55dB (A). The indoor control room and duty room will employ anechoic room to meet requirement and standard of every work position. Noise-abatement equipment will be installed in the smoke discharge pipe. The noise of boundary of the project can meet the standard of *Standard of noise at boundary of industrial enterprises* (GB12348-90).

Solid waste

Solid waste will be reduced during the operation period, it will be collected and treated according to relevant regulations. After the fuel switch from coal to oven gas, the solid waste is almost eliminated because of the

replacement of coal-burning equipment The main solid waste is broken glass, which will be recycled as raw material in the glass furnace.

In summary, the proposed project activity meets the environmental protection requirements and reduce the environmental pollution. It has no significant negative impact to 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:

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According to the EIA and approval of Environmental Protection Bureau of Hunan Province, there is no significant negative environmental impact of the proposed project. Furthermore, the proposed project improves the local environment significantly by switching fuel from coal to coke oven gas.

SECTION E. Stakeholders' comments

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

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In Jan. 2009, Loudi WUJO began to discuss with stakeholders about supporting construction of the proposed project and put up a Poster of the Waste Coke Oven Gas Recovery project. In order to obtain comments on the proposed project from stakeholders, the project owner invite stakeholders include residents, local authorities, employees to discuss the environmental impact of the project on Jan. 8th, 2009. The questions and comments put forward by stakeholders in the meeting were recorded and archived. At the meeting, 50 environmental impact questionnaires were distributed to them to investigate the impact of the project on environment and people's life, and to know people's attitudes towards the project. The questions include: Do you think this project will have negative influence on your health; do you support the construction of this project; etc. Because having put up a poster about the survey a week before, most of residents nearby can get the information. During the survey, totally 50 questionnaires had been handed out to the local residents, and the ratio of the completed questionnaires reached 100%.

The survey mainly focuses on the following issues:

1. What's the extent of the stakeholders' knowledge about the proposed project activity?
2. What's the attitude of the stakeholders on the construction of the Project?
3. What impacts will be introduced to the local economy and environment by implementation of the Project?
4. What impacts will be introduced to the daily life of the stakeholders?
5. What's the extent of the stakeholders' knowledge about the clean development mechanism? Whether they will support designing the project as a CDM project?

Table E.1 - Structure of residents in the survey

Gender			Education grade			Age grade			Vocation		
Gender	No.	%	Education	No.	%	Age	No.	%	Vocation	No.	%
Male	38	76.0%	Preliminary school	7	14.0%	20-30	5	10.0%	Peasant	27	54.0%
Female	12	24.0%	Junior school	16	32.0%	31-40	13	26.0%	Staffer	15	30.0%
			Senior school	21	42.0%	41-50	21	42.0%	Other	8	16.0%
			Above	6	12.0%	Above	11	22.0%			

E.2. Summary of the comments received:

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Comments from local stakeholders have been sought in the following aspects:

1. 100.0 % of the respondents show that they have a good understanding of the proposed project activity.

2. 96.0 % of the respondents who know about the proposed project agreed the benefits in environment and economics and show a positive attitude to the proposed project activity.

3. 97.0 % of the respondents who know about the proposed project show that there is no negative impact to their life because of the proposed project.

4. 98.0 % of the respondents expect that the proposed project activity can be registered as a CDM project which is critical for project implementation.

5. The opinions of stakeholders to the proposed project are summarized as follows: The use of oven gas as a substitute for coal in industrial production is expected to reduce environmental pollution. It makes significant improvements in the local environment by reducing CO_2 and SO_2 emissions from fossil fuel consumption. The consumption of oven gas from HUIYUAN Coking Co. Ltd will not cause new pollution. At the same time, this project can bring benefits to local residents by creating new employment opportunities and providing technical training opportunities to employees.

We know from the results of questionnaire statistics and the consultation meeting that the stakeholders generally understand and support the construction of the Project, and hope the proposed project could be operated as soon as possible.

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

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There is no negative comment on the proposed project.

The stakeholders' have no negative comments on the proposed project and they are very supportive to the construction of the proposed project. The proposed project is also supported by local government.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Project owner

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding is involved in this project activity.

Annex 3

BASELINE INFORMATION

No further information.

Annex 4

MONITORING INFORMATION

No further information.