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

## CONTENTS



## Annexes

## SECTION A. General description of project activity

### A.1. Title of the project activity:

Clean and Efficient Cooking and Heating Project, China
Version of Document: 4
Date of Document: 24/04/2012

### A.2. Description of the project activity:

**Project Description:**

This proposed Voluntary Gold Standard carbon credit project (henceforth referred to as the "Project") installs efficient and clean household energy technologies that can be used for cooking and heating throughout coal endemic areas of China. The Project initially replaces annually an estimated minimum of 7,000 inefficient "traditional" coal burning stoves with improved biomass cooking technologies starting in Shanxi Province, Guizhou Province, and Enshi State. The Project reduces greenhouse gases (GHGs) by replacing household use of high emissions fuels such as coal with readily available excess renewable agricultural residues, primarily corn cobs and corn stalks that are currently burned in fields as waste. The Project will leverage carbon revenues and matching local government support to subsidize the cost of distributing the improved stoves to poor rural households currently using traditional coal stoves, achieving an estimated average reduction of 399,501 tCO2e per annum, and total emissions reductions of 2,796,503 tCO2e throughout the entire 7-year crediting period (twice renewable). Associated emissions reductions will be applied for carbon credits using the Gold Standard "Methodology for Improved Cook-stoves and Kitchen Regimes V.02 – 08/02/2010," hereafter referred to as GS VER Methodology.

**Rural Household Energy Sector:**

One of the most visible signs of the urban/rural disparity in China is in the household energy sector. While cleaner-burning petroleum-based fuels are increasingly common in wealthier areas, at least 50% of all households still depend on solid fuels as an important household fuel[1]. Shanxi Province, for example, itself ranks fourth amongst China's 32 provinces in terms of total residential coal consumption, with rural residential coal use in the province having increased 28% during the ten year period of 1997-2007. These high rates of coal use, combined with poor stove design and low-quality manufacturing have resulted in a generation of household coal stoves that are identified as the leading cause of air pollution in most rural areas and middle/small towns in China.

Presently, however, poor households are unable to easily switch away from coal because of the high cost and lack of awareness of cleaner-burning fuels or technologies. Compounding this problem is the abundant supply of coal in regions such as Shanxi Province. This necessitates a solution that both incorporates locally available resources and is able to attain significant reductions in fossil fuel use and thus greenhouse gas emissions. The introduction of clean and efficient gasifier stoves, which promote fuel switching from coal to renewable surplus crop residues, is an attractive rural energy solution that can mitigate greenhouse gas

[1] Zhang, Z. and K. R. Smith (2007). "Household Air Pollution from Coal and Biomass Fuels in China: Measurements, Health Impacts, and Interventions." Environmental Health Perspectives **115**(6): 848-855.

emissions and reduce air pollution, if carbon finance can help overcome cost barriers and adoption issues.

**Contribution to Poverty Alleviation and Health Impacts:**

The World Health Organization (WHO) considers reliance on solid fuel to be both a result and cause of poverty. In regards to the former, poor families do not possess the resources necessary to secure access to cleaner fuels and improved technologies. As for the latter, the health complications that result from dependence on traditional appliances and fuels are severe enough to hinder economic development and further entrench households in poverty.

- Strong evidence exists which links exposure to indoor air pollution (IAP) from smoke to acute infections of the lower respiratory tract, lung cancer, and chronic obstructive pulmonary disease (COPD). The use of solid fuels in households increases the risk of pneumonia in children under 5 by a factor of 2.0 and increases the risk of COPD in adult women by a factor of 3.2. Other studies suggest IAP is a contributor to tuberculosis, asthma, and cataracts[2].

- Worldwide, IAP has been estimated to be responsible for 2.6% of the total global burden of disease. In human terms, this equates to 1.6 million premature deaths per year. Moreover, it is estimated to account for the loss of 38.5 million disabilities adjusted life-years (DALYs) [3][4].

The links between IAP and poverty have been especially well-documented in China. According to the WHO, household solid fuel use is responsible for 1.6% of the Chinese national burden of disease, over 380,000 premature deaths and more than 3.2 million DALYsper year. A recent World Bank study estimates that IAP is responsible for 111,000 premature deaths, 220,000 hospital admissions, more than 4.3 million emergency room visits and has caused economic losses of up to US$10.7 billion each year in China[5].

It is clear that the Project will improve the health of individuals by reducing exposure to dangerous coal smoke. Poverty alleviation is achieved through improvements in health, as well as cost savings from fuel switching away from purchased coal fuels, to free and readily available renewable biomass fuels.

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[2] Zhang, Z. and K. R. Smith (2007). "Household Air Pollution from Coal and Biomass Fuels in China: Measurements, Health Impacts, and Interventions." Environmental Health Perspectives **115**(6): 848-855.

[3] Disability-Adjusted Life Year (DALY) is a quantifiable way of addressing the economic cost of ill-health. DALYs combines the years of life lost due to disability with the years of life lost due to death to create a comparative public health measure.

[4] Ezzati, M., S. V. Hoorn, et al., Eds. (2006). Comparative Quantification of Mortality and Burden of Disease Attributable to Selected Risk Factors. Global Burden of Disease and Risk Factors,ed. New York, Oxford University Press.

[5] These statistics were drawn from a report entitled, Sustainable and Efficient Energy Use to Alleviate Indoor Air Pollution in Poor Rural Areas in China: Project Completion Report. The report does not list any authors, but the following information was provided along with the report by Dr. TANG, Ning, China CDC / IEHS, 29 Nanwei Rd, Xuanwu Dist., Beijing 100050, China. Phone: 8610-83132550, 13521157797; email: ningtanglcp@126.com. Name of the project: Sustainable and efficient energy use to alleviate indoor air pollution in poor rural areas in China; Financial source of the project: Endowment from the World Bank; Persons in charge of the project: Enis Baris, Wei Huanzhang, and Jin Yinlong; Project Regions: Guizhou Province, Shaanxi Province, Gansu Province and the Neimeng Autonomous Region; Duration of the project: from 2002 to 2006

## A.3. Project participants:

| Name of Party involved (*) ((host) indicates a host Party) | Private and/or public entity(ies) project participants (*) (as applicable) | Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No) |
|---|---|---|
| N/A to voluntary Gold Standard VER project in China | Impact Carbon (Private) | No |
| N/A to voluntary Gold Standard VER project in China | My Climate (Private) | No |

All rights to carbon ownership resulting from the sale and use of project stoves are transferred at the point of sale from stove purchasers to the manufacturer. For the initial verification period all stoves were sold by Shanxi Jinqilin Energy Technology Company. Beginning with the second verification, stoves will also be sold by Zhiqi and Huifeng stove manufacturers. The stove purchaser signs a carbon waiver that relinquishes all future rights to credits, with an understanding that the carbon project will support rural development through future carbon revenues.

Subsequently, all carbon rights resulting from the sale and use of improved stoves are transferred from the manufacturer to Impact Carbon and My Climate through an emissions reduction purchase agreement. The first manufacturer ERPA has been established with Shanxi Jinqilin Energy Technology. ERPAs have also been established with Zhiqi and Huifeng stove manufacturers.

A similar model of carbon rights transfer will be used for new technologies and manufacturers as they are incorporated into the project activity.

## A.4. Technical description of the project activity:

### A.4.1. Location of the project activity:

The project area is coal endemic areas of China. Initially, the project will focus in Shanxi Province, with initial primary target areas in 6 townships (Xiyan, Shangshe, Niucun, Changchi, Donghui, Chakou) in rural areas within the border of Yangquan City in Eastern Shanxi Province of China. All townships of the initial target project area are approximately within east longitude E113°88′ and north latitude N38°30′. The initial target project area is approximately 1,403 $km^2$. It is calculated as the combined area of the 6 included townships (boundaries for individual townships defined below in section A.4.1.4.), and therefore does not include geographies between the included townships.

Additional project areas beginning in Issuance-2 include Enshi Tujia and Miao Autonomous Prefecture in Hubei province, and Guizhou province. Target project area is approximately within E109°29’ and N30°17′ for Enshi, and E106°50’ and N26°50′ for Guizhou. Enshi is approximately 24,000 km2,, and Guizhou is 176,100 /km2.

| A.4.1.1. | Host Party(ies): |
|---|---|

N/A to Gold Standard VER Project

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

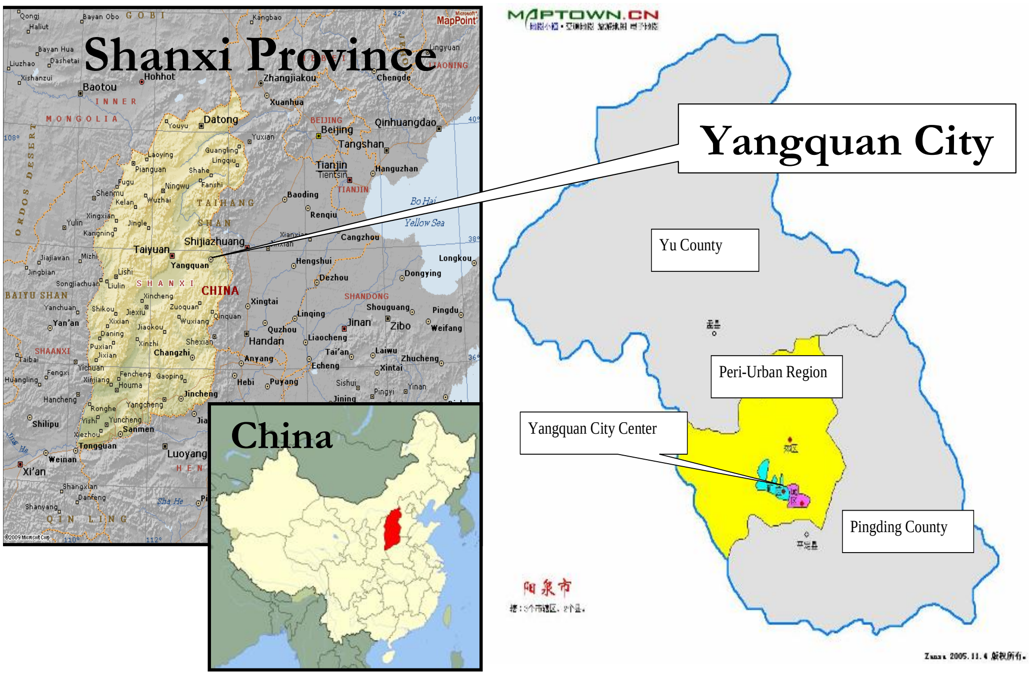
China

| A.4.1.3. | City/Town/Community etc.: |
|---|---|

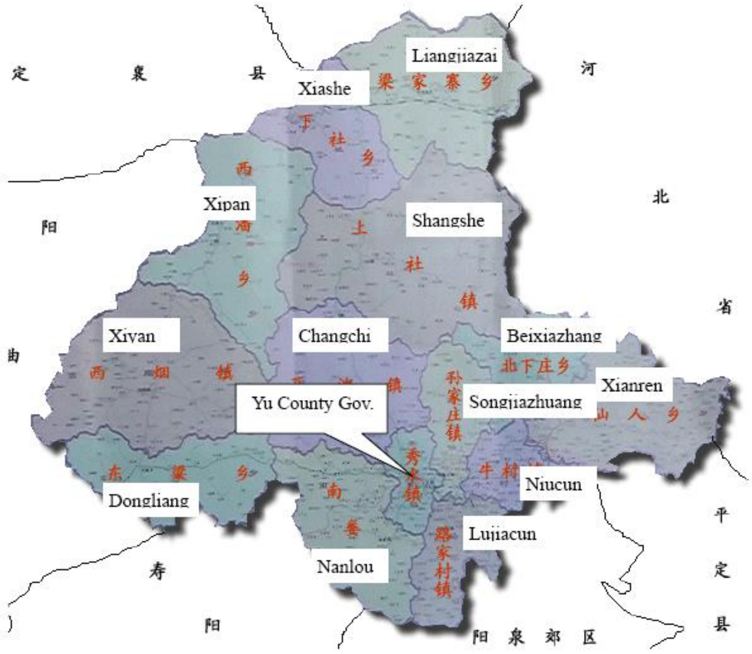
The Project's primary initial targets are 6 townships in Shanxi Province: (Xiyan, Shangshe, Niucun, Changchi, Donghui, Chakou) in rural areas within the border of Yangquan City.

The second verification includes the Enshi cities of Enshi, Lichuan, Jianshi, Badong, Xuan'en, Xianfeng, Laifeng, Hefeng. In Guizhou, the initial target cities are Anshun, Guiyang, Liupanshui, Xingyi, Kaili, Bijie.

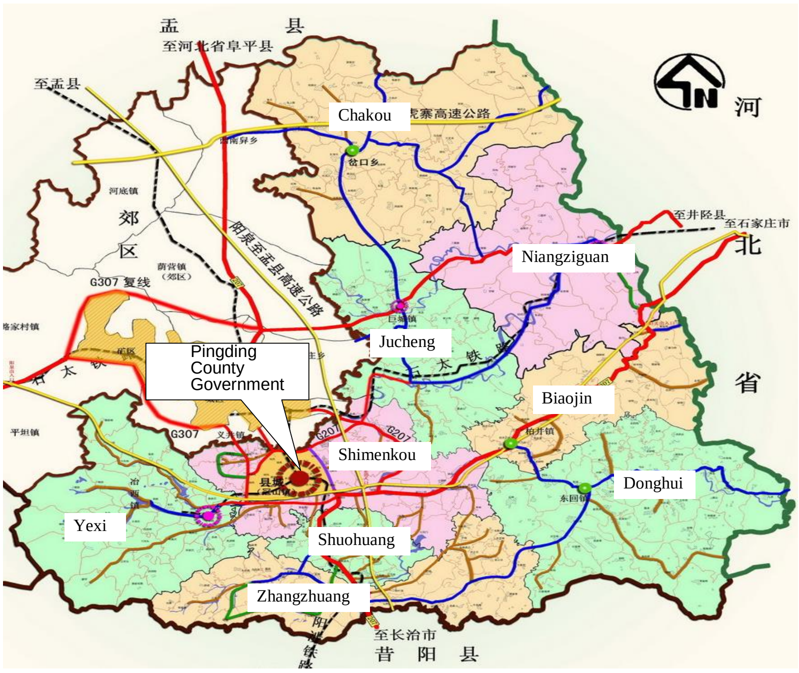
**A.4.1.4. Details of physical location, including information allowing the unique identification of this project activity (maximum one page):**




**Map Source:** http://en.wikipedia.org/wiki/File:China_Shanxi.svg, http://encarta.msn.com/map_701516475/shanxi.html, http://www.yq.gov.cn/



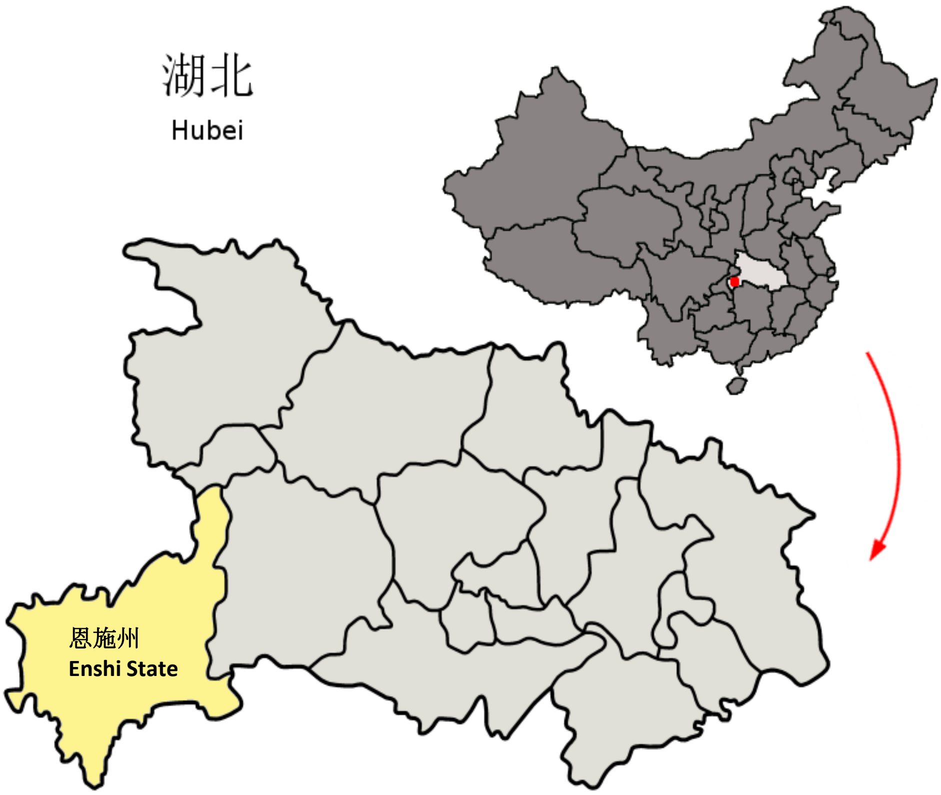

Yu County Map, Source: http://www.sxyx.gov.cn/




Pingding County Map. Source: http://www.pd.gov.cn/

**Figure A1. List of townships in Project boundary (Shanxi Province)**

| Township or City | Area (km$^2$) | Population | Households | Location | |
|---|---|---|---|---|---|
| Xiyan | 312.1 | 20,438 | 7,510 | N38°18'01" | E113°07'64" |
| Shangshe | 384.4 | 17,028 | 6,928 | N38°29'65" | E113°33'32" |
| Niucun | 69.5 | 19,290 | 7,193 | N38°09'51" | E113°51'68" |
| Changchi | 213.9 | 24,116 | 8,286 | N38°16'87" | E113°35'61" |
| Donghui | 239.7 | 30,191 | 10,924 | N37°77'85" | E113°87'87" |
| Chakou | 183.5 | 19,695 | 7,591 | N38°05'75" | E113°80'38" |
| **Total** | 1,403.1 | 130,758 | 48,432 | | |



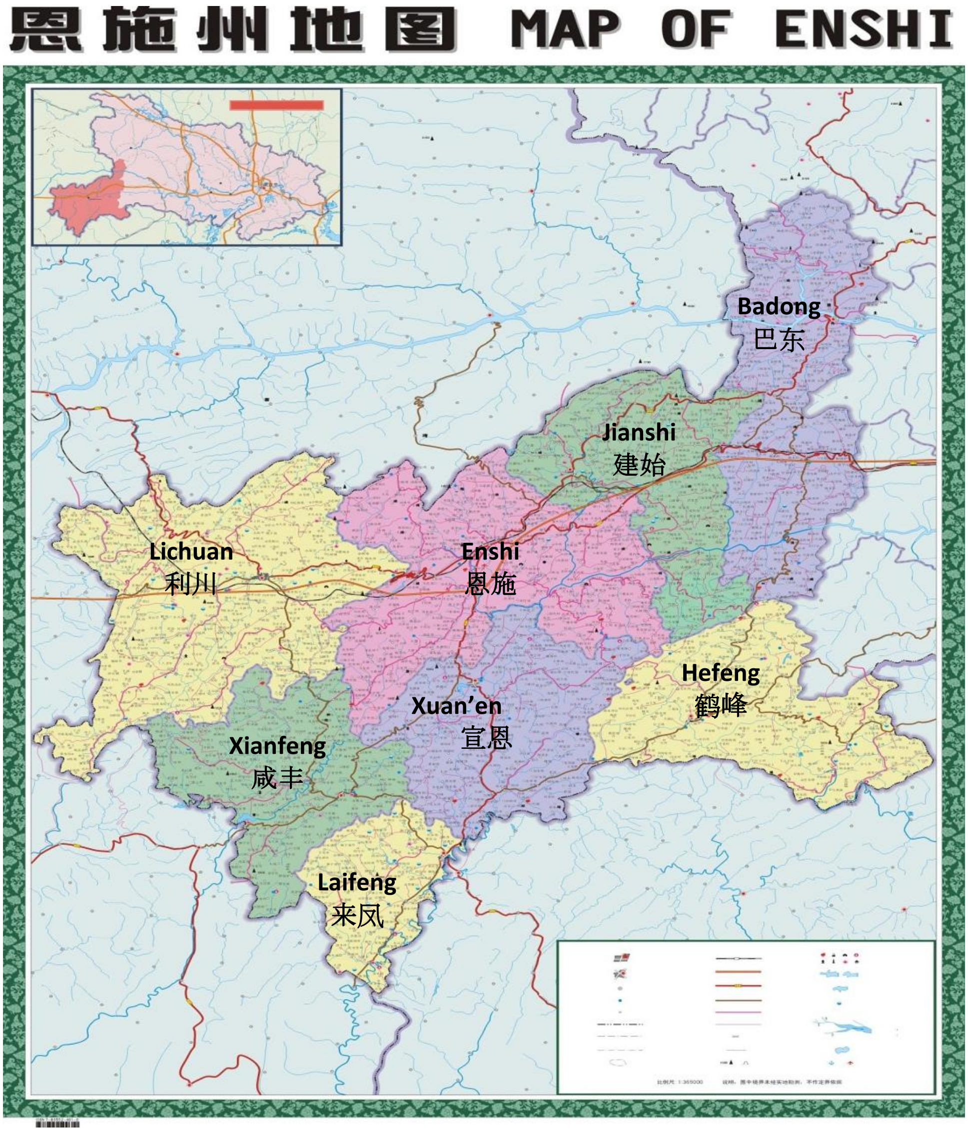



**Figure A2. List of townships in Project boundary (Hubei Province, Enshi State)**

| County or City | Area (km2) | Population | Households | Location (GPS Coordinates | |
|---|---|---|---|---|---|
| 恩施市Enshi City | 3,972 | 795,000 | 260,477 | N30°17'21" | E109°28'49" |
| 来凤县Laifeng County | 1,345 | 320,000 | 99,076 | N29°29'51" | E109°24'24" |
| 巴东县Badong County | 3,354 | 490,000 | 172,987 | N31°02'34" | E110°20'54" |
| 建始县Jianshi County | 2,666 | 520,000 | 142,164 | N30°36'05" | E109°43'36" |
| 咸丰县Xianfeng County | 2,550 | 380,000 | 133,468 | N29°40'43" | E109°09'10" |
| 宣恩县Xuan'en County | 2,730 | 360,000 | 115,549 | N29°59'12" | E109°29'29" |
| 鹤峰县Hefeng County | 2,872 | 220,000 | 78,105 | N29°55'15" | E110°01'58" |
| 利川县Lichuan City | 1,345 | 896,000 | 292,690 | N30°17'27" | E108°56'11" |
| **Total** | **20,834** | **3,981,000** | **1,294,516** | | |


Guizhou Province


Xiuwen
(Guizhou)
Kaili
Jinping
Shuicheng
Puding
Pingba
Guanling
Ziyun
Xingren
Xingyi
Wangmo
Yibin
河池市 (Hechi)

**Figure A3. List of townships in Project boundary (Guizhou Province))**

| County or City | Area (km2) | Population | Households | Location (GPS Coordinates | |
|---|---|---|---|---|---|
| Ziyun County | 2,251 | 360,000 | 93,890 | N25° 45′ 0″ | E106° 4′ 48″ |
| Pingba County | 987 | 350,000 | 110,610 | N26° 25′ 0″ | E106° 16′ 0″ |
| Puding County | 1,080 | 460,000 | 137,402 | N26° 18′ 0″ | E105° 44′ 35″ |
| Guanling County | 1,464 | 370,000 | 102,942 | N25° 57′ 0″ | E105° 38′ 0″ |
| Xiuwen County | 1,072 | 310,000 | 88,584 | N26° 50′ 24″ | E106° 36′ 0″ |
| Shuicheng County | 3,594 | 830,000 | 223,778 | N26° 33′ 0″ | E104° 57′ 36″ |
| Jinping County | 1,619 | 230,000 | 61,422 | N26° 40′ 48″ | E109° 12′ 0″ |
| Kaili City | 1,304 | 493,000 | 137,430 | N26° 35′ 0″ | E107° 58′ 0″ |
| Wangmo County | 3,018 | 320,000 | 73,537 | N25° 10′ 48″ | E106° 6′ 0″ |
| Xingren County | 1,778 | 530,000 | 133,266 | N25° 26′ 24″ | E105° 12′ 0″ |
| Xingyi City | 2,908 | 813,000 | 219,612 | N24° 32′ 0″ | E104° 19′ 0″ |
| **Total** | **21,075** | **5,066,000** | **1,382,473** | | |

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

**Project Type:** Large-scale Gold Standard (GS) Voluntary Emission Reduction (VER) Project

**Category:** Renewable Energy Supply

**Sub Category:** Energy Efficient Cooking Stoves

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

**Technology:**

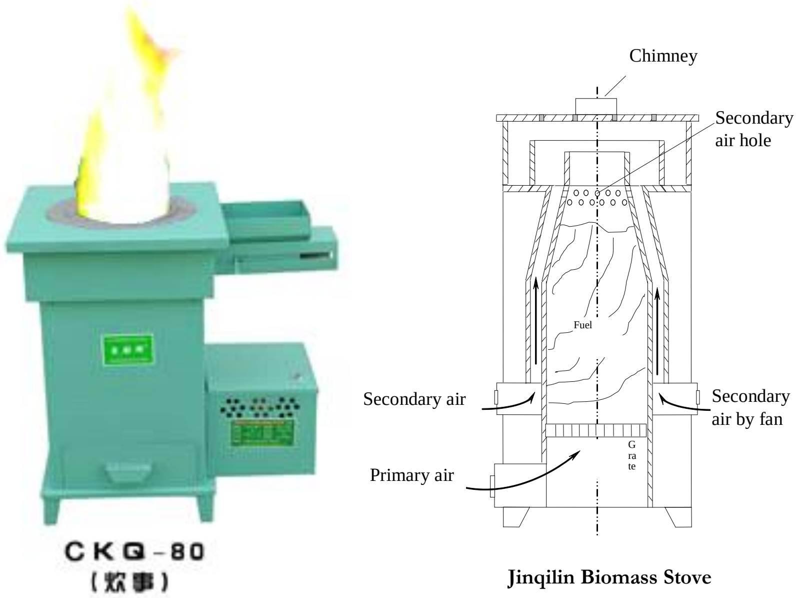
This partnership promotes the use of efficient and clean household energy technologies that can be used for cooking and heating throughout coal endemic areas of China, and generates carbon credits in the voluntary market based on the greenhouse gas emission reductions of these technologies. Additional energy savings technologies may be added during the project period as new fuel-saving technologies are identified.

The first technology presented for crediting is classified as “semi-gasifier,” but here after shortened to “gasifier.” This gasifier is manufactured by Shanxi Jinqilin Energy Technology Company Ltd (Figure A2) and features carefully engineered airflow and insulated combustion chambers to burn biomass crop residues cleanly and efficiently. The thermal efficiency in laboratory testing using biomass residues for the Jinqilin stove model CKQ 80 is 41.4%, and for model CKQ80I is40.4%.[6] Published research shows 8-15% traditional coal

[6] Lab test results available to DOE. Both models CKQ and CKQI have identical combustion chamber designs. CKQ model additionally has a chamber for heating water and an optional fan to facilitate combustion.

stove efficiencies when performance was measured in-homes, and lab testing of traditional coal stoves shows efficiencies of 20%.[7,8]

**Figure A4.** Technical specifications for Jinqilin biomass gasifier stove




Jinqilin Biomass Stove

| Jinqilin Stove Specifications | | |
|---|---|---|
| Testing data[9] | CKQ 80 | CKQ 80I |
| Thermal Efficiency | 41.4% | 40.4% |
| Cooking Power | 4.2 kW | 3.8 kW |

Both Jinqilin CKQI and CKQ model stoves can use unprocessed crop residues and processed “briquette” crop residues, which are continually loaded with a manual fuel-feed. The stoves increase combustion efficiency by using primary airflow that flows up through the grate at the bottom of the stove, and secondary airflow that enters the combustion chamber through holes added on the upper part of the stove. The primary airflow coming into the lower grate results in biomass fuel that is burned incompletely.  This incomplete burning

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[7] Thermal efficiency testing on traditional coals stoves conducted by: The Center of China Rural Energy Research and Training Add: Rm 801, Maizidian Street No.41 Chaoyang District, Beijing China. Tel. 0086 10 65928412 Mr. Xiao Mingsong, xiaoms@sohu.com

[8] The first generation of improved coal stoves (now considered old and “traditional” technologies) in China introduced in the 1980s and early 1990s had efficiency standards of 20%, but field studies and lab testing have shown efficiencies ranging from 8-10%, well below the proposed benchmarks.  These published findings further support Yu County government coal stove efficiency test results.  See the following study for comprehensive explanation of technical performance of stoves resulting from NISP: Sinton, J. E., K. R. Smith, et al. (2004). "An Assessment of Programs to Promote Improved Household Stoves in China." Energy for Sustainable Development **8**(3): 33-52.

[9] Stove specifications certified by: Shanxi Mechanical Products Quality Supervision and Testing Center. Address: No.228 Shengli Street Taiyuan, Shanxi province. Tel.  0351-3184754

releases combustible gases into the upper combustion chamber, where the secondary airflow facilitates further burning of the released gases. This transforms the two-phase burning between solid biomass fuel and released gases into one-phase of gas burning. This semi-gasification combustion method is fuel efficient and improves indoor air quality by reducing particulate matter and carbon monoxide emissions. The CKQ model stove also utilizes a small electric fan that forces ventilation and air turbulence in order to facilitate primary and secondary air flow and increased thermal efficiency and high power cooking. The project has installed approximately 1000 model CKQ 80I stoves, and roughly 12,400 model CKQ 80 stoves, for crediting in the first verification period.

As carbon revenues are made available, the project will install efficient and clean household energy technologies that can be used for cooking and heating throughout coal endemic regions of China, including:

| Manufacturer | Province |
|---|---|
| Hebei Guanglei Stove Industry Co.,Ltd | Hebei |
| Huanghua Haotian Energy Equipment Co.,Ltd | Henan |
| Renqiu Chuangxin Energy-saving Stove Co.,Ltd | Shandong |
| Yuzhou Helou Stove Co.,Ltd | Liaoning |
| Enshi Zhiqi Biomass Science and Technology Co., Ltd. | Hubei |

The second verification includes two new stove manufacturers- Enshi Zhiqi Biomass Science and Technology Co., Ltd (herewithin referred to as "Zhiqi") and Anshun Huifeng Energy Saving Stove Company Ltd (herewithin referred to as "Huifeng").

Zhiqi Biomass combined heating and cooking stove:
The first technology presented for crediting is classified as "semi-gasifier," but here after shortened to "gasifier." This gasifier is manufactured by Enshi Zhiqi Biomass Energy Science& Technology Development Company Ltd and features carefully engineered airflow and insulated combustion chambers to burn woods and biomass residues cleanly and efficiently. The thermal efficiency for combined heating & cooking in laboratory testing using biomass residues for the Zhiqi stove model ZQ-JG-220 is 81.5% against the Standard GB/T 16157-1996, HJ/T398-2007 and DB11/T540-2008.

**Figure A5.** Technical specifications for Zhiqi biomass gasifier stove

| Item | Testing Data |
|---|---|
| Thermal Efficiency for combined heating & cooking | 81.5% |
| Cooking Power | 3.1kw |
| Weight | 43kg |
| Top size | 750mm×750mm |
| Body size | ∮290mm*62mm |
| Base size | 440mm*440mm*140mm |

Zhiqi stove can use unprocessed woods, crop residues and processed “briquette” crop residues, which are continually loaded with a manual fuel-feed. The stoves increase combustion efficiency by using primary airflow that flows up through the grate at the bottom of the stove, and secondary airflow that enters the combustion chamber through holes added on the upper part of the stove. The primary airflow coming into the lower grate results in biomass fuel that is burned incompletely. This incomplete burning releases combustible gases into the upper combustion chamber, where the secondary airflow facilitates further burning of the released gases. This transforms the two-phase burning between solid biomass fuel and released gases into one-phase of gas burning. This semi-gasification combustion method is fuel efficient and improves indoor air quality by reducing particulate matter and carbon monoxide emissions.
The stove is designed to be used especially in winter for heating. It can also meet user’s cooking needs at the same time. The big size of stove ensures the heat radiation to warm the room. People can sit around the stove and use the stove as a table due to the big top.

Huifeng Biomass combined heating and cooking stove

The first technology presented for crediting is classified as “semi-gasifier,” but here after shortened to “gasifier.” This gasifier is manufactured by Anshun Huifeng Energy Saving Stove Company Ltd and features carefully engineered airflow and insulated combustion chambers to burn woods and biomass residues cleanly and efficiently. The thermal efficiency for combined heating & cooking in laboratory testing using biomass residues for the Huifeng stove model HF-CS is 88.7% against the Standard GB/T 16157-1996, HJ/T398-2007 and DB11/T540-2008.

**Figure A6.** Technical specifications for Huifeng biomass gasifier stove

| Item | Testing Data |
|---|---|
| Thermal Efficiency for combined heating & cooking | 88.7% |
| Cooking Power | 3.6kw |
| Weight | 36kg |
| Top size | 650mm×650mm |
| Body size | ∮250mm*60mm |
| Base size | 420mm*420mm*160mm |

Huifeng stove can use unprocessed woods, crop residues and processed "briquette" crop residues, which are continually loaded with a manual fuel-feed. The stoves increase combustion efficiency by using primary airflow that flows up through the grate at the bottom of the stove, and secondary airflow that enters the combustion chamber through holes added on the upper part of the stove. The primary airflow coming into the lower grate results in biomass fuel that is burned incompletely. This incomplete burning releases combustible gases into the upper combustion chamber, where the secondary airflow facilitates further burning of the released gases. This transforms the two-phase burning between solid biomass fuel and released gases into one-phase of gas burning. This semi-gasification combustion method is fuel efficient and improves indoor air quality by reducing particulate matter and carbon monoxide emissions.
The stove is designed to be used especially in winter for heating. It can also meet user's cooking needs at the same time. The big size of stove ensures the heat radiation to warm the room. People can sit around the stove and use the stove as a table due to the big top.

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

**Figure A7.** Estimated amount of emission reductions over 7-year crediting period

| Crediting Period | Estimate of emission reductions in tonnes of CO2e per annum |
|---|---|
| 2009-2010 | 51,274 |
| 2010-2011 | 249,902 |
| 2011-2012 | 426,301 |
| 2012-2013 | 596,522 |
| 2013-2014 | 715,296 |
| 2014-2015 | 757,209 |
| 2015-2016 | |
| Total estimated reductions ($tCO_2e$) | 2,796,504 |
| Total number of crediting years | 7 |
| Estimated emission reduction per annum over total crediting period (tCO2e) | 399,501 |

Per GS VER Methodology, adoption of new fuels and stoves *"…may occur in a phased manner, a program or project comprising a progressive increase over the project years in adoption of an improved fuel mix, improved stoves…"* (GS VER Methodology Pg.2). As new stove and fuel technologies become available, the project will conduct *"A "New-Stove KT" to measure fuel consumption [that will] take place for new models and designs when they are launched, and will be repeated not less frequently than bi-annually"* (GS VER Methodology Pg.25, Step 6).

For the purposes of the PDD and first verification period, the project estimates sales based on the current Jinqilin CKQ model stoves, which have been determined to be roughly 7,000 stove sales per year. The second verification period, the project estimates sales based on the Jinqilin, Zhiqi, and Huifeng stoves. With the assistance from carbon revenues, the project hopes that expanded R&D, social marketing, and increased awareness of improved stoves will increase sales for other improved stove technologies sold in different regions and clusters. As new stove technologies are phased into the project activity, the project will adjust sales projections based on the types of technologies and companies being credited during the appropriate future verification period.

Hence, since new stove technologies have not yet been installed, the project is unable to identify specific geographical locations beyond the current target areas for the Jinqilin, Zhiqi, and Huifeng stove. During the appropriate future verification period, the project will provide evidence for new areas using coal fuels, and if necessary evidence for sufficient agricultural residues for cooking and heating needs, and if necessary will reassess additionality of new clusters and technologies. It is likely that during the first 7-year crediting period the project will incorporate 5 new manufacturers and 5 locations all located within the project boundary of China.

### A.4.5. Public funding of the project activity:

No ODA financing is used. See Annex 2.

## SECTION B. Application of a baseline and monitoring methodology

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

The Project applies the approved GS VER methodology: "Methodology Improved Cook-stoves and Kitchen Regimes V.02" – 08/02/2010 (hereafter referred to as "GS VER Methodology"). Details can be found at: http://www.cdmgoldstandard.org/Gold-Standard-Methodologies.347.0.html

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

The project proponents are initiating a project in coal endemic areas of China, starting with Shanxi Province and expanding to Guizhou Province and Enshi State, to promote the sale of improved energy-saving stoves. As carbon finance is made available, the Project will expand the availability of new types of energy saving stoves that are both culturally and location appropriate. According to GS VER Methodology:

> *"This methodology is applicable to programs or activities* ***introducing improved cook-stoves*** *or water treatment technology (e.g. water filters) and practices to households and institutions that result in improved kitchen regimes within a distinct geographical area."*

> *"The methodology addresses the switch from cook-stoves and kitchen regimes used in institutions or domestic homes having significant green-house gas emissions to those having considerably less or zero emissions. Kitchen regimes with significant green-house gas emissions may involve the use of more than one fuel type and more than one stove type, and the switch to low emission regimes may involve a shift in the apportionment of fuel types and/or adoption of new fuels and cook-stoves and/or water treatment technology.* ***The shift may occur in a phased manner, a program or project comprising a progressive increase over the project years in adoption of an improved fuel mix, improved stoves*** *and/or water treatment technology."*

The Project adopts a phased approach to transitioning households and institutions towards cleaner kitchen regimes. The Project will initially introduce improved clean-burning Jinqilin biomass gasifier stoves to residential households in the initial target areas. As carbon financing is made available, the Project will expand the availability of new technologies to include other types of improved stoves (eg. other manufacturers of improved stoves, institutional stoves, and heating stoves), that accomplish emissions reductions in accordance with the approved GS VER Methodology. When necessary the Project will monitor new baselines and will redefine clusters as new technologies and new customer groups are introduced to the project.

Finally, the GS VER methodology is applicable to the project because:

**Figure B1.** Project justification for choice of methodology

| GS VER Methodology Measure | Project Justification |
|---|---|
| Low-emission cook-stoves and regimes replace relatively high-emission baseline scenarios. | The Project replaces higher emission residential coal combustion with thermal energy from lower emission improved stoves |
| The project boundary can be clearly identified, and the stoves or water treatment technology counted in the project are not included in another voluntary market or CDM project (i.e. no double-counting takes place) | The project boundary is China. More specifically the project boundary is clearly defined as users of efficient and clean household energy technologies that can be used to replace cooking and heating with coal fuels in coal endemic areas of China.<br><br>Project stoves have exclusive contracts with the project's GS VER China project, and project stoves cannot be used by other project proponents. The project applies sales only to the GS VER registry, and no CDM or alternative registry is used for project stoves. Publicly available information on GS VER and CDM stove projects can confirm that PP's project stoves are not used by other groups and that double counting has been avoided. |
| The project is located in a single country. | The Project is located in the People's Republic of China. |
| The improved cook-stoves or water treatment technology do not number more than ten per kitchen and each have continuous useful energy outputs of less than 50kW (defined as total energy delivered usefully from start to end of operation divided by time of operation) | The Project installs one cook-stove per household. The gasifier promoted by the Project have a capacity of 4.2kW for the Jinqilin stove, 3.1 kW for the Zhiqi stove, and 3.6 kW for the Huifeng stove.<br><br>To identify project stoves, per monitoring requirements in GS VER Methodology Page 22, all stove sales will record the name, phone, and address of all bulk purchases, and the same information for households (as many as possible). If a stove is returned for any reason, or replaced with a new stove, the electronic database is updated to ensure no double counting. |

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

| | Sources | Gas | Included/Excluded | Justification/Explanation |
|---|---|---|---|---|
| Baseline | Emissions from baseline combustion | $CO_2$ | Included | Main source of emission in the fossil baseline |
| | | $CH_4$ | Included | Main source of emission in the fossil baseline |
| | | $N_2O$ | Included | Main source of emission in the fossil baseline |
| Project Activity | Emissions from project combustion, production, and transport | $CO_2$ | Included | Main source of emission from fossil sources. Renewable energy (RE) agricultural residues and renewable woodfuel excluded. |
| | | $CH_4$ | Included | Main source of emission from fossil sources. Renewable energy (RE) agricultural residues and renewable woodfuel excluded. |
| | | $N_2O$ | Included | Main source of emission from fossil sources. Renewable energy (RE) agricultural residues and renewable woodfuel excluded. |

**Figure B2.** Description of emission sources and GHG categories of the proposed Project:

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

According to the methodology: "The project proponent should carry out a Baseline Study and summarize its results in the PDD, in accordance with the procedure set out in the steps listed below:"

**1. Determine customer groups or "clusters"**

Step 1.1: Establish a pilot Sales Record
Step 1.2: Provisionally assess fuel types, fuel mix, and kitchen regimes
Step 1.3: Analyze renewability status of wood-fuels
Step 1.4: Divide pilot Sales Record into customer groups or clusters
Step 1.5: Carry out a qualitative survey (Kitchen Survey)
Step 1.6: Refine demarcation of clusters and populate Project Database

**2. Calculate baseline emissions**

Step 2.1: Estimate expected variation and improvement in emission reductions
Step 2.2: Specify the Units of emission reduction or fuel consumption
Step 2.3: Make quantitative measurements (Kitchen Tests)
Step 2.4: Calculate baseline

## 1. Determine customer groups or "clusters"

### Step 1.1: Establish a pilot Sales Record

Greater than 70% of total sales of Jinqilin stoves have occurred in Yu County. The survey team therefore focused initial surveys on customers in villages within this county who had owned the gasifier stove for at least 8 months, a period which encompassed both a winter and summer season.[10] Market penetration of Jinqilin stoves into rural households of Yangquan City by the fourth quarter of 2008 was 4%.[11]

In Hubei, 100% of total sales have been conducted in Enshi City. The survey team focused on townships and villages within Enshi City for both baseline and project activity surveys. Market penetration of Zhiqi stoves into rural households of Enshi City by the first quarter of 2012 was 3.54%.

In Guizhou, the survey team focused on townships and villages within 2 townships and representatively sampled for both baseline and project activity surveys. Market penetration of Huifeng stoves into rural households of Guizhou by the first quarter of 2012 was 6.14%.

### Step 1.2: Provisionally assess fuel types, fuel mix, and kitchen regimes

In October 2008 the Project surveyed 100 households within Yangquan City to assess fuel type, fuel mix, and kitchen regimes of customers who recently bought Jinqilin gasifier stoves[12]. The survey showed that all Jinqilin stove customers previously used traditional coal stoves and pieces of raw coal chunk as their primary cooking fuel, and all improved stove users used renewable corn-cobs as their primary cooking fuel. Survey findings are further evidenced by the China Bureau of Statistics latest national census in 2005, which reports the percentage of village households in Shanxi Province using coal as their primary cooking was 82%, biomass 15%, electricity 0.3%, gas 1%, and the rest "other." Yangquan city government official statistics report an even higher percentage of coal users – 93% -- for rural residents in Yangquan city during 2009.[13]

Surveys also showed that in homes having adopted the gasifier stove for one year, 100% of respondents report that during the non-heating season gasifier stoves and agricultural residues are used exclusively, and that coal stoves and coal fuel are not used at all. Surveys also reveal that winter heating by coal stoves is more convenient than biomass because of the long burn cycle of coal, especially when raw coal is pulverized and mixed with clay to create a semi-combustible material. A household can stoke a traditional coal stove with more coal after dinner has been made and still have reliable heat into the night. In contrast, biomass burns quickly and cannot sustain long-duration thermal output. Thus, coal stoves are preferred during heating months, but are disliked during hot summer months due to the excess thermal output after cooking is done, and because of the high cost of

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[10] Initial surveys were conducted in August 2008. The surveys targeted users who had purchased stoves prior to 2008 (at least 8 months prior to survey), which allowed for stove usage during both cold and warm seasons. This long adoption period also allow for a full assessment of stove performance.

[11] Detailed sales statistics can be found in Annex 3: Baseline Monitoring Report, Section 4.3, Table 8

[12] See Annex 3 Baseline Monitoring Report

[13] For details of fuel use in the project boundary see Annex 3 Baseline Monitoring Report. Yangquan City Government statistics can be found at http://www.yqtjj.gov.cn/E_ReadNews.asp?NewsID=776. China National Bureau of Statistics data is can be found online through the University of Michigan at http://chinadataonline.org/

purchasing coal. Household use of coal stoves for heating is monitored and emission reduction estimates will be adjusted accordingly due to seasonal use. Refer to the monitoring plan for details.

Although future adoption rates will vary by village, survey results indicate high levels of continued Jinqilin stove use after one year as all respondents in the survey reported using the Jinqilin stove daily for three meals. Jinqilin customers also state that stoves are used only for residential (non-commercial) purposes, and that an average of 3 persons is cooked for per household.

For Huifeng stoves in Guizhou, baseline survey (BS) of target population characteristics and baseline Kitchen Performance Test (KPT) and associated Kitchen Surveys of fuel consumption were conducted on Huifeng stoves. In total, 311 households were sampled for surveys and household testing. Results show that in the heating season, the primary fuel source for all households is coal (86%), which is also supplemented by biomass (14%) (see Baseline Report). During winter months, residual thermal heat from coal stoves serves as a primary heating source for the home. Baseline survey results reveal that the overall average self-reported number of months of household winter heating is 4.34 (n=155, std. dev=0.32).

For Zhiqi stoves in Hubei, baseline survey (BS) of target population characteristics and baseline Kitchen Performance Test (KPT) and associated Kitchen Surveys of fuel consumption were conducted on Huifeng stoves. In total, 568 households were sampled for surveys and household testing. Results show that in the heating season, the primary fuel source for all households is coal (97%), which is also supplemented by other fuels such as biomass, biogas, and electricity (See Baseline Report). Baseline survey results reveal that the overall average self-reported number of months of household winter heating is 5.0 (n=400, std. dev=0.7).

In both Huifeng and Zhiqi stoves, adoption rates in the first year of use was 100%. It is clear that end users prefer the low cost wood fuel over expensive coal. Respondents shared that the new woodfuel “heating” gasifier stoves maintain long burn cycles and efficient burning of woodfuel that make it convenient to use the improved stove during the heating months. However, during the summer months most respondents revert to either coal or to electric stoves. In the cold winter months, there is simply not the option to not heat a home, further contributing to the high adoption rates of the improved stove.

**Step 1.3: Analyze renewability status of wood-fuels**

Renewable biomass energy and/or agricultural residues are used in the Project activity, and fossil fuel raw bituminous coal is used in the baseline. In Shanxi, renewable agricultural residue is used in the project activity. In Guizhou and Hubei, renewable woodfuel is used in the project activity.

Moreover, in Shanxi province, nearly 75% of agricultural residues are disposed of in open-field burning, and only 25% is used as household fuel.[14] Amongst all provinces, Shanxi ranks 3rd highest in terms of the percentage of total agricultural residue disposed of using

[14] Reference: Yan, X., Ohara, T., Akimoto, H., 2006. Bottom-up estimate of biomass burning in mainland China. Atmospheric Environment 40, 5262-5273.

open-field burning, as opposed to being used as a household fuel. The high rate of agricultural residue field burning is due the abundant supply of coal. Shanxi Province ranks 1st amongst all provinces in terms of total coal production – the large supply of coal makes alternative fuels such as agricultural residues an under-utilized fuel.

Although the Jinqilin gasifier stove is designed to use all types of agricultural residues, surveys show that Jinqilin stove users prefer to use corn residues because they are a primary crop for farmers. A typical household with 4 persons in Yangquan City will produce annually approximately 1.67 tons corn agricultural residues, and an additional 0.45 tons of other cereal-based residues that can also be used in biomass stoves.[15] Quantitative assessments during the kitchen tests indicate that a typical household requires approximately 1500 kg of corn residues per year for cooking during the non-heating season (figure B4). Thus, the combined 2.12 tons of corn and cereal residues available is more than sufficient to satisfy household energy needs for cooking using the Jinqilin stove. Moreover, this assumes that every rural household uses a biomass stove, which simply is not the case in coal endemic regions like Shanxi. As described in section B4 sub-step 1.2, over 93% of households in Yangquan city use coal stoves as their primary cooking and heating technology, leaving much of the crop residues left to waste.

Agricultural residues are a renewable energy source that results in net-zero $tCO_2e$ emissions. Consumption of agricultural residues by Project activities does not change baseline LULUCF, as agricultural residues used in the project activity result from normal farming practices that are not changed by the introduction of the new stove. Previously, the primary project fuel (corn cobs) have been dried and disposed of in open field burning. Thus, biomass combustion by project activities does not increase the rate of build-up of CO2 in the atmosphere relative to baseline activities or their related sources and sinks.

For technologies implemented using woodfuel in Enshi and Guizhou, additional fNRB analysis has been conducted. It is shown that 100% demonstrably renewable fuelwood is used in all project boundary areas. The fuel used in Enshi and Guizhou for heating comes from woody biomass originating from land areas that are forests. These forests and the fuelwood supplied by them are demonstrably renewable. Total forest area in these regions has increased significantly in the past 10 years due to the continuously strengthened forestry land protection and afforestation efforts of the Government. The National Forest Protection Program introduced nationwide logging bans in 1998, and has since resulted in 14.34 million hectares of public welfare forest, the protection of 95 million hectares of forest, and a reduction of 270 million cubic meters of forest resource consumption.[16]

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[15] Information in this section is sourced from Agriculture Bureau of Yangquan City. There are two Counties (Yu County and Pingding County) and three Districts in the city. The rural population is 717 thousand. The total land for planting is 750 thousand Mu (1Mu=666.7m2), which will produce 380 thousand tons agricultural residues, of which 300 thousand tons consists of corn crop residues. This results in 0.418 tons corn residues per person (300,000 tons corn residue / 717,000 rural population), and 1.67 tons corn residue per household (0.418 tons corn residue per person * 4 persons per household). Large amounts of agricultural residues are burned in fields as waste (75%), and some is used for heating and cooking (25%). The wasted crop residues far exceed the needed agricultural residue for the project activity. Details of biomass residue usage, both nationally and in Shanxi Province, can be found in: Yan, X., Ohara, T., Akimoto, H., 2006. Bottom-up estimate of biomass burning in mainland China. Atmospheric Environment 40, 5262-5273. Yangquan City Statistical Information website can be found at: http://www.yqtjj.gov.cn/

[16] United Nations Food and Agriculture Organization, Regional Office for Asia & the Pacific. (2010). Forest law enforcement and governance: progress in Asia and the Pacific. RAP Publication 2010/05. Pg. 1

The government has also designated land as “fuelwood forests” which are used to satisfy energy needs in rural areas. In 1981, the state officially listed development of fuelwood forests into the national reforestation program and rural energy development. By 1998, over 5.3 million hectares of fuelwood forests with an annual average increase of 25 million tons of fuelwood.[17] These areas are designated for household fuelwood collection and provide rapidly renewable wood sources to rural populations as an alternative to harvesting in natural forests.

The government of Hubei and Guizhou sustainably manage the fuelwood forests to ensure that carbon stocks are not depleting. A permit and quota system is used for all logging, and the local forestry agency tracks the annual fuelwood forest ouput. This data, which is used in the calculations provided in Annex 3C and 3D , shows that supply of renewable fuelwood far exceeds the household demand for fuelwood.

**Step 1.4: Divide pilot Sales Record into customer groups or clusters**

The Project establishes one initial cluster comprising of coal fuel users for Shanxi. In the second verification, additional clusters are added for Guizhou Province, and Enshi State. Based on the results of the feasibility study and pilot sales record, the Project determined that coal is the overwhelmingly dominant fuel of choice for cooking in nearly every home within the project boundary, and that traditional coal stoves are the dominant technology used.

The Project applies a fixed baseline for the initial cluster “Shanxi” province, as well as for subsequent clusters in Guizhou and Enshi. During the first crediting period (7 years), stoves will be installed progressively as carbon revenues are made available to subsidize additional stoves. In coal endemic regions like Shanxi, Hubei, and Guizhou, the near-term simply provides no credible alternative to coal fuels. For example, Shanxi province is the leading provider of coal to China, making coal resources readily available within the province itself. The abundance of coal in Shanxi has led to an increased trend towards greater rural residential coal use in Shanxi province between 1997-2007 (China Energy Statistical Yearbook, various years). During the 7-year crediting period, historical trends and future projections provide evidence that the baseline will not change in the next 5 years (the project applies retroactively 2 years of crediting), and in fact, will likely trend towards even greater coal use in the future.

Per GS VER Methodology, and in accordance with a phased approach for the adoption of new technologies in the project activity, sales regions outside the initial cluster of “Shanxi” have been evaluated for baseline conditions during relevant future verification periods. New clusters were defined for Guizhou and Enshi. If necessary, new clusters will be defined in accordance with GS VER Methodology guidance.

**Step 1.5: Carry out a qualitative survey (Kitchen Survey)**

Baseline monitoring was conducted by a collaborative effort between the third party consultancy Berkeley Air Monitoring Group, and researchers from the University of California

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[17] Zhang, L. et al. (2009). Rural energy in China: Pattern and policy. Renewable Energy, 2009, 34. Pg. 2819

at Berkeley and Beijing University of Chemical Technology. A combination of ex-ante household surveys and in-home fuel use monitoring were conducted in representative villages to evaluate market and fuel use conditions in the project area. The results of this baseline monitoring are summarized below, and a full report of the study including tables and figures can be found in Annex 3.

***Kitchen Surveys:***

A total of 410 ex-ante kitchen surveys in Shanxi were conducted to assess baseline indicators such as household demographics, typical local cooking practices, fuel use and mix, stove types, and seasonal effects on household energy use. These households did not have an improved biomass stove but were representative of potential customers in the project boundary. The ex-ante surveys were conducted in two counties within the proposed project boundary (Yu County (n=305), and Pingding County (n=105)). Six representative villages with similar demographic and economic characteristics as defined by the cluster analysis (based on County records) were chosen to take part in the survey. Village populations ranged from 500-800 residents. Household participation was solicited by first obtaining the names of head of households in each village and then randomly selecting from the list. The survey information, combined with results from the household fuel use study, allows for estimates of total fuel use before and after the introduction of gasifier stoves.

Key parameters found in the ex-ante survey are listed below:

-The average and median numbers of persons cooked for by village ranged between 3-4 persons (st.dev., 0.9-1.2 persons). Average household size by village is similar to average overall HH size from all 6 villages combined and confirms that the inter-household size between villages is similar. Based on these results the household selection criteria for the fuel use study limited household size to 2-6 persons[18].

-Over 90% of HHs report using some form of coal stove as their primary cooking appliance for the entire year (Heating season = 99.8% (409 HH), Non-heating season = 94.1% (386 HH)), and over 90% use coal as the primary fuel source for the entire year (Heating season = 99.8% (409 HH), Non-heating season = 93.4% (383 HH)).

-Residual thermal heat from traditional coal stoves also act as primary heat sources for the home during winter months. In Shanxi, for example, the ex-ante survey finds that the average number of self-reported heating months equal 4.4 non-usage months (in Shanxi, these are the heating months), leaving 7.6 months for usage months (or the non-heating months in Shanxi). Although households may continue to use both biomass and coal stoves during the non-usage (in the case of Shanxi, the winter heating months) months, we conservatively assume for emission reduction calculations that gasifier stove use is completely discontinued during non-usage months months due to insufficient thermal output to accommodate home heating, and that households instead revert to traditional coal stoves for both heating and cooking. Conversely it is also assumed that during the usage months households included in the Project will use the improved stoves exclusively. Actual use will be determined by sampling surveys (see section B.7.2 for details of the monitoring program).

[18] These figures of family size are also in agreement with China's "One Child Policy," as well as with the common practice in rural regions for couples to be granted exceptions for additional children and/or for couples to take care of elderly parents.

In Enshi, Hubei, baseline Kitchen Surveys showed that 97% of all Zhiqi stove customers previously used traditional coal stoves and pieces of raw coal chunk as their primary heating fuel, and all improved stove users used renewable fuelwood and biomass residues as their primary heating fuel. Surveys also showed that in homes having adopted the Zhiqi stove for one year, 100% of respondents report that during the heating season, gasifier stoves and renewable biomass fuels are used exclusively, and that coal stoves and coal fuel are not used at all. For the nine townships surveyed, the overall average number of persons cooked for was 3.86 persons (n = 400, std. dev. = 1.04), and average length of the heating season is 5 months (n= 400, std. dev = 0.7).

In Guizhou, baseline Kitchen Surveys showed that 86% of all Huifeng stove custormers previously used traditional coal stoves and pieces of raw coal chunk as their primary heating fuel, and all improved stove users used renewable fuelwood and biomass residues as their primary heating fuel. Surveys also showed that in homes having adopted the Huifeng stove for one year, 100% of respondents report that during the heating season, gasifier stoves and renewable biomass fuels are used exclusively, and that coal stoves and coal fuel are not used at all. For the seven townships surveyed, the overall average number of persons cooked for was 4.44 persons (n = 155, std. dev. = 1.20), and average length of the heating season is 4.34 months (n=155, std. dev=0.32).

**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):**

According to GS VER Methodology: “The most recent version of the UNFCCC “Tool for the Demonstration and Assessment of Additionality” is to be applied.” The Project applies the most recent version UNFCCC Version 5.2, EB 39, Annex 10[19] to demonstrate the project activity would not have occurred due all of the following barriers:

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

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

- ***Alternative Scenario 1***: Continued use of coal in traditional coal stoves for cooking and heating, and no project activity or other alternatives are undertaken.

- ***Alternative Scenario 2***: The proposed project activity is undertaken without being registered as a VER project activity.

***Sub-step 1b: Consistency with mandatory laws and regulations:***

[19] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v5.2.pdf/history_view (referenced 6-Jul-2010)

- ***Alternative scenario 1*** (Continued use of coal in traditional stoves for cooking and heating) is in compliance with all mandatory applicable legal and regulatory requirements. Although there are rules governing coal use in major cities across China, no legislation exists (nor is it expected) banning the use of coal stoves in rural areas. Coal fuel is sold openly and legally for residential use.

- ***Alternative scenario 2*** (Project Activity without VER credits) is in compliance with all applicable legal and regulatory requirements. The stove technologies implemented in the project activity are registered and protected under standard Chinese patent law, and has been approved for retail sale.

**Step 2: Investment analysis**

***Sub-step 2a: Determine appropriate analysis method***
UNFCCC Version 5.2, EB 39, Annex 10 "Additionality Tool" Page-15 Step-15 states:

*"The benchmark approach is therefore suited to circumstances where the baseline does not require investment or is outside the direct control of the project developer, i.e. cases where the choice of the developer is to invest or not to invest."*

The Project applies benchmark analysis (Option III) because the only investment option was to invest or not to invest in the project activity. Our benchmark analysis concludes that, the project activity is not economically or financially feasible without the revenue from the sale of voluntary emission reductions (VERs).

***Sub-step 2b*: Apply investment analysis (Option III)**

Shanxi: As described in the GS VER Passport, in 2006 Impact Carbon (formerly CEIHD), with support from the Shell foundation, designed and conducted a national competition to identify and recognize the best innovative biomass stove designs throughout China with commercial potential. One of the best gasifier stoves in this group is being manufactured by Jinqilin. The Jinqilin stove's high performance and limited initial market penetration made it a strong candidate for pilot government subsidy support designed to assist with growth and expansion.

In 2007 and 2008 the Yangquan City government in Shanxi decided to provide pilot subsidy support for several thousand Jinqilin stoves. However, before the end of the 2007-2008 pilot, it was clear that the commercial market for Jinqilin biomass gasifier stoves was still not independently sustainable because the technology remained unaffordable at the retail price of 700RMB (US $103). Recognizing the stove's inability to scale commercially, in 2008 the project proponents proposed carbon finance as a viable form of long-term scalable financing that could provide ongoing subsidy support for the stoves.

Thus, in consultation with local government officials, the Project secured a matching commitment from Yangquan City government to provide the additional project support needed to make the project financially viable. The project proponents estimate that the commitment secured from the Yangquan City government can be valued at over US $1 million (see Figure B.3.4), which is approximately 14% of the total support required for the project, with the other estimated 86% coming from carbon revenues and end-user stove payments.

Guizhou and Hubei Project History: In May 2005, a new partnership between China's Association for Rural Energy Industry (CAREI), the Center for Entrepreneurship in International Health and Development (CEIHD) at University of California, Berkeley, Shell China, and the Shell Foundation was formed to speed the spread of highly improved biomass stoves (Annex 18_Shell Foundation Stove Competition Publication 2005, Page 1).

In 2006, the Shell Foundation hosted a competition to identify the best biomass gasifier stoves in China. The Jinqilin, Huifeng, and Zhiqi stove designs were among the highest ranked stoves in this competition. In 2008, Impact Carbon's Executive Director, Evan Haigler, published a peer-reviewed article identifying the strongest co-benefit and carbon market potential for China was to switch rural coal stove users to biomass gasifier stoves (Annex 19_Impact Carbon Publication on Coal to Biomass Gasifier Co-benefits_2008, Figure 2). Subsequently, CAREI and Impact Carbon signed VERPAs with several stove manufacturers that scored highly in the Shell Foundation competition. This included a July 2008 VERPA with Jinqilin (Submitted at Registration), a November 2008 VERPA with Zhiqi in Hubei (Annex 16_VERPA Zhiqi And CAREI), and January 2009 VERPA with Huifeng in Guizhou (Annex 17_VERPA Huifeng And CAREI). In parallel, local governments agreed to provide initial stove subsidies with expectation that future carbon revenues would eventually be able to provide a sustainable source of funding for stove distribution (DOE Site Visit; Annex 14_Certification of Subsidy for Zhiqi Stove; Annex 15_Certification of Subsidy for Huifeng Biomass Stove).

In 2008, with very few carbon financed stove projects actually registered, MyClimate Foundation agreed to fund only the initial project with Jinqilin in Shanxi. PP agreed to develop the PDD with initial target area in Shanxi to mitigate risk of non-registration, with expectation that future carbon revenues would allow for the inclusion of other manufacturers and regions after carbon revenues were available to fund expanded fieldwork and testing.

The project received Issuance-1 in October 2010, which was too late to plan and execute the needed field work in Guizhou and Hubei during the winter heating months. Thus, the project focused on solidifying operations at Jinqilin, and subsequently in the following winter of 2011, the project began large scale field work in Guizhou and Hubei. In February 2012, a design change memo was submitted to GS to include heating stoves in Guizhou and Hubei, and the current Issuance-2 Verification site visit occurred in June 2012. In summary, the project establishes a start date according the VERPAs. Stove crediting will include stoves sold from Zhiqi in Hubei from November 18, 2008, and stoves sold from Huifeng in Guizhou from January 5th, 2009.

Benchmark Analysis:
This benchmark analysis outlines the costs associated with implementing the project activity with and without carbon revenues. We demonstrate that the proposed project activity is unlikely to be financially/economically attractive without carbon revenues.

Shanxi Province:
For the purposes of this investment analysis, the present assumes approximately 7,000 stoves are sold in the first year of the project, 2009, followed by year-on-year sales growth of 500 stoves starting in 2012 once carbon revenues are fully realized. The sale of an

additional 500 stoves per year is based on the Jinqilin manufacturer's conservative estimate of 8% sales growth beginning in 2012, followed by slower year-on-year growth until 2015.

The current retail cost of a stove is 700RMB per stove. Stove purchasers are asked to contribute roughly 233RMB/stove (34% of retail stove costs) to promote ownership and sustainability of the Project, thus the project proponent's stove subsidy capital requirement is 462RMB/stove (66% of retail stove costs). The stove user contribution level has been established through sales in 2009 and 2010 that show the vast majority of community members are not willing to pay more than 200-300RMB per stove, or roughly 34% of current stove construction costs.

The discount rate is set to 3.6% to determine the project's NPV.[20] Project implementation costs include all costs associated with project development and continued monitoring and management throughout the crediting period. A project period of 7 years is used for IRR analysis to reflect the expected length of partnership with current Jinqilin stove models installed in the project activity. Carbon revenues assume $12 per tCO2e for VERs.

Assuming a 7-year project period with cumulative sales of 54,101 stoves, and construction costs per stove of 700RMB (US$ 103), the Project's cumulative funding requirement is US $4,775,686 (US$5,569,221 for stove capital costs + US$1,100,000 for basic project implementation costs - US$1,893,535 from HH customers contributing 233RMB per stove) (see Figures B.3.1 and B.3.2).

**Figure B.3.1 Net income for project activity <u>without</u> carbon revenues**

| | | |
|---|---|---|
| **Income** | | |
| | 34% Stove User Payment | **$1,893,535** |
| | Total Income | **$1,893,535** |
| **Expenses** | | |
| | Operations and Management | **$700,000** |
| | Stove Expenses | **$5,569,221** |
| | Total Expenses | **$6,269,221** |

[20] The discount rate used to calculate the NPV is 3.6%. The benchmark IRR is also determined to be 3.6%. This is set at the Chinese Yuan (RMB) deposit rate for 5 years which was 3.60% at the start of the project implementation (January 2009). The source is the website of Bank of China: http://www.boc.cn/finadata/lilv/fd31/200812/t20081222_508225.html. According to Annex 58 of EB 51, required/expected returns on equity can be used as benchmark for equity IRR. To the project owner, the capital cost of the investment on the project is the opportunity cost of depositing the same amount of fund to the bank. Thus, the expected return on investment is the bank deposit rate.

| | |
|---|---|
| Net Income | **$ (4,375,686)** |
| NPV | **$ (3,787,914)** |
| IRR | **(negative invalid value due to no return)** |

**Figure B.3.2 Net income for project activity with carbon revenues**

| | |
|---|---|
| **Income** | |
| 34% Stove User Payment | **1,893,535** |
| Carbon Revenue | **4,569,766** |
| Expected Matching Government Subsidy | **1,058,824** |
| Total Income | **7,522,124** |
| **Expenses** | |
| Carbon Project Development | **400,000** |
| Operations and Management | **700,000** |
| Stove Expenses | **5,569,221** |
| Total Expenses | **$ 6,669,221** |
| Net Income | **$ $852,904** |
| **NPV** | **$625,789** |
| **IRR** | **24%** |

**Figure B.3.3. IRR and NPV Sensitivity Analysis for project activity without carbon revenues**

| | | % Stove User Payment | | | | |
|---|---|---|---|---|---|---|
| **IRR** | **#NUM!** | 55.4% | 58.4% | 62% | 64.6% | 67.7% |
| Stove Cost (USD) | $112 | #NUM! | #NUM! | #NUM! | #NUM! | #NUM! |
| | $118 | #NUM! | #NUM! | #NUM! | #NUM! | #NUM! |
| | $124 | #NUM! | #NUM! | #NUM! | #NUM! | #NUM! |
| | $130 | #NUM! | #NUM! | #NUM! | #NUM! | #NUM! |

| | | | | | |
|---|---|---|---|---|---|
| $136 | #NUM! | #NUM! | #NUM! | #NUM! | #NUM! |

*(IRR has negative invalid value due to no return under any sensitivity analysis scenario)

| NPV | -$5,413,399 | % Stove User Payment | | | | |
|---|---|---|---|---|---|---|
| | | 55.4% | 58.4% | 62% | 64.6% | 67.7% |
| Stove Cost (USD) | $112 | ($5,637,674) | ($5,291,366) | ($4,945,059) | ($4,598,752) | ($4,252,444) |
| | $118 | ($5,917,034) | ($5,551,488) | ($5,185,941) | ($4,820,395) | ($4,454,848) |
| | $124 | ($6,196,395) | ($5,811,609) | ($5,426,823) | ($5,042,038) | ($4,657,252) |
| | $130 | ($6,475,756) | ($6,071,731) | ($5,667,706) | ($5,263,680) | ($4,859,655) |
| | $136 | ($6,755,117) | ($6,331,852) | ($5,908,588) | ($5,485,323) | ($5,062,059) |

**Figure B.3.4. IRR and NPV Sensitivity Analysis for project activity with carbon revenues**

| IRR | -41% | % Stove User Payment | | | | |
|---|---|---|---|---|---|---|
| | | 55.4% | 58.4% | 62% | 64.6% | 67.7% |
| Stove Cost (USD) | $112 | #NUM! | -12% | 30% | 66% | 111% |
| | $118 | #NUM! | #NUM! | 4% | 43% | 83% |
| | $124 | #NUM! | #NUM! | #NUM! | 20% | 60% |
| | $130 | #NUM! | #NUM! | #NUM! | -7% | 39% |
| | $136 | #NUM! | #NUM! | #NUM! | #NUM! | 18% |

| NPV | -$226,923 | % Stove User Payment | | | | |
|---|---|---|---|---|---|---|
| | | 55.4% | 58.4% | 62% | 64.6% | 67.7% |
| Stove Cost (USD) | $112 | ($451,197) | ($104,890) | $241,417 | $587,725 | $934,032 |
| | $118 | ($730,558) | ($365,012) | $535 | $366,082 | $731,628 |
| | $124 | ($1,009,919) | ($625,133) | ($240,347) | $144,439 | $529,225 |
| | $130 | ($1,289,280) | ($885,255) | ($481,229) | ($77,204) | $326,821 |
| | $136 | ($1,568,641) | ($1,145,376) | ($722,112) | ($298,847) | $124,417 |

The project applies a benchmark value of 3.6% IRR (benchmark reference described in B.5. Step-2, Sub-step 2b). The project faces clear investment barriers without carbon revenues. Figure B.3.1 shows that the project activity without carbon finance has negative NPV and IRR. A sensitivity analysis is not required because there is simply no realistic parameter (project expense, stove cost, sales growth, stove user payment, discount rate) that will allow for a positive NPV or IRR without the assistance of carbon revenues, nonetheless the analysis is presented in Figure B.3.3. The project activity is financially unattractive without carbon finance and is significantly below the benchmark IRR.

Conversely, Figure B.3.2 provides evidence for positive NPV and positive IRR when carbon revenues are considered. Figure B.3.4 provides an IRR and NPV sensitivity analysis (+/-

10%) based on variable stove price and stove user contributions. Carbon revenues make the project financially attractive over the 7-year crediting period and the project IRR becomes greater than the benchmark IRR.

Hubei Province:
The Project applies benchmark analysis (Option III) because the only investment option was to invest or not to invest in the project activity. Our benchmark analysis concludes that, the project activity is not economically or financially feasible without the revenue from the sale of voluntary emission reductions (VERs).

This benchmark analysis outlines the costs associated with implementing the project activity with and without carbon revenues. We demonstrate that the proposed project activity is unlikely to be financially/economically attractive without carbon revenues.

For the purposes of this investment analysis, the present assumes approximately 6,000 stoves are sold in the first year of the project, 2010, followed by year-on-year sales growth of approximately 4,600 stoves until 2013, when stove sales stay at a constant 20,000 per year until 2015.

The current retail cost of a stove is 780RMB per stove. Stove purchasers are asked to contribute roughly 480 RMB/stove (61.5% of retail stove costs) to promote ownership and sustainability of the Project, thus the project proponent's stove subsidy capital requirement is 300RMB/stove (38.5% of retail stove costs). The stove user contribution level has been established through sales in 2009 and 2010 that show the vast majority of community members are not willing to pay more than 200-300RMB per stove, or roughly 34% of current stove construction costs.

The discount rate is set to 3.6% to determine the project's NPV. Project implementation costs include all costs associated with project development and continued monitoring and management throughout the crediting period. A project period of 6 years is used for IRR analysis to reflect the expected length of partnership with current Zhigi stove models installed in the project activity until the end of the first 7-year crediting period. Carbon revenues assume $8 per tCO2e for VERs.

Assuming a 6-year project period (2010-2015, 7-year twice renewable) with cumulative sales of 93,661 stoves, and construction costs per stove of 780 RMB (US$ 124), the Project's cumulative funding requirement is US $5,058,916 (US$11,581,601 for stove capital costs + US$600,000 for basic project implementation costs - US$7,122,685 from HH customers contributing 480 RMB per stove) (see Figure 0-1and Figure 0-2).

**Figure 0-1** Zhiqi Net income for project activity without carbon revenues

| | | |
|---|---|---|
| Income | | |
| | 62% Stove User Payment | $7,122,685 |
| | Total Income | $7,122,685 |
| | | |
| Expenses | | |
| | Operations and Management | $600,000 |
| | Stove Expenses | $11,581,601 |
| | Total Expenses | $ $12,281,601 |

| | | |
|---|---|---|
| | Net Income | $ (5,058,916) |
| NPV | | $ (4,405,292) |
| IRR | | (negative invalid value due to no return) |

**Figure 0-2** Zhiqi Net income for project activity with carbon revenues

| | | |
|---|---|---|
| Income | | |
| | 62% Stove User Payment | 7,122,685 |
| | Carbon Revenue | 8,569,392 |
| | Expected Matching Government Subsidy | 1,426,782 |
| | Total Income | 17,118,859 |
| Expenses | | |
| | Carbon Project Development | 400,000 |
| | Operations and Management | 700,000 |
| | Stove Expenses | 11,581,601 |
| | Total Expenses | $ 12,681,601 |
| | Net Income | $ 4,587,258 |
| NPV | | $3,884,167 |
| IRR | | 272 % |

**Figure 0-3** Zhigi IRR and NPV Sensitivity Analysis for project activity without carbon revenues

| | | % Stove User Payment | | | | |
|---|---|---|---|---|---|---|
| IRR | #NUM! | 55.4% | 58.4% | 62% | 64.6% | 67.7% |
| Stove Cost (USD) | $112 | #NUM! | #NUM! | #NUM! | #NUM! | #NUM! |
| | $118 | #NUM! | #NUM! | #NUM! | #NUM! | #NUM! |
| | $124 | #NUM! | #NUM! | #NUM! | #NUM! | #NUM! |
| | $130 | #NUM! | #NUM! | #NUM! | #NUM! | #NUM! |
| | $136 | #NUM! | #NUM! | #NUM! | #NUM! | #NUM! |

*(IRR has negative invalid value due to no return under any sensitivity analysis scenario)

| | | % Stove User Payment | | | | |
|---|---|---|---|---|---|---|
| NPV | -$4,405,292 | 55.4% | 58.4% | 62% | 64.6% | 67.7% |
| Stove Cost (USD) | $112 | ($4,586,151) | ($4,306,884) | ($4,027,617) | ($3,748,351) | ($3,469,084) |
| | $118 | ($4,811,431) | ($4,516,649) | ($4,221,868) | ($3,927,087) | ($3,632,305) |
| | $124 | ($5,036,711) | ($4,726,414) | ($4,416,118) | ($4,105,822) | ($3,795,526) |
| | $130 | ($5,261,991) | ($4,936,180) | ($4,610,369) | ($4,284,558) | ($3,958,747) |

| | | | | | |
|---|---|---|---|---|---|
| $136 | ($5,487,271) | ($5,145,945) | ($4,804,619) | ($4,463,293) | ($4,121,968) |

**Figure 0-4** Zhiqi IRR and NPV Sensitivity Analysis for project activity with carbon revenues

| | | % Stove User Payment | | | | |
|---|---|---|---|---|---|---|
| IRR | 272% | 55.4% | 58.4% | 62% | 64.6% | 67.7% |
| Stove Cost (USD) | $112 | 240% | 292% | 365% | 473% | 649% |
| | $118 | 207% | 251% | 312% | 398% | 534% |
| | $124 | 179% | 218% | 270% | 342% | 451% |
| | $130 | 157% | 191% | 236% | 297% | 387% |
| | $136 | 137% | 168% | 208% | 261% | 337% |

| | | % Stove User Payment | | | | |
|---|---|---|---|---|---|---|
| NPV | $3,884,167 | 55.4% | 58.4% | 62% | 64.6% | 67.7% |
| Stove Cost (USD) | $112 | $3,703,309 | $3,982,576 | $4,261,842 | $4,541,109 | $4,820,375 |
| | $118 | $3,478,029 | $3,772,811 | $4,067,592 | $4,362,373 | $4,657,155 |
| | $124 | $3,252,749 | $3,563,045 | $3,873,341 | $4,183,638 | $4,493,934 |
| | $130 | $3,027,469 | $3,353,280 | $3,679,091 | $4,004,902 | $4,330,713 |
| | $136 | $2,802,189 | $3,143,515 | $3,484,841 | $3,826,166 | $4,167,492 |

The project applies a benchmark value of 3.6%. The project faces clear investment barriers without carbon revenues. Figure 0-1 shows that the project activity without carbon finance has negative NPV and IRR. A sensitivity analysis is not required because there is simply no realistic parameter (project expense, stove cost, sales growth, stove user payment, discount rate) that will allow for a positive NPV or IRR without the assistance of carbon revenues, nonetheless the analysis is presented in

**Figure 0-3**. The project activity is financially unattractive without carbon finance and is significantly below the benchmark IRR.

Conversely, Figure 0-2 provides evidence for positive NPV and positive IRR when carbon revenues are considered. Figure 0-4 provides an IRR and NPV sensitivity analysis (+/- 10%) based on variable stove price and stove user contributions. Carbon revenues make the project financially attractive over the 6-year crediting period and the project IRR becomes greater than the benchmark IRR.

Huifeng Stoves (Guizhou Province):
For the purposes of this investment analysis, the present assumes approximately 1,145 stoves are sold in the first year of the project, (Q4, 2010), followed 15,660 sales in 2011, 25,000 sales in 2012 and 2013, and 30,000 sales in 2014 and 2015.

The current retail cost of a stove is 700 RMB per stove. Stove purchasers are asked to contribute roughly 100 RMB/stove (14% of retail stove costs) to promote ownership and sustainability of the Project, thus the project proponent's stove subsidy capital requirement is 600 RMB/stove (86% of retail stove costs). The stove user contribution level has been established through sales in 2009 and 2010 that show the vast majority of community members are not willing to pay more than 100-200RMB per stove, or roughly 34% of current stove construction costs.

The discount rate is set to 3.6% to determine the project's NPV. Project implementation costs include all costs associated with project development and continued monitoring and management throughout the crediting period. A project period of 6 years is used for IRR analysis to reflect the expected length of partnership with current Huifeng stove models installed in the project activity. Carbon revenues assume $8 per tCO2e for VERs. Assuming a 6-year project period with cumulative sales of 126,805 stoves, and construction costs per stove of 700 RMB (US$111), the Project's cumulative funding requirement is US $12,661,542 (US$14,071,799 for stove capital costs + US$600,000 for basic project implementation costs - US$2,010,257 HH customers contributing 100 RMB per stove) (see Figure 0-5 and Figure 0-6).

**Figure 0-5** Huifeng Net income for project activity without carbon revenues

| | | |
|---|---|---|
| Income | | |
| | 14% Stove User Payment | $ 2,010,257 |
| | Total Income | $ 2,010,257 |
| Expenses | | |
| | Operations and Management | $ 600,000 |
| | Stove Expenses | $ 14,071,799 |
| | Total Expenses | $ 14,671,799 |
| | Net Income | $ (12,661,542) |
| NPV | | $ (10,925,953) |
| IRR | | (negative invalid value due to no return) |

**Figure 0-6** Huifeng Net income for project activity with carbon revenues

| | | |
|---|---|---|
| Income | | |
| | 14% Stove User Payment | 2,010,257 |
| | Carbon Revenue | 8,337,432 |
| | Expected Matching Government Subsidy | 9,207,977 |
| | Total Income | $ 19,555,666 |
| Expenses | | |
| | Carbon Project Development | 350,000 |
| | Operations and Management | 600,000 |
| | Stove Expenses | 14,071,799 |
| | Total Expenses | $ 15,021,799 |
| | Net Income | $ 4,533,867 |
| NPV | | $ 3,837,535 |
| IRR | | 261% |

IRR Sensitivity Analysis

| | | % Stove User Payment | | | | |
|---|---|---|---|---|---|---|
| IRR | #NUM! | 12.9% | 13.6% | 14% | 15.0% | 15.7% |
| Stove Cost (USD) | $100 | #NUM! | #NUM! | #NUM! | #NUM! | #NUM! |
| | $105 | #NUM! | #NUM! | #NUM! | #NUM! | #NUM! |
| | $111 | #NUM! | #NUM! | #NUM! | #NUM! | #NUM! |
| | $117 | #NUM! | #NUM! | #NUM! | #NUM! | #NUM! |
| | $122 | #NUM! | #NUM! | #NUM! | #NUM! | #NUM! |

**Figure 0-7 .** Huifeng IRR and NPV Sensitivity Analysis for project activity without carbon revenues

*(IRR has negative invalid value due to no return under any sensitivity analysis scenario)

| | | % Stove User Payment | | | | |
|---|---|---|---|---|---|---|
| NPV | -$10,925,953 | 12.9% | 13.6% | 14% | 15.0% | 15.7% |
| Stove Cost (USD) | $100 | ($10,042,391) | ($10,112,556) | ($10,112,556) | ($10,045,899) | ($9,905,920) |
| | $105 | ($9,583,458) | ($9,649,283) | ($9,649,283) | ($9,586,749) | ($9,455,427) |
| | $111 | ($9,599,881) | ($9,664,886) | ($9,664,886) | ($9,603,131) | ($9,473,448) |
| | $117 | ($10,070,349) | ($10,137,752) | ($10,137,752) | ($10,073,720) | ($9,939,251) |
| | $122 | ($11,042,772) | ($11,115,990) | ($11,115,990) | ($11,046,433) | ($10,900,362) |

**Figure 0-8** Huifeng IRR and NPV Sensitivity Analysis for project activity with carbon revenues

| | | % Stove User Payment | | | | |
|---|---|---|---|---|---|---|
| IRR | 261% | 12.9% | 13.6% | 14% | 15.0% | 15.7% |
| Stove Cost (USD) | $100 | 349% | 341% | 341% | 348% | 363% |
| | $105 | 399% | 391% | 391% | 398% | 413% |
| | $111 | 397% | 390% | 390% | 396% | 411% |
| | $117 | 346% | 339% | 339% | 345% | 359% |
| | $122 | 251% | 244% | 244% | 250% | 264% |

| | | % Stove User Payment | | | | |
|---|---|---|---|---|---|---|
| NPV | $3,837,535 | 12.9% | 13.6% | 14% | 15.0% | 15.7% |
| Stove Cost (USD) | $100 | $4,721,097 | $4,650,932 | $4,650,932 | $4,717,589 | $4,857,568 |
| | $105 | $5,180,030 | $5,114,205 | $5,114,205 | $5,176,739 | $5,308,060 |

| | | | | | |
|---|---|---|---|---|---|
| $111 | $5,163,607 | $5,098,602 | $5,098,602 | $5,160,356 | $5,290,040 |
| $117 | $4,693,138 | $4,625,736 | $4,625,736 | $4,689,768 | $4,824,237 |
| $122 | $3,720,716 | $3,647,497 | $3,647,497 | $3,717,055 | $3,863,125 |

The project applies a benchmark value of 3.6% IRR. The project faces clear investment barriers without carbon revenues. Figure 0-7 shows that the project activity without carbon finance has negative NPV and IRR. A sensitivity analysis is not required because there is simply no realistic parameter (project expense, stove cost, sales growth, stove user payment, discount rate) that will allow for a positive NPV or IRR without the assistance of carbon revenues, nonetheless the analysis is presented in Figure 0-7. The project activity is financially unattractive without carbon finance and is significantly below the benchmark IRR.

Conversely, Figure 0-6 provides evidence for positive NPV and positive IRR when carbon revenues are considered. Figure 0-8 provides an IRR and NPV sensitivity analysis (+/- 10%) based on variable stove price and stove user contributions. Carbon revenues make the project financially attractive over the 6-year crediting period and the project IRR becomes greater than the benchmark IRR.

***Conclusion Sub-step 2b: The benchmark analysis shows that the project activity is unlikely to be financially/economically attractive without carbon revenues.***

**Step 3: Barrier analysis**

In this step, the Project demonstrates the proposed project activity in Shanxi, Guizhou and Hubei faces barrier that:

(a) Prevent the implementation of the Project activity (Alternative Scenario 2 – Improved stoves); and

(b) Do not prevent the implementation of at least one of the alternatives (Alternative Scenario 1 – Continued use of coal in traditional stoves for cooking and/or heating)

**Sub-step 3a: Identify barriers that would prevent the implementation of the proposed VER project activity:**

***Investment Barriers***
UNFCCC Version 5.2, EB 39, Annex 10 "Additionality Tool" states:

> *"Investment barriers, other than the economic/financial barriers in Step 2 above, inter alia: No private capital is available from domestic or international capital markets due to real or perceived risks associated with investment in the country where the proposed CDM project activity is to be implemented, as demonstrated by the credit rating of the country or other country investments reports of reputed origin."*

Improved cooking devices such as the Jinqilin, Huifeng and Zhiqi stoves remain a prohibitively expensive technology for rural households in coal endemic areas of China such as Shanxi, Guizhou and Hubei Provinces. Per capita annual incomes in 2008 for rural Shanxi was 4097RMB; rural Hubei 5832RMB; rural Guizhou 3472RMB - while current per stove construction costs are roughly 700RMB for each manufacturer -- construction costs will likely increase even more in the coming years due to the rising costs of labor and raw materials.[21] From the experience of local Chinese stove manufacturers, financial support in the form of subsidies or rebates has been necessary to promote improved stove technologies in rural Shanxi. The low penetration rates of improved biomass stoves found in the kitchen surveys is further evidence that rural households in Shanxi, Guizhou and Hubei on their own do not invest in new stove technologies in the absence of external incentives[22].

One of the goals of the Project is to assist in the establishment of a fully commercialized stove industry that is independent of external financial assistance. As recent literature suggests[23], however, stove entrepreneurs in poor regions such as rural Shanxi are unable to transition immediately to a fully commercialized and market-based model. Donor and state funding continues to play a critical role in expanding markets for technologies such as stoves that provide minimal financial returns, yet provide large public goods such as improved health and improved climate conditions from reduced air pollution.

The Project adopts a balanced “partial subsidy” approach that values the importance of nurturing sound business practices that will foster long-term growth of the rural stove industry, but which also acknowledges the vital role that donor and state funding provides for the sustainable transition away from philanthropic support towards a purely market-based model. Carbon revenues are an important source of bridge financing that will enable this transition.

Obtaining scalable project financing for a “partial subsidy” approach is not possible through standard financing mechanisms. There simply is not an investment case for distributing improved stoves, as there is neither income generating activities nor any financial returns other than carbon revenues. Domestic and international private markets are not willing to provide capital due to the high perceived risk and lack of financial returns involved with dealing in “bottom of the pyramid” markets. Moreover, international donor groups are unable to grant the amounts needed to bring stove dissemination efforts to viable scale. As described in Sub-step 2b, the cumulative project costs are over US$4 million. There are no donor groups with the available mandate, let alone the financial resources, to fund the Project’s capital needs over the 7-year project period.

***Conclusion: There is clear evidence private capital markets are not a viable option to cover the needed US $4 million to transition households away from coal to renewable fuels given there is no financial case for payback. Project financing poses a clear and significant barrier that would have prevented the implementation of the proposed project activity from being carried out if the project activity was not registered as a VER activity.***

[21] For details on the rising costs of labor and materials, see: U.S. Bureau of Labor Statistics, "International comparisons of hourly compensation costs in manufacturing, 2008," August 26, 2010, available at www.bls.gov/news.release/pdf/ichcc.pdf. Erin Lett and Judith Banister, "China's manufacturing employment and compensation costs: 2002-06," Monthly Labor Review, April 2009, p.35, available at www.bls.gov/opub/mlr/2009/04/art3full.pdf

[22] For details of market penetration of biomass stoves, see Section B.4, Step 1.1

[23] Bailis, R., Cowan, A., Berrueta, V., Masera, O., 2009. Arresting the Killer in the Kitchen: The Promises and Pitfalls of Commercializing Improved Cookstoves. World Development 37, 1694-1705.

**Sub-step 3b: Show that the identified barriers would not prevent the implementation of at least one of the alternatives (except the proposed project activity):**

The lack of project financing for stove subsidies (excluding carbon finance) does not prevent the continued use of coal fuels in traditional coal stoves in the baseline (Alternative #1). In the absence of partial subsidies for improved stoves, the alternative "continued use of coal in traditional stoves for cooking and/or heating" would be implemented. In other words, without financial support in the form of subsidies, households would continue using their traditional coal stoves to cook during the non-heating months in Shanxi, and continue to use traditional coal stoves to heat and cook during the heating months in Guizhou and Hubei. This is evidenced by the low penetration rates (0.2% of rural households in Shanxi) of improved biomass semi-gasifier stoves.[24] Both the kitchen surveys and KPTs, and the latest China 2005 national census,[25] further confirm that coal and traditional coal stoves (over 80% of rural households in Shanxi, and over 93% in Yangquan City) remain the overwhelmingly dominant technology and fuel of choice in the project boundary in the absence of project financing for subsidies. Hence, the financing barriers discussed in 3a do not prevent alternative #1 from occurring.

***Conclusion: The identified barriers described in sub-step 3a will not prevent at least one of the alternatives (Alternative #1 – Continued use of coal fuels in traditional coal stoves).***

**Step 4: Common practice analysis**

**Sub-step 4a: Analyze other activities similar to the proposed project activity:**
UNFCCC Version 5.2, EB 39, Annex 10 "Additionality Tool" states:

> *"**Provide an analysis of any other activities that are operational and that are similar to the proposed project activity.** Projects are considered similar if they are in the same country/region and/or rely on a broadly similar technology, are of a similar scale, and take place in a comparable environment with respect to regulatory framework, investment climate, access to technology, access to financing, etc. Other CDM project activities (registered project activities and project activities which have been published on the UNFCCC website for global stakeholder consultation as part of the validation process) are not to be included in this analysis. Provide documented evidence and, where relevant, quantitative information. **On the basis of that analysis, describe whether and to which extent similar activities have already diffused in the relevant region.**"*

In the absence of stove subsidies, the users will continue to use their current traditional coal stoves. At present, no realistic and credible alternative to the proposed VER project activity can deliver energy services with comparable quality and properties to the same target population. Coal stove users in rural Shanxi will continue to rely on coal for cooking because of the high cost of new stove technologies, and the long standing tradition of using coal as the primary cooking fuel.

[24] Shanxi's Rural Energy Office (REO) estimates that 18,000 biomass semi-gasifier stoves have been sold in Shanxi by 2009. Given the roughly 9,000,000 rural households in Shanxi, this is a penetration rate of 0.2%.
[25] China National Bureau of Statistics. National 1% Census, 2005. China National Bureau of Statistics data is can be found online through the University of Michigan at http://chinadataonline.org/

Similarly, coal stove users in Guizhou and Hubei will continue to rely on coal for heating and cooking during the winter months due to the high cost of new efficient biomass heating stove technologies, and the long standing tradition of using coal for heating. The use of wood fuel in traditional coals stoves is not a plausible alternative. Coal stoves are designed to burn coal slowly over a period of hours. Wood fuel does not burn well in traditional coal stoves due to combustion chambers not designed for the burning of wood. The air intake in coal stoves does not allow optimal draft to maintain wood burning over time for space heating, and traditional coal stoves do not have "gasification" systems that enable hot gases to be more completely combusted and thus making wood a viable, easy to use, heating fuel. While it is theoretically possible for wood to be burned in a traditional coal stove, in reality households instead choose to use a wood stove designed specifically to burn wood fuel more efficiently. However, to date, there has not been widely available wood stove technology specifically designed for heating in these regions. The long history of baseline coal usage for heating further supports the common practice of using coal, and not wood, in the winter months.

Multiple generations of families have grown up using coal stoves disseminated by the Chinese government in the 1970's and 1980's, which remain the dominant stove today. The China National Improved Stove Program (NISP) of the 1980's achieved high penetration rates of "improved stoves," but the stoves that were disseminated are considered by today's standards as conventional and traditional stoves. As the reference Sinton et al (2004)[26] states: "…most coal stoves, even those using improved fuel (briquettes), lack flues and cannot be considered improved. While in most areas ''improved'' stove technology became ''conventional'', some areas remain significant exceptions and require intervention."

The NISP initially disseminated biomass stoves, but later also disseminated coal stoves to regions such as Shanxi where only coal is used: *"It [NISP] was designed to provide rural households with more efficient biomass stoves and, later, improved coal stoves, for cooking and heating [Sinton et al, 2004]."* According to the China Ministry of Agriculture (MOA), nearly 80% of homes received a NISP stove by 1998: "*MOA claims that, in 1998, 185 million of China's 236 million rural households had improved biomass or coal stoves [Sinton et al, 2004]."*

Economic development, and advances in stove technology, are now enabling a new generation of "improved" stoves to enter the market. But it still remains a challenge to switch households away from "traditional" stoves that have been used since the 1980's. Furthermore, the abundant supply of coal in coal endemic regions such as Shanxi, Guizhou and Hubei provides little incentive to switch to other forms of fuel (see Section B4. Step 1.4 for statistics and references on coal stove use). Nonetheless, there has been small market penetration of biomass gasifier stoves in the provinces through government pilot programs. The Shanxi Rural Energy Office (REO) estimates that 18,000 biomass semi-gasifier stoves have been disseminated in Shanxi province, or roughly 0.2% of the total 9,000,000 rural households in Shanxi; roughly 100,000 biomass gasifier stoves have been disseminated throughout China, or roughly 0.05% of the total 200 million rural households in the People's Republic of China.[27] In Guizhou, the penetration of Zhiqi biomass gasifier stoves is also

[26] P Sinton, et al., 2004. An Assessment of Programs to Promote Improved Household Stoves in China. Energy for Sustainable Development 8, 33-52.

[27] *China National Bureau Statistics* reports 351,233,698 households in China. The population is 57% rural, and 43% urban. Total rural households in China is estimated to be roughly 200 million (200,203,207 rural HH =

below 2% of the rural population. [28] The government's limited support is a natural consequence of too many civic projects pursuing too few resources. Local governments deal with limited budgets and must decide annually how to best allocate funds. Subsidizing stoves is only one option amongst a plethora of potential rural development projects, including paving roads, building new schools, and subsidizing other welfare programs such as crop seed trading programs and water rights programs.

***Conclusion: On the basis of this analysis, it is likely that coal will remain the dominant fuel of choice in coal endemic regions of China unless strong economic incentives are provided to switch to other fuels and technologies.***

**Sub-step 4b: Discuss any similar Options that are occurring:**
UNFCCC Version 5.2, EB 39, Annex 10 "Additionality Tool" states:

> *"…if similar activities are identified above, then it is necessary to demonstrate why the existence of these activities does not contradict the claim that the proposed project activity is financially/economically unattractive or subject to barriers. This can be done by* ***comparing the proposed project activity to the other similar activities, and pointing out and explaining essential distinctions between them that explain why the similar activities enjoyed certain benefits that rendered it financially/economically attractive (e.g., subsidies*** *or other financial flows) and which the proposed project activity cannot use or did not face the barriers to which the proposed project activity is subject."*

There are no similar activities widely observed and commonly carried out in the project boundary. As demonstrated above, market penetration of biomass gasifier stoves in Shanxi province is 0.2% (nearly all of which are the Jinqilin stove model), and market penetration of all gasifier stoves into rural households of China (including Guizhou and Hubei) are 0.05%. In Guizhou, French NGO Initiative Developpement implements a biogas stove project in a small region of Guizhou – Weining and Danzhai district – using carbon finance. Similarly in Hubei, the World Bank and Chinese government subsidized the full cost of every biogas stove for a CDM project using AMS-I.C and AMS-III.R. The World Bank project is limited in number and not a sustainable long-term model for widespread dissemination of improved cookstoves too poor households, as the cost of biogas stoves will never be covered by carbon revenues without continued and indefinite government and World Bank funding. Given these extremely low penetration rates and related cost barriers for biomass gasifier stoves, the existence of the project activity does not contradict the claim that the proposed project activity is financially/economically unattractive or subject to barriers.

***Conclusion: There are no similar activities widely observed in the project boundary and the project activity is clearly subject to multiple barriers.***

---

57% rural population * 351,233,698 total households in China). Penetration rate for biomass gasifier stoves in China is estimated to be 0.05% of rural households (2E-4 = 100,000 biomass stoves / 200,000,000 rural households). China Bureau of Statistics data is publicly available online the University of Michigan database: http://chinadataonline.org/, and Wikipedia
http://en.wikipedia.org/wiki/Demographics_of_the_People%27s_Republic_of_China

[28] See baseline reports for kitchen survey and kitchen performance data.

## B.6. Emission reductions:

### B.6.1. Explanation of methodological choices:

**Baseline emissions**

***Step 2.1: Estimate expected variation and improvement in emission reductions***

The project claims emissions reductions for that portion of baseline coal consumption which is displaced by renewable crop residues in the project activity. For conservative estimates, the Project applies a lower 90% confidence interval adjustment to fuel savings if 90/30 confidence and precision are not met. Figure B4 summarizes baseline monitoring results based on the lower 90% confidence interval for each fuel type.

**Figure B4.** Expected improvement in emission reductions in Shanxi

| FUEL USE PER HH | Baseline Coal Consumption Shanxi | | | | | |
|---|---|---|---|---|---|---|
| Fuel Type | N | Daily Mean Coal Use (kg/day) | Lower 90% CI Adjustment Factor (kg/day) | Adjusted Daily Mean Coal Use - Lower 90% CI (kg/day) | Avg. Annual Coal Use (Months) | Annual Mean Coal Use (tons/yr) |
| Coal | 38 | 7.74 (3.84) | 87% | 6.73 | 12 | 2.46 |
| FUEL USE PER HH | Project Coal Consumption Shanxi | | | | | |
| Fuel Type | N | Daily Mean Coal Use (kg/day) | Lower 90% CI Adjustment Factor (kg/day) | Adjusted Daily Mean Coal Use - Lower 90% CI (kg/day) | Actual Months Stove is Used | Annual Mean Coal Use (tons/yr) |
| Coal | 38 | 7.74 (3.84) | 87% | 6.73 | 9.25 | 0.90 |

**Standard deviation reported in parenthesis ( ).*
**Monitoring study results are detailed separately in Annex 3 – Baseline Information, Monitoring Report*

**Figure B5.** Expected improvement in emission reductions in Enshi, Hubei

| FUEL USE PER HH | Daily Coal Consumption- Hubei | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Scenario & Fuel Type | Daily Mean Coal Use (kg/day) | N | SD | CI +/- | 90% CI Lower | Precision | 90/30 Met? | Avg. Annual Coal Use (Months) | Annual Mean Coal Use (tons/yr) |
| Baseline Coal | 13.92 | 84 | 4.32 | 0.92 | 12.99 | 7% | YES | 5 | 2.12 |
| Project Coal | 0.00 | 84 | NA | NA | NA | NA | NA | 5 | 0.00 |

**Figure B6.** Expected improvement in emission reductions in Guizhou

| FUEL USE PER HH | Daily Coal Consumption- Hubei | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Scenario & Fuel Type** | **Daily Mean Coal Use (kg/day)** | **N** | **SD** | **CI +/-** | **90% CI Lower** | **Precision** | **90/30 Met?** | **Avg. Annual Coal Use (Months)** | **Annual Mean Coal Use (tons/yr)** |
| Baseline Coal | 12.96 | 78 | 6.32 | 1.40 | 11.56 | 11% | YES | 4.34 | 1.71 |
| Project Coal | 0 | 78 | NA | NA | NA | NA | NA | 4.34 | 0.00 |

**Step 2.2: Specify the Units of emission reduction or fuel consumption**

Emissions reductions are measured per household in tons of carbon dioxide equivalent per year (tCO2e). Specific fuel consumption is measured as the amount in kilograms or MWh of coal or fossil fuel consumed by a household per day for cooking or heating purposes. Emission reductions are calculated based on daily household fuel use and stove usage rates, which are gathered through periodic kitchen surveys.

**Step 2.3: Make quantitative measurements (Kitchen Tests)**

Quantitative Kitchen Performance Tests (KTs) measuring in-home fuel use was performed in target and baseline users: 80 HHs for Jinqilin, 168 HHs for Enshi;156 HHs for Guizhou, within the proposed project boundary, results can be found in Annex 3. The KPT was conducted over three full days, with home visits occurring on the day prior to and the day after the start and end dates of the study. In Shanxi, the cross-sectional study examined two villages each with 40 HHs: (1) Xiaohu village in which the Jinqilin stove had been introduced and adopted for over one year, and (2) Hedi village in which only traditional coal stoves were used for cooking. Sample size was determined using inputs gathered from the HH surveys asking users to self-report coal use both before and after installation of the improved stove. The project's ex-ante sample size calculation maximized the lower limit of the 90% CI by using basic statistics found from the surveys (mean fuel savings and standard deviation). In the Berkeley Air Monitoring Report, Table 1 and Table 4 report HH self-reported coal use as 6.1kg/day during the non-heating season before receiving the improved biomass stove, and 0kg/day coal during the non-heating season after receiving the Jinqilin stove. Sample size analysis found that an estimated 80HH would achieve results within a 90% CI with p-values ≤ 0.05, but that sampling greater than approximately 80HH provided minimal tightening of the CI. The sample calculations are available to the DOE at validation.

The two villages are less than 1 kilometre apart and have similar demographic and geographic makeup, which was confirmed by ex-ante household surveys that helped to ensure sampled HHs are representative of those in the cluster analysis and proposed project boundary. HH's were selected within each village using clustered random sampling techniques. Clusters within each village were previously defined by the Chinese government which grouped homes for administrative purposes based on their location in a village – homes near each other are grouped together. In each study village there are roughly 6-8 administrative groups ranging from 50-75HH's per group. HH's were randomly sampled from each administrative group. HH's were screened for basic demographic and socio-economic indicators to ensure the study sample was representative of potential customers in Shanxi province. The screening criteria included indicators related to "household income, occupation, family size, and educational district, among other indicators" (See Berkeley Air Monitoring Report footnote #6).

In Guizhou, clustered random sampling was employed to select 6 villages within project boundary. The villages were randomly selected and covered a diverse geography that included stratification based on elevation, and geographic clustering across the region. The villages were randomly chosen from each township. simple random sampling identified 26 households per village for Kitchen Survey and KPT testing. In four of the villages (落叶(Luoye), 寨(Shitouzhai), 罗院（Luoyuan）, 硐口（Dongkou）), a cross-section of 13 households were chosen as baseline homes that were currently using the traditional stoves, and 13 homes were chosen as project activity homes that already had the improved heating stove. In two of the villages (文山(Wenshan) and 包包（Baobao）), 26 households per village were chosen as baseline homes in Wenshan village, and 26 households per village were chosen as project homes in Baobao village.

In Enshi, clustered random sampling was employed to select 3 townships within the project boundary. Subsequently, 4 villages were randomly selected from each township. These areas covered a diverse geography that included stratification based on elevation, and geographic clustering across the region. simple random sampling identified 56 households per township and 14 HH's per village, for Kitchen Survey and KPT testing. In each township, a cross-section of 28 households were chosen as baseline homes that were currently using the traditional stoves, and 28 homes were chosen as project activity homes that already had the improved heating stove.

Daily HH self-administered surveys recording stove use, fuel type, meals, and number of persons cooked for helped ensure consistent cooking habits and stove use. In order to cover the typical range of people being cooked for and to avoid outliers, households cooking for between 2 and 6 people were included in the KPT. Households cooking for very large numbers (greater than 6) were excluded from the KPT so as to be conservative with overall fuel savings estimates[29]. Agricultural residues and coal fuel was monitored before and after the KPT for Shanxi, and wood fuels in Guizhou and Enshi. Supplementary coal fuels were also directly measured.

**Step 2.4: Calculate baseline**

Baseline emissions are calculated according to:

> *GS VER Methodology Approach #3 -- The KT measures fuel consumption of the primary fuel only, while the households involved are carrying on a degree of typical fuel and stove-type mixing and/or typical use of RE forms during the KT itself ("**subsumed-fuel KT**"). Where a secondary fuel or stove is subsumed, the quantity or fraction of secondary fuel or RE is treated as zero (AF and Xaf, Xre in the equations below) and the effect of fuel mixing is to reduce the saving made in primary fuel between baseline and project scenarios.*

Based on project surveys and government data, coal is used in over 90% of homes in Yangquan City, and over 90% for heating in Guizhou and Enshi. To capture differences in fuel savings due to possible fuel/stove mixing, however, the KT utilized a "subsumed"

[29] This exclusion criterion essentially excluded the less common situation of commercial cooking and large extended families in this rural farming province.

kitchen test approach that accounts for multiple stoves and fuels. In a subsumed approach, users are asked to continue cooking as they naturally would, incorporating the improved stove into their cooking routine as they see fit. The KT measures only the amount of coal and agricultural residue used during normal cooking practices, and assumes that alternative fuels (eg. electricity) are subsumed by the fuel measurements.

GS VER Methodology also states:

> *It is legitimate to derive emission reduction values on a per Unit basis directly from the KT tests, and* ***modify the mode of calculation of project emission reductions (and of baseline and project emissions) accordingly, in cases where this results in the most transparent and clear mode of calculation****, and where this is consistent with the calculations above."*

The project applies calculations as prescribed in the GS VER Methodology, but diverges only with respect to the incorporation of leakage. Kitchen surveys reveal that there is seasonal use of the Jinqilin, Zhiqi, and Huifeng stoves. This "seasonal" use is incorporated into project emissions calculations for simplicity. Thus, for non-heating season cooking stoves the project annual emissions from the displacement of coal with renewable agricultural residues is adjusted to reflect the household self-reported use of the improved stove during the current verification period, ie. 4.4 months of coal use, instead of 12 months. For the heating season combined heating and cooking stoves, the project credits only self-reported usage months for the intial verification period. For the heating season combined heating and cooking stoves, the project credits only self-reported heating season months for the initial verification period. The months of usage for heating and non-heating stoves may be different; self-reported months of usage is used to calculate project annual emission reductions for all clusters.

Emission reduction equations account for specific technologies and distinct clusters as they currently exist, and will accommodate new project situations (new improved stove models and manufacturers, clusters, baseline, etc.) as they are phased into the project activity.

**<u>Baseline Emissions</u>**

In accordance with GS VER Methodology, the project adopts Approach #1 to fit "subsumed" fuel measurements. The KT measured coal and biomass / agricultural residue consumption. Any additional fuel used other than these fuels are assumed to be "subsumed" by the KT.

**Baseline Emissions**

$BE_c = AF_{bl, Acoal,c} \,.\, NCV_{coal} \,.\, EF_{coal,CO2}$
$+ \Sigma$(Non-CO2 emissions during cooking) **+** $\Sigma$(emissions during fuel production)[30]…**Eqn (1)**

**And**

[30] The project conservatively excludes emissions from coal fuel production. Processed fuels such as biomass briquettes and pellets are not currently used in the baseline or project scenarios. The project will assess fuel and technology clusters throughout the crediting period, and if necessary, will adjust emission reduction calculations to reflect emissions from fuel production.

$AF_{bl,\ Acoal,c} = AF_{bl,Dcoal,c\ *}\ T_{bl\ usage\ days,c}$ ……**Eqn (2)**

$T_{bl\ usage\ days,c} = T_{bl\ usage\ months,c}$ / 12 months * 365 days……**Eqn (3)**

**Where**

$BE_c$ = baseline emissions (tonnes CO2e per year) specific to cluster c.

$AF_{bl,\ Acoal,c}$ = the mass (tons/year) of fossil fuel coal consumed *annually* during cooking and/or heating in the baseline by traditional coal stoves in cluster c.

$AF_{bl,\ Dcoal,c}$ = the mass (tons/year) of fossil fuel coal consumed *daily*[31] during cooking and/or heating in the baseline by traditional coal stoves in cluster c.

$T_{bl\ usage\ days,c}$ = Average self-reported months of usage of baseline technology in cluster c (in the baseline scenario of Shanxi, baseline stoves are used all year; for Guizhou and Hubei, baseline stoves are used in heating months).
$NCV_{coal}$ = Net calorific value of fossil fuel coal in TJ/Gg

$EF_{coal,co2}$ = the CO2 emission factor for use of coal in the baseline scenario in tons CO2 per TJ fuel

**Non-CO2 emissions during cooking**
= Σ ($AF_{bl,\ Acoal,c}$. $EF_{coal,non\text{-}co2,j}$) …**Eqn (3)**

**Where**

$EF_{coal,non\text{-}co2,\ j}$ = Non-CO2 emission factor during cooking for coal fuel for GHG gas j in tons gas per tons fuel

**Project Emissions**

$PE_{y,\ i,c}$ = ($AF_{pj,\ Acoal,y,i,c}$ . $NCV_{coal}$ . $EF_{coal,CO2}$
+ Σ(Non-CO2 emissions during cooking) **+** Σ(emissions during fuel production))[32]
* $AU_{y,\ i,c}$ …**Eqn (4)**

**And**

$AF_{pj,\ Acoal,y,i,c}$ = ($AF_{py,\ Dcoal,\ y,i,c}$ * (365 days - $T_{pj\ non\text{-}usage\ days,c}$)) + ($AF_{bl,\ Dcoal,c\ *}\ T_{pj\ non\text{-}usage\ days,c}$) …**Eqn (5)**

---

[31] Initially, the project conservatively applies baseline non-heating season coal consumption to heating season coal consumption in both baseline and project years. This is conservative because daily coal consumption during the heating season is higher than non-heating season, since coal is used for both heating and cooking during the heating season. The project may choose to directly measure coal consumption in the heating season and apply this value to future fuel savings estimates.

[32] Processed fuels such as biomass briquettes and pellets are not currently used in the baseline or project scenarios. The project will assess fuel and technology clusters throughout the crediting period, and if necessary, during the appropriate future verification period the will adjust emissions reduction calculations to reflect emissions from fuel production.

$T_{pj\ on\text{-}usage\ days,c} = T_{pj\ non\text{-}usage\ months,c} / 12\ months * 365\ days$ …**Eqn (6)**

$AU_{y,i,c} = (U_{y,i,c} + U_{y-1,i,c}) / 2$ …**Eqn (7)**

**Where (noting that parameters common to baseline equations are not repeated):**

$PE_{y,i,c}$ = project emissions (tCO2e per year) during year y specific to HH's with stove technology i and cluster c

$AF_{pj,\ Acoal,y,i,c}$ = the mass (tons per year) of fossil fuel consumed *annually* during year y of the project activity specific to HH's with stove technology i and cluster c

$AF_{py,Dcoal,y,i,c}$ = the mass (kg/day) of fossil fuel coal consumed *daily during the usage* season in the project activity by traditional coal stoves in year y specific to HH's with stove technology i and cluster c

$T_{pj\ non\text{-}usage,c}$ = Average self-reported months of non-usage of project technology in cluster c (in the project scenario of Shanxi, project stoves are not used in heating months; for Guizhou and Hubei, project stoves are not used in non-heating months).

$AU_{y,\ i,c}$ = Annual usage rate during stove age y specific to technology i and cluster c

$U_{y,i,c}$ = Cumulative usage rate during stove age y specific to technology i and cluster c

**Non-CO2 emissions during cooking**
$= \Sigma\ (AF_{pj,\ Acoal,y,i,c} .\ NCV_{coal}\ .\ EF_{coal,non\text{-}co2,j})$…**Eqn (8)**

**Emissions during production of biomass pellet fuels**[33]

$= \Sigma\ EC_{pj,y,i,c} * EF_{EL,y,i,c} * (1+TDL_{y,i,c})$ …**Eqn (9)**

**And**

$EC_{pj,y,i,c} = AF_{pj,\ Apellets,y,i,c} * EF_{Pellet\ Machine,i,c}$

**Where**

$EC_{pj,y,i,c}$ = quantity of electricity (MWh) consumed in the project activity in year y by biomass pellet production technology i in cluster c

$EF_{EL,y,i,c}$ = emission factor ($tCO_2$/MWh) for electricity generation in year y for use by biomass pellet production technology i in cluster c

[33] UNFCCC CDM methodological tool "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" version 01." http://cdm.unfccc.int/Reference/tools/ls/meth_tool05_v01.pdf

$EF_{Pellet\ Machine,i,c}$ = emission factor (MWh/kg) for electricity consumption in year y for use by biomass pellet production technology i in cluster c

$TDL_{y,i,c}$ = average technical transmission and distribution losses in year y for providing electricity to biomass pellet technology i in cluster c

$AF_{pj,\ Apellets,y,i,c}$ = the mass (kg/year) of biomass pellets produced annually for use in the project activity by in year y by pellet production technology i in cluster c

**Leakage**

In accordance with GS VER Methodology, "The project proponent should assess each of the following forms of leakage and present in the PDD an estimate for each case, together with a justification:"

**Figure B5:** Assessment and justification of leakage

| **Leakage Assessment and Outcome** |
|---|
| ***a)*** *Some users of the efficient stoves respond to the fuel savings associated with higher efficiency stoves by increasing consumption of fuels with GHG emission characteristics by retaining some use of inefficient stoves, to the extent that project emissions are higher than those calculated from the assumption that cooking energy is constant. This is sometimes referred to as the 'rebound' effect.*<br><br>Justification (a): No leakage. The rebound effect was not found during the kitchen survey and direct household observations. The results show that coal stoves are retained for heating during the winter season but are not used during the non-winter season. The project conservatively estimates emission reductions by not crediting any reduction in coal used during the winter season, when in fact some HHs with improved stoves continue to use their stoves in the winter. The monitoring plan has provisions to assess coal consumption throughout the crediting period. |
| ***b)*** *The project activity stimulates increased use of a high emission fuel either for cooking or for other purposes outside the project boundary (as would be the case for example if efficient cooking stimulated an increase in NRB consumption - possibly because the NRB fuel becomes cheaper due to the project activity).*<br><br>Justification (b): No leakage. The Project does not result in increased use of high emission fuels. The alternative to renewable biomass / agricultural residues is fossil fuel coal. Stated preferences during household interviews were for free biomass fuels over purchased coal fuels. The use of alternatives to coal is further inhibited by the abundant supply of coal, making coal the dominant fuel for all commercial and residential sectors in Shanxi. Renewable biomass / agricultural residues such as corn cobs, on the other hand, are in abundance for rural farmers. |
| ***c)*** *By virtue of promotion and marketing of a new model and type of stove with high efficiency, the project stimulates substitution of a cooking fuel or stove type with relatively* |

*high emissions by households who commonly using a cooking fuel or stove type with relatively lower emissions, in cases where such a trend is not eligible as an evolving baseline.*

Justification (c): No leakage. Lab test results show substantially lower emissions in improved stoves as compared to traditional stoves.

---

***d)** The project population compensates for loss of the space heating effect of inefficient cook-stoves by adopting some other form of heating or by retaining some use of inefficient stoves.*

Justification (d): Leakage. The Project conservatively assumes that the improved stove is not used during heating months and credits only 7.6 "non-heating" months of displaced coal used for cooking. The duration of heating and non-heating months was determined from over 400 kitchen surveys. During months in which space-heating is required, it is assumed that local users revert to traditional stoves for both heating and cooking, and discontinue use of the improved stove[34]. Although it is possible that some biomass stoves are used during the heating season, the project conservatively excludes coal replacement during heating months due to biomass stove use.

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***e)** The traditional stoves displaced are re-used outside the boundary in a manner suggesting more usage than would have occurred in the absence of the project.*

Justification (e): No leakage. The traditional stoves are not portable. They are large units built into the walls of the home that make them very difficult to disassemble and move.

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***f)** Significant emissions from transportation or construction involved in the project activity, including emissions associated with production/transport of the efficient stoves themselves, or production/transport of project fuels (for example briquette manufacture and supply may be energy-intensive).*

Justification (f): No leakage. All biomass fuels are manually harvested and sourced locally. Project activities will result in a reduction in production and transport of raw coal, which is generally much more energy intensive than household biomass harvesting.

With regards to technology distribution, all stoves during the first verification period have been distributed locally within Yangquan city. During the period March 1, 2009 - December 31, 2010, Jinqilin stoves were trucked in bulk to villages 97 times.[35] The furthest distance

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[34] In reality there will be a transition period during which users will continue to use coal or biomass. Conceptually, the proportion of users using coal during the non-heating months, and biomass during the heating months, is assumed to roughly equal each other. For reference on fuel transitions, see Venkataraman, C., Sagar, A., Habib, G., Lam, N., Smith, K., 2010. The Indian National Initiative for Advanced Biomass Cookstoves: The benefits of clean combustion. Energy for Sustainable Development 14, 63-72.

[35] Source: Project Database

traveled was 67 kilometers.[36] Each Jinqilin stove weighs 45kg. Applying a conservative estimate of 105 gCO2/ton-km,[37] total transport emission is 0.03 tCO2 per stove. A one-time transport leakage factor will be applied to each stove.

| | |
|---|---|
| Truck deliveries | 97 |
| Distance traveled per delivery (km) | 67 |
| Stove weight (g) | 0.045 |
| Stoves sold 01/01/2008-12/31/2009 | 13403 |
| Emission factor truck (gCO2/ton-km | 105 |
| Total Transport Emissions (tCO2) | **412** |
| Transport Emissions Per Stove (tCO2) | **0.03** |

***g)*** *The non-renewable biomass saved under the project activity is used by non-project households/users who previously used renewable energy sources.*

- Justification (g): No leakage. NRB is not used in the Project.

***h)*** *The non-renewable biomass saved under the project activity is used to justify the baseline of other project activities.*

Justification (g): No leakage. No NRB used in the Project. Within the project boundary there is large amounts excess supply of unused agricultural residues in the project area, and 100% renewable biomass and woodfuel. See relevant NRB report for Guizhou and Enshi.

## Emission Reductions

$ER_{y,i,c} = \Sigma\ BE_c - \Sigma\ PE_{y,i,c} - \Sigma\ LE_{y,i,c}$…**Eqn (10)**

**Where**

$ER_{y,i,c}$ = Emission reduction in total project population in year y by technology i in cluster c (tCO2e/yr)

$BE_c$ = Baseline emissions in cluster c (tCO2e/yr)

$PE_{y,i,c}$ = Project emissions in year y by technology i in cluster c (tCO2e/yr)

[36] Total area of Yanguan City is 4451 $km^2$. Truck deliveries travel a maximum distance of 67 kilometers (67km = sqrt(4451$km^2$).

[37] Truck emissions range between 60-150gCO2/ton-km, the midpoint is 105 gCO2/ton-km. http://timeforchange.org/co2-emissions-shipping-goods

$LE_{y,i,c}$ = Leakage in year y by technology i in cluster c (tCO2e/yr)

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

| **Data / Parameter:** | $EF_{coal,co2}$ |
|---|---|
| Data unit: | tons CO2/TJ |
| Description: | Emission factor for fossil fuel coal |
| Source of data used: | IPCC default value for "other bituminous coal" |
| Value applied: | 94.6 |
| Justification of the choice of data or description of measurement methods and procedures actually applied: | Adopt IPCC default values.<br><br>Emission factors were not measured in actual baseline and project conditions due to the difficulty in conducting accurate in-field measurements, thus the project uses IPCC default values.<br><br>Reference: 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 2: http://www.ipcc-nggip.iges.or.jp/public/2006gl/vol2.html |
| Any comment: | None |

| **Data / Parameter:** | $EF_{coal,CH4}$ |
|---|---|
| Data unit: | tons CH4/TJ |
| Description: | Emission factor for fossil fuel coal |
| Source of data used: | IPCC default value for "other bituminous coal" |
| Value applied: | 0.3 |
| Justification of the choice of data or description of measurement methods and procedures actually applied: | Adopt IPCC default values.<br><br>Emission factors were not measured in actual baseline and project conditions due to the difficulty in conducting accurate in-field measurements, thus the project uses IPCC default values.<br><br>Reference: 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 2: http://www.ipcc-nggip.iges.or.jp/public/2006gl/vol2.html |
| Any comment: | None |

| **Data / Parameter:** | $EF_{coal,N2O}$ |
|---|---|
| Data unit: | tons N2O/TJ |
| Description: | Emission factor for fossil fuel coal |
| Source of data used: | IPCC default value for "other bituminous coal" |
| Value applied: | 0.0015 |
| Justification of the choice of data or description of | Adopt IPCC default values.<br><br>Emission factors were not measured in actual baseline and project |

| | |
|---|---|
| measurement methods and procedures actually applied: | conditions due to the difficulty in conducting accurate in-field measurements, thus the project uses IPCC default values.<br><br>Reference: 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 2: http://www.ipcc-nggip.iges.or.jp/public/2006gl/vol2.html |
| Any comment: | None |

| **Data / Parameter:** | $NCV_{coal}$ |
|---|---|
| Data unit: | TJ/Gg |
| Description: | Net calorific value for fossil fuel (coal) |
| Source of data used: | IPCC default value for “other bituminous coal” |
| Value applied: | 25.8 |
| Justification of the choice of data or description of measurement methods and procedures actually applied: | Adopt IPCC default values.<br><br>Net Calorific Values were not measured in actual baseline and project conditions, thus the project uses IPCC default values.<br><br>Reference: 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 2: http://www.ipcc-nggip.iges.or.jp/public/2006gl/vol2.html |
| Any comment: | None |

| **Data / Parameter:** | $AF_{bl,Dcoal,Stove\ ,Province}$ |
|---|---|
| Data unit: | Kilograms/day per household |
| Description: | Net quantity of coal consumed per day in baseline by traditional coal stoves during the non-heating season in cluster Shanxi, and for heating season in cluster Hubei and Guizhou.This will generally be referenced as “usage season.” |
| Source of data used: | Baseline Monitoring Report (Annex 3) |
| Value of data | 6.73 kg/day per household during usage season in Shanxi<br>13.92 kg/day per household during usage season in Hubei<br>12.96 kg/day per household during usage season in Guizhou |
| Description of measurement methods and procedures to be applied: | Lower 90% confidence interval adjusted value used in fixed baseline where 90/30 is not met.<br><br>Baseline fuel use study evaluated average daily fuel use in homes with traditional coal stoves and improved biomass stoves. As per the methodology, the baseline may be reassessed if the KS reveals significant changes over time. Estimates for average annual fuel use are derived from the baseline fuel use study. |
| QA/QC procedures to be applied: | Review by VER Director |
| Any comment: | The project conservatively applies baseline usage season coal consumption to heating season coal consumption in both baseline and project years for cooking stoves in Shanxi. This is conservative because daily coal consumption during the heating season is higher than non-heating season due to coal being used for both heating and |

| | |
|---|---|
| | cooking during the heating season. PP may choose to directly measure coal consumed during the heating months at a later time.<br><br>The project applies baseline usage season coal consumption to heating season coal consumption in both baseline and project years for heating and cooking stoves in Hubei and Guizhou. These values are directly measured and will only be used for heating season, unless additional fuel measurements during non-heating season show otherwise.<br><br>All data collected as part of monitoring was archived electronically and will be kept at least for 2 years after the end of the last crediting period. |

| **Data / Parameter:** | $AF_{py,Dcoal\ 1,Stove,Province}$ |
|---|---|
| Data unit: | Kilograms/day per household |
| Description: | The mass of coal consumed *daily during the project activity year$_y$*in traditional coal stoves by project households with stove technology Jinqilin CKQ, Huifeng, and Zhiqi (via bi-annual monitoring is extrapolated over 2 years) in clusters Shanxi, Guizhou and Enshi. |
| Source of data to be used: | Bi-annual (every 2 years) fuel use study report |
| Value of data | 0 kg/day per household |
| Description of measurement methods and procedures to be applied: | Per GS VER Methodology: An "Aging-Stove KT" should be undertaken not less frequently than bi-annually for sales made in the first year, to measure coal fuel reduction and other relevant factors in successive years of stoves of Age x years, Age y years, and so on. A linear extrapolation is applied to all stoves of intermediate age and extended age, when calculating overall project GHG reductions. |
| QA/QC procedures to be applied: | Review by VER Director |
| Any comment: | All data collected as part of monitoring will be archived electronically and will be kept at least for 2 years after the end of the last crediting period. |

| **Data / Parameter:** | $T_{usage\ months,province}$ |
|---|---|
| Data unit: | Months |
| Description: | Average self-reported months of usage in cluster Shanxi/Enshi/Guizhou |
| Source of data used: | Baseline Monitoring Report (Annex 3) |
| Value of data | 9.25months in Shanxi<br>5.00 months in Enshi<br>4.34 months in Guizhou<br><br>Value derived from ex-ante baseline survey results |
| Description of measurement methods and procedures to be applied: | Value used in fixed baseline.<br><br>Baseline household surveys evaluated average self-reported months of usage in year y. Values for average annual months of usage are derived from the results of the household survey. |
| QA/QC procedures | Review by VER Director |

| | |
|---|---|
| to be applied: | |
| Any comment: | All data collected as part of monitoring was archived electronically and will be kept at least for 2 years after the end of the last crediting period. |

| **Data / Parameter:** | $U_{1,stove,Province}$ |
|---|---|
| Data unit: | Stoves |
| Description: | Cumulative usage rate for stove ages 0-1 years of stove technology “Jinqilin CKQ” in cluster Shanxi, “Huifeng” in cluster Guizhou, and “Zhiqi” in cluster Hubei. |
| Source of data used: | Usage Survey Reports forStove Ages 0-1 Years |
| Value of data | 100% for Jinqilin<br>100% for Huifeng<br>100% for Zhiqi |
| Description of measurement methods and procedures to be applied: | Per GS VER Methodology, value is fixed for all stove ages 0-1 years in cluster Shanxi.<br><br>Household surveys of representative and randomly sampled stove purchasers determined average drop-off in usage (cumulative usage) for stoves age 0-1. |
| QA/QC procedures to be applied: | A random sample of stoves was selected for follow-up by the VER director. A combination of household visits and phone calls to households verified information in the electronic sales database and determined usage drop-off rates. |
| Any comment: | All data collected as part of monitoring was archived electronically and will be kept at least for 2 years after the end of the last crediting period. |

| **Data / Parameter:** | $U_{2,Stove,Province}$ |
|---|---|
| Data unit: | Stoves |
| Description: | Cumulative usage rate for stove ages 1-2 years of stove technology “Jinqilin CKQ” in cluster Shanxi, “Huifeng” in cluster Guizhou, and “Zhiqi” in cluster Hubei. |
| Source of data used: | Usage Survey Reports  Stove Ages 1-2 Years |
| Value of data | 89% for Jinqilin<br>100% for Huifeng<br>100% for Zhiqi |
| Description of measurement methods and procedures to be applied: | Per GS VER Methodology, value is fixed for all stove ages 1-2 years in cluster Shanxi.<br><br>Household surveys of representative and randomly sampled stove purchasers determined average drop-off in usage (cumulative usage) for stoves age 1-2. |
| QA/QC procedures to be applied: | A random sample of stoves was selected for follow-up by the VER director. A combination of household visits and phone calls to households verified information in the electronic sales database and determined usage drop-off rates. |
| Any comment: | All data collected as part of monitoring was archived electronically and will be kept at least for 2 years after the end of the last crediting period. |

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

**Baseline Emissions Ex-Ante Calculation Issuance-1**

***Shanxi***

$BE_{Shanxi} = AF_{bl, Acoal,Shanxi} . NCV_{coal} . EF_{coal,CO2}$
+ Σ(Non-CO2 emissions during cooking)
***** $N_{y,i,c}$

**Where**

$AF_{bl,Acoal,Shanxi}$= 6.73 kg/day * 365 Days * (1ton/1000kg)

= 2.46 tCoal/household-yr

$BE_{Shanxi}$ = $AF_{bl,Acoal,Shanxi}$ * $NCV_{coal}$ * (1 Gg / 1000 tons)
*(($EF_{CO2}$*$GWP_{CO2}$) + ($EF_{CH4}$ * $GWP_{CH4}$) + ($EF_{N2O}$ * $GWP_{N2O}$))
***** $N_{y,i,c}$

= 2.46 tCoal/household-yr * 25.8 TJ/Gg * (1 Gg / 1000 tons)
* ((94.6$ton_{CO2}$/TJ*1) + (0.3$ton_{CH4}$/TJ*21) + (0.0015$ton_{N20}$/TJ*310))
***** $N_{y,i,c}$

= 6.43 tCO2e per stove-yr
*[1775.25 $Q1_{stoves\ sold}$ *320 Days/ 365 Days
+1775.25 $Q2_{stoves\ sold}$ *231 Days/ 365 Days
+1775.25 $Q3_{stoves\ sold}$ *139 Days/ 365 Days
+1775.25 $Q4_{stoves\ sold}$ *47 Days/ 365 Days]

**$BE_{Shanxi}$= 23,041 tCO2e**

***Guizhou***

$BE_{Guizhou} = AF_{bl, Acoal,Guizhou} . NCV_{coal} . EF_{coal,CO2}$
+ Σ(Non-CO2 emissions during cooking)
***** $N_{y,i,c}$

**Where**

$AF_{bl,Acoal,Guizhou}$= 12.96 kg/day * (132 days[38]) * (1ton/1000kg) +

= 1.71 tCoal/household-yr

$BE_{Guizhou}$ = $AF_{bl,Acoal,Guizhou}$ * $NCV_{coal}$ * (1 Gg / 1000 tons)
*(($EF_{CO2}$*$GWP_{CO2}$) + ($EF_{CH4}$ * $GWP_{CH4}$) + ($EF_{N2O}$ * $GWP_{N2O}$))
***** $N_{y,i,c}$

= 1.71 tCoal/household-yr * 25.8 TJ/Gg * (1 Gg / 1000 tons)

---

[38] 132 days are usage days; 4.34 usage months/12*365

$* ((94.6ton_{CO2}/TJ*1) + (0.3ton_{CH4}/TJ*21) + (0.0015ton_{N20}/TJ*310))$
$* N_{y,i,c}$

= 4.48 tCO2e per stove-yr
$*[1775.25\ Q1_{stoves\ sold} *320$ Days/ 365 Days
$+1775.25\ Q2_{stoves\ sold} *231$ Days/ 365 Days
$+1775.25\ Q3_{stoves\ sold} *139$ Days/ 365 Days
$+1775.25\ Q4_{stoves\ sold} *47$ Days/ 365 Days]

**$BE_{Guizhou}$= 16,058.77 tCO2e**

***Enshi***

$BE_{Enshi} = AF_{bl,\ Acoal,Enshi} . NCV_{coal} . EF_{coal,CO2}$
+ Σ(Non-CO2 emissions during cooking)
$* N_{y,i,c}$

**Where**

$AF_{bl,Acoal,Enshi}$= 13.92 kg/day * 152.1 Days[39] * (1ton/1000kg)

= 2.12 t/Coal/household-yr

$BE_{Enshi} = AF_{bl,Acoal,Enshi} * NCV_{coal} * (1\ Gg / 1000\ tons)$
$*((EF_{CO2}*GWP_{CO2}) + (EF_{CH4} * GWP_{CH4}) + (EF_{N2O} * GWP_{N2O}))$
$* N_{y,i,c}$

= 2.12 tCoal/household-yr * 25.8 TJ/Gg * (1 Gg / 1000 tons)
$* ((94.6ton_{CO2}/TJ*1) + (0.3ton_{CH4}/TJ*21) + (0.0015ton_{N20}/TJ*310))$
$* N_{y,i,c}$

= 5.53 tCO2e per stove-yr
$*[1775.25\ Q1_{stoves\ sold} *320$ Days/ 365 Days
$+1775.25\ Q2_{stoves\ sold} *231$ Days/ 365 Days
$+1775.25\ Q3_{stoves\ sold} *139$ Days/ 365 Days
$+1775.25\ Q4_{stoves\ sold} *47$ Days/ 365 Days]

**$BE_{Enshi}$= 19,822 tCO2e**

Emissions from fossil fuel coal are calculated assuming an IPCC default value for NCV = 25.8 TJ/Gg. Carbon dioxide global warming potential (GWP) is assumed to be $GWP_{CO2}$ = 1, and $EF_{CO2}$ = 94.6tons/TJ; $GWP_{CH4}$ = 21, and $EF_{CH4}$ = 0.3tons/TJ; Nitrous oxide $GWP_{N2O}$ = 310, and $EF_{N2O}$ = 0.0015tons/TJ.

Annual household coal use is 2.46 tons/year ((6.73 kg/stove-day * 365days) / 1000) in Shanxi. Annual emissions are calculated based on the date of sale for an improved stove, thereby establishing a replacement date for baseline traditional coal stoves. Here we

[39] 152.1 days are usage days; 5 usage months/12*365

assume that in Year-1, 7101 Jinqilin stoves are sold on a quarterly basis, with actual sale dates approximated as midway into each quarter. So, the first 1775.25 stoves were sold on February 15th, which is halfway into the first 3-month quarter, and are thus used for 320 days in the first year. Sales of the next 1775.25 stoves occurred on May 15th, which again is halfway into the second 3-month quarter, and thus are used for 231 days in the first year. Sales of the next 1775.25 stoves occurred on August 15th, and sales of the final 1775.25 stoves on November 15th. During the actual Project period, the exact day of sales will be recorded, and actual stove-days will be used to calculate annual emissions reductions.

*Guizhou Province and Enshi state follow the same calculations.*

**Project Emissions Issuance-1**

$PE_{Year\text{-}1,\ Stove,\ Province} = (AF_{pj,Year\text{-}1,Acoal,\ Stove,\ Province} \cdot NCV_{coal} \cdot EF_{coal,CO2}$
$+ \Sigma(\text{Non-CO2 emissions during cooking}) + \Sigma(\text{emissions during fuel production}))$[40]
$* AU_{Year\text{-}1,\ Manufacturer,\ Province} * N_{y,i,c}$

**And**

$AF_{pj,Year\text{-}1,Acoal,\ Stove,\ Province} = (AF_{py,Year\text{-}1,Dcoal,\ Stove,\ Province} * (-T_{usage\ days,province})) + (AF_{bl,Dcoal,Shanxi} * T_{heating\ days,Province})$

$T_{usage\ days,province} = T_{usage\ months,province} / 12\ months * 365\ days$

$AU_{Year\text{-}1,Stove,Province} = (U_{Year\text{-}2,Stove,Province} + U_{Year\text{-}1,Ji\ Stove,\ Province}) / 2$

**Where**

$AU_{Year\text{-}1,Stove,Province} = (100\% + 1) / 2$

$= 100\%$

$T_{usage\ days,Province} = 4.4\ months / 12\ months * 365\ days$

$= 133.8\ days$

$AF_{pj,Year\text{-}1,Acoal,\ Stove,\ Province} = (0\ kg/day * (133.8\ days)) + (6.73\ kg/day * 133.8\ days) * (1ton/1000kg)$

$= (0\ kg/day * 231.2\ days) + (6.73\ kg/day * 133.8\ days) * (1ton/1000kg)$

$= 0.90\ tCoal/household\text{-}yr$

$PE_y = AF_{pj,Year\text{-}1,Acoal,Stove,Province} * NCV_{coal} * (1\ Gg / 1000\ tons)$

---

40 Processed fuels such as biomass briquettes and pellets are not currently used in the baseline or project scenarios. The project will assess fuel and technology clusters throughout the crediting period, and if necessary, will adjust emissions reduction calculations to reflect emissions from fuel production. In accordance with a phased approach to introducing new fuels and stove technologies, if new biomass pellet technologies are added to the project activity in the future, the project will provide during the appropriate future verification period evidence for emissions from production of pellet fuel technologies (if any).

$*((EF_{CO2}*GWP_{CO2}) + (EF_{CH4} * GWP_{CH4}) + (EF_{N2O} * GWP_{N2O}))$
$* AU_{Year-1,Stove,Province} * N_{y,i,c}$

= 0.90 tCoal/household-yr * 25.8 TJ/Gg * (1 Gg / 1000 tons)
$* ((94.6ton_{CO2}/TJ*1) + (0.3ton_{CH4}/TJ*21) + (0.0015ton_{N20}/TJ*310))$
$* AU_{Year-1,Stove,Province} * N_{y,i,c}$

= 2.36 tCO2e per stove * 100% usage yr 0-1
*[1775.25 $Q1_{stoves\ sold}$ *320 Days/ 365 Days
+1775.25 $Q2_{stoves\ sold}$ *231 Days/ 365 Days
+1775.25 $Q3_{stoves\ sold}$ *139 Days/ 365 Days
+1775.25 $Q4_{stoves\ sold}$ *47 Days/ 365 Days]

**$PE_{Year-1}$= 8,446 tCO2e**

Project participants discontinue use of the improved gasifier stove for $T_{heating\ months,Province}$ = 4.4 months of the year during the winter months, in exchange for traditional coal stoves with heating capabilities. Project emissions include emissions from coal consumed during these winter months. It is, however, possible that improved stove users will continue some use of the biomass stove into the winter heating seasons, thereby reducing further the amount of coal used in Project activities. The Project conservatively excludes from ER calculations any displacement of coal during the winter heating months by biomass stoves. Furthermore, kitchen tests occurred in the non-winter months, thereby establishing a conservative non-winter baseline for coal use, since winter heating results in higher coal consumption.

Daily coal use during the heating season in both the baseline and project activity assumes lower 90% confidence interval of 6.73 kg/household (Figure B.4). In the project year, coal is used during 133.8 days of the heating season (133.8 days = 4.4 months / 12months * 365 days), which equals 900 kg coal per household used during the heating season (133.8 days * 6.73 kg). Coal is not used during the non-heating season, thus annual coal consumption for project households is 0.90 tons/year.

Annual emissions are calculated based on stove-age and usage rates. Here we assume that in Year-1, 7101 stoves are sold on a quarterly basis, with actual sales dates approximated as midway into each quarter. So, the first 1775.25 stoves were sold on February 15th, which is halfway into the first 3-month quarter, and thus are used for 320 days in the first year. Sales of the next 1775.25 stoves occurred on May 15th, which again is halfway into the second 3-month quarter, and thus are used for 231 days in the first year. Sales of the next 1775.25 stoves occurred on August 15th, and sales of the final 1775.25 stoves on November 15th. During the actual Project period, the exact day of sales will be recorded, and actual stove-days will be used to calculate annual emissions reductions. Emissions reductions for subsequent years apply the same logic for calculations, until the stove is retired.

Lifetime emissions are calculated over the 7-year Project period 2009-2015 based on usage and drop-off rates. Cumulative Usage Rates ($U_{y,i,c}$) are determined annually through monitoring surveys. Here we assume $U_{year-1,\ Manufacturer,\ Province}$ amongst all stoves up to age 1 year = 100%, age 1-2 years = 89%, age 2-3 years = 40, age-4 to age-6 = 20%, and age-7 to be completely discontinued. Annual Usage Rates during year y of technology iin cluster c, are calculated to reflect drop-off in cumulative usage $U_{y,i,c}$. Annual Usage Rate ($AU_{y,i,c}$) is the average annual cumulative usage. So for Ages 0-1 the annual usage rate is

(1+100%)/2=100%; for Ages 1-2 the annual usage rate is (100%+89%)/2 = 94.5%. Annual usage rate is applied to all stoves equally over the full year of a given stove age (Age 0-1, Age 1-2, etc.), with each stove beginning its "stove age" based on the day of sale.

**Figure B6**. Stove usage rates based on estimated annual drop-off of stove users. These will be updated over time with monitored usage data.

| Annual Usage Rate by Stove Age | | Cumulative Usage | |
|---|---|---|---|
| Age 0-1 | 100.0% | CumU1 | 100% |
| Age 1-2 | 94.5% | CumU2 | 89% |
| Age 2-3 | 64.5% | CumU3 | 40% |
| Age 3-4 | 30.0% | CumU4 | 20% |
| Age 4-5 | 20.0% | CumU5 | 20% |
| Age 5-6 | 20.0% | CumU6 | 20% |
| Age 6-7 | 10.0% | CumU7 | 0% |

**Leakage**

$LE_y = 0.03\ tCO2/stove$[41] *

*[1775.25 $Q1_{stoves\ sold}$ *320 Days/ 365 Days
+1775.25 $Q2_{stoves\ sold}$ *231 Days/ 365 Days
+1775.25 $Q3_{stoves\ sold}$ *139 Days/ 365 Days
+1775.25 $Q4_{stoves\ sold}$ *47 Days/ 365 Days]

$\boldsymbol{LE_y = 110\ tCO2e}$

**Emission Reductions Issuance-1**

$ER_y = BE_y - PE_y - LE_y$

= 23,010 tCO2e - 8,434 tCO2e – 110 tCO2e

$\boldsymbol{ER_{year-1}}$**= 14,466 tCO2e**

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

The Project adopts a twice-renewable 7-year crediting period. During the initial 7-year crediting period estimated cumulative emissions reductions is equal to 2,796,503 tCO2e. Average annual emissions reductions are 399,501 tCO2e.

**Figure B9.** Ex-ante estimation of emission reductions in tCO2e per year

| Crediting Period | Stoves Sold | Leakage | Total-Leakage | Cumulative |
|---|---|---|---|---|
| 2009-2010 | 7,101 | 110 | 14,484 | 14,484 |
| 2010-2011 | 7,000 | 109 | 42,388 | 56,872 |
| 2011-2012 | 7,000 | 109 | 64,872 | 121,744 |

[41] Leakage from one-time stove transport at time of sale (Figure B.5)

| | | | | |
|---|---|---|---|---|
| 2012-2013 | 7,500 | 116 | 79,389 | 201,133 |
| 2013-2014 | 8,000 | 124 | 89,216 | 290,350 |
| 2014-2015 | 8,500 | 132 | 99,537 | 389,887 |
| 2015-2016 | 9,000 | 140 | 109,280 | 499,167 |
| Average | 7,729 | 839 | 71,310 | N/A |

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

### B.7.1. Data and parameters monitored:

| **Data / Parameter:** | $N_{y,i,c}$ |
|---|---|
| Data unit: | Stoves |
| Description: | Number of stoves sold in year y of technology i in cluster c |
| Source of data to be used: | Manufacturer sales database |
| Value of data | 7,000 Jinqilin Stoves (estimate)<br>6,000 Zhiqi Stoves (estimate)<br>15,000 Huifeng Stoves (estimate) |
| Description of measurement methods and procedures to be applied: | Sales cards will be collected for each stove at the point of sale for as many stoves as possible. The card includes the user's address, phone number, name, and signature consent to waive rights to the carbon offsets. End user information will be inputted into an electronic sales database categorized by village and date. |
| QA/QC procedures to be applied: | A random sample of annual sales will be selected for follow-up by the VER director. The combination of surveys and direct phone calls to households will verify information in the electronic sales database. |
| Any comment: | All data collected as part of monitoring will be archived electronically and will be kept at least for 2 years after the end of the last crediting period. |

| **Data / Parameter:** | $U_{y,i,c}$ |
|---|---|
| Data unit: | Stoves |
| Description: | Cumulative annual usage rate for stove age y of stove technology i in cluster c |
| Source of data to be used: | Usage survey record |
| Value of data | Older stoves will be monitored over the course of the project. |
| Description of measurement methods and procedures to be applied: | Per GS VER Methodology, "A Usage Survey should be undertaken not less frequently than bi-annually (every two years) for sales made in the first year of the project, to establish the drop-off rates in stove usage (or new regime application) over time." |
| QA/QC procedures to be applied: | A random sample of stoves will be selected for follow-up by the VER director. A combination of household visits and phone calls to households will verify information in the electronic sales database and determine usage drop-off rates. |

| | |
|---|---|
| Any comment: | Usage has been determined for Jinqilin stove CKQ ages 0-1 and 1-2 years (retroactive crediting for 2 years) in cluster Shanxi, and for stoves sold by Zhiqi and Huifeng ages 0-1 and 1-2 years in Enshi and Guizhou, respectively, and is available at the time of validation. Usage for older stoves will be monitored.<br><br>All data collected as part of monitoring will be archived electronically and will be kept at least for 2 years after the end of the last crediting period. |

| **Data / Parameter:** | $AF_{py,Dcoal,y,i,c}$ |
|---|---|
| Data unit: | Kilograms/day per household |
| Description: | Net quantity of coal consumed per day in the project activity by traditional coal stoves in project households with improved stove technology i that is of age y years in cluster c. |
| Source of data to be used: | Bi-annual (every 2 years) fuel use study report. |
| Value of data | N/A |
| Description of measurement methods and procedures to be applied: | Per GS VER Methodology: An “Aging-Stove KT” should be undertaken not less frequently than bi-annually for sales made in the first year, to measure coal fuel reduction and other relevant factors in successive years of stoves of Age y years, Age y+1 years, and so on. A linear extrapolation is applied to all stoves of intermediate age and extended age, when calculating overall project GHG reductions. |
| QA/QC procedures to be applied: | Review by VER Director |
| Any comment: | All data collected as part of monitoring will be archived electronically and will be kept at least for 2 years after the end of the last crediting period. |

| **Data / Parameter:** | $AF_{py,Apellet,y,i,c}$ |
|---|---|
| Data unit: | Tons per year |
| Description: | Net quantity of biomass pellets produced per year for use in the project activity in year y by pellet production technology i for cluster c. |
| Source of data to be used: | Quarterly monitoring survey |
| Value of data | N/A |
| Description of measurement methods and procedures to be applied: | Quarterly surveys will be conducted to assess the amount of biomass pellets produced for use in the project activity. The pellets will be tracked at the point of production and a sales record will be recorded. The project assumes that the sale of pellets to households with project stoves is equal to the amount of pellets used in the project activity. The pellets have no other use in the household other than for project biomass stoves, since there is no other biomass technology that can use small processed biomass fuels. |
| QA/QC procedures to be applied: | Review by VER Director |
| Any comment: | All data collected as part of monitoring will be archived electronically and will be kept at least for 2 years after the end of the last crediting |

| | |
|---|---|
| | period. |

| Data / Parameter: | $EF_{Pellet\ Machine,i,c}$ |
|---|---|
| Data unit: | MWh/kg |
| Description: | Emission factor (MWh/kg) for electricity consumption in year y for use by biomass pellet production technology i in cluster c |
| Source of data used: | Lab test for NCV, or publicly available data |
| Value applied: | N/A |
| Justification of the choice of data or description of measurement methods and procedures actually applied: | The project does not currently use biomass pellet fuels in the project activity. $EF_{Pellet\ Machine,i,c}$ will be assessed during the relevant future verification period once a biomass pellet technology has been identified and installed in the project activity. |
| Any comment: | None |

| Data / Parameter: | $EF_{EL,y,i,c}$ |
|---|---|
| Data unit: | $tCO_2$/MWh |
| Description: | Emission factor for electricity generation in year y for use by biomass pellet technology i in cluster c |
| Source of data to be used: | China Bureau of Statistics – Energy Statistical Yearbook |
| Value of data | N/A |
| Description of measurement methods and procedures to be applied: | During the appropriate verification period when biomass pellets are used, updated emission factors for electricity generation will be referenced from the China Bureau of Statistics.<br><br>Reference: UNFCCC CDM methodological tool "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" version 01." http://cdm.unfccc.int/Reference/tools/ls/meth_tool05_v01.pdf |
| QA/QC procedures to be applied: | Review by VER Director |
| Any comment: | None |

| Data / Parameter: | $EC_{pj,y,i,c}$ |
|---|---|
| Data unit: | MWh |
| Description: | Quantity of electricity consumed in the project activity in year y by biomass pellet technology i in cluster c |
| Source of data to be used: | Quarterly monitoring surveys |
| Value of data | N/A |

| | |
|---|---|
| Description of measurement methods and procedures to be applied: | The quantity of electricity used to produce pellets will be derived from actual pellet sales to the project activity. Biomass pellet sales for use by the project activity will be monitored through quarterly surveys.<br><br>Reference: UNFCCC CDM methodological tool "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" version 01." http://cdm.unfccc.int/Reference/tools/ls/meth_tool05_v01.pdf |
| QA/QC procedures to be applied: | Review by VER Director |
| Any comment: | All data collected as part of monitoring will be archived electronically and will be kept at least for 2 years after the end of the last crediting period. |

| **Data / Parameter:** | $TDL_{y,i,c}$ |
|---|---|
| Data unit: | Percentage |
| Description: | Average technical transmission and distribution losses in year y for providing electricity to biomass pellet technology i in cluster c |
| Source of data to be used: | China Bureau of Statistics – Energy Statistical Yearbook |
| Value of data | N/A |
| Description of measurement methods and procedures to be applied: | During the appropriate verification period when biomass pellets are used, updated technical transmission and distribution losses for electricity delivery to biomass pellet technologies will be referenced from the China Bureau of Statistics.<br><br>Reference: UNFCCC CDM methodological tool "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" version 01." http://cdm.unfccc.int/Reference/tools/ls/meth_tool05_v01.pdf |
| QA/QC procedures to be applied: | Review by VER Director |
| Any comment: | All data collected as part of monitoring will be archived electronically and will be kept at least for 2 years after the end of the last crediting period. |

| **Data / Parameter:** | $LE_{pj,y,c,i}$ |
|---|---|
| Data unit: | tCO2/stove per lifetime of stove |
| Description: | One-time leakage emission factor applied to stove sales during project activity year "y" in cluster "c" by transport and/or production of project technologies and activities "i" |
| Source of data to be used: | Various |
| Value of data | 0.03 |
| Description of measurement | Leakage will be assessed bi-annually using actual sales records. |

| | |
|---|---|
| methods and procedures to be applied: | |
| QA/QC procedures to be applied: | Review by VER Director |
| Any comment: | All data collected as part of monitoring will be archived electronically and will be kept at least for 2 years after the end of the last crediting period. |

| **Data / Parameter:** | **Sustainability** |
|---|---|
| Data unit: | Variable |
| Description: | Sustainability Indicators |
| Source of data to be used: | Bi-annual survey |
| Value of data | Refer to Sustainability Monitoring Plan in Passport Section G |
| Description of measurement methods and procedures to be applied: | Per GS VER Methodology, *"The wider social and economic impact of the project should be investigated biannually and an assessment made of its contribution, positive or otherwise, to sustainable development in the area."*<br><br>A bi-annual survey will evaluate sustainable indicators as outlined in the GS Passport, Section G: Sustainability Monitoring Plan. |
| QA/QC procedures to be applied: | Results will be made available for public review. |
| Any comment: | All data collected as part of monitoring will be archived electronically and will be kept at least for 2 years after the end of the last crediting period. |

| **Data / Parameter:** | **fNRB** |
|---|---|
| Data unit: | fraction |
| Description: | Fraction of non-renewable biomass |
| Source of data to be used: | Bi-annual study |
| Value of data | 0.00 |
| Description of measurement methods and procedures to be applied: | A bi-ennial study will evaluate fNRB for each applicable region using fuelwood in the project activity. Publicly available literature, government statistics, or study data will be used to determine fNRB. |
| QA/QC procedures to be applied: | Results will be made available for public review. |
| Any comment: | All data collected as part of monitoring will be archived electronically and will be kept at least for 2 years after the end of the last crediting period. |

**B.7.2. Description of the monitoring plan:**

**Data Monitored**

In accordance with GS VER Methodology, the Project will monitor the following variables:

*Continuously:*

- **Total Sales Record** that includes date of sale, location, model, number sold, contact information (as many as possible).
- **Detailed Customer Database** that records the results of kitchen surveys.
- **Project Database** that provides emission reduction calculation based on total sales and the results of the monitoring kitchen surveys, including adjustments for clusters and other factors influencing emission reductions.

*Quarterly:*

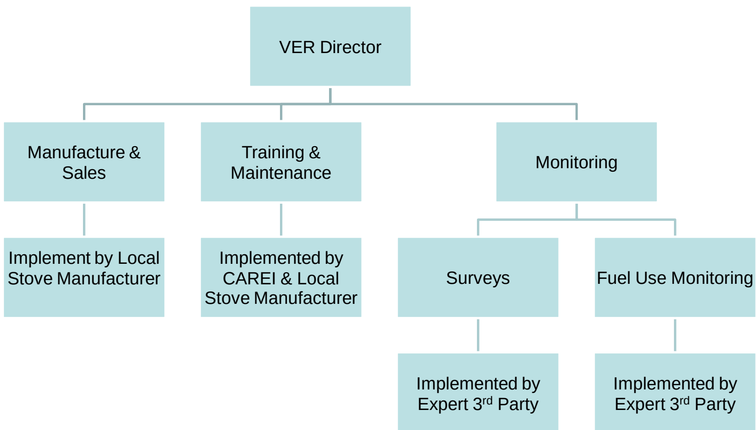
- **Monitoring Kitchen Survey** to reassess kitchen regimes. 25 households per quarter will be randomly selected from the relevant period, with not less than 50% of households being contacted in the homes. Information collected will include contact information, seasonal stove/fuel combinations used for cooking, domestic versus institutional use, number cooked for, and number of meals cooked per day.

*Bi-annually (Every 2 Years):*

- **NRB** fraction ( if applicable)
- **Leakage** identified in the PDD (including average self-reported months of heating) and the possibility of new effects
- **Aging-Stove KT** to measure fuel reduction performance and other relevant factors in successive years of stove age
- **New-Stove KT** (if applicable) to measure fuel consumption amongst new stove models.
- **Usage Survey** to establish the drop-off rates in stove usage from year-1 sales, and to be applied to each relevant stove vintage in the project database.
- **Sustainability** indicators

**Monitoring Organization**

A monitoring team will be established to ensure monitoring of project activities are in accordance with GS VER Methodology guidelines. The organizational structure is outlined below:



A. **VER Director:** This post will oversee all three divisions of the monitoring team and will ensure that all methodological and regulatory guidelines are adhered to, as well as providing quality assurance and quality control of all data provided by each division. The director is also responsible for verifying and cross-checking stoves sales and usage drop-off, and reviewing results from the monitoring division. All paper and electronic documentation will be consolidated within the auspices of the VER Director, and subsequent reporting and verification requirements will be managed by the VER Director. The VER Director is responsible for organizing and maintaining the Detailed Customer Database (DCD), Total Sales Record (TSR) database, Project Database.

B. **Manufacturing and Sales Division**: This division will be responsible for collecting, recording, and documenting ongoing sales of the improved stoves. Pertinent information contained in the sales cards collected for each stove at the point of sale will be inputted and organized into an electronic TSR database. The card includes the user's address, phone number[42], name, and signature consent to waive rights to the carbon offsets. All documentation including the sales cards and the electronic database will be transferred to the VER Director for quality control review and database compilation.

C. **Training and Maintenance Division:** This division will be responsible for providing training and demonstration activities to end users on how to operate and maintain new project stoves. Training activities include safety considerations, igniting, and feeding of fuel. Maintenance training will include training on how to fix cracks on the inner wall of the stove with basic clay mixtures (when applicable), cleaning of ash repository, and chimney maintenance, amongst other end user considerations.

D. **Monitoring Division:**
   a. **Survey Team:** The survey team will be responsible for managing the logistics of all survey activities and developing survey studies that are random, that have sample sizes that are compliant with the methodology and are representative of the area encompassed within the project boundary. The surveys will gather data compliant with the requirements of the methodology. All paper and electronic versions of supporting documents, reports, and databases will be delivered to the VER Director for substantiation.

   b. **Fuel Use Monitoring Team:** The fuel use monitoring team will be responsible for conducting bi-annual Kitchen Tests (KT) and/or surveys that capture average household coal consumption. These studies will be used to adjust the baseline when required, and will include the "Aging-stove KT," and when applicable the "New-stove KT." The studies will capture average daily fuel use, which will be the basis for estimates of annual fuel use. A household survey will be conducted in tandem to the KT to assess sustainability indicators. The study will be random and will include sampling that is representative of the area encompassed within the project boundary. All paper and electronic reports, field notes, and databases will be delivered to the VER Director.

**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):**

[42] Phone numbers will be gathered when possible, as not all households own phones.

Full description and results of baseline monitoring is attached in Appendix 3.

Date of completion of baseline study: 22-07-2009

Key implementing party involved in baseline study:

Berkeley Air Monitoring Group
2124 Kittredge Street #57
Berkeley, CA 94704
United States
Tel. 01-510-649-9355

The key implementing party of the baseline study is not a 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:

01-03-2009

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

21 years operational lifetime. Renewable crediting period (7 years, twice renewable)

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

#### C.2.1. Renewable crediting period:

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

Retroactive active registration beginning: 01-03-2009

##### C.2.1.2. Length of the first crediting period:

7 years

#### C.2.2. Fixed crediting period:

##### C.2.2.1. Starting date:

N/A

##### C.2.2.2. Length:

N/A

## SECTION D. Environmental impacts

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

Numerous studies have been conducted on indoor air pollution (IAP) due to inefficient burning of coal in rural Chinese households. According to a study which analysed potential health benefits of reducing household solid fuel use in Shanxi province "the urban coal using population experience a 17% increase in exposure from IAP"[43] . The project is expected to have a number of positive environmental impacts.

- Avoidance of in-house air pollution
- Reducing GHG emissions from coal usage
- Reduction of GHG from avoidance of open fires to burn biomass
- Use of waste biomass as a renewable source of energy

### 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:

Following the previous consultation activities held 10 April 2010 at the Yu County Hotel located in Yu County of Yangquan City in Shanxi province, the Project finds no significant environmental or social impacts resulting from the project activity.

Issuance-2 stakeholder consultations (see LSC reports) also find no significant environmental or social impacts resulting from the project activity.

Documents related to an Environmental Impact Assessment are provided separately.

## SECTION E. Stakeholders' comments

Refer to GS VER Passport for detailed stakeholder feedback and analysis of environmental impacts of Project.

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

The objectives of the meeting were to introduce the project to stakeholders, and to seek stakeholder opinions and advice on the Project's planned project design for Shanxi.

[43] See peer reviewed article: Mestl, H., Aunan, K., Seip, H., 2006. Potential health benefit of reducing household solid fuel use in Shanxi province, China. Science of The Total Environment 372, 120-132.

Participants in attendance represented a wide array of stakeholders for the carbon project, including government leaders, village leaders and residents, dealers, cooperative enterprises, NGOs, university, and project developers. Invitation letters were sent to 27 people, of whom 22 people confirmed receiving the invitations, and 19 people actually attended the meeting. An additional 5 persons not on the invitation list voluntarily attended the meeting, as well as another 4 representatives from Jinqilin Energy Technology Co.Ltd. In total 28 persons attended the stakeholder meeting.

Additinoal meetings were held for Guizhou and Hubei. Project proponents informed stakeholders about the expansion of the project into Hubei and Guizhou provinces and gave them an opportunity to discuss the impact the Project would have on individuals, the target community, and local environment. A full Local Stakeholder Consultation was conducted according to the Gold Standard Methodology and the both reports are included as Annexes in the Design Change Report. Feedback rounds have been conducted through in-person consultations and follow-up phone conversations with local officials.

A broad range of stakeholders were invited to the stakeholder consultation meeting, including individuals from each of the six categories that GS recommends. Invitations were sent by email whenever possible, but if the stakeholder did not have email, direct phone call invitations were made. Both thought leaders and local users within the community were invited, including village leaders, residents, government officials, media, manufacturers, NGOs, and international representatives.
In Hubei, five local people from Sancha Town, Shuidong Village and Yangtianping Village were invited. A local leader invited them directly by giving them a written invitation letter. The invitation letter was also posted in the county and was uploaded to the local government website. Invitation letters were sent to 30 people, of whom 27 people confirmed receiving the invitations, and 21 people actually attended the meeting.

In Guizhou, Five local people from Pingba County and Ziyun County were invited to the meeting by a Local leader who gave them the invitation directly. The invitation letter was also posted in the county and uploaded the on local government website. Invitation letters were sent to 26 people, of whom 23 people confirmed receiving the invitations, and 22 people actually attended the meeting.

## E.2. Summary of the comments received:

The project proponents informed stakeholders about the project and gave them an opportunity to discuss the impact the Project would have on individuals, the target community, and local environment. As discussed in the GS Passport, stakeholder feedback was overwhelming positive and in support of the Project’s planned GS VER carbon program for Yu County.

The main conclusions from the Shanxi meeting are:

1. All stakeholders expressed their support for the project. They think implementing the project can 1) beneficially expand the market for improved biomass stoves; 2) save money from reduced coal consumption; 3) reduce emissions and improve indoor air quality; 4) enhance local rural residents quality of life; and 5) promote development of the local rural economy.

2. Project education and marketing campaigns should be strengthened. Rural residents should have a better understanding of the possible energy-savings and emission-reductions. Project developers should also enhance training efforts for end-users.

3. Many stakeholders suggested reducing the stove price to allow greater participation by poor residents. A few stakeholders suggested promoting biomass pellets as a way to supplement the corn cob residues, and using funding from the carbon credits to develop a briquette making supply system.

4. Local government officials reiterated their support for the Project and affirmed their commitment to providing subsidies for at least 6,000 stoves per year in the coming years. Local officials also expressed hope that the Project could assist in rural development by reinvesting carbon revenues into the local community and economy.

All stakeholders in both Hubei and Guizhou expressed their support for the project. Overall, the stakeholders think implementing the project will

1. Beneficially expand the market for improved biomass stoves
2. Reduce coal consumption and emissions
3. Increase fuel savings
4. Meet household energy demand with abundant yield of forest residue
5. Promotes local sustainable development and rural economy
6. Improves health condition and reduce disease incident
7. Increase disposable income

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

According to the sustainability matrix, none of the indicators were scored less than “positive” by the stakeholders. The Project proponents are encouraged by the overwhelming positive feedback and support by stakeholders. There was clear agreement that only positive, and no negative, impacts will occur as a result of the project. There were, however, suggestions for accelerating the growth of the project design.

Many stakeholders stressed the importance of educating local residents of the health and environmental benefits of the stove. They also encouraged greater training and technical support for current users of the allstove models. As a result of these comments, the Project will design a comprehensive education and training program to encourage dissemination and appropriate use of the stove. Project partners at the China Association for Rural Energy Industries (CAREI) have extensive experience in training, promotion, and education for improved stoves. Most recently, CAREI and Impact Carbon led a US Environmental Protection Agency (EPA) and Wuppertal Institute funded project that promoted capacity building and training for the scale-up of improved stoves in poor western regions of China. This expertise will be utilized in the carbon project.

Stakeholders also suggested expanding the availability of biomass fuels so that residents in areas outside of Yu County – who have less corn cob production – can also take advantage of the improved stove program. In response to this, the Project proponents are investigating options for new and innovative biomass pellet supply chains. Following the suggestion of stakeholders, the Project is exploring the option to utilize the abundant surplus of wheat, corn stalk, and other agricultural residues to produce biomass pellets. It is possible that pellets can be used to supplement current corn cob fuel stocks, as well as enable the Project to expand to areas with fewer available corn cob residues.

Due account of stakeholder feedback from meetings in Guizhou and Huifeng were also taken into account. …According to the sustainability matrix from these meetings, none of the indicators were scored less than "positive" by the stakeholders. Similar to Shanxi, there was clear agreement that only positive, and no negative, impacts will occur as a result of the project.

Many stakeholders stressed the importance of educating local residents of the health and environmental benefits of the stove. They also encouraged greater training and technical support for current users of the Zhiqi and Huifeng stove. As a result of these comments, the Project will design a comprehensive education and training program to encourage dissemination and appropriate use of the stove. Project partners at the China Association for Rural Energy Industries (CAREI) have extensive experience in training, promotion, and education for improved stoves

The project proponents did not elicit from the stakeholder meeting and or feedback round any major changes for the project design. The Project proponents have conducted extensive formal and informal meetings with stakeholders regarding the project design. The positive results of the stakeholder meeting reinforce our confidence that the project design will deliver high quality social and environmental benefits to all participants and stakeholders.

**Annex 1**

**CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY**

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| Last Name: | Haigler | |
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| Department: | | |
| Mobile: | | |
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| Direct tel: | | |
| Personal E-Mail: | | |

**Annex 2**

**INFORMATION REGARDING PUBLIC FUNDING**

Per the Official Development Assistance Declarations submitted in the GS Passport, the Project claims no public funding for the project activity

**Annex 3**

**BASELINE INFORMATION**

See Monitoring Report by Berkeley Air Monitoring Group**:** *Impact of Jinqilin Improved Semi-gasifier Stoves on Fuel Usage Monitoring in Shanxi Province, China.*

Annex 3A Baseline Report Guizhou

Annex 3B Baseline Report Enshi

Annex 3C fNRB Report Guizhou

Annex 3D fNRB Report Enshi

**Annex 4**

**MONITORING INFORMATION**

See Section B.7.2 “Description of Monitoring Plan”