

Monitoring Report

Issuance 4: 01 March 2013 – 28 February 2015

Version 1: March 06, 2015

Version 2: July 03, 2015

Version 3: September 17, 2015

Version 4: September 30, 2015

Version 5: January 21, 2016

Version 6: February 26, 2016

Version 7: April 28, 2016

Project name: GS 949; Clean and Efficient Cooking and Heating Project, China

Report filename: GS 949; Monitoring Report; 130301 – 150228

Period(s) reported: 01 March 2013 through 28 February 2015

Project Database period (stove sales eligible for crediting): 29 March 2009 - 28 February 2015

Emissions Reduction crediting period: 01 March 2013 to 28 February 2015 (4th Issuance Period)

Start of Project crediting: 29 March 2009; project was registered on 29 March 2011 with retroactively 2 years of crediting.

Submitted by Impact Carbon on behalf of Project Stove Manufacturers with assistance from MyClimate and local partner, China Association for Rural Energy Industries (CAREI)



Huifeng Stove (Guizhou)



Jinqilin Stove (Shanxi)



Zhiqi Stove (Enshi)

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1. Introduction

With respect to the registered Voluntary Gold Standard PDD authored by Impact Carbon and titled **PDD, GS 949 Design Change Highlights v4**¹, and the Voluntary Gold Standard Passports titled **Passport GS949 V7_26042011, Annex 30, Enshi Passport and Annex 31, Guizhou Passport** for GS 949 project labelled “Clean and Efficient Cooking and Heating Project, China,” registered on 29th March 2011²:

This report documents the installation and on-going monitoring of three types of stoves sold from 05 March 2009 – 28 February 2015:

- Improved agricultural residue semi-gasifier cooking stoves in Shanxi Province, China as sold by Jinqilin Stove Manufacturers Ltd. (Model CKQ),
- Improved biomass stoves that function as both cooking and heating technologies, as sold by Enshi Zhiqi Biomass Energy Science and Technology Development Co. Ltd (Zhiqi – Model ZQ-JG-220) and Anshun Huifeng Energy Saving Stove Company Ltd (Huifeng – Model HK-HF-70) in coal endemic areas of Enshi state, and Guizhou province, respectively. The project began crediting these stoves at the start of Issuance-2 on October 1st, 2010. Sales are retroactively included beginning with the signing date of the VERPAs; which are 18th November 2008 (Zhiqi) and 5 January 2009 (Huifeng).

This Monitoring Report (MR) documents the emissions reductions generated by project stoves in the monitoring period between 01st of March, 2013 and the 28th of February, 2015 (both days inclusive).

2. Project Description and Summary

The project 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 associated 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 1) 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 is 40.4%.³ Published research shows 8-15% traditional coal stove efficiencies when performance was measured in-homes, and lab testing of traditional coal stoves shows efficiencies of 20%.^{4,5}

¹ Project design change approved by the GS on April 29, 2013.

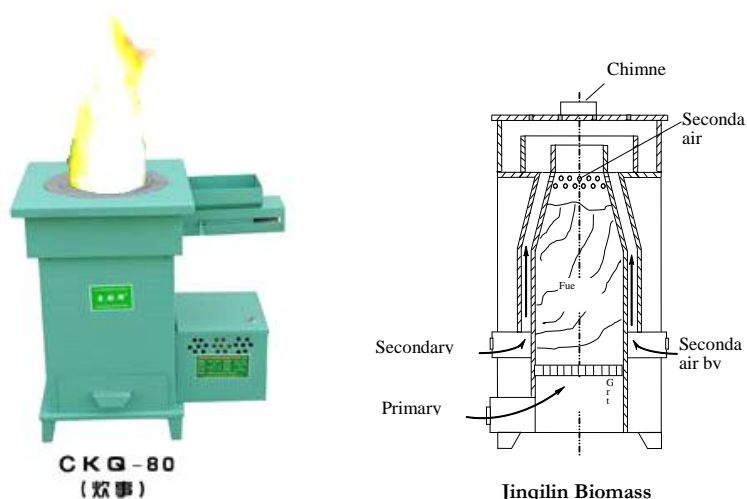
² The project is listed as “issued” on the GS project registry, having issued twice thus far. The project issued credits most recently in May 2013.

³ 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.

⁴ Thermal efficiency testing on traditional coal 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

⁵ 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.

Figure1. Technical specifications for Jinqilin improved stove



Jinqilin Stove Specifications		
Testing data ⁶	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 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.

The second verification included two new stove manufacturers- Enshi Zhiqi Biomass Science and Technology Co., Ltd (here within referred to as “Zhiqi”) and Anshun Huifeng Energy Saving Stove Company Ltd (here within referred to as “Huifeng”).

The Zhiqi improved stove 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 and 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.

⁶ Stove specifications certified by: Shanxi Mechanical Products Quality Supervision and Testing Center. Address: No.228 Shengli Street Taiyuan, Shanxi province. Tel. 0351-3184754

Figure 2. 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	φ290mm*62mm
Base size	440mm*440mm*140mm

The 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 users’ 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.

The Huifeng improved stove 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 and 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 3. 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	φ250mm*60mm
Base size	420mm*420mm*160mm

The 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 users’ cooking needs at the same time. The large stove size 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.

During the period from March 2009 through today, this project has achieved significant results in three areas: business development among local enterprise; social, economic and environmental co-benefits to local communities; and greenhouse gas emissions reductions.

The Project’s first implementing partner and stove manufacturer, Jinqilin, is transitioning from a make-shift village level business into an efficient and well-structured company exhibiting sustainable growth and improved practices. With assistance from project partners, Jinqilin has established sound business operating practices, including tracking of procurement and distribution supply chains, and expanded assembly and maintenance operations.

Jinqilin has developed a quality control system for the stove production process in order to increase the average lifetime of stoves sold. To this end, Jinqilin is also establishing a customer service system which will assist with end-user technical support. Since project inception Jinqilin’s reporting and record keeping has become progressively more clear, rigorous, and comprehensive. For carbon credit generation, the system was set up to provide a conservative catalogue of stoves distributed.

The Project now also credits stoves produced by two additional Manufacturing Partners; Enshi Zhiqi Biomass Energy Science and Technology Development Co. Ltd (Zhiqi) and Anshun Huifeng Energy Saving Stove Company Ltd (Huifeng). Zhiqi is based in Enshi, Hubei Province, China. Huifeng is based in Guizhou Province, China. Both companies manufacture, distribute and maintain stoves for local communities.



Both of these new Project Manufacturing Partners have developed quality control systems as well as mechanisms for customer support. In the last year, both Zhiqi and Huifeng were able to invest in additional and more advanced manufacturing equipment, which enables improved stove quality, as well as additional human capacity. Both Partners were also able to engage in market development activities, such as participating in stove exhibitions and demonstrations and gaining media exposure.



Figure 4. Stakeholders in Guizhou participate in a local stakeholder meeting. Overwhelmingly, stakeholders continue to provide positive feedback and are eager for carbon finance to increase rural residents' ability to access and benefit from these efficient technologies.

Clustering Definitions

Cluster Name	Project Technologies Distributed	Current Distribution	Implementing Partner
Shanxi Province	CKQ stove model	Direct Sales	Jinqilin Stove Manufacturers Ltd.
Enshi State	ZQ-JG-220 stove model	Direct Sales	Zhiqi Biomass Energy Science Technology Development Co. Ltd.
Guizhou Province	HK-HF-70 stove model	Direct Sales	Huifeng Energy Saving Stove Company Ltd.

Manufacturing Partners continue to undergo regular recordkeeping spot checks and receive regular business development support and feedback from the Project as part of capacity building and maintaining rigor of data quality.



Figure 5. Village level stove usage training ensures proper use, combined with overall improved customer service, increases the trust and reputation of the Manufacturing Companies. Depicted here is a Huifeng user training in Guizhou Province.



Figure 6. Workers are provided with a steady workflow, and a steady income, as a result of the business development introduced by the project proponents. Pictured here is an artisan crafting the Zhiqi stove.

In addition to business development, this project provides many ancillary benefits in Shanxi, Guizhou and Enshi. Locally, the project provides employment for significant numbers of workers, office staff and field technicians, and continues to do so as the companies grow - Zhiqi employed 22 employees in this monitoring period, Huifeng employed 47 employees, and Jinqilin employed 35 employees⁷. The program aims to reach underprivileged families, which normally cannot afford improved stoves, by subsidizing the manufacture and sale of high quality, long lasting stoves with financial subsidies. This is an opportunity that was not previously viable without carbon finance to help cover project implementation expenses during the credit period. This becomes increasingly true as the cost of raw materials and other manufacturing expenses rise – carbon finance is thus an integral component in both ensuring low-income families’ ability to afford and access the stoves and providing opportunity for Manufacturing Partners’ growth and scale.

⁷ As per information provided by manufacturers.



Figure 7. Traditional coal heating practices in Guizhou Province result in black stained kitchen floors from cooking indoors with coal fuels.

Reduced coal consumption, and subsequent cost savings for regular families using Jinqilin, Zhiqi and Huifeng stoves is a significant social benefit of this project. Families spend between 10% and 14% of their annual income and 14% to 17% of their total living expenditures on cooking fuels in rural settings in Shanxi, Enshi, and Guizhou.⁸

Once a family owns a stove, reduced coal consumption (and the subsequent financial savings and other benefits for families using Project Stoves) are evident social benefits of this project as well. In Shanxi, where low-income families spend as much as 12% of annual income on cooking fuels, the cost savings are immense: families using the Jinqilin stove can save an average of ¥1,961 RMB (US\$319) per year. Users provide positive feedback on the stove:



Figure 8. “I was one of the first persons to get a Jinqilin stove 4 years ago. Through a government subsidy program I was able to buy it for a good price. Before the stove, we would throw away our corn cobs. We had no use for them, so we burned them in the fields to get rid of them. Now we save our corn cobs and use it for fuel with our Jinqilin stove. It is so fast and easy to use, much better than the long wait time for our old coal stove. But what I like most about the stove, besides the convenience, is that since buying the stove I’ve saved so much money from not having to buy coal for cooking. It is wonderful, every home in our Shanxi should have one.”

The Project also introduces environmental benefits through reduced fossil fuel coal use. The dissemination of high-efficiency cooking stoves, in provinces in which more than 80% of the population cooks with traditional stoves and coal fuels, is an example of the kind of solution that is needed to address increasing trends of fossil fuel usage.

⁸ Calculated using self-reported coal prices from KS, average annual coal consumption for each region from the KPTs, and net income and living expenditure data from 1) China Yearly Provincial Macro Statistics, 2011 Basic Statistics for People’s Livelihood, 2) Enshi 2011 Statistical Yearbook, 9-8 Basic Conditions of Rural Households, and 3) Guizhou 2011 Statistical Yearbook, 10-1 People’s Livelihood in Urban and Rural Areas.

Project proponents have taken steps to prepare Manufacturing Partners for sustainable growth that could meet the future projected demand for stoves. First, the project proponents assisted with developing a monitoring and tracking system for stove sales. This has allowed Manufacturing Partners to better prepare for potential future cost barriers, as well as more accurately track customer locations and needs. With respect to the latter, the project proponents are assisting with the development of a customer service and technical maintenance division at the factories. This new division will help to ensure quality follow-up is available for both village level customer training as well as technical training related to maintenance issues. This new division addresses an important barrier to systemically changing fuel use in coal-rich Shanxi, which is the lack of a concerted and sophisticated customer service operation to create market trust and technological reliability.



Figure 9. Above Left: Raw coal being delivered and sold for cooking and heating in rural Shanxi. **Above Right:** Household corn yield being dried before the kernels are removed for sale. The remaining corn cobs will be saved for use with the Jinqilin stove.

Several new initiatives are planned to improve the customer service division:

- Setting up an increased sales network and stove production and promotion
- Expanded marketing activities and increased media exposure and awareness
- Enhance after-sales service
- Strengthen technology innovation based on user feedback
- Partnership with Cummins Emission Solution on stove design improvement

Site visits and Kitchen Surveys reveal that the project continues to achieve the intended social, economic, and environmental impacts. Kitchen Surveys also regularly assess the project's continued positive social impacts. Environmentally, the project achieves all positive impacts outlined in the PDD, as stove sales continue to reduce pressure on inefficient use and burning of fossil fuel coal. Economically, Manufacturing Partners continue to improve the limited incomes of impoverished rural Chinese families, and are also helping to improve their indoor air quality and health. Further detail can be found in the Kitchen Survey reports, **Annexes 04, 05, and 06**. Information on sustainable development indicators can also be found in Section 9 of this report.

Impact Carbon is focused on changing the household energy paradigm in China from inefficient and unhealthy cook stoves to efficient, improved stoves. Achieving this shift on a national scale requires sustained business development assistance and stove subsidies financed by expected carbon payments.

In 2013, with expectation of future emissions reductions from retroactive carbon credits, Huifeng planned to build new manufacturing facilities to handle expanded production and stove promotion. The new manufactory has been constructed and in use since May 2014. This facility also helps to ensure steady work for employees by allowing excess stoves to be stored in the storage facility prior to actual sales. The project proponents have also worked with Project Manufacturing Partners to improve the quality and durability of their stoves. During the

project period, all manufacturers bought more advanced manufacturing equipment. Jinqilin changed the location on the stove where fuel is added based on customer feedback.

The project proponents are also collaborating with Manufacturing Partners on creating a strategic vision for long-term growth. Jinqilin hopes to eventually reach poor rural households outside of Yangquan City, and has also begun to explore possible biomass pellet technologies that could be cost-competitive with coal fuels for communities with less biomass supplies. With carbon revenues, Jinqilin will have the resources to product test pellet technologies and new distribution networks in other regions of Shanxi.

New Project Manufacturing Partners, Zhiqi and Huifeng, also have strategic growth plans which primarily focus on reducing barriers to access for their customer population and making the stoves more affordable. Future carbon revenues will help to ensure the growth and availability of improved stove technologies in these regions.

3. Data and Parameters

Data and parameters fixed ex-ante

The tables below summarize the values of all validated and fixed ex-ante parameters, defined in the section B.6.2 of the registered PDD⁹.

Data / Parameter:	EF _{coal,CO2}
Data unit:	tons CO ₂ /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. 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 CH ₄ /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. 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 N ₂ O/TJ
Description:	Emission factor for fossil fuel coal
Source of data used:	IPCC default value for “other bituminous coal”

⁹ https://products.markit.com/br-reg/PublicReport.action?getDocumentById=true&document_id=103000000021468

Value applied:	0.0015
Justification of the choice of data or description of measurement methods and procedures actually applied:	Adopt IPCC default values. 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. 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	7.74 kg/day per household during usage season in Shanxi 13.92 kg/day per household during usage season in Hubei 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. 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:	Reviewed by VER Director
Any comment:	

Data and parameters monitored

Data / Parameter:	N _{y,i,c}
Data unit:	Number
Description:	Number of stoves sold in year y of technology i in cluster c
Source of data to be used:	Manufacturer sales database - Annex 12; Sales Record, Shanxi 2009 – Feb 2015 - Annex 13; Sales Record, Enshi, 2009 – Feb 2015 - Annex 14; Sales Record, Guizhou 2009 – Feb 2015

Value of data	Year	Shanxi	Guizhou	Enshi	Total
	2009	7,101	8,546	3,383	19,030
	2010	6,672	2,727	3,338	12,737
	2011	9,020	15,663	9,722	34,405
	2012	6,844	12,696	5,441	24,981
	2013	1,289	14,696	5,555	21,540
	2014	-	5,833	7,689	13,522
	2015 (Till 28 Feb.)	-	900	1,655	2,555
	Total	30,926	61,061	36,783	128,770
Description of measurement methods and procedures to be applied:	Sales cards are 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 is inputted into an electronic sales database categorized by village and date.				
QA/QC procedures to be applied:	A random sample of annual sales was selected for follow-up by the VER director. The combination of surveys and direct phone calls to households verifies the information in the electronic sales database.				
Any comment:	All data collected as part of monitoring is archived electronically and will be kept at least for 2 years after the end of the last crediting period.				

Data / Parameter:	$T_{\text{usagemonths, province}}$
Data unit:	Months
Description:	Average self-reported months of usage in cluster Shanxi/Enshi/Guizhou
Source of data to be used:	Kitchen Surveys
Value of data	9.54 months in Shanxi 4.94 months in Enshi 4.41 months in Guizhou
Description of measurement methods and procedures to be applied:	As per the methodological requirement, kitchen surveys were conducted for each province.
QA/QC procedures to be applied:	Reviewed by VER Director
Any comment:	All data collected as part of monitoring is 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:	Fraction

Description:	Cumulative annual usage rate for stove age y of stove technology i in cluster c																															
Source of data to be used:	Usage surveys (see specific sources in tables below)																															
Value of data	<table border="1"> <thead> <tr> <th>Shanxi - Parameter</th> <th>Value</th> <th>Units</th> <th>Source</th> </tr> </thead> <tbody> <tr> <td>Usage, Age 0-1</td> <td>100%</td> <td>fractional</td> <td>Usage survey & report: Jinqilin Stove Ages 0-1; (Already verified during last Monitoring)</td> </tr> <tr> <td>Usage, Age 1-2</td> <td>85%</td> <td>fractional</td> <td>Usage survey & report: Jinqilin Stove Ages 1-2; (Already verified during last Monitoring)</td> </tr> <tr> <td>Usage, Age 2-3</td> <td>85%</td> <td>fractional</td> <td>Usage survey & report: Jinqilin Stove Ages 2-3 (Already verified during last Monitoring)</td> </tr> <tr> <td>Usage, Age 3-4</td> <td>76%</td> <td>fractional</td> <td>Usage survey & report: Jinqilin Stove Ages 3-4 (Already verified during last Monitoring)</td> </tr> <tr> <td>Usage, Age 4-5</td> <td>56%</td> <td>fractional</td> <td>Usage survey & report: Jinqilin Stove Ages 4-5 (Annex – 08a)</td> </tr> <tr> <td>Usage, Age 5-6</td> <td>56%</td> <td>fractional</td> <td>Usage survey & report: Jinqilin Stove Ages 4-5 (Annex – 08a)</td> </tr> </tbody> </table>				Shanxi - Parameter	Value	Units	Source	Usage, Age 0-1	100%	fractional	Usage survey & report: Jinqilin Stove Ages 0-1; (Already verified during last Monitoring)	Usage, Age 1-2	85%	fractional	Usage survey & report: Jinqilin Stove Ages 1-2; (Already verified during last Monitoring)	Usage, Age 2-3	85%	fractional	Usage survey & report: Jinqilin Stove Ages 2-3 (Already verified during last Monitoring)	Usage, Age 3-4	76%	fractional	Usage survey & report: Jinqilin Stove Ages 3-4 (Already verified during last Monitoring)	Usage, Age 4-5	56%	fractional	Usage survey & report: Jinqilin Stove Ages 4-5 (Annex – 08a)	Usage, Age 5-6	56%	fractional	Usage survey & report: Jinqilin Stove Ages 4-5 (Annex – 08a)
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	Usage, Age 1-2	100%	fractional	Usage survey & report: Huifeng Stove Ages 1-2; (Already verified during last Monitoring)																												
	Usage, Age 2-3	100%	fractional	Usage survey & report: Huifeng Stove Ages 2-3 (Already verified during last Monitoring)																												
	Usage, Age 3-4	100%	fractional	Usage survey & report: Huifeng Stove Ages 3-4 (Already verified during last Monitoring)																												
	Usage, Age 4-5	86%	fractional	Usage survey & report: Huifeng Stove Ages 4-5 (Annex – 08c)																												
	Usage, Age 5-6	86%	fractional	Usage survey & report: Huifeng Stove Ages 4-5 (Annex – 08c)																												
	<table border="1"> <thead> <tr> <th>Enshi - Parameter</th> <th>Value</th> <th>Units</th> <th>Source</th> </tr> </thead> <tbody> <tr> <td>Usage, Age 0-1</td> <td>100%</td> <td>fractional</td> <td>Usage survey & report: Zhiqi Stove Ages 0-1; (Already verified during last Monitoring)</td> </tr> <tr> <td>Usage, Age 1-2</td> <td>100%</td> <td>fractional</td> <td>Usage survey & report: Zhiqi Stove Ages 1-2; (Already verified during last Monitoring)</td> </tr> <tr> <td>Usage, Age 2-3</td> <td>100%</td> <td>fractional</td> <td>Usage survey & report: Zhiqi Stove Ages 2-3 (Already verified during last Monitoring)</td> </tr> <tr> <td>Usage, Age 3-4</td> <td>100%</td> <td>fractional</td> <td>Usage survey & report: Zhiqi Stove Ages 3-4 (Already verified during last Monitoring)</td> </tr> <tr> <td>Usage, Age 4-5</td> <td>89%</td> <td>fractional</td> <td>Usage survey & report: Zhiqi Stove Ages 4-5 (Annex – 08b)</td> </tr> <tr> <td>Usage, Age 5-6</td> <td>89%</td> <td>fractional</td> <td>Usage survey & report: Zhiqi Stove Ages 4-5 (Annex – 08b)</td> </tr> </tbody> </table>				Enshi - Parameter	Value	Units	Source	Usage, Age 0-1	100%	fractional	Usage survey & report: Zhiqi Stove Ages 0-1; (Already verified during last Monitoring)	Usage, Age 1-2	100%	fractional	Usage survey & report: Zhiqi Stove Ages 1-2; (Already verified during last Monitoring)	Usage, Age 2-3	100%	fractional	Usage survey & report: Zhiqi Stove Ages 2-3 (Already verified during last Monitoring)	Usage, Age 3-4	100%	fractional	Usage survey & report: Zhiqi Stove Ages 3-4 (Already verified during last Monitoring)	Usage, Age 4-5	89%	fractional	Usage survey & report: Zhiqi Stove Ages 4-5 (Annex – 08b)	Usage, Age 5-6	89%	fractional	Usage survey & report: Zhiqi Stove Ages 4-5 (Annex – 08b)
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For the first two months of 2015, Usage Factor of Age 4-5 has been applied.																																
Description of measurement methods and procedures to be applied:	As per the methodological requirement, usage surveys were conducted in each Province for this this monitoring period on stoves ages 4-5.																															

QA/QC procedures to be applied:	A random sample of stoves was selected from the current monitoring period's Sales Record of for follow-up by the 3 rd party BUCT monitoring team. A combination of household visits and phone calls to households verified information in the electronic sales database and determine usage drop-off rates. 82%, 84%, and 74% of interviews were conducted through a household visit in Shanxi, Enshi, Guizhou, respectively.
Any comment:	For increased accuracy, usage factors are assessed annually rather than biennially. These numbers are applied to each year. Previous usage survey data for all clusters was verified for Ages 0-1, 1-2, 2-3 and 3-4. For stoves Ages 4-5, refer to Annex 08a Usage Monitoring Report, Shanxi; Annex 08b Usage Report, Enshi and Annex 08c Usage Report, Guizhou . All data collected as part of monitoring is 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 /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:	Kitchen Survey submitted as Annex 01 to 03.
Value of data	Shanxi = 0 Guizhou = 0 Enshi = 0
Description of measurement methods and procedures to be applied:	Per GS VER Methodology: "" Monitoring Kitchen Survey should be done to reassess the kitchen regime. The same has been done and submitted. It is clear from the MKS that none of the HH has purchased coal after using the project stove. Hence the net quantity of cola consumed per day in the project activity by traditional or project stoves in the project household with improved stove technology are 0.
QA/QC procedures to be applied:	Reviewed by VER Director
Any comment:	All data collected as part of monitoring is 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	No pellets have been distributed yet.

Description of measurement methods and procedures to be applied:	The project does not currently use biomass pellet fuels in the project activity. This parameter will be assessed during the relevant future verification period once a biomass pellet technology has been identified and installed in the project activity.
QA/QC procedures to be applied:	Reviewed 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:	$EF_{\text{Pellet Machine},i,c}$
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:	No pellets have been distributed yet.
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. $EF_{\text{Pellet Machine},i,c}$ 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:	No pellets have been distributed yet.
QA/QC procedures to be applied:	Reviewed by VER Director
Any comment:	None

Data / Parameter:	$EC_{pj,y,i,c}$
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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:	No pellets have been distributed yet.
QA/QC procedures to be applied:	Reviewed 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:	No pellets have been distributed yet.
QA/QC procedures to be applied:	Reviewed 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:	$LE_{p,j,y,c,i}$
Data unit:	tCO ₂ /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:	Multiple, see Annex 15, Leakage Assessment
Value of data	Negligible (See Section 5)

Description of measurement methods and procedures to be applied:	Leakage is assessed biennially using actual sales records. Leakage assessments have been conducted for each issuance period, summarized in Section 5 and Annex 20.
QA/QC procedures applied:	Reviewed 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:	Quarterly Kitchen Surveys were conducted in this monitoring period to assess the impact of the sustainability indicators listed in the GS Passport. See the following annexes: <ul style="list-style-type: none"> - Annex 04; KS Report, Shanxi - Annex 05; KS Report, Enshi - Annex 06; KS Report, Guizhou
Value of data	Refer to Sustainability Monitoring in Section 9 of the Monitoring Report
Description of measurement methods and procedures to be applied:	Per GS VER Methodology, <i>“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.”</i> Quarterly Kitchen Survey data collected in each Province for this Monitoring Period was used to assess and report the project’s impact on the sustainable indicators as outlined in the GS Passport, Section G: Sustainability Monitoring Plan. The results of this monitoring and details on the Project’s achievements are outlined in the Monitoring Report Section 2 “Project description and summary.”
QA/QC procedures to be applied:	Reviewed by VER Director
Any comment:	All data collected as part of monitoring is archived electronically and will be kept at least for 2 years after the end of the last crediting period.

Data / Parameter:	f_{NRB}
Data unit:	Fraction
Description:	Fraction of non-renewable biomass
Source of data to be used:	Biennial study
Value of data	0

Description of measurement methods and procedures to be applied:	A biennial study evaluates f_{NRB} for each applicable region using fuelwood in the project activity. Publicly available literature, government statistics, study data and KS Survey are used to determine f_{NRB} . The study was based on the principles of renewability outlined by the CDM AMS II.G methodology. For detailed study please refer to Annex-22 and Annex-23.
QA/QC procedures to be applied:	Reviewed 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.

Table 1. Summary of Monitored Parameters

		Monitored Parameter Description				Values for each Cluster					
Item	Revised Description	Revised Parameter	Unit	Frequency	Tool	Shanxi		Enshi		Guizhou	
1	Number of units installed of technology i in year y to cluster c	$N_{y,c,i}$	# units/yr	On-going	Sales Database	30,926		36,783		61,061	
2	Percent sales of project technology i in year y to cluster c to baseline fuel group coal users	$S_{bl,coal}$	%	Annual	Kitchen Survey	94.87% (baseline coal use during non-heating season)		96.33% (baseline coal use during heating season)		90.36% (baseline coal use during heating season)	
3	The mass of coal consumed daily during the project activity in traditional coal stoves by project households with project stove technology ¹⁰	$AF_{py,Dcoal,c}$	kg / day	As necessary	Kitchen Test	0.00		0.00		0.00	
4	Usage of project technologies in place	$U_{y,c,i}$	%	Biennial	Usage Survey	Age 0-1	100%	Age 0-1	100%	Age 0-1	100%
						Age 1-2	85%	Age 1-2	100%	Age 1-2	100%
						Age 2-3	85%	Age 2-3	100%	Age 2-3	100%
						Age 3-4	76%	Age 3-4	100%	Age 3-4	100%
						Age 4-5	56%	Age 4-5	89%	Age 4-5	86%
						Age 5-6	56%	Age 5-6	89%	Age 5-6	86%
5	Average self-reported months of usage	$T_{usage\ months,c}$	months / year	On-going for KS, Biennial for KT	Shanxi – KT Enshi – KS Huizhou - KS	9.54		4.94		4.41	
Item	Revised Description	Revised Parameter	Unit	Frequency	Tool	Shanxi		Enshi		Guizhou	
7	Leakage from project technologies	$LE_{pj,c}$	tCO ₂ e/stove-	Biennial	Study	Negligible		Negligible		Negligible	

¹⁰ The values listed for this parameter represent coal per day consumption during the usage months of the project activity.

			lifetime					
8	CO ₂ emission factor for coal fuel	EF _{coal,co2}	kg CO ₂ /TJ	Fixed	IPCC Default	94600		
9	CH ₄ emission factor for coal fuel	EF _{coal,CH4}	kg CH ₄ /TJ	Fixed	IPCC Default	300		
10	N ₂ O emission factor for coal fuel	EF _{coal,N2O}	kg N ₂ O/TJ	Fixed	IPCC Default	1.5		
11	Net calorific value of coal	NCV _{coal}	TJ / Gg	Fixed	IPCC Default	25.8		
12	Global warming potential of CO ₂	GWP _{CO2}		Fixed	IPCC Default	1		
13	Global warming potential of CH ₄	GWP _{CH4}		Fixed	IPCC Default	25		
14	Global warming potential of N ₂ O	GWP _{N2O}		Fixed	IPCC Default	298		

Project Forward Action Requests

Table 2 below outlines the forward action requests (FARs) issued from previous project verification as well as PP actions fulfilled this issuance period to meet these requests.

Table 2. FARs

Issuance	FAR #	Description	PP Comment
3	FAR 1	The follow up with users in major sales regions performed by the provider in order to collect information on stoves that require maintenance is to be checked during next verification process as well as the result of actions undertaken.	<p>The PP has checked the improved stove maintenance in Enshi Region, and interviewed with Anshun stove manufacturer, Huifeng from Guizhou Province. The fact is that Huifeng, has offered an additional grate with each stove sold at no additional charge. In addition, the company is following up with users in major sales regions to collect information on stoves that require maintenance. Huifeng will offer repairs to all stoves that require it. Once again, warranty cards provide contact information for end users to contact the manufacturer directly if they are dissatisfied with their stove or its performance – the manufacturer also services stove repairs through this channel.</p> <p>Relevant manufacturers in three clusters, Jinqilin, Huifeng and Zhiqi are also exploring alternative stove materials that will extend the life of the grate.</p> <p>Stove service cards are being submitted to the DOE¹¹. For any maintenance of the stoves the user can just call the company</p>

¹¹ Submitted as Annex 16, 17 and 18 to DOE MR, 01 March 2013 – 28 February 2015

Carbon Calculator Inputs:

Based on the fuel consumption values determined by the Kitchen Tests conducted the Kitchen Survey data collected for this Monitoring Period, the estimated emissions reduction per stove year is calculated as following:

Shanxi	5.29 tCO ₂ e/stove-year
Enshi	5.33 tCO ₂ e/stove-year
Guizhou	4.16 tCO ₂ e/stove-year

(Detailed calculations of the ER values can be found in the Issuance 4 Project Calculation Files).

Annual emission reductions (ERs) are based on the mean value (according to 90/30 rule) for daily baseline coal use, annual usage drop-off rates, and average self-reported heating months during which the Project stove is used

4. Emission Reductions Calculations

Table 3 shows the CO₂e emissions reductions achieved during the project period reported by the GS VER project *Clean and Efficient Cooking and Heating Project, China*. Crediting for these stoves is for the Issuance 4 crediting period (01 March 2013 – 28 February 2015).

Table 3. Summary of emission reductions during crediting period 01 March 2013 – 28 February 2015:

Verification Period 01 March 2013 – 28 February 2015									
	Cluster	Shanxi		Guizhou		Enshi		Leakage	Total ERs
Year	Quarter	Stove Years	tCO ₂ e	Stove Years	tCO ₂ e	Stove Years	tCO ₂ e		
2013	1 Mar - 31 Mar	2,173	11,494	3,659	15,223	1,904	10,148	-	36,865
	Q2	6,211	32,854	11,804	49,106	5,591	29,799	-	111,759
	Q3	6,142	32,489	11,265	46,863	5,664	30,188	-	109,540
	Q4	6,035	31,927	13,289	55,282	6,231	33,210	-	120,419
2014	Q1	5,822	30,798	13,335	55,474	6,875	36,644	-	122,916
	Q2	5,746	30,397	14,030	58,365	6,981	37,206	-	125,968
	Q3	5,593	29,586	14,490	60,277	7,056	37,610	-	127,473
	Q4	5,454	28,853	14,670	61,029	7,915	42,188	-	132,070
2015	1 Jan - 28 Feb	3,452	18,261	9,559	39,764	5,754	30,669	-	88,694
Total		46,628	246,659	106,103	441,383	53,971	287,662	-	975,704

Total Vintage 2013	378,583
Total Vintage 2014	508,427
Total Vintage 2015	88,694
Total	975,704

Comparison of actual emission reductions or net GHG removals by sinks with estimates in registered PDD (Design change version)

Item	Values estimated in ex ante calculation of registered PD	Actual values achieved during this monitoring period
Emission reductions or GHG removals by sinks (t CO ₂ e)	1,338,599 ¹²	975,704

Remarks on difference from estimated value in registered PD

The actual emission reductions are approximate 25% lower as compared to ex-ante calculation on the registered PDD (Design change version). It is because the drop in usage rate. The actual values are less than the estimated values, hence it is conservative.

Explanation of Emission Reduction Calculations

The Emissions Reduction (ER) Calculator calculates total emissions reductions on a quarterly basis for each stove in the Project Database. The ER Calculator is run separately for each cluster of stoves defined for the project.

The calculator accounts for the day that each stove begins use and calculates the usage of each stove in each quarter. It factors in the monitored annual drop-off in usage as stoves age, and other monitored parameters¹³. Stove usage is calculated in stove-years¹⁴, the number of stove days the stove was used divided by 365 (days). Quarterly usage¹⁵ (stove-years) for the cluster is multiplied by the emissions reduction per stove-year (tCO₂e/stove-year) calculated in the PDD to quantify total ERs per project quarter.

The ‘Parameters’ worksheet of each ER Calculation workbook states ‘Usage Rates’, and ‘Emission Reductions’ (tCO₂e/stove-year). Project sales are listed in the ‘Project Database’ worksheet.

Stove quantities and ‘Usage Start-Dates’ are sourced from the ‘Usage Record’ worksheets. These ‘Use’ worksheets calculate usage on a daily basis for each day of the project period (x-axis) for each ‘Usage Start-Date’ and the corresponding stove quantity (y-axis). The ‘Use’ worksheets are separate to account for stove usage at different ages: Usage for all stoves aged 0 - 1 year, which are in their 1st year of use, is accounted in the ‘Age 0-1’ worksheet. Usage for all stoves aged 1 – 2 years, which are in their 2nd year of use, is accounted in the ‘Age 1-2’ worksheet and so on.

Daily stove use (stove-days) is calculated using Annual Usage Rates for stoves of different ages (age_{i,j}). The Annual Usage Rates are calculated to reflect annual usage drop-off from the Cumulative Usage Rates (CumUi) determined in the monitoring studies below. The Annual Usage Rate (age_{i,j}) is the average annual drop-off in usage. That rate is applied to all stoves equally over the full year they are of a given age (Age 0-1, Age 1-2, etc.).

¹² 497,102 (for 2013), 715,296 (for 2014) and 126,201 (for 2015) tCO₂e, yearly emission reductions in the registered PDD (Design change version). The figures are calculated as monthly pro-rata basis for year 2013(10 Months) and 2015 (2 Months).

¹³ The full set of parameters is given in the monitoring tables below.

¹⁴ Stove years are the number of days that the stove was used divided by the number of days in the year. So, for example, one stove-day may be 1/365th stove year. In the case of a leap-year, this is accounted for – the tab in the calculator lists out all of the days in a year, giving each day its own row; on leap-years, this day is automatically considered. This can be checked in the “Project Database” tab of the calculator files. For every stove that goes into use, the stove-days are tracked in the calculator and added up. The tCO₂e value as measured by the KPT (and adjusted based on seasonal months of usage as explained in the MR and on site) is used to calculate tons of CO₂e reduced per stove-year; factoring in stove years enables the calculator to account for the fact that not all stoves are used for 100% of each usage season (for example, some are sold later in the season, whereas others may have been in use and then go out of use, based on the usage monitoring). This method of calculation has been verified for 3 GS projects, including this China project.

¹⁵ Excel Worksheet: Summary ERs

Per Gold Standard and DOE request, PP has improved the sampling approach for usage surveys and has applied random sampling to sales made in the first year of the project (as opposed to following a cohort of stoves).

Calculating Annual Usage Rates (age_i) from Cumulative Usage Rates (CumU_i) is straightforward: If 100 of 100 monitored stoves are still in use after one year, the Cumulative Usage Rate (CumU₁) after one year is 100%. If 50 of the original 100 stoves are still in use after two years, the Cumulative Usage Rate (CumU₂) after two years is 50%. The Annual Usage Rate (age_{0_1}) in year 1 is 100%. The Annual Usage Rate (age_{1_2}) in year 2 is 75% ((100%+50%)/2) and so on.

Once daily stove usage (stove-days) is accounted in the 'Use' worksheets for stoves from each 'Usage Start-Date', it is converted to stove-years by dividing stove-days by 365. Stove-years of usage are aggregated on a quarterly basis in the 'ER Calculations' worksheet.

Finally, on the 'ER Calculations' worksheet, aggregate quarterly stove use (stove-years) is multiplied by ERs per stove-year (tCO_{2e}/stove-year) to calculate total ERs on a quarterly basis. The values from the 'ER Calculations' worksheet provides a summary of ERs for the current verification crediting period.

5. Leakage Assessment

The PDD outlines the data and information that is to be collected in order to monitor leakage effects of the project activity. In accordance with Gold Standard VER methodology "Improved Cookstove Kitchen Regime-V.02, "the project assessed each of the listed forms of leakage. The project finds leakage in section 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*" (see analysis below) . No leakage is found for fuel production in the project activity since pellets were not used. Leakage is, however, applied for stove transport in the project activity.

Table 4.Leakage Assessment for each Stove Manufacturer (from PDD Section B.6.1)

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.

Jinqilin (Shanxi): The project now credits actual months of use for the Jinqilin stove, starting with the Aging KPT in 2011 (as can be found in Footnote 8, the project was previously crediting "non-heating" months only; this was deemed to be less accurate as many users actually use the stove outside of the heating season as well; therefore, now the project begins to ask users about actual months of Jinqilin use; the project then uses a weighted fuel savings to account for this switch in this verification. The duration of months used was determined from over 400 kitchen surveys. During winter months in which light space-heating is required, users continue to use the Jinqilin stove for cooking as well as for heating purposes. The project conservatively applies non-heating season coal use values (coal used for cooking) to the heating season usage. This is conservative because heating requirements during the winter season are much higher than for cooking in non-heating season. Therefore the project conservatively under-credits the coal actually replaced in the winter by Jinqilin users, as a KPT done in this season would likely demonstrate that users actually consume more coal during the winter in the baseline scenario. In absence of this data, the project conservatively assumes that the values measured in the non-heating months are applicable year-round.

Zhiqi (Enshi): The Project conservatively assumes that the Zhiqi improved stove is not used during most of the non-heating months and credits only 4.94 usage months of displaced coal used for heating. The duration of heating and non-heating months was determined from cumulative quarterly kitchen surveys. During months in which space-heating is not required, it is assumed that local users revert to traditional stoves or electric stoves, and discontinue use of the improved stove. Although it is possible that some biomass stoves are used during the non-heating season for cooking, the project conservatively excludes coal replacement during non-heating heating months due to biomass stove use.

Huifeng (Guizhou): The Project conservatively assumes that the Huifeng improved stove is not used during most of the non-heating months and credits only 4.41 heating months of displaced coal used for heating. The duration of heating and non-heating months was determined from cumulative quarterly kitchen surveys. During months in which space-heating is not required, it is assumed that local users revert to traditional stoves and electric stoves, and discontinue use of the improved stove. Although it is possible that some biomass stoves are used during the non-heating season for cooking, the project conservatively excludes coal replacement during non-heating heating months due to biomass stove use.

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): 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 sold during the 3rd verification period have been distributed locally within their respective Provinces.

Jinqilin (Shanxi): During MR 4 - 1,047 Jinqilin stoves, weighing 45 kg each, were trucked in bulk 26 times to villages in Yu County. Each delivery truck contained about 42 stoves, weighed approximately 2 tonnes, and furthest possible distance it travelled was 67 km to the village delivery site. Applying a conservative mid-point estimate of 0.12427 kgCO₂/ton-km, total transport emission is 0.375 kg CO₂, or 0.008% of total annual stove emission reductions. No leakage is applied as transport emissions are insignificant by virtue of constituting less than 1% of overall emissions.

Zhiqi (Enshi): During MR 4 - 14,372 Zhiqi stoves, weighing 42.8 kg each, were trucked in bulk 455 times to villages in Enshi State. Each delivery truck contained an average of 30 stoves, weighed approximately 1.31 tonnes, and the furthest possible distance it travelled was 107 km from Enshi City to the village delivery site. Applying the a conservative mid-point estimate of 0.12427 kgCO₂/ton-km, total transport emission is 0.57 kg CO₂ per stove, or 0.01% of total annual stove emission reductions. No leakage is applied as transport emissions are insignificant by virtue of constituting less than 1% of overall emissions.

Huifeng (Guizhou): During MR 4 - 19,318Huifeng stoves, weighing 40 kg each, were trucked in bulk 88 times to villages in Guizhou Province. Each delivery truck contained an average of 58 stoves, weighed approximately 2.31 tonnes, and the furthest possible distance it travelled was 171 km to the village delivery site. Applying a conservative mid-point estimate of 0.12427 kgCO₂/ton-km, total transport emission is 0.85 kg CO₂ per stove, or 0.020% of total annual stove emission reductions. No leakage is applied as transport emissions are insignificant by virtue of constituting less than 1% of overall emissions

Please see **Annex 15** for the full leakage calculations and details on the number and distance of deliveries made in all three provinces for Issuance 4.

6. Project Database: Quality assurance

Both Partners have established recordkeeping systems that enable them to meet the monitoring requirements in GS VER "Methodology for Improved Cook-stoves and Kitchen Regimes V.02 – 08/02/2010," Page 22: all stove sales 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 Partners ensure that the electronic database is updated to ensure no double counting. Monitoring of parameter values can be found in Section 3.

In accordance with the Project's PDD Section B.7.1. *Data and parameters monitored*, careful attention has been paid to the accuracy of the sales record. As explained in this section, the Project Database for each manufacturer is a conservative record of all stoves that have entered use.

The project began in 2008 selling and distributing stoves with the expectation of carbon finance to assist with carbon asset development costs and stove subsidies. In 2009, a system was set up to track stoves sold. The current system does not count stoves that go missing from the Factories to further ensure conservativeness; only invoiced sales are credited.

Method of Collection:

A Project Database is kept electronically by Impact Carbon: each Excel Calculator a tab titled *Project Database*. The database logs how many stoves entered use on each day based on the sales records (Annexes 12, 13 and 14). Impact Carbon maintains this file as a password protected excel document.

The Project Database is created from the Manufacturers' Sales Records. The Sales Records log sales and distribution information in an excel spread sheet. Manufacturers save paper sales receipts that allow cross checks of sales. The sales records were checked by the Beijing based Ministry of Agriculture NGO – China Association for Rural Energy Industries (CAREI). CAREI audited sales entries and contacted customers to confirm that sales records were accurate. Paper invoices and receipts are saved to provide an additional cross-check.

Project Database Electronic Record History:

Project Manufacturers supplement their paper sales record with an electronic record stored in Microsoft Excel. The electronic file records the day of sale, county and village, and number of stoves sold.

7. The Detailed Customer Database

The Detailed Customer Database is maintained by Impact Carbon to capture records of Kitchen Survey interviews.

Project Database Information

Sales cards are collected for each stove at the point of sale. The card includes the user's name and contact information. End user information is inputted into an electronic sales database categorized by location and date. CAREI verifies the sales database against paper sales cards, follow-up phone calls and site visits.

8. Quality Assurance

Quality assurance measures have been implemented by the China Association for Rural Energy Industries (CAREI). CAREI is a Chinese non-profit staffed by rural energy experts based in Beijing, China. CAREI is housed under a branch of the China Ministry of Agriculture (MOA), and was founded by previous MOA minister Madam Deng Keyun. CAREI was instrumental in the 1980's and 1990's in organizing MOA's National Improved Stove Program (NISP) that disseminated over 180 million improved stoves throughout China. Although the NISP stoves are now considered inefficient and "traditional" by today's standards, CAREI continues monitoring and evaluation, and outreach efforts to sustain the rural energy infrastructure set up by the NISP. CAREI has extensive experience developing and employing household energy survey tools, and with assistance from Dr. Liu Guangqing, Professor of Environmental Engineering at the Beijing University of Chemical Technology, has extensive experience conducting trainings in customer and group assessment. To date, CAREI and BUCT have conducted extensive surveys and site visits to verify all Manufacturing Partners' sales records. CAREI and BUCT are also responsible for applying random spot checks by calling the phone numbers on sales cards to ensure the validity of information gathered. CAREI continues to work with each Manufacturing Partner to implement a system of precise and accurate production and inventory accounting.

The BUCT monitoring team consists of 3 professors, 3 Ph.D. students and 4 master students. The professors are in charge of overall supervision and consulting work. Students are responsible for on-site monitoring, data input and analysis, and record keeping. In 2008 and 2009, 3 Ph.D. students were trained by and assisted Berkeley Air Monitoring Group to conduct a kitchen survey (KS), kitchen performance test (KPT) and indoor air pollution (IAP) monitoring in more 700 HHs in Yu County and Pingding County in Shanxi, and Tongliang County in Chongqing. All the activities were conducted to monitor and evaluate the effectiveness of improved biomass stoves for USEPA project “Scale-up of High-Efficiency Low-Emissions Biomass Household Stoves in Western China” as well as for the development of carbon project activities by the project team. Subsequently, the Ph.D. students have trained other BUCT surveyors in monitoring techniques, data processing, and quality control. The training program begins with intensive class training of KS and KPT forms in the lab. Surveyors then conduct pilot interviews and practice fuel weighing to harmonize methods and techniques, and may go to the field after demonstrating competency.

The data collection and field measurements included pre-field deployment training of field personnel, including training through pilot testing that helped to ensure high response rates and harmonization of enumerators. Field teams were trained by team leaders who had conducted previous KPT and Survey testing in other regions of China (eg. In Shanxi Province for GS ID#949 that have previously verified and issued credits). The survey methods and questionnaires have been field tested multiple times throughout China, which helps ensure reliable data and unbiased data. Two enumerators were used to provide data transfer between paper to electronic records, and the paired enumerators subsequently cross-checked each other’s data input.

Both BUCT and CAREI ensure Quality Assurance for the program.

Sustainable development indicators

The project has monitored the SD indicators according the registered Monitoring plan as outlined in the registered Passport. Project achievements have been outlined in the Monitoring Report Section 2 “Project description and summary.” The following table monitors the most sensitive sustainable development indicators:

Table 5. Sustainable Development Indicators

Sustainable Development Indicator	Monitoring source	Variables, Units and Frequency of Measurements	Monitored result																																																																																				
<i>Air quality</i>	Fuel Use Monitoring Report, Kitchen Surveys managed by China Association of Rural Energy Industries and Beijing University of Chemical Technology	<i>Air pollutants (CO, particulates); measured annually</i>	<p>As stated in the PDD Section A2, improved stoves generally reduce indoor air pollution and improve air quality.</p> <p>In every province, all users report their improved stoves reduce cooking time, fuel use, fuel cost, smoke, symptoms of coughing and eye irritation, and are easier to use. See summaries of self-reported stove performance evaluations collected through kitchen surveys for each province below.</p> <p>Shanxi</p> <table border="1"> <thead> <tr> <th>Indicator</th> <th>More</th> <th>Less</th> <th>Same</th> </tr> </thead> <tbody> <tr> <td>Cooking time</td> <td>0</td> <td>120</td> <td>0</td> </tr> <tr> <td>Fuel use</td> <td>0</td> <td>120</td> <td>0</td> </tr> <tr> <td>Fuel expense</td> <td>0</td> <td>120</td> <td>0</td> </tr> <tr> <td>Ease of use</td> <td>120</td> <td>0</td> <td>0</td> </tr> <tr> <td>Amount of smoke</td> <td>0</td> <td>120</td> <td>0</td> </tr> <tr> <td>Coughing & eye irritation</td> <td>0</td> <td>120</td> <td>0</td> </tr> </tbody> </table> <p>Enshi</p> <table border="1"> <thead> <tr> <th>Indicator</th> <th>More</th> <th>Less</th> <th>Same</th> </tr> </thead> <tbody> <tr> <td>Cooking time</td> <td>0</td> <td>141</td> <td>9</td> </tr> <tr> <td>Fuel use</td> <td>0</td> <td>145</td> <td>5</td> </tr> <tr> <td>Fuel expense</td> <td>0</td> <td>149</td> <td>1</td> </tr> <tr> <td>Ease of use</td> <td>150</td> <td>0</td> <td>0</td> </tr> <tr> <td>Amount of smoke</td> <td>0</td> <td>150</td> <td>0</td> </tr> <tr> <td>Coughing & eye irritation</td> <td>0</td> <td>150</td> <td>0</td> </tr> </tbody> </table> <p>Guizhou</p> <table border="1"> <thead> <tr> <th>Indicator</th> <th>More</th> <th>Less</th> <th>Same</th> </tr> </thead> <tbody> <tr> <td>Cooking time</td> <td>0</td> <td>224</td> <td>16</td> </tr> <tr> <td>Fuel use</td> <td>0</td> <td>237</td> <td>3</td> </tr> <tr> <td>Fuel expense</td> <td>0</td> <td>240</td> <td>0</td> </tr> <tr> <td>Ease of use</td> <td>240</td> <td>0</td> <td>0</td> </tr> <tr> <td>Amount of smoke</td> <td>0</td> <td>240</td> <td>0</td> </tr> <tr> <td>Coughing & eye irritation</td> <td>0</td> <td>240</td> <td>0</td> </tr> </tbody> </table> <p>Biennial Kitchen Performance Tests further assesses air quality impacts of the Project stoves.</p>	Indicator	More	Less	Same	Cooking time	0	120	0	Fuel use	0	120	0	Fuel expense	0	120	0	Ease of use	120	0	0	Amount of smoke	0	120	0	Coughing & eye irritation	0	120	0	Indicator	More	Less	Same	Cooking time	0	141	9	Fuel use	0	145	5	Fuel expense	0	149	1	Ease of use	150	0	0	Amount of smoke	0	150	0	Coughing & eye irritation	0	150	0	Indicator	More	Less	Same	Cooking time	0	224	16	Fuel use	0	237	3	Fuel expense	0	240	0	Ease of use	240	0	0	Amount of smoke	0	240	0	Coughing & eye irritation	0	240	0
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<i>Livelihood of the poor</i>	KS/KPT Reports. Kitchen Surveys and Fuel Performance Tests managed	<i>Financial impact; measured annually</i>	The impact of the Project on livelihood of the poor was monitored by the amount of money saved by Project stove users based on the price of coal and the amount of fuel savings recorded in the Kitchen Performance Test.																																																																																				

	<p>by China Association of Rural Energy Industries and Beijing University of Chemical Technology.</p>		<p>The Project continues to increase the spending power of lower income residents by reducing the amount families must spend on coal.</p> <p>Shanxi: Based on ex-ante surveys and monitoring, the average household using a Jinqilin stove saves 2.83 tonnes of coal per year.¹⁶ The average self-reported coal price (collected through kitchen surveys) in Shanxi was \$694 RMB/ton (US \$112), therefore the Jinqilin stoves saves households an average of \$1,961 RMB (US \$319) per year.</p> <p>Enshi and Guizhou: Where coal is completely replaced with biomass (i.e baseline consumption equals savings), households saved an average of \$2,205 and \$2,152 RMB respectively (based on self-reported coal prices collected through kitchen surveys). The average baseline coal consumption costs and their percentage of the average household's annual income and living expenditures for each Province is presented in the table below.</p> <p>Household Coal Expenditure by Province</p>
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¹⁶ Reported as $AF_{bl,Acoal,c}$.

			Calculations - Financial Impacts of Project Activity			
			Shanxi	Enshi	Guizhou	
			Self-Reported Cost per coal ton (from KS)	¥ 694	¥ 1,035	¥ 1,244
			Avg. HH Baseline Coal Consumption (tons/year) (from KPT)	2.83	2.13	1.73
			Total Annual HH Coal Cost	¥ 1,961	¥ 2,205	¥ 2,152
			Average # people per household (from KS)	3.02	3.93	4.36
			Avg Annual Net Income per capita[1]	¥ 5,601	¥ 5,832	¥ 3,472
			Avg Annual Living Expenditure per capita[2]	¥ 4,587	¥ 4,091	¥ 2,852
			Average Annual Net Income-household	¥ 16,915	¥ 22,920	¥ 15,138
			Average Annual Living expenditure-household	¥ 13,853	¥ 16,078	¥ 12,435
			% fuel of total income	12%	10%	14%
			% fuel of total living expenditures	14%	14%	17%
			<p>[1] China Yearly Provincial Macro Statistics, 2011 Basic Statistics for People's Livelihood, 2) Hubei 2011 Statistical Yearbook, 9-8 Basic Conditions of Rural Households, and 3) Guizhou 2011 Statistical Yearbook, 10-1 People's Livelihood in Urban and Rural Areas.</p> <p>[2] Ibid.</p> <p>Providing upfront financing in the form of partial subsidies not only assists in expanding the market for cleaner burning and more efficient stoves, but also helps to ameliorate the large economic burden resulting from a reliance on coal for year round cooking needs.</p>			
<i>Access to Affordable and Clean Energy Services</i>	02-Electronic Sales Records.xlsx	<i>Fuel cost, consumption, ease of collection; measured annually</i>	As stated in the Passport, "burning surplus agricultural biomass instead of purchasing expensive coal will save users money and provide a cheaper and cleaner alternative to coal fuels." As mentioned above, families reduce the quantity of coal they purchase and therefore use per year as a result of having access to these			

			<p>improved stoves. In Shanxi, households save an average of 1,961 RMB per year. In Enshi State and Guizhou Province, where coal is completely replaced with biomass (i.e. baseline consumption equals savings), households saved an average of 2,205 and 2,152 RMB respectively.</p> <p>With each stove sale, more families have the ability to access these stove benefits. Project proponents monitor the access stove manufacturers provide for rural households to efficient energy technologies through sales records. Between March 01, 2013 and February 28, 2015, the Project provided Chinese residents with a total of 34,737 stoves (1,047 in Shanxi; 14,372 in Enshi; and 19,318 in Guizhou). This is an average of 1,021 efficient stoves per month (as 24 months elapsed between 01 Mar 2013 and 28 February 2015). Monthly sales records are cross-checked with production records by CAREI and reported to Impact Carbon.</p>
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9. Annexes

1. Annex 01a - MR 4; Shanxi KS Data Analysis v1
2. Annex 01b - MR 4; Shanxi QKS Data Analysis v1
3. Annex 02 - MR 4; Enshi (Hubei) KS & QKS Data Analysis v1
4. Annex 03 - MR 4; Guizhou KS&QKS Data Analysis v1
5. Annex 04 - MR 4; Shanxi KS_KPT Report v1
6. Annex 05 - MR 4; Enshi (Hubei)KS_KPT Report v1
7. Annex 06 - MR 4; Guizhou KS_KPT Report v1
8. Annex 07 - MR 4; 4-5 yr Usage survey for Shanxi Enshi and Guizhou v1
9. Annex 08a - MR4; Shanxi(Jinqilin) Usage Survey v1
10. Annex 08b - MR4; Enshi (Zhiqi) Usage Survey v1
11. Annex 08c - MR4; Guizhou (Huifeng) Usage Survey v1
12. Annex 09- MR 4; Records of training for customers by Jinqilin v1
13. Annex 10- MR 4; Records of training for customers by Zhiqi v1
14. Annex 11- MR 4; Records of training for customers by Huifeng v1
15. Annex 12- MR 4; Sales Record, Shanxi 2009-Feb 2015 v1
16. Annex 13 - MR4; Sales Record, Enshi (Hubei) 2009-Feb 2015 v1
17. Annex 14 - MR 4; Sales Record, Guizhou 2009-Feb 2015 v2xls
18. Annex 15 - MR 4; Leakage Assessment v1
19. Annex 16 - MR4; Huifeng Biomass Stove Service Card
20. Annex 17 - Jinqilin Stove Service Card
21. Annex 18 - Zhiqi Biomass Stove Service Card
22. Annex 19 - Guizhou KPT data
23. Annex 20 - Hubei KPT data
24. Annex 21 - Shanxi KPT data
25. Annex 22 NRB Study Guizhou Iss 4
26. Annex 23 - NRB Study Enshi Iss 4
27. Annex 24 - Certification of forest resource in Enshi (The data is still valid)
28. Annex 25 - Certification of forest resource in Guizhou (The data is still valid)