

Monitoring Report

1 October 2010 – 15 May 2012

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

Report filename: GS 949; Monitoring Report; 101001-120515 V8¹

Period(s) reported: 1 October 2010 through 15 May 2012

Project Database period (stove sales eligible for crediting): 29 March 2009 through 15 May 2012

Emissions Reduction crediting period: 1 October 2010 to 15 May 2012 (2nd Issuance Period)

Start of Project crediting: 29th March 2011, 2 years retroactive beginning 29th March 2009

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)

¹ Version History: Version 1 28th May 2012, Version 2 12th July 2012, Version 3 29th August 2012, Version 4 26th October 2012, Version 5 12th November 2012, Version 6 15th November 2012, Version 7 20th November 2012, Version 8 4th December 2012

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1. Introduction

With respect to the registered Voluntary Gold Standard PDD authored by Impact Carbon and titled **PDD GS949 V4_26042011**², and the Voluntary Gold Standard Passport titled **Passport GS949 V7_26042011**, for GS 949 project labelled "Clean and Efficient Cooking and Heating Project, China," registered on 29th March 2011³:

This report documents the installation of three types of stoves from 18 November 2008 – 15 May 2012:

- 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 begins crediting these new 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, listed as Annex 37) 5 January 2009 (Huifeng, listed as Annex 38).

This report also documents the emissions reductions generated by these stoves between 1 October 2010 and 15 May, 2012.

2. Project Description and Summary

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 is 40.4%.⁴ 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%.^{5,6}

² The project is currently undergoing a design change with GS; the modified PDD with track changes is labelled **PDD, GS 949 Design Change Highlights v4**, the additional Passports are labelled **Annex 30, Enshi Passport** and **Annex 31, Guizhou Passport**.

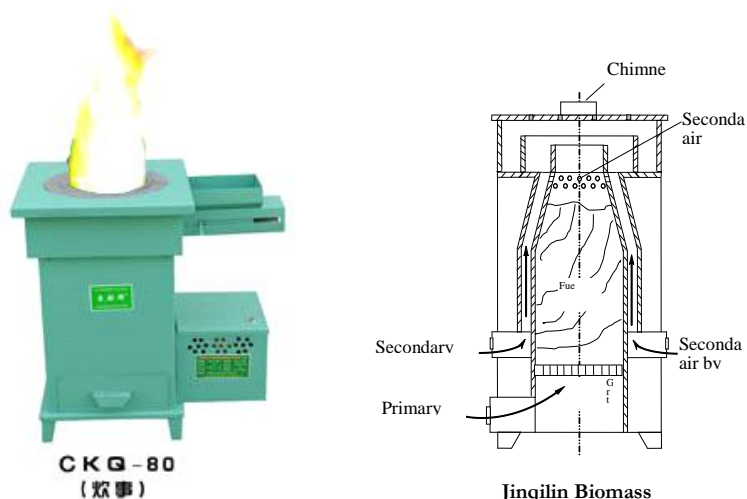
³ The project is listed as "issued" on the GS project registry, having issued once thus far. The project issued credits most recently in 2011.

⁴ 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.

⁵ 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

⁶ 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.

Figure A4. Technical specifications for Jinqilin improved stove



Jinqilin Stove Specifications		
Testing data ⁷	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 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”).

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 & 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.

⁷ Stove specifications certified by: Shanxi Mechanical Products Quality Supervision and Testing Center. Address: No.228 Shengli Street Taiyuan, Shanxi province. Tel. 0351-3184754

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	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 & 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	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 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.

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.



Enshi

Guizhou

Both of these new Project Manufacturing Partners have begun to develop 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 1. 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.

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



Figure 2. 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 3. 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 provinces. 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 12 employees in the past year, Huifeng employed 20 employees, and Jinqilin employed 18 employees. 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.



Figure 4. 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 perhaps the most pronounced social benefit of this project. Families spend between 11% and 18% of their

annual income and 16% to 22% 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 15% of annual income on cooking fuels, the cost savings are immense: families using the Jinqilin, which reduce fuel use by 41.4% compared to traditional cooking methods, can save more than ¥2,609 RMB (US\$412) per year. In Guizhou and Enshi provinces, the thermal efficiencies are 88.7% and 81.5%, respectively. Users provide positive feedback on the stove:



Figure 5. "I live with my husband, son (17yrs) and daughter (15yrs). My husband and I are farmers in Xiaohu village of Shanxi province. Our children are good students, and our greatest hope is that they can continue their schooling. In our hometown in Yangquan City, middle school is free, but the county high school and university cost money. We save as much as possible so we can afford the school fees, clothes and better food for our children. The Jinqilin stove has helped us save extra money because we no longer have to buy coal for cooking. Even though this area of Shanxi has many coal mines, coal prices are still very expensive, especially for farmers like ourselves. Since getting the stove in 2008, we've been able to save so much money. This stove is helping us afford an education for our children."

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.

In developing the carbon asset, the project proponents have taken several 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.

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.



Figure 6. 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:

- Expanded up-front customer training on stove usage
- Setting up an increased sales network
- Expanded marketing activities and increased media exposure and awareness
- Enhance after-sales service
- Strengthen technology innovation based on user feedback

Site visits and Kitchen Surveys conducted during 2010, 2011 and 2012 by Impact Carbon and CAREI reveal that the project continues to achieve the social, economic, and environmental impacts that it is intended to achieve. Kitchen Surveys also repeatedly assess the project’s continued positive social impacts. Environmentally, all impacts outlined in the PDD are being achieved, 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 to improve their health. Further detail can be found in the Kitchen Survey reports, **Annexes 04, 05, and 06.**

Impact Carbon is focused on changing the household energy paradigm in China from inefficient and unhealthy cookstoves 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 2012 and 2013, with expectation of future emissions reductions from retroactive carbon credits, new partners Zhiqi and Huifeng are planning to build larger manufacturing facilities to handle expanded production and storage. This facility will also help to ensure steady work for employees by allowing excess stoves to be stored in the storage facility prior to actual sales. Both companies also plan to increase stove promotion endeavors.

The project proponents have also worked with Project Manufacturing Partners to improve the quality and durability of their stoves. During the project period, Jinqilin began exploring new dials that would more easily adjust flame power and provide easier use.

The project proponents have also provided strategic vision for growth. Jinqilin hopes to eventually reach poor rural households outside of Yangquan City. Thus Jinqilin 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 these regions.

Costs related to stove production are increasing steadily as the price of raw materials rises. In January 2008, the Jinqilin production manager estimated that the raw material and labor cost of each Jinqilin stove was 600RMB. By January 2009 this cost had risen to 700RMB. This indicates an increase of 16%, with labor costs and steel prices expected to rise even more sharply in the coming years.

The Zhiqi stove currently costs 520 RMB to make, and sells for 650 RMB. The Huifeng stove costs 558 RMB to make, and sells for 700 RMB.

3. Emission Reductions Calculations

The table 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 Issuance period #2 from 1 October 2010 – 15 May 2012.

Figure 7: Summary of emission reductions during crediting period 1st October 2010 – 15 May 2012:

Verification Period: 1 October 2010 - 15 May 2012									
Total Emission Reductions (tCO ₂ e):		448,844							
Cluster:									
Year	Quarter	Shanxi		Hubei		Guizhou		Leakage tCO ₂ e	Total Emission Reductions tCO ₂ e
		Stove Years	tCO ₂ e	Stove Years	tCO ₂ e	Stove Years	tCO ₂ e		
2010	q4	3,309	17,593	2,593	14,350	4,241	18,979	Negligible	50,922
2011	q1	3,340	17,753	3,557	19,687	5,034	22,529	Negligible	59,968
	q2	3,800	20,200	3,851	21,315	5,762	25,786	Negligible	67,300
	q3	4,397	23,375	3,937	21,792	6,552	29,323	Negligible	74,489
	q4	5,107	27,148	3,937	21,792	6,912	30,933	Negligible	79,873
2012	q1	5,394	28,672	3,876	21,450	6,285	28,129	Negligible	78,250
	1 Apr - 15 May	2,710	14,406	1,893	10,475	2,941	13,162	Negligible	38,042
Total		28,057	149,146	23,644	130,859	37,727	168,841	-	448,844

Total Vintage 2010:	50,922
Total Vintage 2011:	281,630
Total Vintage 2012:	116,292

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 parameters⁹.

⁹ The full set of parameters is given in the monitoring tables below.

Stove usage is calculated in stove-years¹⁰, the number of stove days the stove was used divided by 365 (days). Quarterly usage¹¹ (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 linked from the 'Usage Record' worksheet to the 'Age 0-1', 'Age 1-2', worksheets. These two '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 two '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 'Age1-2' worksheet.

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.). 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_j}) from Cumulative Usage Rates (CumUi) 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).

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 (tCO₂e/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.

¹⁰ 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.

¹¹ Excel Worksheet: Summary ERs

4. Monitoring of parameter values and QA/QC

The tables below summarize the updated values of all the monitored parameters as defined in the PDD monitoring plan. The source of each value is given in the table, and the relevant reports are separate files sent with this document. The values applied were assessed in the Baseline Study and updated in the KPT Monitoring Report which was performed beginning in 2011 and 2012.

The following tables reproduce the parameters listed in the PDD Section B.7.1. Data and parameters monitored:

Figure 8 - Monitored parameters/variables

ID #	Data variable	Source of data, units	Recording frequency	Comment	Values For ER Calculator
1	Number of stoves sold ($N_{y,i,c}$)	Manufacturer Sales Database	Continuous	The Project Sales Record provides a conservative record of Project sales. These records are kept in Microsoft Excel. More information on sales records is provided in Section 6: Project Database. The sales record is used to create the Project Database, which re-organizes sales data and tracks the quantity of stoves sold each day, by cluster.	Each Project Manufacturers' Sales Record is kept in a separate database. The Excel file names are as follows: <ul style="list-style-type: none"> - Annex 17; Sales Record – Shanxi, Jinqilin - Annex 18; Sales Record – Enshi, Zhiqi - Annex 19; Sales Record – Guizhou, Huifeng
2	Net quantity of coal consumed per day in project year y ($AF_{py,Dcoal,y,i,c}$)	Kitchen Performance Test	Biennial	The findings of the monitoring KPTs as reported in Annexes 04, 05, and 06 . The reported Baseline and Project Fuel consumption values have been updated for the full set of current stove vintages, the Project was due for an Aging KPT on the original cluster as well as new-stove KPTs on the newly added clusters (thus 2 biennial KT has been conducted). The Kitchen Tests were conducted in 2011 early 2012.	Figure 9

3	Clustering definitions	Kitchen Surveys	Biennial	<p>On January 13th 2011, the Gold Standard (GS) authorized the expansion of GS project activity GS949 in China to include additional energy saving technologies in existing and new clusters. The design change is similar to the initial project activity in that it replaces baseline inefficient “traditional” coal-burning stoves; however the replacement is improved biomass stoves that function as both cooking AND heating technologies. The new project sites are in the coal-endemic areas of Hubei province, and Guizhou province. The combined cooking and heating stoves installed in these regions reduce GHGs by replacing household use of coal with readily available biomass, which mostly consists of wood fuel. Baseline surveys were conducted to substantiate the cluster characteristics, which consist primarily of baseline traditional coal stoves used with raw coal fuel. The results of these surveys can be found in the KS/KPT reports, Annexes 04, 05 and 06.</p> <p>The project now has 3 clusters; one cluster for each region. The cluster names are as follows:</p> <ul style="list-style-type: none"> - Shanxi improved stove - Guizhou improved stove - Enshi improved stove 	N/A
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4	Usage rate of improved stoves ($U_{y,i,c}$)	Usage Surveys	Biennial	<p>For increased accuracy, usage factors are assessed annually rather than biennially. These numbers are applied to each year. Previous usage survey data for the Shanxi cluster was verified for Age 0-1 and 1-2 (Annex 35 series). For Shanxi Stoves Age 2-3 and 3-4, refer to Annex 07 Usage Monitoring Report, Shanxi.</p> <p>For New Stoves in Guizhou and Enshi age refer to Annex 08 and 08b Usage Report, Enshi and Annex 09 and 09b Usage Report, Guizhou.</p> <p>A summary of all usage data can be found in Figure 10.</p>	<p>See Figure 10</p> <p>See also:</p> <ul style="list-style-type: none"> - Annex 07 - Annex 08 - Annex 08b - Annex 09 - Annex 09b - Annex 10 - Annex 35a - Annex 35b - Annex 35c
5	New Stove performance	Additional Kitchen Performance Tests and Kitchen Surveys for additional stove clusters and stove technologies	When a new cluster or technology is added, or every two years	<p>Additional baseline and project KPTs were administered for new clusters. In Enshi, the baseline survey visited 400 households, 168 of which had KPTs conducted. In Guizhou, the baseline survey visited 311 households, 156 of which had a KPT conducted. Sample size was determined to ensure 90/30 confidence and precision. For details on the sampling methodology, see Annex 05 Enshi KPT/KS Report and Annex 06 Guizhou KPT/KS Report.</p>	Figure 9
6	Net quantity of biomass pellets produced per year ($AF_{py,Apellet,y,i,c}$)	Monitoring Survey	Quarterly	No pellets were produced or used in the current verification period	N/A
7	Emission factor (MWh/kg) for electricity consumption for pellet production ($EF_{Pellet Machine,i,c}$)	Lab test for NCV, or publicly available data	Biennial	No pellets were produced or used in the current verification period	N/A

8	Emission factor (tCO ₂ /MWh) for electricity generation for pellet production (EF _{EL,y,i,c})	China Bureau of Statistics – Energy Statistical Yearbook	Biennial	No pellets were produced or used in the current verification period	N/A
9	Quantity (MWh) of electricity consumed for pellet production (EC _{pi,y,i,c})	Monitoring Survey	Quarterly	No pellets were produced or used in the current verification period	N/A
10	Average technical transmission and distribution losses (TDL _{y,i,c})	China Bureau of Statistics – Energy Statistical Yearbook	Biennial	No pellets were produced or used in the current verification period	N/A
11	Quantity of electricity consumed in the project activity in year y by biomass pellet technology i in cluster c (EC _{PL,y,i,c})	Monitoring Survey	Biennial	No pellets were produced or used in the current verification period	N/A
12	Leakage from transport and or production.(LE _{pi,y,i,c})	Study, Leakage Assessment based on sales records	Biennial	Leakage assessed in MR Figure 12. No leakage found, apply value of zero (0).	0

Carbon Calculator Inputs:

Based on the fuel consumption tables below (Figure 9), the estimated emissions reduction per stove year is assessed to be the following:

- **Shanxi:** 5.32 tonnes CO₂e per stove-year¹²

¹² In Shanxi, kitchen surveys show that households use the stove for more months per year than just the non-heating months; actually, it is common for stove users to continue usage of the improved stove through part or all of the heating season. Therefore, as “self-reported non-heating months” do not always correlate with “self-reported actual months of usage”, PP now uses self-reported actual months of usage. As this data is only available during the 2nd biennial aging KPT for Shanxi, PP conservatively uses a weighted average to account for using self-reported non-heating months (7.75 months) for stoves Age 0-1, and using self-reported months of actual use (9.25 months) in for stoves Age

- **Guizhou:** 5.53 tonnes CO2e per stove-year
- **Enshi:** 4.48 tonnes CO2e per stove-year

(Detailed calculation found in *Calculation Files* in excel tab *Assumptions*). Annual emission reductions (ER) are based on the mean value (according to 90/30 rule) for daily baseline coal use, annual usage drop-off rates (Figure 8), and average self-reported heating months during which the Project stove is used (Figure 9).

The above values for CO2e savings per stove year are entered into the ER Calculator.

Figure 9. Annual Coal Consumption – Baseline/Project Activity

9a. Shanxi

Shanxi Coal Consumption:

FUEL USE PER HH		Baseline Coal Consumption				
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	87%	6.73	12.00	2.83
FUEL USE PER HH		Project Coal Consumption				
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	87%	6.73	4.40	1.04

The 90% confidence interval is [6.71, 8.76], and the precision of the 90% CI end-points is 13% (Figure 8). The 90/30 rule is thus satisfied. PP adopts a mean fuel use savings approach for emission reduction calculations.

90/30 Rule established for mean fuel savings approach

FUEL USE PER HH	Avg.	N	SD	CI +/-	90% CI Lower	90% CI Upper	Diff
Total Coal	7.74	38.00	3.84	1.02	6.71	8.76	13%

Shanxi Fuel Savings: ¹³

1+. These calculations are available and can be transparently traced in Annex 01; Shanxi KPT & KS data Analysis_v2. Moreover, as new clusters have been added for efficient heating stoves, the description for parameter Afpy,Dcoal, y, i, c is no longer appropriate as was listed in the original PDD; limit-ing the parameter to only non-heating months is no longer appropriate. This has been up-dated as part of the design change: whereas parameter Afpy,Dcoal, y, i, c was listed as “the mass (kg/day) of fossil fuel coal consumed daily during the non-heating season in the project activity by traditional coal stoves in year y specific to HH’s with stove technology i and cluster c” -- clause ‘non-heating season’ has been updated to ‘usage season.’”

Data on self-reported months of usage is available for Shanxi, whereas it is not yet available in Guizhou and Enshi; PP will include this question in future monitoring surveys for new clusters also.

This has had an impact on the number of ERs, as the ERs per stove-year have increased to 5.32 tCO2e for Shanxi. Therefore, total ERs have increased from what was originally reported in the MR.

¹³ As mentioned in Footnote 11, PP now uses self-reported actual months of usage. As this data is only available during the 2nd biennial aging KPT for Shanxi, PP conservatively uses a weighted average to account for using self-reported non-heating months (7.75 months) for stoves Age 0-1, and using self-reported months of actual use (9.25 months) in for stoves Age 1+. In order to get a weighted project savings figure, savings for Age 0-1 (1.79 t) are weighted by percent of sales (37%), whereas savings for Age 1+ (2.18t) are weighted by percent of sales (63%). This brings us to 2.03t weighted value, which is then multiplied by the “Combined EF by mass” (2.62) to get the total weighted tCO2e of 5.32 tCO2e.

Fuel Savings	
Fuel Consumption	tonnes coal/household-yr
Baseline	2.83
Project, Age 0-1	1.04
Savings, Age 0-1	1.79
# Sales, Age 0-1	9,740
% Sales, Age 0-1	37%
Project, Age 1+	0.65
Savings, Age 1+	2.18
# Sales, Age 1+	16,249
% Sales, Age 1+	63%
Weighted Project Savings, All	2.03

Shanxi ER Value Calculations:

Stoves and Carbon Volumes Calculation			
Variable	Value	Units	Fuel Type
NCV ⁽¹⁾	25.8	TJ/Gg	Bit. Coal
Combined EF ⁽¹⁾	101,365	kg CO ₂ e/TJ	Bit. Coal
Combined EF by mass	2.62	tCO ₂ e/t_fuel	Bit. Coal
Combined EF by household-yr	5.32	tCO₂e/household-year	Bit. Coal

9b. Enshi

Enshi Coal Consumption:

Baseline Coal Consumption										
FUEL USE PER	N	Daily Mean Coal Use (kg/day)	CI +/-	90% CI Lower	Precision	90/30 Met?	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	84	13.92	0.92	12.99	7%	YES	93%	12.99	5.00	2.12
Project Coal Consumption										
FUEL USE PER	N	Daily Mean Coal Use (kg/day)	CI +/-	90% CI Lower	Precision	90/30 Met?	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	84	0.00	NA	NA	NA	NA	NA	NA	5.00	0.00

Enshi Fuel Savings:

Fuel Savings	
Fuel Consumption	tonnes coal/household-yr
Baseline	2.12
Project	0.00
Savings	2.12

Enshi ER Value Calculations:

Stoves and Carbon Volumes Calculation			
Variable	Value	Units	Fuel Type
NCV ⁽¹⁾	25.80	TJ/Gg	Bit. Coal
Combined EF ⁽¹⁾	101,365.00	kg CO ₂ e/TJ	Bit. Coal
Combined EF by mass	2.62	tCO ₂ e/t_fuel	Bit. Coal
Combined EF by household-yr	5.53	tCO₂e/household-year	Bit. Coal

9c. Guizhou

Guizhou Coal Consumption:

FUEL USE PER HH		Baseline Coal Consumption								
Fuel Type	N	Daily Mean Coal Use (kg/day)	CI +/-	90% CI Lower	Precision	90/30 Met?	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	78	12.96	1.40	11.56	11%	YES	89%	11.56	4.34	1.71
FUEL USE PER HH		Project Coal Consumption								
Fuel Type	N	Daily Mean Coal Use (kg/day)	CI +/-	90% CI Lower	Precision	90/30 Met?	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	78	0.00	NA	NA	NA	NA	NA	NA	4.34	0.00

Guizhou Fuel Savings:

Fuel Savings	
Fuel Consumption	tonnes coal/household-yr
Baseline	1.71
Project	0.00
Savings	1.71

Guizhou ER Value Calculations:

Stoves and Carbon Volumes Calculation			
Variable	Value	Units	Fuel Type
NCV ⁽¹⁾	25.80	TJ/Gg	Bit. Coal
Combined EF ⁽¹⁾	101,365	kg CO2e/TJ	Bit. Coal
Combined EF by mass	2.62	tCO2e/t_fuel	Bit. Coal
Combined EF by household-yr	4.48	tCO2e/household-year	Bit. Coal

A household survey of representative, randomly sampled, stove purchasers determine average drop-off in usage ($U_{y,i,c}$). To date, the initial kitchen survey reports 100% usage after year 1, and a September 2010 usage survey that reports 89% usage after year 2 (this is prior to the biennial survey, but was conducted for the purposes of initial DOE validation and verification). The following stove usage numbers are entered into the calculator:

Figure 10. Cumulative Usage Rate for all Clusters

Figure 10a. Shanxi Jinqilin Stove Users

Parameter	Value	Units	Source
Usage, Age 0-1	1.00	fractional	Annex 35b; Usage Survey Report Jinqilin Stove Ages 0-1 Years Iss-1
Usage, Age 1-2	0.85	fractional	Annex 07; Usage Survey, Shanxi
Usage, Age 2-3	0.85	fractional	Annex 07; Usage Survey, Shanxi

Figure 10b. Enshi Zhiqi Stove Users

Parameter	Value	Units	Source
Usage, Age 0-1	1.00	fractional	Annex 08; Usage Report, Enshi

Usage, Age 1-2	1.00	fractional	Annex 08; Usage Report, Enshi
Usage, Age 2-3	1.00	Fractional	Annex 08b; Usage Survey, Enshi

Figure 10c. Guizhou Huifeng Stove Users

Parameter	Value	Units	Source
Usage, Age 0-1	1.00	fractional	Annex 09; Usage Report, Guizhou
Usage, Age 1-2	1.00	fractional	Annex 09; Usage Report, Guizhou
Usage, Age 2-3	1.00	Fractional	Annex 09b; Usage Survey, Guizhou

Figure 11. Cumulative stoves sold

The total number of stoves sold between Project Start and 15 May 2012 is **69,318**.

11a. Shanxi

Parameter	Value	Units	Source
N ₁ ,Jinqilin CKQ,Shanxi	7,101	Stoves sold in 2009	<i>01-Emissions Reduction Calculation.xlsx</i> in excel tab <i>Project Database</i> ; verified in <i>Issuance 1</i>
N ₂ ,Jinqilin CKQ,Shanxi	6,672	Stoves sold in 2010	<i>01-Emissions Reduction Calculation.xlsx</i> in excel tab <i>Project Database</i> ; Verified through 30 September 2010 in <i>Issuance 1</i> (6,302 stoves total)
N ₃ ,Jinqilin CKQ,Shanxi	9,020	Stoves sold in 2011	Annex 17 – Sales Record, Shanxi
N ₄ ,Jinqilin CKQ,Shanxi	3,196	Stoves sold in 2012 (until 15 May 2012)	Annex 17 – Sales Record, Shanxi

11b. Enshi, beginning sale date from 18th November 2008 (Zhiqi) per VERPA, please see Annex 37

Parameter	Value	Units	Source
N ₀ ,Zhiqi ZQ-JG-220,Enshi	3,383	Stoves sold in 2009	Annex 18 – Sales Record, Enshi Zhiqi_v2
N ₁ ,Zhiqi ZQ-JG-220,Enshi	3,338	Stoves sold in 2010	Annex 18 – Sales Record, Enshi Zhiqi_v2
N ₂ , Zhiqi ZQ-JG-220,Enshi	9,722	Stoves sold in 2011	Annex 18 – Sales Record, Enshi Zhiqi_v2
N ₃ ,Zhiqi ZQ-JG-220,Enshi	0	Stoves sold in 2012 (until 15 May 2012)	Annex 18 – Sales Record, Enshi Zhiqi_v2

11c. Guizhou, beginning sale date from 5 November 2009 (Huifeng) per VERPA, please see Annex 38

Parameter	Value	Units	Source
N ₀ ,Huifeng HK-HF-70,Guizhou	8,546	Stoves sold in 2009	Annex 19; Sales Record, Guizhou Huifeng_v2
N ₁ ,Huifeng HK-HF-70,Guizhou	2,727	Stoves sold in 2010	Annex 19 – Sales Record, Guizhou Huifeng_v2
N ₂ , Huifeng HK-HF-70,Guizhou	15,663	Stoves sold in 2011	Annex 19 – Sales Record, Guizhou Huifeng_v2
N ₃ , Huifeng HK-HF-	4,950	Stoves sold in 2012	Annex 19 – Sales Record, Guizhou Huifeng_v2

70,Guizhou		(until 15 May 2012)	
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Figure 12. From PDD Section B.7.1:

12a. Shanxi

Data / Parameter:	$T_{usage\ months, Shanxi}$
Data unit:	Months
Description:	Average self-reported months of usage with a traditional coal stove in cluster Shanxi. As mentioned in Footnotes 11 and 12, the project now begins to ask users actual months of stove usage, as this is more precise than heating months (heating months was the original question). This is because it is common for users to continue Jinqilin use beyond the non-heating months. The project uses a weighted value to arrive at a weighted project fuel savings value to account for this switch in questioning.
Source of data used:	Baseline Monitoring Report (Annex 04)
Value of data	Non-heating months (as measured for Age 0-1) are 7.6 months. Actual months of usage (as measured in the Aging KPT for Age 1+) are 9.25 months. Values derived from household survey results.
Description of measurement methods and procedures to be applied:	Household surveys evaluated average self-reported months of heating with a traditional coal stove in year y. Estimates for average annual non-heating months are derived from the results of the household survey.
QA/QC procedures to be applied:	Review by VER Director
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.

12b. Enshi

Data / Parameter:	$T_{heating\ months, Enshi}$
Data unit:	Months
Description:	Average self-reported months of heating in cluster Enshi. It is possible that the project will begin asking about actual months of usage, like with Shanxi.
Source of data used:	Baseline Monitoring Report (Annex 05)
Value of data	5.00 months Value derived from household survey results (n=400, st.dev = 0.71)
Description of measurement methods and procedures to be applied:	Household surveys evaluated average self-reported months of heating in year y. Estimates for average annual heating months are derived from the results of the household survey.
QA/QC procedures to be applied:	Review by VER Director
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.

12c. Guizhou

Data / Parameter:	$T_{heating\ months, Guizhou}$
Data unit:	Months
Description:	Average self-reported months of heating in cluster Guizhou. It is possible that the

	project will begin asking about actual months of usage, like with Shanxi.
Source of data used:	Baseline Monitoring Report (Annex 06)
Value of data	4.34 months Value derived from household survey results (n=311, st. dev= 0.32)
Description of measurement methods and procedures to be applied:	Household surveys evaluated average self-reported months of heating in year y. Estimates for average annual heating months are derived from the results of the household survey.
QA/QC procedures to be applied:	Review by VER Director
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.

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,*” thus emission reduction calculations apply the reported value in the PDD of 4.4 months of average self-reported months of heating. 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.

Figure 13. From PDD Section B.6.1 Sub-step 2.4, Figure B.5:

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 Footnotes 11 and 12, 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. Refer to Footnotes 11 and 12 for more information on calculations, as well as Annex 01 to trace the Excel calculations). 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 the non-heating months and credits only 5.0 heating months of displaced coal used for heating.. The duration of heating and non-heating months was determined from 400 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 the non-heating months and credits only 4.34 heating months of displaced coal used for heating. The duration of heating and non-heating months was determined from 311 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 2nd verification period have been distributed locally within their respective Provinces.

Jinqilin (Shanxi): During the period October 1st, 2010 to May 15th 2012, 12,586 Jinqilin stoves weighing 45 kg each, were trucked in bulk 130 times to villages in Yu County. Each delivery truck contained 97 stoves, weighed approximately 4.36 tonnes, and furthest possible distance it travelled was 67 km to the village delivery site. Applying the 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 (4,770 kgCO₂e/stove). No leakage is applied as transport emissions are insignificant by virtue of constituting less than 1% of overall emissions.

Zhiqi (Enshi): During the period October 1st, 2010 to April 30th 2012 (the last sale being in December 2011), 12,922 Zhiqi stoves, weighing 42.8 kg each, were trucked in bulk 334 times to villages in Enshi State. Each delivery truck contained a little under 40 stoves, weighed approximately 1.67 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 (5,530 kgCO₂e/stove). No leakage is applied as transport emissions are insignificant by virtue of constituting less than 1% of overall emissions.

Huifeng (Guizhou): During the period October 1st, 2010 to April 30th 2012, 21,758 stoves, weighing 40 kg each, were trucked in bulk 331 times to villages in Guizhou Province. Each delivery truck contained an average of 65 stoves, weighed approximately 2.63 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 kg CO₂/ton-km, total transport emission is 0.85 kg CO₂ per stove, or 0.019% of total annual stove emission reductions (4,480 kgCO₂e/stove). No leakage is applied as transport emissions are insignificant by virtue of constituting less than 1% of overall emissions.

The table below presents the inputs and calculations for the transportation emissions leakage assessment for each Province. Please see Annex 27 for the full leakage calculations and details on the number and distance of deliveries made in all three provinces for Issuance 2.

Inputs	Jinqilin (Shanxi)		Zhiqi (Enshi)	Huifeng (Guizhou)
	<i>Issuance 1</i>	<i>Issuance 2</i>	<i>Issuance 2</i>	<i>Issuance 2</i>
Truck deliveries	97	130	334	331
Distance traveled per delivery (km)	67	67	107	171
Stove weight (t)	0.045	0.045	0.0428	0.04
Stoves sold	13,403	12,586	12,922	21,758

Emission factor Heavy Goods Vehicle Truck (tCO ₂ /tonne-km)	0.12427	0.12427	0.12427	0.12427
Calculations				
Stoves per delivery truck	138.175	96.815	39.102	65.734
Weight of Stove Freight (t)	6.218	4.357	1.674	2.629
Tonne-km of single delivery	416.598	291.898	179.804	449.798
Tonne-km of all deliveries made	40,410.045	37,946.790	60,054.602	148,883.239
Emissions all deliveries (kg CO ₂)	5,021.76	4,715.65	7,462.99	18,501.72
Transport emissions per stove (kg CO ₂ /stove)	0.375	0.375	0.571	0.850
Emissions Reductions (ER) per stove (kg CO ₂ e/stove year)	4,770	4,770	5,530	4,480
% transport leakage emissions of total ER	0.008%	0.008%	0.010%	0.019%

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 4.

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 2009 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 19, 20, and 21**). 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 spreadsheet. 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.

9. 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:

Figure 14. Sustainable development indicators.

Sustainable Development Indicator	Monitoring source	Variables, Units and Frequency of Measurements	Monitored result																																																												
<i>Air quality</i>	Fuel Use Monitoring Report , Field Surveys managed by China Association of Rural Energy Industries and Beijing University of Chemical Technology	<i>Air pollutants (CO, particulates)</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, 100% of users report their improved stoves reduce cooking time, fuel use, fuel cost, smoke, symptoms of coughing and eye irritation, and are easier to use:</p> <p>Shanxi</p> <p>Self-Reported Stove Performance Evaluation</p> <table border="1"> <thead> <tr> <th>Stove Performance Indicator</th> <th>More</th> <th>Less</th> <th>Same</th> </tr> </thead> <tbody> <tr> <td>Cooking time</td> <td>0</td> <td>150</td> <td>0</td> </tr> <tr> <td>Fuel use</td> <td>0</td> <td>150</td> <td>0</td> </tr> <tr> <td>Fuel expense</td> <td>0</td> <td>150</td> <td>0</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> <p>Stove Performance and SD Indicator Evaluation</p> <table border="1"> <thead> <tr> <th>Stove Performance & SD Indicator</th> <th>More</th> <th>Less</th> <th>Same</th> </tr> </thead> <tbody> <tr> <td>Heating time</td> <td>0</td> <td>0</td> <td>78</td> </tr> <tr> <td>Cooking Time</td> <td>0</td> <td>78</td> <td>0</td> </tr> <tr> <td>Fuel Use</td> <td>0</td> <td>78</td> <td>0</td> </tr> <tr> <td>Fuel Expense</td> <td>0</td> <td>78</td> <td>0</td> </tr> <tr> <td>Ease of Use</td> <td>78</td> <td>0</td> <td>0</td> </tr> <tr> <td>Amount of Smoke</td> <td>0</td> <td>78</td> <td>0</td> </tr> <tr> <td>Coughing & Eye Irritation</td> <td>0</td> <td>78</td> <td>0</td> </tr> </tbody> </table> <p>Enshi</p>	Stove Performance Indicator	More	Less	Same	Cooking time	0	150	0	Fuel use	0	150	0	Fuel expense	0	150	0	Ease of use	150	0	0	Amount of smoke	0	150	0	Coughing & eye irritation	0	150	0	Stove Performance & SD Indicator	More	Less	Same	Heating time	0	0	78	Cooking Time	0	78	0	Fuel Use	0	78	0	Fuel Expense	0	78	0	Ease of Use	78	0	0	Amount of Smoke	0	78	0	Coughing & Eye Irritation	0	78	0
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			Stove Performance Indicator	More	Less	Same
			Heating time	0	0	84
			Cooking Time	0	84	0
			Fuel Use	0	84	0
			Fuel Expense	0	84	0
			Ease of Use	84	0	0
			Amount of Smoke	0	84	0
			Coughing & Eye Irritation	0	84	0
			Biennial Kitchen Performance Tests further assesses air quality impacts of the Project stoves.			

<p><i>Livelihood of the poor</i></p>	<p>KS/KPT Reports. Field Surveys managed by China Association of Rural Energy Industries and Beijing University of Chemical Technology.</p>	<p><i>Financial impact</i></p>	<p>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> <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 2.03 tonnes of coal per year. The average self-reported coal price in Shanxi was \$923 RMB/ton (US \$145), therefore the Jinqilin stoves saves households an average of \$1874 RMB (US \$294) 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 \$2,587 and \$2,775 RMB respectively. 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> <table border="1" data-bbox="813 1003 1417 1694"> <thead> <tr> <th>Calculations - Financial Impacts of Project Activity</th> <th>Shanxi</th> <th>Enshi</th> <th>Guizhou</th> </tr> </thead> <tbody> <tr> <td>Self-Reported Cost per coal ton (from KS)</td> <td>\$923</td> <td>\$1,220</td> <td>\$1,622</td> </tr> <tr> <td>Avg. HH Baseline Coal Consumption (tons/year) (from KPT)</td> <td>2.825</td> <td>2.120</td> <td>1.711</td> </tr> <tr> <td>Total Annual HH Coal Cost</td> <td>\$2,609</td> <td>\$2,587</td> <td>\$2,775</td> </tr> <tr> <td>Average # people per household (from KS)</td> <td>3.21</td> <td>3.86</td> <td>4.44</td> </tr> <tr> <td>Avg Annual Net Income per capita¹⁴</td> <td>\$5,601</td> <td>\$5,832</td> <td>\$3,472</td> </tr> <tr> <td>Avg Annual Living Expenditure per capita¹⁵</td> <td>\$4,587</td> <td>\$4,091</td> <td>\$2,852</td> </tr> </tbody> </table>	Calculations - Financial Impacts of Project Activity	Shanxi	Enshi	Guizhou	Self-Reported Cost per coal ton (from KS)	\$923	\$1,220	\$1,622	Avg. HH Baseline Coal Consumption (tons/year) (from KPT)	2.825	2.120	1.711	Total Annual HH Coal Cost	\$2,609	\$2,587	\$2,775	Average # people per household (from KS)	3.21	3.86	4.44	Avg Annual Net Income per capita ¹⁴	\$5,601	\$5,832	\$3,472	Avg Annual Living Expenditure per capita ¹⁵	\$4,587	\$4,091	\$2,852
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¹⁴ 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.

¹⁵ Ibid

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<i>Access to Affordable and Clean Energy Services</i>	02-Electronic Sales Records.xlsx	<i>Fuel cost, consumption, ease of collection</i>	<p>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 improved stoves. In Shanxi, households save an average of 1,874 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 2,587 and 2,775 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 October 1, 2010 and 15 May, 2012, the Project provided Chinese residents with a total of 47,266 stoves (12,586 in Shanxi, 12,922 in Enshi, and 21,758 in Guizhou). This is an average of 2,423 efficient stoves per month (as 19.5 months elapsed between 1st October and 15th May; to get the average sales the total sales from the period were divided by 19.5 to reach the average). Monthly sales records are cross-checked with production records by CAREI and reported to Impact Carbon.</p>																

10. Appended files list

Calculation Files:

1. Iss 2 ER Calcs; Shanxi
2. Iss 2 ER Calcs; Enshi
3. Iss 2 ER Calcs; Guizhou
4. Summary ERs

Appendix Files:

1. Annex 1 – Shanxi KPT & KS Data Analysis_v2
2. Annex 2 – Enshi KPT & KS Data Analysis
3. Annex 3 – Guizhou KPT & KS Data Analysis
4. Annex 4 – KS_KPT Report; Shanxi_v2
5. Annex 5 – KS_KPT Report; Enshi
6. Annex 6 – KS_KPT Report; Guizhou
7. Annex 7 – Usage Report, Shanxi
8. Annex 8 – Usage Report, Enshi
9. Annex 8b – Usage Survey, Enshi
10. Annex 9 – Usage Report, Guizhou
11. Annex 9b – Usage Survey, Guizhou
12. Annex 10 – Usage Data, all
13. Annex 11 – Training Record, Shanxi
14. Annex 12 – Training Record, Enshi
15. Annex 13 – Training Record, Guizhou
16. Annex 14 – Spot Check, Shanxi Jinqilin
17. Annex 15 – Spot Check Report, Enshi Zhiqi
18. Annex 16 – Spot Check Report, Guizhou Huifeng
19. Annex 17 – Sales Record - Shanxi
20. Annex 18 – Sales Record - Enshi
21. Annex 19 – Sales Record - Guizhou
22. Annex 20 – Design Change Memo
23. Annex 21 – NRB Study, Enshi
24. Annex 22 – NRB Calculations, Enshi
25. Annex 23 – NRB Study, Guizhou
26. Annex 24 – NRB Calculations, Guizhou
27. Annex 25 – EIA Waiver Certification – Enshi
28. Annex 26 – EIA Waiver Certification – Guizhou
29. Annex 27 – Leakage Assessment
30. Annex 28 – Enshi LSC Report
31. Annex 29 – Guizhou LSC Report
32. Annex 30 – Enshi Passport
33. Annex 31 – Guizhou Passport
34. Annex 32 – China GS949 Design Change Report
35. Annex 33; ISS-1 Monitoring Report Berkeley Air 2009 - GS949
36. Annex 34a; KPT Scanned Sample
37. Annex 34b; QKS Scanned Sample
38. Annex 34c; KS Scanned Sample
39. Annex 35a; Usage Survey Record Jinqilin Stove Ages 0-1 and 1-2 Years Iss-1
40. Annex 35b; Usage Survey Report Jinqilin Stove Ages 0-1 Years Iss-1
41. Annex 35c; Usage Survey Report Jinqilin Stove Ages 1-2 Years Iss-1
42. Annex 36a; Scale Calibration Records
43. Annex 36b; Scale Calibration Engineer Signature

44. Annex 37; VERPA Zhiqi and CAREI
45. Annex 38; VERPA Huifeng and CAREI