CLEAN DEVELOPMENT MECHANISM
SMALL-SCALE PROGRAMME OF ACTIVITIES DESIGN DOCUMENT FORM
(CDM-SSC-PoA-DD) Version 01

CONTENTS

Annexes

NOTE:

(i) This form is for the submission of a CDM PoA whose CPAs apply a small scale approved methodology.

(ii) At the time of requesting registration this form must be accompanied by a CDM-SSC-CPA-DD form that has been specified for the proposed PoA, as well as by one completed CDM-SSC-CPA-DD (using a real case).

SECTION A. General description of small-scale programme of activities (PoA)

A.1 Title of the small-scale programme of activities (PoA):

Fuel Efficient Stoves in Zambia

Version 5
13/07/2011

A.2. Description of the small-scale programme of activities (PoA):

1. General operating and implementing framework of PoA

The proposed small scale PoA involves the distribution of domestic fuel-efficient stoves by 3 Rocks Ltd. (3RL) in Zambia, as described in each of the PoA's CDM Programme Activity Design Documents (CPA-DD) and according to the requirements of the appropriate small scale methodology: AMS II.G *Energy efficiency measures in thermal applications of non-renewable biomass, Version 2*. The efficient stoves are based on a design commissioned by 3RL and will be installed by 3RL for recipient households in exchange for certain labour and materials during installation. The stove design was tested independently to determine its thermal efficiency. It is the revenue from the sale of CERs only that will fund the installation process. 3RL is the Managing Entity for the PoA.

Traditionally, the majority of Zambian families cook on an open fire, utilizing the 'three rocks' method for heating pots. This method is inefficient and leads to the unsustainable use of non-renewable biomass in the process. The replacement fuel-efficient stove will lead to a reduction in the annual usage of biomass for users by approximately 66%. The majority of Zambians do not have access to the market for fuel-efficient cooking stoves, mainly for economic reasons. Utilizing carbon finance, the proposed PoA aims to overcome this barrier to market entry for households, substituting three rock fires for fuel-efficient stoves.

Recipient households will sign an agreement acknowledging that 3RL is the owner of the rights to the emissions reductions generated by the stove and agreeing for the stove to be included in the monitoring programme as described in this PoA Design Document (PoA-DD) and the relevant CPA-DD. The benefits of the stove and various user commitments will be clearly explained to prospective users during communication events at the CPA implementation stage.

The stove "liner" consists of a standardized, alloy metal combustion chamber, with an insulating layer surrounding it. Stove liners will be manufactured, imported and distributed to local Zambian teams responsible for stove installations within each CPA. The installation teams will then build a brick enclosure to secure the liner *in situ*. Materials, such as those required for the brick enclosure, will be manufactured locally to each CPA and household recipients will be involved in the construction process by advising on the preferred location of the stove and providing certain materials for its installation.

Installation teams will be appointed to install the stoves according to a uniform installation process and they will be trained to build each stove to a pre-determined design, eliminating variation in performance. Installers will also be trained to capture monitoring data from the installation process indentifying each stove by owner name and/or government identification number, address or location, and GPS location

reference. Each stove will be assigned a unique reference number in an electronic data management system, or monitoring database.

Data collected during the installation process stoves will be captured on electronic handheld devices and uploaded to the monitoring database. This database will be maintained locally in Zambia and backed-up securely offsite. A hardcopy back-up of the emissions rights acknowledgement will also be collected at the installation phase. This system will be available for review by the Designated Operational Entity (DOE) during verification of the PoA.

3RL will undertake stakeholder engagement at the PoA level, including national awareness raising meetings, regional meetings and user trials of prototype stoves. It is, furthermore, the intention of 3RL to run an ongoing, post-registration programme of awareness-raising of the optimal usage of the stove, allowing a further mechanism for feedback on its performance from recipients.

A monitoring programme will be conducted at the PoA-level to determine the emissions reductions generated by the stoves during every monitoring period. This will be summarized in a monitoring report, including the emissions reduction calculations.

The PoA is funded entirely by private investment and does not form a part of any government-funded or supported programme in Zambia.

2. Policy/measure or stated goal of the PoA

The goal of the proposed PoA is to install fuel efficient cooking stoves throughout Zambia. The stoves will replace wood-fired, 3-rock fires only. The stoves will help recipient households reduce their non-renewable wood use, protect standing forests, and will help limit valuable time spent gathering fuel wood. Greenhouse gases will be mitigated by reducing the harvesting of non-renewable biomass for use in cooking purposes.

3. Confirmation that the proposed PoA is a voluntary action by the coordinating/managing entity.

This PoA is a voluntary action, which will be implemented by 3RL. There is no law or policy in Zambia that mandates the use of fuel-efficient stoves.

4. Contribution to sustainable development

The proposed PoA contributes to the sustainable development of the Zambian economy in a number of ways:

i. Environmental
   - The PoA will help significantly reduce Zambia's greenhouse gas emissions over its lifetime
   - The PoA will help reduce the use of non-renewable biomass from Zambian forests, assisting the maintenance of existing forest stock, protecting natural forest eco-systems and wildlife habitats[1]
   - The protection of standing forests will ensure the maintenance of watersheds that regulate water table levels and prevent flash flooding[2]

[1] http://www.illegal-logging.info/approach.php?a_id=54

ii. Social
- Considerably less time will need to be spent collecting wood fuel for the family home thereby reducing the work burden on families and presenting alternative opportunities for economic development
- Cooking and heating with solid fuels on open fires or traditional stoves results in high levels of indoor air pollution. Indoor smoke contains a range of health-damaging pollutants, such as small particles and carbon monoxide[3]. Less carbon dioxide, carbon monoxide and particulates will be emitted by the fuel-efficient stove due to the decrease in total biomass burned, the increase in the efficiency of biomass burning and an increased fire temperature.
- The stove provides a safer method for combusting biomass for cooking, helping to reduce burn injuries, especially for children, in the family home

iii. Economic
- The PoA will help develop a section of the Zambian economy; in the installation of the stoves (including certain materials production; e.g. bricks and mortar) and monitoring activities.
- The PoA will bring employment benefits to Zambia and jobs will be created for its administration

The proposed PoA will deliver a long-term and secure contribution to sustainable development in Zambia that, without carbon finance, would not exist.

A.3. Coordinating/managing entity and participants of SSC-POA:

Name of Party Involved ("Host" indicates a host Party)	Private and/or Public entity(ies) project participants (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (yes/no)
Zambia (Host)	3 Rocks Ltd. (3RL)	No

3RL is a private entity and will act as the managing entity of the PoA.

A.4. Technical description of the small-scale programme of activities:

A.4.1. Location of the programme of activities:

Zambia

A.4.1.1. Host Party(ies):

Zambia

A.4.1.2. Physical/ Geographical boundary:

[2] http://www.meted.ucar.edu/hazwarnsys/ffewsrg/FF_EWS.Chap.2.pdf

[3] http://www.who.int/indoorair/en/

The geographical boundary for the proposed PoA is the country of Zambia. All CPAs included in the PoA will be implemented in Zambia. The Republic of Zambia, lies within the latitude and longitude of 15 00 S and 30 00 E[4].

Figure 1: Zambia - the geographical boundary of the proposed PoA

The Zambian National Policy on the Environment (2007) indicates areas where Zambian policy is not adequately protecting environmental resources, including:

- widespread forest clearance and degradation
- forest degradation leading to reduced biodiversity
- fuel-wood demand increased and alternative energy not given sufficient attention at all levels
- Policy failure to invest more in increased access to electricity and insufficient attention and investment in low-cost alternative supplies, to offset pressure upon wood resources
- Inadequate attention in both use and regulation of the main sources of supply of energy, hydro-power and fuel-wood, to their environmental impacts and requisite amelioration in sectoral policies
- The pace of rural electrification is too slow thus compounding the pressure upon wood resources in proportion to the rapid increase in the human population

Furthermore, the policy seeks to encourage 'implementation strategies' that will: "focus more on establishing an enabling environment to promote community-based sustainable natural resource use and less on traditional government managed development projects."

The National Energy Policy (2008), states: "Although there is no immediate woodfuel crisis in most parts of Zambia, woodfuel can no longer be considered as a renewable resource because consumption rates are exceeding yield rates mainly as a result of inefficient production and use and the increasing population…

[4] http://wwp.greenwichmeantime.co.uk/time-zone/africa/zambia/map.htm

If current trends of woodland depletion continue an "energy crisis" that will affect the majority of the people is likely to occur in the near future. This is in addition to desertification, which is already threatening some parts of the country."

In addition, under policy measures and strategies for household energy, the National Energy Policy seeks to "promote the use of efficient cook stoves" through "innovative financing schemes designed to reduce the initial cost problem for low income households."

A.4.2. Description of a typical small-scale CDM programme activity (CPA):

Each CPA will involve the installation of a maximum of 180GWh of stove thermal output in recipient households (this is the AMS IIG limit as clarified by the SSC WG on 04/11/2008[5]) and this will translate to a maximum number of stoves per CPA. The efficient stoves will replace traditional wood-fired, three rock fires in households where they are present. CPAs will not be limited geographically to individual villages or towns. Each CPA will comprise the manufacture, installation and monitoring of the stoves over the CPA crediting period.

3RL will employ manufacturers to produce the components for the installation of each stove. These components will then be distributed to each CPA via a central location, where installation teams will be responsible for the assembly of each stove.

Each installation team will be trained to build each stove, in partnership with the stove recipient, to a uniform design and will be responsible for ensuring that data is captured at installation to ensure the accurate monitoring of emissions reductions during each PoA monitoring period.

Recipient households will sign an agreement acknowledging that 3RL is the owner of the rights to the emissions reductions generated by the stove and agreeing for the stove to be included in the monitoring programme as described in this PoA Design Document (PoA-DD) and the relevant CPA-DD. Installation data will be captured and recipient households will then receive an installed stove and training on its use.

The installed stoves will have GPS reference coordinates logged and given a unique reference number in the monitoring database. Monitoring of emissions reductions will take place at the PoA level.

A.4.2.1. Technology or measures to be employed by the SSC-CPA:

The PoA will provide energy efficient cooking stoves based on the 'rocket stove' design. This technology ensures a 29.5% thermal efficiency against the 10% methodology default for the traditional 3-rock fire.

The stove consists of a durable metal alloy liner, with an insulating layer surrounding it. The liner and insulation are encased in a metal outer container, which is further attached to brick enclosure for protection and security. The liner is tapered at the top, where a galvanized cooking surface provides a rest for the cooking pot. The flame is directed onto the pot speeding up the flow of gases from the combustion chamber and the biomass fuel is supported using a metal grate to ensure adequate air flow to the fire. The whole stove is cemented to the floor ensuring the stove is largely protected from damage and theft.

[5] http://cdm.unfccc.int/UserManagement/FileStorage/AM_CLAR_VIIC5MTUUWR9PRPJL0EXOT3G2CKSFQ

Stove alloy liner Constructed Stove

Figure 2: Stove design

The fuel-efficient cooking stove technology has been tested independently in accordance with the *"Stove Manufacturers Emissions & Performance Test Protocol (EPTP)"*[6] and certified by the Engines and Energy Conversion Laboratory at Colorado State University for its thermal efficiency. More information on this test and the procedures followed is available in Annex 3.

The liner, insulation, pot rest and metal grate will be manufactured in a specialist stove factory to ensure standardised production. All other components, including bricks and mortar, will be produced locally in Zambia.

The stove will be constructed according to a standardized design and construction procedure by Zambian installation teams. Teams responsible for the construction of stoves in each CPA will be trained accordingly. The trained stove builders will receive a stove kit that they assemble on site. A separate Operations Plan and Installation Process details how individual households will receive stoves and the timescale for each CPA's implementation.

The replacement of the fuel efficient stoves, described above, for a more efficient version will only be possible if the crediting period of the PoA is renewed at the end of the existing crediting period. A more efficient stove will require the baseline data to be changed and this will require additional validation. The technology described above is state-of-the-art and designed as a bespoke solution for Zambia. A more efficient technology would require considerable additional research and development over a period of time.

A.4.2.2. Eligibility criteria for inclusion of a SSC-CPA in the PoA:

The following criteria must be met by each CPA to ensure its eligibility under the PoA:

1. Each CPA-DD will apply the baseline and monitoring methodology AMS II.G: *Energy efficiency measures in thermal applications of non-renewable biomass, Version 2*

[6] Stove Manufacturers Emissions & Performance Test Protocol (EPTP): A protocol for testing stove fuel efficiency and emissions and a standard for improved stoves; Defoort, L'Orange, Kreutzer (EECL), Lorenz (Envirofit), Kamping (Philips) 2009

2. Each CPA-DD must demonstrate that it is not registered as another CPA under a registered PoA or as another CDM project
3. Each CPA-DD shall apply the UNFCCC Methodological Tool: "Tool for the demonstration and assessment of additionality" (Version 05.2) and will apply a simple cost analysis to demonstrate its additionality
4. Each CPA will demonstrate that no revenues, other than those from the sale of CERs, are attributable to the programme activity
5. Each CPA will not exceed 180GWh of combined power output, which is the methodology limit
6. Each CPA must satisfy de-bundling rules for PoAs

A.4.3. Description of how the anthropogenic emissions of GHG by sources are reduced by a SSC-CPA below those that would have occurred in the absence of the registered PoA (assessment and demonstration of additionality):

The proposed PoA will reduce GHG emissions through the installation of fuel efficient stoves that reduce the total quantity of non-renewable biomass used by each recipient household. The PoA is additional as it relies solely on carbon finance to ensure its implementation. There are no other sources of revenue from the project other than from the sales of issued Certified Emissions Reductions (CERs). There is no other incentive to undertake the PoA, nor is there any regulation in Zambia mandating this activity.

Technology Transfer:

The technology being employed has been commissioned by, and specifically designed for, 3RL to implement in the proposed PoA, meeting the unique requirements for Zambia. The technology was originally designed in the USA and is transferred from that Annex 1 country. It is robust and secure, significantly more efficient than the traditional method of cooking and culturally acceptable for users. This is all demonstrated in the baseline and stakeholder assessment data collected for the PoA. In this way, a state-of-the-art, bespoke-designed technology is being transferred from an Annex 1 country to a non-Annex 1 Least Developed Country (LDC).

Prior Consideration of the CDM:

It may be demonstrated that the CDM was considered prior to the PoA's start date as, in accordance with EB 44, Annex 3, paragraph 99, the Global Stakeholder Consultation was undertaken prior to the starting date of the PoA. The starting date of the proposed PoA is 22/12/2010, which is the starting date of the first CDM programme activity. The initial PDDs were submitted to the UNFCCC's Global Stakeholder Process on 24/11/2010. In this way, the starting date of the programme activity is after the starting date of validation, giving clear evidence proving that incentive from the CDM was seriously considered in the decision to proceed with the programme activity.

(i) The proposed PoA is a voluntary coordinated action:

There is no mandated government programme or policy in Zambia ensuring the distribution of domestic fuel-efficient cooking stoves. Recipient households may only participate voluntarily in the Fuel Efficient Stoves in Zambia PoA. It is hereby confirmed that the proposed PoA is a voluntary coordinated action by 3RL.

(ii) If the PoA is implementing a voluntary coordinated action, it would not be implemented in the absence of the PoA:

In the absence of the proposed PoA, the distribution of domestic fuel-efficient cooking stoves would not be undertaken. The implementation of the PoA relies solely on the revenues gained from the sale of its issued CERs. There are no other identifiable revenue streams from the PoA and therefore, the revenue from the sale of CERs was considered at the earliest stage of the PoA's development, as, without this revenue stream, project finance could not be sought.

The assessment of the PoA's additionality is addressed utilizing the step-wise approach outlined in the UNFCCC Methodological Tool: "Tool for the demonstration and assessment of additionality" (Version 05.2)

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

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

(i) The proposed project activity undertaken without being registered as a CDM project activity:

Alternatives to implementing the installation of domestic fuel-efficient cooking stoves cost-free for recipients in Zambia without the benefit of carbon finance are:

a) Donor-funded projects

There have been projects implementing domestic fuel-efficient cooking stoves in Zambia, such as the GTZ's Programme for Basic Energy Conservation in Southern Africa - Probec[7]. However, these have involved the small-scale sale of energy efficient stoves, where the economic case makes sense, i.e. where users purchase fuel (e.g. charcoal) for cooking purposes, mostly in urban areas or at the institutional level.

b) Government-funded projects

There is no history of this type of activity in Zambia to date. There are no plans at the time of writing for the Zambian government to implement a fuel-efficient cooking stoves programme. Only 0.2% of planned investments in the public investment plan are allocated to energy efficiency systems (Ministry of Finance and National Planning, 2002)[8].

The success of efficient stove projects to date in Zambia is extremely limited. This is evidenced by the poor penetration rate of fuel-efficient cooking stoves in Zambia (4,082 in 2006[9]) and the continuing high usage of non-renewable biomass in the country.

[7] www.probec.org

[8] http://www.afrepren.org/adb_finesse/Task%203/Background%20Material/Background%20Material%20-%20Background%20to%20Africa%20Energy%20Sector.pdf

[9] Energy, Environment and Development Network for Africa, 2006: http://www.afrepren.org/adb_finesse/Presentations/Module%204%20-%20Traditional%20and%20Improved%20Biomass%20Part%201.ppt

(ii) Other realistic and credible alternative scenario(s) to the proposed CDM project activity scenario that deliver outputs or services with comparable quality, properties and application areas, taking into account, where relevant, examples of scenarios identified in the underlying methodology:

The only other alternative scenario delivering the same output, i.e. the replacement of wood-fired three-rock fires for domestic purposes, would be private sector implementation of a commercial project to sell fuel-efficient stoves for profit. This scenario is extremely unlikely. Zambia has a population with 86% living below the poverty line, combined with a 50% unemployment rate[10]. Presently, more than three out of four Zambians live in poverty and more than half of them are extremely poor and unable to meet their minimum nutritional needs. In rural parts of the country, where wood fuel is mostly used, about 83% of the inhabitants are poor, and 71% of them are extremely poor[11]. Per capita income averages about US$430[12].

Typically, it is poorer, rural parts of the population that utilize wood-fired, three rock fires, as urban households have more disposable cash to purchase alternative fuels, such as charcoal. This is evidenced by the higher rates of wood fuel usage in rural areas. Amongst 90 percent of rural households, utilization of firewood was a very common source of cooking compared with 8 percent of the urban households[13]. Therefore, the commercial viability of selling stoves, where there is no economic incentive to buy them, is minimal.

(iii) If applicable, continuation of the current situation (no project activity or other alternatives undertaken).

The continuation of the current situation in Zambia would undoubtedly see the continued use of wood-fired, three rock fires for cooking. As discussed above, the Zambian poor are excluded from the market for purchasing stoves, owing to the high levels of poverty. With 86% of the population living below the poverty line, the cost of fuel-efficient stoves is too great for families to manage within the household budget.

Firewood is the most common type of energy with 56% of households nationally citing it as the major source of cooking energy, followed by charcoal, and 90% of rural households utilizing it primarily for cooking purposes[14]. Where charcoal is utilized, there is an incentive to purchase a fuel-efficient stove, as it reduces the long-term household expenditure on fuel. This economic incentive does not exist for users of wood-fired, three rock fires, as wood is collected mostly for free.

The status quo of continuing the inefficient usage of non-renewable biomass for cooking purposes, involving no additional investment, makes it the most likely alternative scenario.

Sub-Step 1b: Consistency with mandatory laws and regulations:

[10] CIA World Factbook https://www.cia.gov/library/publications/the-world-factbook/geos/za.html

[11] http://www.ruralpovertyportal.org/web/guest/country/home/tags/zambia

[12] http://www.ruralpovertyportal.org/web/guest/country/home/tags/zambia

[13] The Living Conditions Monitoring Survey 2004, Central Statistics Office, Zambia

[14] The Living Conditions Monitoring Survey 2004, Central Statistics Office, Zambia

The proposed scenarios outlined above are all compatible with mandatory applicable legal and regulatory requirements in Zambia. The Zambian National Policy on the Environment (2007) and the National Energy Policy (2008), quoted above, underline this. The proposed PoA is not the only alternative that complies with national mandatory laws and regulations.

The PoA is not implementing a specific Zambian mandatory regulation or law related to the installation of fuel-efficient cooking stoves, but is consistent with existing national policies.

Step 2: Investment Analysis:

Sub-step 2a: Determine appropriate analysis method

An investment analysis will be carried out at the CPA level, by calculating a simple cost analysis (Option I) in each CPA-DD.

Step 3: Barrier analysis is skipped in favour of the investment analysis for each CPA

Step 4: Common practice analysis:

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

There is a lack of precedent to the proposed PoA. Activities to date have not produced the scale of technological penetration required to circumvent the continued widespread use of non-sustainable biomass, as less than 1% of the addressable rural market has fuel-efficient firewood cooking stoves installed[15]. Common practice in Zambia, outside of urban areas, is to use traditional 3-rock fires for domestic purposes.

To date, the only significant dissemination of stoves has been under two projects:

1. Probec (GTZ) – the dissemination of stoves in Zambia has relied on subsidies from German government development (GTZ) aid. Stoves have been sold under this programme to both domestic and institutional clients. GTZ financial support for this programme ended in 2010. There have been pronouncements of private sector continuation of the programme in Zambia, utilizing carbon finance as an alternative support, although there is no physical evidence of this at the time of writing.

2. RWE/Climate InterChange - CDM Lusaka Sustainable Energy Project (LSEP)[16]. This project relies on carbon finance to subsidize the planned sale of 30,000 stoves. LSEP is a fuel-switching project, focusing on the selling a replacement to charcoal stoves in the urban market of Lusaka. LSEP applies a different UNFCCC baseline and monitoring methodology to the proposed PoA.

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

Taking each project individually:

[15] Energy, Environment and Development Network for Africa, 2006: http://www.afrepren.org/adb_finesse/Presentations/Module%204%20-%20Traditional%20and%20Improved%20Biomass%20Part%201.ppt

[16] http://cdm.unfccc.int/Projects/DB/TUEV-SUED1252930846.25/view

1. Probec: This initiative focussed on disseminating charcoal burning stoves to households[17], not wood burning stoves, which is a key distinction from the proposed PoA. It also incorporates institutional stoves and tobacco barns. GTZ funding for Probec ended in December 2010[18], demonstrating that it has been incapable of delivering sustainability in its funding and activities. It is understood that the initiative has been passed over to the private sector for carbon market development[19], but to date there is no physical evidence that a CDM project is being developed in Zambia.
2. LSEP: This is a fuel-switching project using a separate methodology from the proposed PoA[20]. This project, although involving the dissemination of fuel efficient cooking stoves, operates on a smaller scale than the proposed PoA, focusing on the urban charcoal market and has a clear economic incentive for participants (i.e. sale of stoves to customers who purchase fuel).

The proposed PoA is larger in scale than both these initiatives, focuses solely on replacing wood-fired appliances for a more efficient version and has only one revenue stream; the sale of CERs.

It is concluded from the above analysis that the proposed PoA is additional.

A.4.4. Operational, management and monitoring plan for the programme of activities (PoA):

A.4.4.1. Operational and management plan:

3RL will have overall operational and management responsibility for the implementation and monitoring of the proposed PoA and is therefore acting as the PoA Managing Entity. 3RL will be responsible for the following operational and management activities related to each CPA included in the PoA:

1. Manufacturing and logistics
   a. Components for the stoves will be manufactured specifically for the project (some imported into Zambia, others produced locally);
   b. Components will be distributed to warehouses within each CPA;
   c. Regional logistics managers will then coordinate the distribution of components to recipient households for installation.

2. CPA household identification
   a. For each CPA, a process for identifying households will be managed by 3RL. This will involve working with local community leaders and other partners to help identify recipient households suitable (i.e. those utilizing wood-fired, three rock fires) for the installation of a stove;

[17] http://www.probec.org/displaysection.php?czacc=&zSelectedSectionID=sec1194685541

[18] http://www.probec.org/displaysection.php?czacc=&zSelectedSectionID=sec1192753796&zSelectedAssetID=ast1291890483

[19] http://www.islan.ch/srcf.aspx

[20] http://cdm.unfccc.int/filestorage/B/M/N/BMNTH5J4Y6XW1U3ORADFK7EC8Z02PS/PDD.pdf?t=TWh8MTMxMDM5MDMzNy40Nw==|z7ZeQrqRfyr__t2Krc4d5TNVLR4=

b. In partnership with community leaders, NGOs and other local organizations, 3RL will initiate a communication process to ensure that households understand the benefits of the stoves, that cultural issues are addressed and that users are trained in the optimal use and performance of the stove;
c. Pre-installation teams will visit recipient households in each CPA and will ensure recipients understand and sign the emissions rights acknowledgement (both electronically and hard copy); this will act as the "order" for each stove.

3. Installation
   a. Regional 3RL logistics managers will identify local partners and train stove installation teams to undertake the implementation of each CPA
   b. Local partners and installers will coordinate the receipt of stove components in the distribution process
   c. Each installer will be trained in the installation of the stove to a standardized design and installation procedure
   d. Each installer will be responsible for physically installing the stoves in partnership with the stove recipient

4. Data collection
   a. Upon installation of each stove in the CPA, a post-installation team will be responsible for collecting installation data, which will enable 3RL to apply the monitoring plan and identify all installed units. This will include:
      i. A GPS location reference
      ii. The household family name and address/physical location (i.e. village) and/or Zambian government identification number of the stove recipient
      iii. Date and time of installation
   b. This data will be collected by the post-installation team electronically and submitted to 3RL administration for entry into the PoA monitoring database
   c. The database will automatically generate a unique reference number for each stove

5. Monitoring
   a. The ongoing monitoring of the stoves will be the responsibility of 3RL and will be conducted at the PoA level
   b. A sampled number of stoves will be monitored during every monitoring period to assess their continued usage
   c. A sampled number of stoves will be monitored during every crediting period year to assess their ongoing efficiency
   d. Potential sources of leakage will also monitored during every monitoring period
   e. Monitoring reports will be written for each monitoring period of the PoA

Furthermore, the following items will be addressed by 3RL in the implementation of each CPA included in the PoA:

A. A record keeping system for the PoA:

As 3RL will act as the CPA implementer for every CPA included in the PoA, 3RL will be responsible for managing the record system for each CPA and the PoA.

Installation data will be collected electronically from each CPA by the post-installation team and uploaded into the PoA monitoring database. This will ensure that each stove is individually referenced and logged for monitoring and verification purposes.

Monitoring data will be collected by the monitoring team responsible and passed to 3RL administration for collation. Periodic monitoring reports and emissions reduction calculations will be generated from this data.

All records will be securely maintained and backed-up by 3RL.

B. A system/procedure to avoid double accounting e.g. to avoid the case of including stoves that have been already registered in another CDM project activity or as in another CPA:

A check will be made on the existence of other registered CDM projects within the PoA boundary for each CPA. Furthermore, double-counting of emissions reductions will be avoided by the unique referencing of stoves included in the PoA. This will be done through:

a. *GPS references*: each stove will have a unique GPS-referenced location. During the verification process the DOE will be able to check the existence of stoves related to this GPS location reference.
b. *Name, location and/or ID number*: an additional check of double-counting may be made against the household name, location and/or Zambian government ID number of the stove recipient ascribed to each stove. This may be checked physically during the verification process.
c. *Unique reference numbers*: each stove will also have a unique reference number in the monitoring database. Only one stove will be installed per household. The DOE will be able to check this during the verification process.

C. The CPA included in the PoA is not a de-bundled component of another CDM programme activity (CPA) or CDM project activity:

Each CPA under the proposed PoA is exempt from a de-bundling check due to each independent subsystem/measure being less 1% of the small-scale methodology energy output threshold (as per guidance EB54 Annex 13).

The methodology threshold for AMS. II.G is 180GWh[21] per annum, meaning that each stove in a typical CPA is responsible for 0.006% of the total potential output.[22] Each CPA is therefore exempt from a de-bundling check due to each or stove being less than 1% of the small-scale methodology energy output threshold and the stoves being installed in multiple locations.

D. The provisions to ensure that those operating the CPA are aware of and have agreed that their activity is being subscribed to the PoA:

3RL is the Managing Entity of the PoA and has overall responsibility for managing and operating each of the CPAs. Therefore, those operating the CPAs are legally contracted to 3RL and are fully aware of, and

[21] http://cdm.unfccc.int/UserManagement/FileStorage/AM_CLAR_VIIC5MTUUWR9PRPJL0EXOT3G2CKSFQ

[22] GWh (By Savings * NCVBiomass) = (2.71* 0.004167) = 0.011; 0.011/180= 0.00006 = 0.006%

have agreed that, their activity is being subscribed to the PoA. Component manufacturers and installation team members will have specific contracts specifying this. There will also be an emissions rights acknowledgement between each stove recipient and 3RL that confirms the user's involvement in the PoA.

A.4.4.2. Monitoring plan:

All monitoring will be conducted at the PoA-level. The AMS II.G requirements for monitoring are:

1. *Monitoring shall consist of an annual check of efficiency of all appliances or a representative sample thereof to ensure that they are still operating at the specified efficiency (η_{new}) or replaced by an equivalent in service appliance. Where replacements are made, monitoring shall also ensure that the efficiency of the new appliances is similar to the appliances being replaced.*

2. *In order to assess the leakage specified above monitoring shall include data on the amount of woody biomass saved under the project activity that is used by non-project households/users (who previously used renewable energy sources). Other data on non-renewable woody biomass use required for leakage assessment shall also be collected.*

3. *Monitoring shall ensure that:*
   (a) Either the replaced low efficiency appliances are disposed off and not used within the boundary or within the region; or
   (b) If the baseline stoves usage continues, monitoring shall ensure that the wood fuel consumption of those stoves is excluded from B_y

The following activities will be completed during the monitoring period by 3RL for the proposed PoA:

1) Selecting the Sample Group (SG)

A sample group of stove household recipients will be selected for each monitoring period. This sample group will be selected with 90/10 precision (90% confidence interval and 10% margin of error), according to General Guidelines For Sampling And Surveys For Small-Scale CDM Project Activities (version 01) from EB 50 Annex 30. According to a researched method of calculation, a total sample size of 68[23] is applicable.

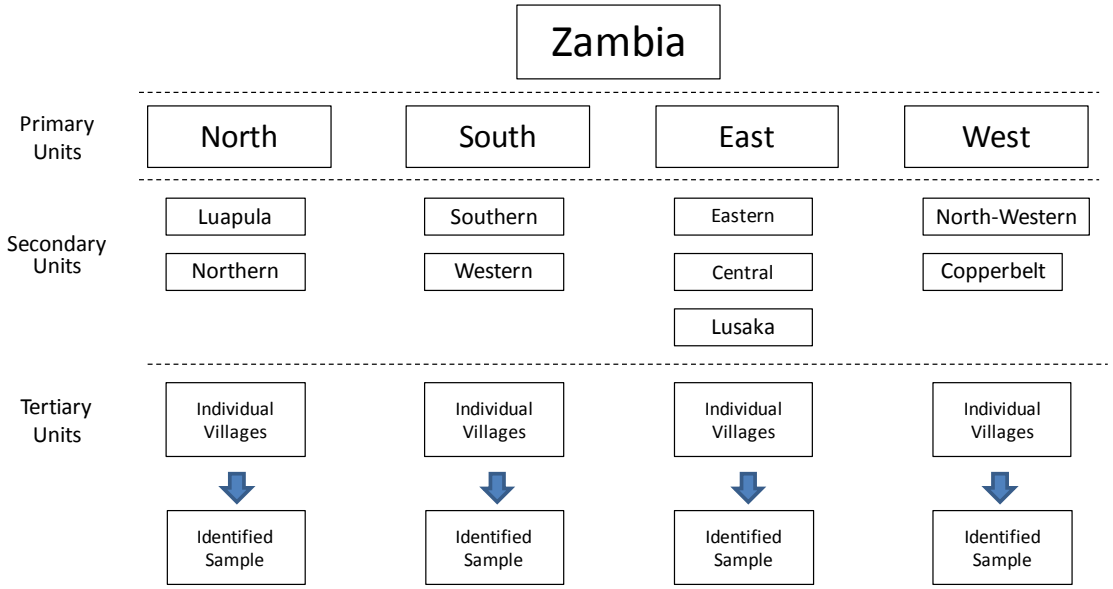
3RL will implement a geographical, multi-stage cluster sampling approach to monitoring, as outlined by the EB50 Guidance:

One version of cluster sampling is area sampling or geographical cluster sampling. Clusters consist of geographical areas. Because a geographically dispersed population can be expensive to survey, greater economy than simple random sampling can be achieved by treating several respondents within a local area as a cluster.

Multistage sampling is a complex form of cluster sampling. Measuring all the sample elements in all the selected clusters may be prohibitively expensive or not necessary. Under those circumstances, multistage cluster sampling becomes useful.

[23] See Annex 4 for sample size calculation

Geographical clusters will be identified in the following manner:



The individual participants will be selected by a random selection programme run on the stoves entered in the PoA monitoring database (the sampling frame), related to the unique reference numbers of stove household recipients within the identified sample. This will generate the participants in the sample group (SG).

A practice of over-sampling will be employed to ensure greater accuracy in the multi-stage sampling approach, which will be documented in each monitoring report. Furthermore, the SG will be re-selected for every monitoring period to ensure the selection remains random.

This statistically-sound, cost-effective sampling method may be used by the DOE for verification of emissions reductions achieved by CPAs under the PoA. In this way the DOE may verify emissions reductions across the PoA by sampling the PoA's monitoring database, only selecting a unique verification SG.

2) On-site SG monitoring

Monitoring teams will survey the usage of 3-rock fires for domestic cooking and water heating purposes only. 3-rock fires used for communal purposes (beer brewing, socializing etc.) will be excluded from the survey, as these were excluded from the baseline woodfuel surveys.

The following monitoring activities of each recipient household in the SG will be undertaken:

a) A confirmation that the stove is still in situ and being utilized in the correct fashion
   – Monitoring staff shall complete an observational check to see that the stove is still located in the same place identified by the installation data and observe that it is still being used.
b) A confirmation that the old appliance (3-rock fire) has been effectively disposed of

- Monitoring staff shall ask users to confirm that the stove is being used for the recipient household's domestic purposes. Staff will ask the recipients to confirm that the 3-rock fire is not being used for day-to-day cooking or water heating purposes.

c) Where the old appliance has not been effectively replaced, a calculation of its continued usage
   - Monitoring staff shall check any residual usage of the domestic 3-rock fire. If this usage includes cooking, water heating or space heating (i.e. those usages measured in the baseline survey), then the average annual wood fuel used for these purposes shall be calculated. This will then be deducted from the baseline woodfuel usage figure (as $B_{y,i}$).

d) A check whether any maintenance of the stove is required following wear and tear
   - Monitoring staff will ask users if there are any maintenance requirements for the stove. A further observational check will be undertaken by staff for maintenance requirements.

These activities will be undertaken by 3RL monitoring teams during every PoA monitoring period and data/responses will be collected electronically and then submitted to 3RL administration.

3) Stove efficiency monitoring

A per-vintage, sampled group of stove household recipients will be selected during every PoA crediting period year to test the ongoing efficiency of the stoves, utilizing the stove manufacturers' EPTP. This stove efficiency sample group (SESG) will be selected with 90/10 precision (90% confidence interval and 10% margin of error), according to General Guidelines For Sampling And Surveys For Small-Scale CDM Project Activities (version 01) from EB 50 Annex 30. According to a researched method of calculation, a total sample size of 68[24] is applicable.

The geographical, multi-stage cluster sampling approach, identified above for the SG, will be applied for the SESG.

The efficiency of each vintage of stove will be monitored separately and a per-vintage efficiency fraction applied to the PoA emissions calculations in each monitoring report. Vintages will correspond to the crediting period year during which the stove was installed.

4) Leakage monitoring

A sample group of non-project households will be selected every PoA monitoring period to assess leakage. This leakage sample group (LSG) will be selected with 90/30 precision (90% confidence interval and 30% margin of error), according to General Guidelines For Sampling And Surveys For Small-Scale CDM Project Activities (version 01) from EB 50 Annex 30. According to a researched method of calculation, a total sample size of 8[25] is applicable.

8 non-project households will be randomly selected, who are identified as having previously solely used renewable energy sources, to assess whether they are using non-renewable biomass during the monitoring period.

[24] See Annex 4 for calculation

[25] See Annex 4 for calculation

If it is found that non-renewable biomass usage has increased in these households as a result of the implementation of the PoA, then this amount shall be estimated from the responses given and a deduction from *By* will be applied.

5) Data Management

Monitoring data from the field surveys will be collated and checked by 3RL administration. Installation data in the monitoring database will be used to identify the households in the SG and SESG. Responses from the monitoring surveys will be retained by 3RL for verification by the DOE.

Monitoring data will be analysed and summarized in the monitoring report.

6) Monitoring report

A PoA monitoring report will be written at the end of every monitoring period and submitted to the DOE responsible for verification. This report will indicate how the monitoring plan has been followed and calculate the PoA emissions reductions for each monitoring period.

A.4.5. Public funding of the programme of activities (PoA):

There will be no public funding involved in the proposed PoA.

SECTION B. Duration of the programme of activities (PoA)

B.1. Starting date of the programme of activities (PoA):

The starting date of the proposed PoA is 22/12/2010, which is the date of commencement of 'real action' in the PoA. This date has been selected as it is the date when the first stoves were ordered under the PoA. It is not earlier than the commencement of validation of the programme of activities, i.e. the date on which the PoA-DD is first published for global stakeholder consultation, which was 24/11/2010.

Individual CPAs may have a starting date prior to the registration of the PoA and this shall not be earlier than the commencement of validation of the programme of activities.

The starting date of the crediting period of each CPA shall not be earlier than the date of its inclusion in the registered PoA.

B.2. Length of the programme of activities (PoA):

The length of the PoA is initially limited to a 7 year crediting period. This may be renewed up to 3 times.

This length has been selected for the PoA as it is consistent with the minimum projected operating lifetime of the stove, as indicated by the stove designer and manufacturer. The actual lifetime may be considerably longer, allowing for the PoA to be potentially extended beyond 7 years.

SECTION C. Environmental Analysis

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C.1. Please indicate the level at which environmental analysis as per requirements of the CDM modalities and procedures is undertaken. Justify the choice of level at which the environmental analysis is undertaken:

1. Environmental Analysis is done at PoA level ✔
2. Environmental Analysis is done at SSC-CPA level ☐

The environmental analysis was chosen to be undertaken at PoA level because there is no variation in the stove technology and the installation procedure amongst CPAs. Furthermore, CPAs are defined by numbers of stoves and not geographically, making a CPA-level environmental analysis difficult.

The PoA does not incur any negative environmental impacts and it is therefore reasonable to consider a single environmental analysis at the PoA level, rather than individual assessments for each CPA.

C.2. Documentation on the analysis of the environmental impacts, including transboundary impacts:

No negative environmental impacts have been identified from the proposed PoA and this has been confirmed by the Environmental Council of Zambia (See Annex 3: letter dated 16/03/2011).

3RL has identified a number of positive environmental impacts related to the implementation of the PoA, although these will not be specifically monitored over the lifetime of the PoA:

- Reduced air pollution related to the reduced, and more efficient, combustion of biomass
- Biodiversity protection, due to the reduction in deforestation rates and the subsequent protection of forest habitat[26]
- Maintenance of watersheds that regulate water table levels and prevent flash flooding, through reduced deforestation[27]

3RL has not identified any localized trans-boundary environmental impacts related to the proposed PoA. Despite significant deforestation, the supply of domestic woodfuel is provided for locally by the existence of sufficient biomass within Zambia, as identified in the baseline data.

Globally, the clear impact from the PoA is a reduction in greenhouse gases mitigating the risk of climate change, as evidenced in the emissions reductions calculations in each monitoring period.

C.3. Please state whether in accordance with the host Party laws/regulations, an environmental impact assessment is required for a typical CPA, included in the programme of activities (PoA),:

In accordance with Zambian regulations, an EIA is not required for typical CPAs included in the proposed PoA. This has been confirmed by the Environmental Council of Zambia, indicating that the project has positive impacts on the environment. (See Annex 3: letter dated 16/03/2011)

[26] http://www.illegal-logging.info/approach.php?a_id=54

[27] http://www.meted.ucar.edu/hazwarnsys/ffewsrg/FF_EWS.Chap.2.pdf

SECTION D. Stakeholders' comments

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D.1. Please indicate the level at which local stakeholder comments are invited. Justify the choice:

1. Local stakeholder consultation is done at PoA level ✔
2. Local stakeholder consultation is done at SSC-CPA level ☐

Note: If local stakeholder comments are invited at the PoA level, include information on how comments by local stakeholders were invited, a summary of the comments received and how due account was taken of any comments received, as applicable.

Stakeholder comments were invited at the PoA level to assess the appropriateness and acceptability of the proposed PoA design. The boundary of the PoA is Zambia and, as CPAs are not defined geographically (only numerically, by total numbers of stoves), it was important to consult stakeholders at the PoA level to ensure that the consultations were inclusive.

3RL has undertaken the following activities to invite stakeholder comments:

Sept-Oct 2010	Regional stakeholder meetings and stove user trials in Nyimba District
March 2011	Regional stakeholder meetings and stove user trials in Katete District
March 2011	National level stakeholder meetings and feedback: • GRZ Ministry of Community Development and Social Services • GRZ Department of Energy • Council of Churches • Islamic Council of Zambia • Zambian Civil Society Climate Change Network • Green Enviro-Watch • House of Chiefs

D.2. Brief description how comments by local stakeholders have been invited and compiled:

Stakeholders were invited to participate in consultations for the implementation of the PoA. These consultations were undertaken as meetings at various stages in the PoA's development. Each meeting was set-up using the following process:

1. Invitations

   Where appropriate, and dependent on local conditions, stakeholders were invited in one of the following ways:

   a. Public Invitation: a newspaper notice and/or radio announcement, placed in local media prior to the stakeholder meeting
   b. Public Notices: fliers placed at strategic locations inviting participants
   c. Personal Invitation: individuals were identified and invited personally with a written or verbal invitation.

   A 'tracking list' of invitations will be established for meetings to ensure that invitations are monitored and logged for responses.

2. Meeting Preparation
   The following must be in place prior to the actual meeting:
   a. Non-technical summary: a simple description of the project that stakeholders will understand
   b. Minute taker: an individual responsible for taking detailed notes of the meeting findings
   c. Participation forms: participants must sign this form to confirm their attendance
   d. Evaluation forms: a simple evaluation form asks each participant to write down their feelings and concerns raised in the meeting and the proposed PoA
   e. Agenda for the meeting
   f. Translator (where required)

3. Meeting conduct
   The meeting will largely follow an agenda according to a common approach:
   a. Opening: introductions, goal of meeting, participation/evaluation form
   b. Explanation of PoA: overview of goals, understanding CDM process, who is involved, project phases and timelines, monitoring requirements, emissions rights acknowledgement
   c. Explanation of stove: the technology, how it is installed and used, the benefits
   d. Questions & Answers: for clarification of key points
   e. Closure: complete evaluation forms and thanks

D.3. Summary of the comments received:

1. Comments from Nyimba meeting and user trials:

First stove recipient: explained that there are major advantages to using the efficient stove installed for her; she found that she only used three pieces of wood to cook within two days whereas previously this would have been used a lot more quickly. She also said there has been much less smoke and less mess due to containment of the ash.

The local councillor for Chiweza ward: has seen a big difference in the amount of wood that people are using and that when he had collected feedback himself it was all positive. He noted that the users don't need to chop down trees because sufficient fuel could be gathered into a basket. Another comment was that there was so little smoke that the family could eat together very soon after the cooking had finished; previously the amount of smoke would mean that it was some time until the room was habitable again after cooking. He stated that his family had more time together as a result. He went on to say that there was visibly less soot in the room, which meant that the roof was likely to remain stronger for longer in his house[28].

Second stove recipient: she had used big pots and that she found it much better than her previous methods, adding that she thought that the cooking area was bigger than the one she had before.

Third stove recipient: made clear the safety aspect that she had noticed, with her three stone fire, there were regular accidents, of people tripping over protruding branches, spilling the water or standing on ash. With her efficient stove this was all solved.

[28] Soot can accumulate in the thatch roof, weakening it and also causing soot to fall on people anytime a rodent/insect comes through the roof. The roof needs more regular replacement as a result.

Fourth stove recipient: was keen to mention the workload and the difference that it made to the quality of life for women. Previously she would be dragging a log, carrying a child and some tools to rush back to cook; now the small amount of wood required was making life much easier with less gathering time required.

Fifth stove recipient: mentioned that she could use the same piece of wood to cook the whole meal due to the efficiency of her stove. One impact that had not been mentioned was the fact that everything was cleaner and easier, including the washing of the pots, which looked like they had been using electricity and were very clean). Previously she would have to scrub using sand to clean them.

Sixth stove recipient: explained that he was particularly pleased with the safety advantages that this stove brings with no tripping hazards or issues with falling into the hot ash.

The following comments were received from the written feedback forms at the community meeting:

- I like it because there's reduction of labour to the women, also prevent from coughing. (Don't like) because it is one stove. *Agnes Daka*
- I think the meeting has been of great importance to us participants. I have liked the project because it reduces the cutting of trees, anyhow, and reduces the risk of women getting sick. *Joseph Beulani, Nyimba Central Orphans Project*
- All I can appeal is that if possible if you can make other stoves, women can have two plates so that when cooking nshima you can cook relish as well. *Gertrude Phiri, Mpeta village*
- It is my first time to hear about it but is very profitable to many lives. The project has come at a right time. *Selina Mumba, Nyimba Congregation, R.C.Z.*
- It's a very good meeting with the meaningful to people who use firewood to cook. I like this project because the cookstove which you have introduced to us is simple to use, and uses little firewood. (Don't like) Because once installed the cookstove you can't remove it. *Benson Zimba, Nyimba District Business Association*
- I like this project because we have been given some modern fire stoves which I didn't have before. What I wouldn't like is if promises are not fulfilled, it will bring a lot of problems to the communities. *Joseph Phiti, Area Councillor, Chiweza Ward*
- I have received it positively and very willing to make use of it with maximum care. It reduces the amount of firewood and natural resources like trees will be conserved, less smoke is produced, less labour is required. It is also free or not costly. (Don't like) the idea of having repairer or people working on them coming overseas. *Captain Clayford Nsana, Secretary, Salvation Army*
- It reduces labour in terms of firewood cutting, improves human health and reduces deforestation. (It is unfortunate) that the stove can only save on household basis and not big institutions like hospitals, schools, churches, community based groups etc. We are lucky because the stove is free of charge. *Evangelist William Daka, Youth Patron, Anglican Church, Nyimba*
- The project will mostly address and reduce labour especially for women, as they tend to spend more time preparing meals for their families. As the stove manufacturers are not locally based but outside, it would be good to train local people to maintain the stoves. *Diana Kawanda Musaka, Ministry of Community Development and Social Services, Nyimba*
- It does not cater to the industries which are major causes of climate change, water and air pollution which are a major threat to human health. These stoves should only be given in rural areas where there is high use of charcoal and wood fuel because people in urban areas have cookstoves using connected power (national grid) and they can afford to pay the bills. *Rafael Monzita, SCORE Zambia*

2. Comments from Katete meeting and user trials:

3RL explained the project to the District Commissioner, District Agricultural Officer and two Katete regional Chiefs. 3RL were was received and invited by the Chiefs to return to install stoves. All four leaders expressed initial support and indicated that the impact of the stoves – reduced pressure on forests, and time and labour savings for women – would be very positive for Katete households.

The community meeting raised a number of comments:

Question / Comment	Response from 3RL
Will people in town benefit?	People in town typically use charcoal. Rural villagers use wood for energy and therefore will be the project focus.
Will people need to supply cement and bricks?	3RL will supply cement and we will ask villagers to supply approximately 25 bricks per stove.
Will the stove heat like a brazier?	The stove is much more energy efficient and therefore keeps heat inside.
What is the lifespan? What happens after that?	If looked after the stove should last 7 years. 3RL intends to maintain a presence in the district through this time and we will make a decision at that point regarding whether to bring new stoves.
Can other organizations help to sensitize people about the project?	Yes, we would like you to get involved.
How can the smoke that is emitted be managed?	The stove will emit less smoke than the traditional fire and as such it can be placed anywhere in the household.
Can the stove be moved if a farmer moves household?	The stove should not be moved. People should contact us if they wish to move households and we'll look into the possibility of constructing a stove in the new home.
Why does the stove need to be built in?	It must be in a fixed location so we can keep track of it. Also, it looks nicer and its durability and security is improved if it is built in.
Well done for supplying the cement which is very expensive for rural people. As it is only 25 bricks people can supply these. (comment from DC)	Thank you
Are the stoves of uniform size?	Yes, we will build each stove to a standard. Each will be made from approximately 25 bricks. However, a user can add to the structure at a later stage.
The demand will be greater than 32000 stoves and people in other areas (Chipata and Petauke) will be interested. How will you manage this demand?	We are focused on Katete to begin with and will assess the project success at end 2011. At that time we will make a decision re where to go next.
Can the stoves be used for institutional use?	This is not the focus of our project.

3. Comments from national stakeholder meetings:

Ministry of Community Development and Social Services
Contact: Ms. Sherry Thole, Permanent Secretary

Date: 21/03/2011

The PS responded positively to the idea of the project and displayed a familiarity with carbon markets. She suggested that 3 Rocks might benefit from coordinating a stove marketing session with a joint Ministry-UNDP event in Eastern Province.

Green Enviro-Watch
Contact: Mr. Abel Musumali, Chief Executive Officer
Date: 22/03/2011

This NGO is focused on addressing youth and employment-related issues in the context of climate change and low-carbon development. They are represented in 70 districts across Zambia, with 350 individual members, 36 member organizations and various connections to regional and international organizations. They have eight full-time staff and are donor-funded.

Questions and feedback which included:

- Who makes the stove? It would have been better for 3 Rocks to manufacture the stoves locally so as to allow Zambia to full benefit from a transfer of technology. Zambians should be involved to some extent in maintenance.
- The environmental and social benefits are clear and very positive.
- Giving stoves away for free is not an ideal approach.
- We will likely come across challenges getting people to switch to the stoves.
- It would be good to offer bigger stoves for cooking in larger pots for larger numbers of people.
- Long term ongoing sensitization and follow up will be necessary.

The two officers agreed enthusiastically that they would like to hear periodically from 3RL regarding the progress of the project, and would be available for support and guidance on community engagement or other challenges we might come up against.

Zambia Civil Society Climate Change Network
Contact: Mr. Machaya Chomba, WWF and ZCCCCN
Date: 24/03/2011

Specific questions and/or feedback included:

- What form the community trust will take and whether it would be possible for communities to buy into the project as 3 Rocks shareholders
- The communities must see the impact over time on their forests and some work by other organizations in the areas surrounding the project would be valuable in establishing environmental, health or social baselines and monitoring the impact of the project.
- It may be a problem for households to all supply bricks – we might consider using clay to install instead.
- 3RL should keep in mind the overall environmental impact of the project.

House of Chiefs
Contact: Chief Madzimawe, Chair of the House of Chiefs of Zambia
Date: 25/03/2011

The Chief said that he had just the day before been briefed by Zambia's Ambassador to the United Nations on issues that had come up during the UN General Assembly, including climate change. The Chief spoke for several minutes about his concerns on climate change and indicated that he was receptive to hearing more about the project.

The Chief's questions and feedback included:

- Deforestation is a major issue – both for firewood and charcoal. What will our children use for cooking?
- He doesn't think anyone will be against the concept of the project as it will reduce the pace of tree-cutting and will have a positive impact on the health of our mothers.
- 3RL has his full support.
- 3RL can feel free to come back to him for guidance or specific assistance on communicating messages about switching to stove us and on distribution.
- It was very good for us to have started with engaging the Chiefs and traditional leaders – they will be our ambassadors. He will inform the Chiefs at their April-May 2011 seating (full meeting in Lusaka) and would like to invite us to come present the project to that audience.

Department of Energy
Contact: Mr. Oscar Kalumiana, Director
Date: 25/03/2011

Questions and feedback included:

- What will the benefits be to local economies?
- The Zambia Gender and Energy Network (ZGEN) might be a good organization to partner with
- CDM should clearly benefit local communities
- Technology transfer should be a key consideration for the project.
- 3RL should look at charging for the stoves, possibly on a monthly instalment plan such as has been used by the Lusaka Sustainable Energy CDM project.
- Energy efficient stoves are a very good idea; the Ministry itself had done some distribution of 200 gel-fuel stoves in Chipata and is very interested in how this project pans out. They'd like to see it succeed and would be interested in periodic updates going forward.
- There is an Energy Week in June 2011 and they would like 3 Rocks to demonstrate the stove. They would also be interested in sending members of their team to any launch events in Katete and might also like to join to observe some of the early installations.
- The concept is very good and the cast iron top will ensure the stove lasts a long time unlike the mud stoves the DoE has been promoting. The project will lessen burdens for women and children and will protect the environment.
- As long as people in Katete are convinced it appears to be a sustainable project.
- There may be political tension regarding distribution and 3RL must involve local chiefs and headmen in order to overcome this.
- All questions during this meeting have been adequately dealt with. It is good that 3 Rocks is being transparent from the outset.
- Sustainability may be an issue after the project moves out of an area – local communities tend to abandon project activities once it's no longer running. Change usually meets resistance as well. Need to leave in place a mechanism for follow-up by local leaders.

- We're happy to have another CDM project in the country.

Council of Churches in Zambia
Contact: Reverend Suzanne Matale
Date: 27/03/2011

The Council of Churches had a very positive response to 3RL's presentation of project plans. While they've traditionally focused on issues of social and economic justice, they have more recently begun to look at climate justice and it is now a core issue on which they are trying to be proactive. Questions and feedback included:

- It's good for households to provide bricks and sand but this isn't a long term sustainable approach.
- Are the stoves secure?
- What about employment and training?
- Will the information be translated? [Yes]
- It's been a challenge for the Church to bring climate change information to the village level. That this project will have the added benefit of informing thousands of people about climate issues is very good.
- It is good not to attempt to introduce a completely new technology – the stove seems to be a natural carry-on or "scaling up" of the 3 stone fire and will have better chance of acceptance.
- The Council of Churches can offer assistance in mobilization of human resources, and would be happy to provide a letter of support or of introduction.
- The project sells itself.
- There is a Climate Justice Network church conference to be hosted in Zambia this year and they would like 3RL to present the project there.

Zambia Islamic Community Services Trust
Contact: Mr. Ibrahim Yusuf, Spokesman
Date: 29/03/2011

The ZICST is the official community outreach arm of the Lusaka Muslim Society. It deals with community projects and charity work for vulnerable communities of any religion. It is the arm of the Muslim Society that engages with government.

The project and stove were presented, with questions and feedback included:

- This is a fantastic idea. They have always toyed with the possibility of distributing stoves but have never followed through.
- Mr. Yusuf is from Chipata (provincial capital near Katete) and grew up in the village and believes that the people there will be very happy with these stoves.
- It is good that the project will also be educating people about environmental issues like deforestation.
- The built-in design is better than a free-standing stove.
- Mr. Yusuf would be happy to facilitate contact with Muslim leaders in Katete and throughout Eastern Province, where there is a large population of Muslims.

D.4. Report on how due account was taken of any comments received:

Comments were responded to in the following ways:

- Installation of stove conducted by non-local people

It was explained that the installation of the stoves will be conducted by local Zambian supervisors in partnership with the recipients. In this way, the project will help to contribute to a local market economy and foster a sense of ownership of the stove for recipients.

- Stove design – non-movable and not robust enough; secure?

3RL explained that the stove is secured to ensure that there is no theft or damage incurred during its lifetime. It was explained that if a recipient moves home, they should inform 3RL to ensure that the ownership of the stove transfers to the new homeowner and allow 3RL to investigate the possibility of the original household recipient participating in the project at their new location. 3RL repeated that once stoves are built in to the brick and cement structure they would be secure from all but the most dedicated attempts to steal or damage them.

- Only one stove

It was explained that the stove is expected to replace the existing cooking appliance (i.e. a 3-rock fire) and that it should be used for all primary cooking and water heating needs. As the stove is more efficient than the existing fire, it was explained that it is able to be used for more purposes. It is not possible to distribute more than one stove per household.

- Only for households – not institutions or businesses

In the explanation of the project, it was made clear that the stove is only for household use. It was explained that there is the possibility of conducting this type of project in institutions and businesses, but that this would have to be considered separately.

- Education and training

3RL outlined in more depth employment and training plans for the PoA, including estimates of job creation. 3RL plans to conduct an ongoing awareness campaign to ensure the successful uptake and correct use of the stove.

- Economic benefits

3RL noted that there are direct and indirect economic benefits – a direct reduction of costs, if any, associated with buying wood; and indirect benefits of increased free time, improved health and a long term reduction of pressure on the surrounding environment.

SECTION E. Application of a baseline and monitoring methodology

This section shall demonstrate how the baseline and monitoring methodology is applied in each CPA. The information defines the PoA-specific elements that shall be included in preparing the PoA specific form used to define and include a CPA in this PoA (PoA specific CPA-DD).

E.1. Title and reference of the approved SSC baseline and monitoring methodology applied to a SSC-CPA included in the PoA:

Each CPA in the proposed PoA will apply the approved small-scale baseline and monitoring methodology II.G. *Energy efficiency measures in thermal applications of non-renewable biomass; Version 2*.

E.2. Justification of the choice of the methodology and why it is applicable to a SSC-CPA:

1. This category comprises appliances involving the efficiency improvements in the thermal applications of non-renewable biomass. Examples of these technologies and measures include the introduction of high efficiency biomass fired cook stoves or ovens or dryers and/or improvement of energy efficiency of existing biomass fired cook stoves or ovens or dryers.

This methodology has been selected as the technologies and measures to be implemented in the proposed PoA include the introduction of high efficiency biomass-fired cooking stoves, as described in section A.4.2.1 above. The introduction of the efficient stoves is the stated goal of each CPA under the proposed PoA.

2. If any similar registered CDM project activities exist in the same region as the proposed project activity then it must be ensured that the proposed project activity is not saving the non-renewable biomass accounted for by the already registered project activities.

A similar registered CDM project exists in the same region as the proposed PoA. The CDM Lusaka Sustainable Energy Project (LSEP), CDM ref. 2969, applies a different methodology (AMS.I.E. *Switch from non-renewable biomass for thermal applications by the user*) from the proposed PoA. This project relies on carbon finance to subsidize the planned sale of 30,000 stoves. It is a fuel-switching project, focusing on the selling a replacement to charcoal stoves, and managing the fuel supply chain, in the urban market of Lusaka.

The amount of non-renewable biomass saved by LSEP has been incorporated into the calculation of the baseline f_{NRB} for the proposed PoA, by accounting for reduced fuel demand in Zambia due to LSEP (see Annex 3).

Furthermore, f_{NRB} will be monitored annually during the proposed PoA's crediting period to assess the ongoing impact of LSEP, and any other registered CDM project, on wood fuel demand in Zambia.

3. Project participants are able to show that non-renewable biomass has been used since 31 December 1989, using survey methods.

The harvesting of non-renewable biomass is commonplace in Zambia and can be reasonably concluded that has been the case since 31 December 1989.

Between 1990 and 2000, Zambia lost, on average, 444,800 hectares of forest per year. This amounts to an average annual deforestation rate of 0.91%. Between 2000 and 2005, the rate of forest change increased by 10.0% to 1.00% per annum. In total, between 1990 and 2005, Zambia lost 13.6% of its forest cover, or around 6,672,000 hectares. Measuring the total rate of habitat conversion (defined as change in forest area plus change in woodland area minus net plantation expansion) for the 1990-2005 interval, Zambia lost 14.3% of its forest and woodland habitat.[29]

[29] All data in this paragraph from: http://rainforests.mongabay.com/deforestation/2000/Zambia.htm

Furthermore, the Food and Agriculture Organization of the United Nations' Global Forest Resources Assessment (FRA) Country Report of Zambia indicates that forested and other wooded land has been steadily decreasing since 1990[30]:

	Forest area (1 000 ha)				Annual change rate					
					1990-2000		2000-2005		2005-2010	
Country/area	1990	2000	2005	2010	1 000 ha/yr	%[a]	1 000 ha/yr	%[a]	1 000 ha/yr	%[a]
Zambia	52800	51134	50301	49468	-167	-0.32	-167	-0.33	-167	-0.33

The f_{NRB} baseline study has shown that non-renewable biomass currently accounts for 93% of the total biomass harvested in Zambia (see Annex 3). It is therefore concluded that non-renewable biomass has been in use since 31 December 1989.

E.3. Description of the sources and gases included in the SSC-CPA boundary

The project boundary is described in the methodology as: *the physical, geographical site of the efficient systems using biomass*. Under the proposed PoA, each CPA is within the country of Zambia and the physical, geographical site of each stove will be within a single household in Zambia which will be identified by a specific unique GPS referenced location.

Emissions sources to be included in, or excluded from, each SSC-CPA boundary in the proposed PoA:

	Source	Gas	Included?	Justification / Explanation
Baseline	Combustion of fire wood for cooking (3-Rock fire)	CO_2	Yes	Major source of emissions
	Combustion of fire wood for cooking (3-Rock fire)	CH_4	No	Minor source of emissions and limited data available. Exclusion is conservative assumption.
	Combustion of fire wood for cooking (3-Rock fire)	N_2O	No	Minor source of emissions and limited data available. Exclusion is conservative assumption.
Project activity	Combustion of fire wood for cooking (efficient stove)	CO_2	Yes	Major source of emissions
	Combustion of fire wood for cooking (efficient stove)	CH_4	No	Minor source of emissions and limited data available. Exclusion is conservative assumption.
	Combustion of fire wood for cooking (efficient stove)	N_2O	No	Minor source of emissions and limited data available. Exclusion is conservative assumption.

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

[30] Global Forests Resources Assessment 2010, FAO (http://www.fao.org/forestry/fra/fra2010/en/)

The baseline scenario, as identified above, is the continued use of non-renewable biomass as fuel on wood-fired, 3-rock fires for cooking purposes in Zambia.

E.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the SSC-CPA being included as registered PoA (assessment and demonstration of additionality of SSC-CPA): >>

Each proposed CPA will reduce GHG emissions through the installation of fuel efficient stoves that reduce the total quantity of non-renewable biomass used by each recipient household for domestic purposes. Each CPA is additional as it relies solely on carbon finance to ensure its implementation. There are no other sources of revenue from the PoA other than from the sales of issued Certified Emissions Reductions (CERs). There is no other incentive to undertake each CPA, nor is there any regulation in Zambia mandating this activity.

E.5.1. Assessment and demonstration of additionality for a typical SSC-CPA:

The assessment of additionality in CPAs will be based on the application of the most recent version of the UNFCCC additionality tool: "Tool for the demonstration and assessment of additionality" (currently version 05.2).

E.5.2. Key criteria and data for assessing additionality of a SSC-CPA:

Additionality will be assessed in each CPA-DD by applying the methodological tool and by selecting the investment analysis (Step 2) and skipping the barrier analysis (Step 3). To demonstrate additionality in the investment analysis step, a simple cost analysis will be undertaken in each CPA-DD.

E.6. Estimation of Emission reductions of a CPA:

E.6.1. Explanation of methodological choices, provided in the approved baseline and monitoring methodology applied, selected for a typical SSC-CPA:

Each CPA will involve the introduction of high efficiency biomass fired cook stoves and therefore will reduce the total amount of non-renewable biomass used by recipients for cooking purposes annually. Emissions reductions will be calculated as per the formulas provided in the baseline and monitoring methodology: AMS II.G. *Energy efficiency measures in thermal applications of non-renewable biomass; Version 2.* Conformity with AMS II.G. has been selected as one of the eligibility criteria for each CPA proposed under the PoA.

B_y is determined by option A: Calculated as the product of the number of appliances multiplied by the estimate of average annual consumption of woody biomass per appliance (tonnes/year).

Leakage is assessed as follows:

1. *Use/diversion of non-renewable biomass saved under the project activity by non-project households/users who previously used renewable energy sources. If this leakage assessment quantifies an increase in the use of non-renewable biomass used by the non project households/users attributable to the project activity then By is adjusted to account for the quantified leakage.*

As the *fNRB* baseline assessment demonstrates, only 7% of biomass in Zambia can be considered renewable. Due to the prevailing levels of extreme poverty in Zambia, very few users of wood-fired, 3-rock fires have access to, or the means to pay for, renewable biomass. Therefore, this type of leakage is highly unlikely.

Under the methodology, this potential source of leakage must be assessed from *ex post* surveys of users and areas from where woody biomass is sourced (using 90/30 precision for selection of samples) when proposing CPAs under a PoA. Therefore, this potential source of leakage **will** be monitored.

2. *If equipment currently being utilised is transferred from outside the boundary to the project activity, leakage is to be considered.*

Equipment for the proposed PoA is being manufactured specifically for the PoA and not transferred from another location, outside the project boundary. Therefore, this potential source of leakage **will not** be monitored.

3. *Use of non-renewable biomass saved under the project activity to justify the baseline of other CDM project activities can also be potential source of leakage. If this leakage assessment quantifies a portion of non-renewable biomass saved under the project activity that is used as the baseline of other CDM project activity then By is adjusted to account for the quantified leakage.*

Non-renewable biomass saved under the project activity is not being used to justify the baseline of the only other CDM project registered in Zambia: the Lusaka Sustainable Energy Project (LSEP). The *fNRB* baseline assessment for the proposed PoA incorporates the fuel saved by LSEP and therefore accounts for this potential source of leakage. The *fNRB* parameter will be monitored annually to assess the ongoing impact. Therefore, this potential source of leakage **will not** be monitored.

4. *Increase in the use of non-renewable biomass outside the project boundary to create non-renewable biomass baselines can also be potential source of leakage. If this leakage assessment quantifies an increase in use of non-renewable biomass outside the project boundary then By is adjusted to account for the quantified leakage.*

The project will not increase the use of non-renewable biomass outside the project boundary (the country border of Zambia is the project boundary). The project will reduce the overall demand for biomass in Zambia and will therefore increase the potential supply of biomass, and not decrease it. Zambian households do not currently source wood fuel from across international borders, due to the sufficient availability of biomass within Zambia. And the use of non-renewable biomass by those outside of the project boundary (i.e. citizens of other countries) will not be affected by the project. Therefore, this potential source of leakage **will not** be monitored.

E.6.2. Equations, including fixed parametric values, to be used for calculation of emission reductions of a SSC-CPA:

Emission reductions per stove will be published in periodic monitoring reports, incorporating all CPAs included in the PoA, and calculated according to the following methodological formula:

Ex-Ante emissions reductions are calculated as follows:

$ER_y = By,_{savings} * f_{NRB,y} * NCV_{biomass} * EF_{projected\_fossilfuel}$

Where:

1. $B_{y,\ savings}$ Quantity of woody biomass that is saved per stove per annum in tonnes. The formula for calculating this is: $B_y * (1-\eta_{old}/\eta_{new})$
2. $f_{NRB,y}$ The fraction of biomass used in absence of the project that is non-renewable (0.93). This is monitored yearly in the PoAs crediting period.
3. *NCVbiomass* IPCC default value for net calorific value of substituted biomass (0.015 TJ/tonne, methodology default)
4. $EF_{projected\_fossilfuel}$ IPCC default value for Coal Briquettes (97.5 tCO2/TJ, see Annex 3)
5. B_y Average quantity of woody biomass used per stove per annum in absence of the project (4.1 tonnes per annum baseline survey, see Annex 3)[31]
6. η_{old} Thermal efficiency of 3-rock fires (0.10, methodology default)
7. η_{new} Thermal efficiency of the new appliance (0.295 baseline EPTP test, see Annex 3).

Ex-post emissions reductions are calculated as follows:

$ER_y = (By,_{savings} * f_{NRB,y} * NCV_{biomass} * EF_{projected\_fossilfuel})$

Where:

1. $B_{y,\ savings}$ Quantity of woody biomass that is saved per stove per annum in tonnes. The formula for calculating this is: $B_{y,i} * (1-\eta_{old}/\eta_{new,i})$
2. $f_{NRB,y}$ Monitored fraction of biomass used in absence of the project that is non-renewable. Figure taken from relevant assessment year.
3. *NCVbiomass* IPCC default value for net calorific value of substituted biomass (0.015 TJ/tonne, methodology default)
4. $EF_{projected\_fossilfuel}$ IPCC default value for Coal Briquettes (97.5 tCO2/TJ, see Annex 3)
5. $B_{y,i}$ Average quantity of woody biomass saved per stove per annum, adjusted for any leakage identified (*Ly*)
6. η_{old} Thermal efficiency of 3-rock fires is selected (0.10)
7. $\eta_{new,i}$ Monitored thermal efficiency of the new appliance

[31] Methodology Option A selected: Calculated as the product of the number of appliances multiplied by the estimate of average annual consumption of woody biomass per appliance (tonnes/year). This can be derived from historical data or a survey of local usage.

ER_y will then be divided by 365 to give emissions reductions per stove per vintage per diem and this figure will be multiplied by the total aggregated number of stove operating days per monitoring period (*OD*) to give the total emissions reductions per monitoring period.

Stoves in a vintage shall be categorized as stoves installed during each complete year of the PoA's crediting period. Each vintage of stove will be subject to a separate calculation of ERs, as the monitoring of $\eta_{new,I}$ will be by vintage.

E.6.3. Data and parameters that are to be reported in CDM-SSC-CPA-DD form:

Data / Parameter:	B_y
Data unit:	Tonnes per annum
Description:	Quantity of biomass used in absence of the project activity (per stove)
Source of data used:	Baseline survey
Value applied:	4.1
Justification of the choice of data or description of measurement methods and procedures actually applied :	The baseline survey assessed the average domestic biomass usage for cooking and water heating per household per annum amongst users of traditional 3-rock fires, according to interviews. This data was gathered according to: General Guidelines For Sampling And Surveys For Small-Scale CDM Project Activities (Version 01); CDM EB50 Annex 30.
Any comment:	See Annex 3 & Sampling Plan for Household Annual Average Woodfuel Usage Survey for details.

Data / Parameter:	η_{new}
Data unit:	Fraction
Description:	Thermal efficiency of the stove
Source of data used:	Stove Manufacturers Emissions & Performance Test Protocol (EPTP) Certificate
Value applied:	0.295
Justification of the choice of data or description of measurement methods and procedures actually applied :	The stove design was tested independently for its efficiency.
Any comment:	See Annex 3

Data / Parameter:	$f_{NRB,y}$
Data unit:	Fraction
Description:	Non-renewable biomass usage in Zambia, as a proportion of total biomass usage
Source of data used:	Baseline calculation
Value applied:	0.93
Justification of the choice of data or description of measurement methods	An independent consultant calculated the overall biomass usage in Zambia and, according to independently published sources, ascertained the proportion of that biomass used in Zambia which is non-renewable.

and procedures actually applied :	
Any comment:	See Annex 3

Data / Parameter:	η_{old}
Data unit:	Fraction
Description:	Efficiency of 3-rock fire cooking method (system being replaced)
Source of data used:	Methodology default
Value applied:	0.10
Justification of the choice of data or description of measurement methods and procedures actually applied :	AMS II.G, version 2
Any comment:	

Data / Parameter:	$NCV_{biomass}$
Data unit:	TJ/tonne
Description:	Net calorific value of the non-renewable woody biomass that is substituted
Source of data used:	IPCC default
Value applied:	0.015
Justification of the choice of data or description of measurement methods and procedures actually applied :	AMS II.G, version 2
Any comment:	

Data / Parameter:	$EF_{projected\_fossilfuel}$
Data unit:	tCO_2/TJ
Description:	Emission factor: substitution of non-renewable biomass by similar consumers
Source of data used:	IPCC default
Value applied:	97.5
Justification of the choice of data or description of measurement methods and procedures actually applied :	The IPCC coal briquette default factor is used.
Any comment:	See Annex 3

Data / Parameter:	*DRB*
Data unit:	tonnes
Description:	Demonstrably renewable biomass
Source of data used:	$f_{NRB,y}$ baseline study

Value applied:	1,253,889
Justification of the choice of data or description of measurement methods and procedures actually applied :	The justification is clearly outlined in the full $f_{NRB,y}$ baseline study, presented in Annex 3.
Any comment:	See Annex 3

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

E.7.1. Data and parameters to be monitored by each SSC-CPA:

Data / Parameter:	*NS*
Data unit:	Number
Description:	Number of stoves still operation during the monitoring period
Source of data to be used:	Installation data and monitoring survey
Value of data applied for the purpose of calculating expected emission reductions	n/a; will only be available ex-post
Description of measurement methods and procedures to be applied:	The total number of stoves in operation in the PoA during the monitoring period compared to the total number of stoves installed in the PoA (according to the installation records in the monitoring database) will be assessed. Stoves in operation in the Sample Group (SG) will be counted during each monitoring period to derive an attrition rate (expressed as a percentage) and this percentage deduction will be applied to the total number of stoves operating in the PoA during that monitoring period. The total number of stoves to be selected for SG monitoring will be 68 per monitoring period. This number has been calculated according to a 90/10 precision (90% confidence interval and 10% margin of error) required by the methodology.
QA/QC procedures to be applied:	The unique reference number of each stove shall be logged in the monitoring database showing the total number of stoves. Data from the SG will be collected in each monitoring period and applied to the emissions reductions calculations. In case of any variation between the installation data and the SG monitoring data, a larger sample may be selected to ensure greater accuracy.
Any comment:	For details of the sample size calculation, see Annex 4.

Data / Parameter:	*OD*
Data unit:	Days
Description:	Total stove operating days in monitoring period
Source of data to be used:	Installation and monitoring survey data in monitoring database
Value of data applied for the purpose of	n/a; will only be available ex-post

calculating expected emission reductions	
Description of measurement methods and procedures to be applied:	The number will be calculated by counting the number of days from the installation date of each stove until the end of the monitoring period and aggregating the total days. This number will be adjusted for any stove attrition rate identified in the SG survey.
QA/QC procedures to be applied:	The unique reference number of each stove shall be logged in the monitoring database. The date of installation shall be utilized to determine the portion of the monitoring period that the stove has been in operation. Any interruption in the stoves' operation (e.g. where stoves are replaced or drop out) will register as missed operating days in the monitoring database for emissions calculation purposes.
Any comment:	

Data / Parameter:	$\eta_{new,i}$
Data unit:	Fraction
Description:	Efficiency of stove by vintage
Source of data to be used:	Crediting period year stove manufacturers' Emissions & Performance Test Protocol (EPTP) test
Value of data applied for the purpose of calculating expected emission reductions	n/a; will only be available ex-post
Description of measurement methods and procedures to be applied:	During every crediting period year, a sample of stoves will be tested for their thermal efficiency. The total number of stoves to be selected for efficiency monitoring will be 68 per vintage. This number has been calculated according to a 90/10 precision (90% confidence interval and 10% margin of error) required by the methodology. Stoves in a vintage shall be categorized as stoves installed during each complete year of the PoA's crediting period.
QA/QC procedures to be applied:	Tests will be undertaken by experienced project staff following the Stove Manufacturers Emissions & Performance Test Protocol (EPTP)[32]. Staff will follow the procedure used in the EPTP and record the thermal efficiency of each stove tested, which will be subsequently uploaded to the monitoring database for emissions calculation purposes. Any variation from the baseline efficiency will be applied to the emissions calculations in the monitoring reports. In the case of any variation in efficiency from the baseline, a larger sample of stoves may be selected to ensure greater accuracy. During the first year of operation for each vintage of stove, the baseline tested figure will apply.
Any comment:	For details of the sample size calculation, see Annex 4.

Data / Parameter:	*Ly*
Data unit:	Fraction

[32] Stove Manufacturers Emissions & Performance Test Protocol (EPTP): A protocol for testing stove fuel efficiency and emissions and a standard for improved stoves; Defoort, L'Orange, Kreutzer (EECL), Lorenz (Envirofit), Kamping (Philips) 2009

Description:	Amount of woody biomass saved under the project activity that is used by non-project households/users (who previously used renewable energy sources)
Source of data to be used:	Leakage survey
Value of data applied for the purpose of calculating expected emission reductions	n/a; will only be available ex-post
Description of measurement methods and procedures to be applied:	Non-project households who previously used renewable energy sources will be surveyed to assess their fuel usage, to determine whether woody biomass being saved by the project is being used by them. The sample size of participants to be selected for leakage monitoring will be 8 per monitoring period (based on a 90% level of confidence, 30% margin of error).
QA/QC procedures to be applied:	If it is determined that leakage exists, it will be averaged across the sample and *By* will be adjusted by this average fraction accordingly. In case of any variation from the baseline *By* a greater sample size may be selected for increased accuracy.
Any comment:	For details of the sample size calculation, see Annex 4.

Data / Parameter:	$B_{y,i}$
Data unit:	Tonnes per annum
Description:	Quantity of biomass saved per stove per annum
Source of data used:	Monitoring survey
Value of data applied for the purpose of calculating expected emission reductions:	n/a; will only be available ex-post
Description of measurement methods and procedures to be applied:	If the baseline 3-rock fire for domestic usage continues, monitoring shall ensure that the wood fuel consumption of those appliances is excluded from *By*. The SG survey will check the presence of domestic 3-rock fires in the household of stove recipients and the survey questionnaire will be used to ascertain the patterns of usage of each appliance. An average proportion of usage of 3 rock fires shall then be calculated across the SG and a deduction made to *By*, where appropriate.
QA/QC procedures to be applied:	The latest version of the survey form 'CDM Monitoring: Sample Group (SG) Survey' will be used to gather data on patterns of appliance usage for each survey participant. Where residual use of 3 rock fires is found in the SG, the proportion of usage will be derived as a fraction and applied as a correction factor to *By*. In case of any variation from *By* a greater sample size may be selected for increased accuracy.
Any comment:	For details of the sample size calculation, see Annex 4.

Data / Parameter:	$f_{NRB,y}$
Data unit:	Fraction
Description:	Non-renewable biomass usage in Zambia, as a proportion of total biomass usage

Source of data used:	Crediting period year calculation
Value of data applied for the purpose of calculating expected emission reductions:	n/a; will only be available ex-post
Description of measurement methods and procedures to be applied:	During every crediting period year of the PoA the overall biomass usage in Zambia will be calculated and, according to independently published sources, the proportion of that biomass which is non-renewable will be ascertained.
QA/QC procedures to be applied:	The calculation will be undertaken according to the formula in the methodology and data will be derived from the most recent published sources. During the first PoA crediting period year, the baseline calculated figure will apply.
Any comment:	

E.7.2. Description of the monitoring plan for a SSC-CPA:

Emissions reductions generated by CPAs included in the PoA will be monitored by 3RL at the PoA level; through the monitoring plan identified in this PoA-DD and according to a sampling technique. A PoA-level monitoring report will be produced for each monitoring period.

E.8 Date of completion of the application of the baseline study and monitoring methodology and the name of the responsible person(s)/entity(ies)

01/11/2010
Nick Marshall
3 Rocks Ltd.

Annex 1

CONTACT INFORMATION ON COORDINATING/MANAGING ENTITY and PARTICIPANTS IN THE PROGRAMME of ACTIVITIES

Organization:	3 Rocks Ltd.
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Represented by:	
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Salutation:	Mr.
Last Name:	Minty
Middle Name:	
First Name:	Bobby
Department:	
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding will be made available for the proposed PoA, or any CPA under the proposed PoA.

Annex 3

BASELINE INFORMATION

1. *By, appliance* The average quantity of woody biomass used per appliance in absence of the project.

CEEZ
Centre for
Energy, Environment and
Engineering Zambia Limited

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3 Rocks Ltd
17A York Street
St Helier
Jersey
JE2 3RQ

15th March 2011

Dear Sirs

Baseline Woodfuel Survey Report

CEEEZ was given the task of finding out the average annual domestic woodfuel use across households in Zambia using a survey method to define a key baseline parameter for the proposed Programme of Activities: Fuel Efficient Stoves in Zambia.

The Sampling Plan for Household Annual Average Woodfuel Usage Survey entailed our selection of four distinct areas and interviews with 120 randomly selected householders in both the wet and dry seasons in Zambia; during July 2010 and March 2011 (we practised oversampling for ease of survey distribution and in order to improve accuracy). The wood used solely for domestic purposes (cooking and water heating) for a typical day was weighed using hanging scales.

Our Consolidated Baseline Woodfuel Survey Report gives the full details on the methodology for conducting the surveys and the findings. We are writing to confirm that the findings show, after removal of 'outliers' in the data, an average annual woodfuel use for domestic purposes in Zambia of 4.1 tonnes per annum.

Yours faithfully

Professor Francis Yamba (M.Sc Ph.D. Hon FEIZ. R. Eng.)
Centre For Energy Environment And Engineering Zambia (CEEEZ) Ltd.
176 Pairenyatwa Road
Suite B. Fairview
P/B E721

In advance of conducting the field surveys, desk research was completed to ascertain values from previous studies. Zambia has a population of 9,885,591 according to the official 2000 census[33]. The total number of household heads is 1,884,741, giving an average figure of 5.25 persons per household.

The Food and Agriculture Organization (FAO) of the United Nations published a "Woodfuel review and assessment in Zambia"[34] indicating that, in 1999, the Zambian Forestry Department calculated a per capita average annual woodfuel usage of 1.025 tonnes per annum.

This would give an average woodfuel usage figure per household per annum of **5.38 tonnes** (5.25 x 1.025).

In July 2010 and March 2011, a survey of average per household per diem woodfuel usage was commissioned by 3RL. The sampling approach to identify households was based on available guidance (General Guidelines For Sampling And Surveys For Small-Scale CDM Project Activities [Version 01]; CDM EB50 Annex 30) and the multi-stage sampling approach was selected. The surveys were undertaken by independent experts, the Centre for Energy, Environment and Engineering Zambia Ltd (CEEEZ), in both the wet and dry seasons and in 4 distinct regions of Zambia.

The sampling approach taken is outlined in 3RL's Sampling Plan for Household Annual Average Woodfuel Usage Survey, available for review by the DOE at validation. The Consolidated Baseline Wood Fuel Survey Final Report by CEEEZ (March 2011) is also available for review by the DOE at validation and is summarized here:

The main objective of the baseline wood fuel survey was to establish the current daily mean wood fuel consumption per household in Zambia. The second objective was to establish demographic setting, cooking habits and socio economic aspects of the selected areas. This was for the purpose of understanding the implications of such factors on wood fuel consumption in household.

The methodology employed in this survey to gather data involved meeting key stakeholders, sampling target areas, use of open-ended questions at focus group discussions, guided questionnaires for households, and actual wood fuel measurement. The survey was conducted in the two main seasons in Zambia; the rainy season, completed in March 2011, and the dry season, completed in July 2010.
A 3-stage, geographical cluster sampling approach was used, according to the EB guidance for Sampling and Surveys for Small-Scale CDM Project Activities, as outlined in EB meeting 50 Annex 30. With regard to the country of Zambia, population clusters occur naturally within political regions and districts, mostly as villages.

Village meetings were held in each of the selected areas (Mpika, Nyimba, Masaiti and Kaoma) at which the aim of the survey was explained in detail. Wood fuel measurements were conducted on three consecutive days in the selected survey sites. Wood stocks were weighed at the start and at the end of the day; the difference being the total consumption of woodfuel on that day. The results of the measurements were then averaged in order to establish actual daily consumption of firewood per household.

[33] http://www.zamstats.gov.zm/census.php

[34] http://www.fao.org/docrep/004/X6802E/X6802E00.htm#TOC

Based on the analysis of the survey undertaken in the four regions of Zambia, it was observed that all selected households use firewood as a major source of energy for cooking. All participants in the study own three stone fire-stoves which they use in separate kitchens or in the open yards.

Only woodfuel used for day-to-day domestic purposes was measured (cooking, water heating and space heating). Additional woodfuel is used in communal three stone fires for beer brewing and socializing. Communal use woodfuel was not included in the survey measurements, as it is not consumed for domestic purposes. Once data was collected from the surveys, and the outliers removed, the national average daily domestic woodfuel consumption was calculated at 11.25kg, or 4.1 tonnes per annum.

In order to be conservative, the selected figure comes from the survey data collected above (as opposed to the higher researched figure), and therefore:

B_y = **4.1 tonnes**

η_{new} Efficiency of the system being deployed

November 11, 2010

ENGINES & ENERGY CONVERSION LAB

DEPARTMENT OF MECHANICAL ENGINEERING
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Emissions and Performance Report

The stove listed below has been tested in accordance with the "*Emissions and Performance Test Protocol*", with emissions measurements based on the biomass stove testing protocol developed by Colorado State University (available at www.eecl.colostate.edu).

Stove Manufacturer:	Envirofit International
Stove Model:	Z-3000
Test Dates:	9/16/2010-9/28/2010
Average Thermal efficiency:	29.5%
80% Confidence Interval:	29.2-29.9

The above results are certified by the Engines and Energy Conversion Laboratory at Colorado State University. All claims beyond the above data are the responsibility of the manufacturer.

Morgan DeFoort
EECL Co-Director
Technical Lead, Biomass Stoves Testing Program

In September 2010, the proposed PoA's selected stove model was tested by the Engines & Energy Conversion Lab of Colorado State University (EECL), according to the Stove Manufacturers Emissions & Performance Test Protocol (EPTP)[35]. The protocol was co-developed by the EECL, the Shell Foundation, Envirofit International and Phillips.

The test report summary is shown above and the baseline average thermal efficiency is calculated as:

$\eta_{new} = 0.295$

[35] Stove Manufacturers Emissions & Performance Test Protocol (EPTP): A protocol for testing stove fuel efficiency and emissions and a standard for improved stoves; Defoort, L'Orange, Kreutzer (EECL), Lorenz (Envirofit), Kamping (Philips) 2009

2. $f_{NRB,y}$ Non-renewable biomass fraction

f_{NRB} is the fraction of woody biomass saved by the project activity in year *y* that can be established as Non-Renewable Biomass (NRB). It has a range from 0 to 1, where 1 equates to 100% of the woody biomass saved by the project being non-renewable. According to the methodology this is calculated with the following equation:

$$f_{NRB} = \frac{NRB}{NRB + DRB} \quad (1)$$

Where,
DRB – Demonstrably Renewable Biomass, tonnes;
NRB – Non-Renewable Biomass, tonnes.

Non-Renewable Biomass is the quantity of woody biomass used in the absence of the project activity (B_y) minus the DRB component, and can be calculated using the following equation:

$$NRB = B_y - DRB \quad (2)$$

Calculating By:
B_y can be calculated by multiplying the amount of fuelwood used per person per year by the total number of people in the project area. In this case study the project area is the whole of Zambia. Estimates of per capita consumption of firewood and charcoal for rural and urban households were obtained from a study by the Government of Zambia's Ministry of Environment and Natural Resources [2]. Rural and urban population estimates were obtained from the 2010 national population census [3], which cited a total population of 13,046,058, with an estimated rural:urban ration of 61:39 [3]. To estimate total national fuel demand in terms of woody biomass, the conversion of wood to charcoal was assumed to be 15% efficient[4]. Woodfuel demands in urban and rural Zambia are summarised in Table 1 below.

Table 1: Estimates of urban and rural population, and rates of fuelwood consumption in Zambia

	rural	urban	total
Population	7,958,095	5,087,963	13,046,058
Firewood consumption (kg person^{-1} yr^{-1})	1,025	240	
Charcoal consumption (kg person^{-1} yr^{-1})	73	139	
Total woodfuel consumption (t yr^{-1})	12,020,199	5,935,956	**17,956,155**

Using cited population estimates and total fuelwood use, the estimated annual demand for woodfuel in Zambia, B_y, is **17,956,155**tonnes per annum, including charcoal.

The above estimate has not considered the influence of existing CDM (e.g. ICS) projects within the studied area, which potentially may lower woodfuel demand by improving fuel efficiency of beneficiary households. The Lusaka Sustainable Energy Project (LSEP) [5] is a CDM project implemented in Lusaka that aims to introduce 30,000 Save80 efficient cooking stoves, which can be fuelled by renewably harvested twigs and lumber-processing waste as an alternative to charcoal. Using an average urban household size of 5.2 persons per household, the LSEP project could reduce urban demand for charcoal by 156,112persons, equivalent to **144,663** tonnes fuelwood per annum. Accounting for reduced fuel

demand due to the LSEP project, annual woodfuel demand B_y, is **17,811,492**tonnes per annum including charcoal.

Calculating DRB:

DRB is calculated as the annual growth of DRB stocks in Zambia. Initially, total DRB stocks must be estimated (from government data) and then the annual DRB growth stocks derived from this data. This will determine the share of DRB in By, as per the methodology.

The total growing stock of forests in Zambia is reported [6][7] as ranging from 1,307,000,000 m^3 to 2,755,380,000 m^3. An average of 2,031,190,000 m^3 was used for the calculations below. Forestry management in Zambian forests has been declining since the 1980s due to a steady reduction in public funding[8]. Consequently, the assumption that forests in national parks and reserves fulfil the above criteria may be misleading. It is difficult to quantify exactly the extent of and the area of poor management, and consequently the reduction in DRB area. What is evident is that there is considerable illegal harvesting of trees and expansion of settlements in GMAs[9]**Error! Reference source not found.** and open forest or forest reserves[10]**Error! Reference source not found.**. Furthermore, the lack of resources available to the Forestry Department has lead to unsustainable forest management practices and poor enforcement of those practices that work[11][12]. Of the total forest growing stocks only 23% have a management plan, and a mere 6.5% are 'forests designated strictly as reserves'[11]. The latter percentage is used as an estimate of the proportion of forest growth stocks that fulfil the criteria of demonstrably renewable woody biomass. This is under the methodological DRB condition 1: the woody biomass is originating from land areas that are forests where:

(a) The land area remains a forest; and

(b) Sustainable management practices are undertaken on these land areas to ensure, in particular, that the level of carbon stocks on these land areas does not systematically decrease over time (carbon stocks may temporarily decrease due to harvesting); and

(c) Any national or regional forestry and nature conservation regulations are complied with.

Cubic meters of wood can be converted into tonnes of wood by multiplying by the wood density. This figure of wood density varies according to species and consequently an appropriate average wood density was sought. Zambia has several woodland types, with miombo the most prominent. Wood densities of a wide range of Zambian species were used to determine a range from light to heavy densities. A typical Zambian species with light wood is *Sterculia acuminata* (bitter cola; density 0.25 to 0.6 t/m3)[13]. A typical Zambian species with hard wood is *Diospyros mespiliformis* (a variety of ebony found in Zambia; density 0.77 to 0.85 t/m3)[13]. The extremities of this range consequently cover most Zambian woodland species. The appropriateness of the range is further confirmed by observing the wood density of a wide range of *Brachystegia* spp. which are characteristic species found in miombo woodlands i.e. the predominate woodland type in Zambia. An intermediate value in the range (0.55 t/m3) was deemed as an appropriate average in terms of a best estimate. This is confirmed by the FAO value of 0.56 t/m3[18]. See table below:

Wood density (FAO, 2003)

Tropical Region	Mean	Common-range
Africa	0.56	0.50-0.79
America	0.6	0.50-0.69

Asia	0.57	0.40-0.69

Woody density for a wide range of species therefore has been documented as ranging from 0.25-0.85 t m^{-3}. We chose an intermediate value of **0.55** t m^{-3} to use as an average wood density in Zambia.

The total DRB stocks in Zambia is calculated by multiplying the total average growing stock by the proportion of that which is deemed renewable and the average wood density. This is calculated to be **72,615,043** t (2,031,190,000 x 6.5% x 0.55).

To obtain the annual DRB stocks, the total standing DRB is multiplied by the annual growth rate of that biomass, shown as a percentage of the total biomass, or Mean Annual Increment (MAI). The MAI of miombo woodland has been reported[15] as ranging from 0.4% - 3.5% annually. In Zambian forest reserves MAI has been reported as 1.57%.[15] Miombo woodland comprises nearly half of all Zambian woodland, and is generally faster growing than teak or mopane forest, and consequently estimation using these rates can be considered conservative. Based on the range of annual growth reported for miombo woodland and that reported for forest reserves, an average growth rate of 1.76% was used in the calculations. This is conservative as the average includes forest areas of poor and no management, which do not meet the DRB criteria.

Therefore, the annually available DRB is **1,278,025** t yr^{-1} (72,615,043 x 1.76%).

Calculating NRB:
Non-renewable woody biomass is supported by the following indicators:

- **Survey results, national or local statistics, studies, maps or other sources of information such as remote sensing data that show that carbon stocks are depleting in the project area;**

Total living biomass carbon stocks (including both above- and below-ground biomass) have depleted from 2578.68 million tons in 1990 to approximately 2415.96 million tons in 2010[6]. The annual loss in biomass carbon has been estimated[16] at between 12.8 and 29.9 mega tonnes of carbon per year.

- **Trends in the type of cooking fuel collected by users, suggesting scarcity of woody biomass.**

"Most households have no alternative to firewood and charcoal. The increasing exploitation of trees for charcoal has contributed to deforestation."[17]

"The high demand for woodfuel has resulted in non-species selective cutting regimes being applied by many woodfuel producers, culminating in severe depletion of many forest ecosystems and the resultant land degradation. Since rural communities can now neither find productive land nor meet the costs for agricultural inputs, the implied situation is one that perpetuates forest destruction irrespective of tree size, species and/or quality."[2]

The values of B_y and DRB, calculated above, were inserted into equation (2) to calculate the annual NRB for Zambia.

Thus NRB is By-DRB = **17,811,492 –1,278,025= 16.53 million tonnes yr^{-1}.**

Calculating fNRB:

Using equation (1), $f_{NRB,y}$ is calculated as NRB/(NRB+DRB) = 16.53/(16.53+1.278) (million tyr^{-1})

Therefore, $f_{NRB,y}$ = **0.93**

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Links to species:
Sterculia sp:
http://www.worldagroforestrycentre.org/sea/Products/AFDbases/WD/asps/DisplayDetail.asp?SpecID=3272

Diospyros:
http://www.worldagroforestrycentre.org/sea/Products/AFDbases/WD/asps/DisplayDetail.asp?SpecID=1134

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$EF_{projected\_fossilfuel}$ Emissions factor of the projected fossil fuel

According to the CDM methodology; II.G. *Energy efficiency measures in thermal applications of non-renewable biomass:* "It is assumed that in the absence of the project activity, the baseline scenario would be the use of fossil fuels for meeting similar thermal energy needs." Therefore the projected emissions factor to be applied in emissions calculations for any CDM project is derived from a fossil fuel baseline:

"*EF projected_fossil fuel*: Emission factor for the substitution of non-renewable woody biomass by similar consumers. The substitution fuel likely to be used by similar consumers is taken: 71.5 tCO2/TJ for Kerosene, 63.0 tCO2/TJ for Liquefied Petroleum Gas (LPG) or the IPCC default value of other relevant fuel."

At present, fuel used in Zambia for domestic purposes is primarily wood fuel, closely followed by charcoal. Firewood was reported by the majority of households (56%), at national level, as the major source of cooking energy, followed by charcoal, which was used by 27% of the households. Among 90% of rural households, utilization of firewood was a very common source of cooking compared with 8% of the urban households. Charcoal was used by the largest percentage of urban households (53%)[36].

In the absence of the project, the most likely fuel to be substituted for wood is charcoal, due to its availability. Charcoal is not, however, considered a fossil fuel. Therefore, the only feasible fossil fuel alternatives to wood and charcoal are: coal (briquettes), kerosene and liquid petroleum gas (LPG).

These options are discussed here:

1. **Coal** - Proven Zambian coal deposits are estimated at over 30 million tonnes.[37] Although Zambia mines coal in the southern part of the country, coal is not currently available for household cooking due to high delivery costs, which make coal more expensive than firewood and charcoal. The economic and financial costs of supplying coal briquettes on a commercial bases and consumer acceptance are not clear.[38] Coal in its raw form is little used for cooking purposes in Zambia and would be inappropriate due to the harmful exhaust emissions. A pilot project of coal briquette production in Lusaka has been on-going since 1991 though it has not been fully commercialized to start producing the coal briquettes due to lack of funding[39]. When commercialized, the coal briquettes would provide an alternative source of energy to charcoal.[40] Coal briquettes utilize waste coal as the main raw material, in addition to bagasse and molasses (which are waste products of sugar manufacturing) and slaked lime. The Lusaka plant utilizes coal waste from Maamba Collieries Ltd. – which produces over 1000 tonnes of waste coal, which was discarded in tailing ponds – as well as bagasse and molasses from Zambia Sugar Company.

[36] The Living Conditions Monitoring Survey, Central Statistics Office, ZAMBIA

[37] CEP factsheet no. 12: energy sources and uses (http://www.sardc.net/imercsa/Programs/Cep/Pubs/Cepfs/CEPFS12.htm)

[38] Zambia country overview: Household energy demand and use, Sparknet, May 2004 (http://www.hedon.info/ZambiaCountrySynthesis)

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[40] An econometric analysis of factors determining charcoal consumption by urban households: The case of Zambia (http://stud.epsilon.slu.se/2274/1/nyembe_m_110214.pdf)

Coal briquettes are smokeless, odourless, and are more economical – and thus more affordable – than charcoal.[41] A 10kg bag of coal briquettes costs about US$1.50, while Zambians have to pay US$5 for the same amount of charcoal, and 1.3kg of coal briquettes can burn for six hours, while the same weight of charcoal will burn for only one and a half hours.[42]

2. **Kerosene** - Zambia has no proven reserves of crude oil from which paraffin and kerosene are derived. As Zambia is landlocked, oil must be imported and transported over great distances, incurring high transportation and insurance charges. Kerosene is primarily used for lighting in Zambia.[43] Cooking with kerosene is the most expensive common means of cooking in both economic and foreign exchange terms. Affordability of kerosene and its appliances are the major constraints, particularly in rural areas, where it cannot compete effectively with freely available energy sources such as wood, crop residues and cow dung. The stoves are relatively cheap, with an efficiency of around 45%. The disadvantages include the smell from kerosene, which sometimes taints the foods and the smoke it produces. There is research which indicates that approximately 4% of the fuel is not burned, and enters the atmosphere as very fine particles with a high concentration of hydrocarbons. Large concentrations of CO are also observed. Another disadvantage of using these cheap kerosene stoves is that they are not durable, and have been blamed for a number of fire accidents and burns.[44] Kerosene prices in Zambia are volatile: the World Bank indicates prices per litre at Kw5,769 in August 2008 and Kw3,834 in January 2009[45]. More recently prices have risen again owing to rises in the price of crude oil, with the Times of Zambia reporting a kerosene price of Kw 4,409 in Lusaka in January 2010[46].

3. **LPG** - LPG is produced locally at INDENI (the crude is imported) and also imported from South Africa and like any other petroleum fuel it is expensive for the low-income households. Appliances, accessories and fuel are expensive and difficult to access and most poor people are unaware of the possibility of using LPG for cooking. There is a perception, among those who do not use LPG, that it is dangerous - mainly due to lack of information on the safe usage of LPG. As a result, LPG is not generally used by low-income households and its use is restricted to industry and the catering trade. Although it is perceived that LPG could be an important household energy source, current limited availability and poor distribution infrastructure limits its use. In the few households where it is used (estimated at less than 500), it is preferred for cooking only, using single burner, high pressure gas cookers.[47]

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[41] Coal Briquettes Avoid Deforestation (http://www.e-parl.net/eparliament/aids/ideas.do?action=summary&interest=28&lan=en&subid=301)

[42] Zambia: a slow start to saving the trees (http://www.irinnews.org/report.aspx?reportid=81797)

[43] CEP factsheet no. 12: energy sources and uses (http://www.sardc.net/imercsa/Programs/Cep/Pubs/Cepfs/CEPFS12.htm)

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[45] Government response to oil price volatility: Experience of 49 developing countries (http://siteresources.worldbank.org/INTOGMC/Resources/10-govt_response-hyperlinked.pdf)

[46] Zambia: Fuel prices go up (http://allafrica.com/stories/201001130066.html)

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In the absence of wood or charcoal, the only likely baseline fossil fuel alternative for cooking energy is likely to be coal-based. This is due to the abundance of coal resources that could be reasonably exploited within Zambia, the affordable price and the potential for conversion and distribution to the local population on a large scale for cooking purposes. Coal briquettes are selected over raw coal particularly, owing to the need to convert raw coal resources for safe household cooking stove usage. Raw coal would represent a health hazard for household use.

There is currently no infrastructure in Zambia supporting the widespread distribution of LPG and the cost of installing this infrastructure is prohibitive. Also, aside from the high costs of refining LPG, there are the additional costs involved in transportation and distribution on a large scale. LPG is therefore not a viable option for substituting biomass-based fuels in Zambia.

Kerosene is currently available in Zambia and mostly used for domestic lighting purposes. It is imported and subject to overseas transport costs and duties. Kerosene would, however, be the most likely alternative to coal briquettes, but is subject to significant price fluctuations in line with the oil price. It is therefore appropriate to make a like-for-like analysis of the kerosene and coal briquettes cost in Zambia.

Kerosene vs. Briquettes Price Analysis:

As noted above, 1kg of coal briquettes costs approximately US$0.15 in Zambia. An average of the kerosene prices quoted above (for 2008, 2009 & 2010) gives Kw4,671, or US$0.98 (using an average conversion of US$1 = Kw4,760[48]) per litre.

	Calorifc Value (TJ/GG)	MJ per KG	Density KG/litre	MJ per litre	Cost	Cost per MJ	$100 would buy (KG)
Kerosene	43.8	43.80	0.817	35.78	$ 0.98	$ 0.0274	3,651
Coal Briquettes	8.9	8.90			$ 0.15	$ 0.0169	5,933

Calorific values taken from the 2006 IPCC Guidelines for National Greenhouse Gas Inventories[49] and the kerosene density conversion rate is quoted publically[50].

This analysis shows that the price per megajoule of coal briquettes is 38% less than that of kerosene in Zambia. Coal briquettes therefore represent the safest, most readily available and least cost option for a projected baseline fossil fuel. Furthermore, coal briquettes are taken as the baseline fuel for the only other registered CDM project in Zambia; the Lusaka Sustainable Energy Project (LSEP).

The IPCC default emissions factor for coal briquettes is 97.5t CO2/TJ[51].

Therefore: ***EF projected_fossilfuel = 97.5***

[48] http://www.exchange-rates.org/history/ZMK/USD/G

[49] http://www.ipcc-nggip.iges.or.jp/public/2006gl/index.html

[50] http://www.simetric.co.uk/si_liquids.htm

[51] 2006 IPCC Guidelines for National Greenhouse Gas Inventories (http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_1_Ch1_Introduction.pdf)

4. Environmental Impacts:

ENVIRONMENTAL COUNCIL OF ZAMBIA

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In reply please quote **ECZ/INS/101/4/1**
No. .....

March 16, 2011

The Programme Coordinator
Africa Carbon Credit Exchange (ACCE)
4th Floor, Godfrey House
Kabelenga Road
P.O. Box 390035
Lusaka, Zambia

Dear Madam,

ENERGY EFFICIENT STOVE PROJECT (ZAMBIA)

Reference is made to your e-mail of 15th September 2010 in which you requested for environmental clearance to allow the Africa Carbon Credit Exchange, in cooperation with ICECAP (a UK-based carbon project developer), to prepare and submit a PDD for a carbon offset project that will involve the distribution of high-efficiency wood fuel cookstoves to rural households in Zambia.

With reference to the information provided by yourselves in the Project Idea Note, ECZ has no objection to the proposed project and therefore there is no need for an environmental impact assessment to be carried out. This is because the negative impacts associated with the project are insignificant while the positive environmental impacts to be enhanced are considerable.

This is in line with the Environmental Impact Assessment Regulations, Statutory Instrument No. 28 of 1997 where ECZ draws powers to identify which projects require environmental assessment.

All correspondence to be addressed to the Director - Head Office

Do not hesitate to contact the undersigned should there be any issues herein that you would wish to clarify.

Yours faithfully,

Maxwell Nkoya
Acting Manager - Inspectorate
For/Director
ENVIRONMENTAL COUNCIL OF ZAMBIA

Annex 4

MONITORING INFORMATION

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A. Sample Size Calculation for Sample Group (SG), Stove Efficiency Sample Group (SESG) and Leakage Sample Group (LSG)

			AMS.II.G.		
			SG/SESG	LSG	
C	Confidence interval	5%	10%	30%	
	Confidence level	95%	90%	90%	
Z	Z Score (function of Confidence Level)	1.96	1.645	1.645	http://www.mypivots.com/dictionary/definition/233/z-score
P	Percentage picking a choice (response distribution)	50%	50%	50%	conservative value used, giving largest sample size
	Sample Size Required	384	68	8	

$$SS = \frac{Z^2 * (p) * (1-p)}{c^2}$$

http://www.surveysystem.com/sample-size-formula.htm

Where:

Z = Z value (e.g. 1.96 for 95% confidence level)
p = percentage picking a choice, expressed as decimal (.5 used for sample size needed)
c = confidence interval, expressed as decimal (e.g., .04 = ±4)

These calculations has been cross-checked using a commercial sample size calculation tool: Raosoft.[52]

Raosoft® — Sample size calculator

What margin of error can you accept? 5% is a common choice	10 %	The margin of error is the amount of error that you can tolerate. If 90% of respondents answer *yes*, while 10% answer *no*, you may be able to tolerate a larger amount of error than if the respondents are split 50-50 or 45-55. Lower margin of error requires a larger sample size.
What confidence level do you need? Typical choices are 90%, 95%, or 99%	90 %	The confidence level is the amount of uncertainty you can tolerate. Suppose that you have 20 yes-no questions in your survey. With a confidence level of 95%, you would expect that for one of the questions (1 in 20), the percentage of people who answer *yes* would be more than the margin of error away from the true answer. The true answer is the percentage you would get if you exhaustively interviewed everyone. Higher confidence level requires a larger sample size.
What is the population size? If you don't know, use 20000	1884741	How many people are there to choose your random sample from? The sample size doesn't change much for populations larger than 20,000.
What is the response distribution? Leave this as 50%	50 %	For each question, what do you expect the results will be? If the sample is skewed highly one way or the other,the population probably is, too. If you don't know, use 50%, which gives the largest sample size. See below under **More information** if this is confusing.
Your recommended sample size is	**68**	This is the minimum recommended size of your survey. If you create a sample of this many people and get responses from everyone, you're more likely to get a correct answer than you would from a large sample where only a small percentage of the sample responds to your survey.

The level of precision for a representative sample is from the AMS II.G methodology (90% confidence interval, 10% margin of error). The population used is the total number of Zambian household heads: 1,884,741, as published in the 2000 Zambian census[53]. This population is selected for the baseline wood fuel surveys and therefore when applied to monitoring is conservative. The sample size is calculated at 68.

[52] http://www.raosoft.com/samplesize.html

[53] http://www.zamstats.gov.zm/media/chapter_3_population_comp._size_and_growth-_final.pdf

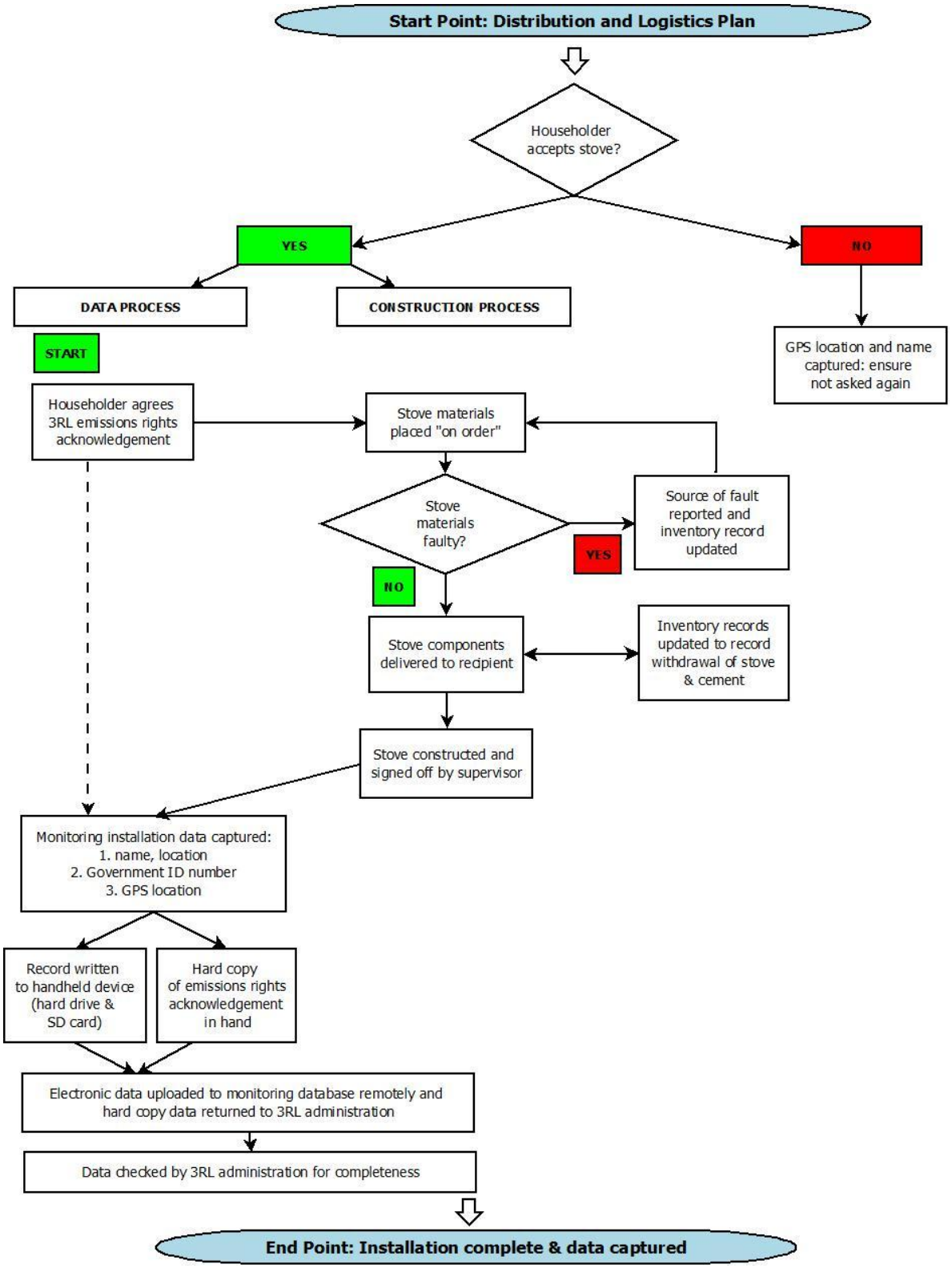
The calculated sample size for 90% confidence interval, 30% margin of error for the LSG is 8:

Raosoft®

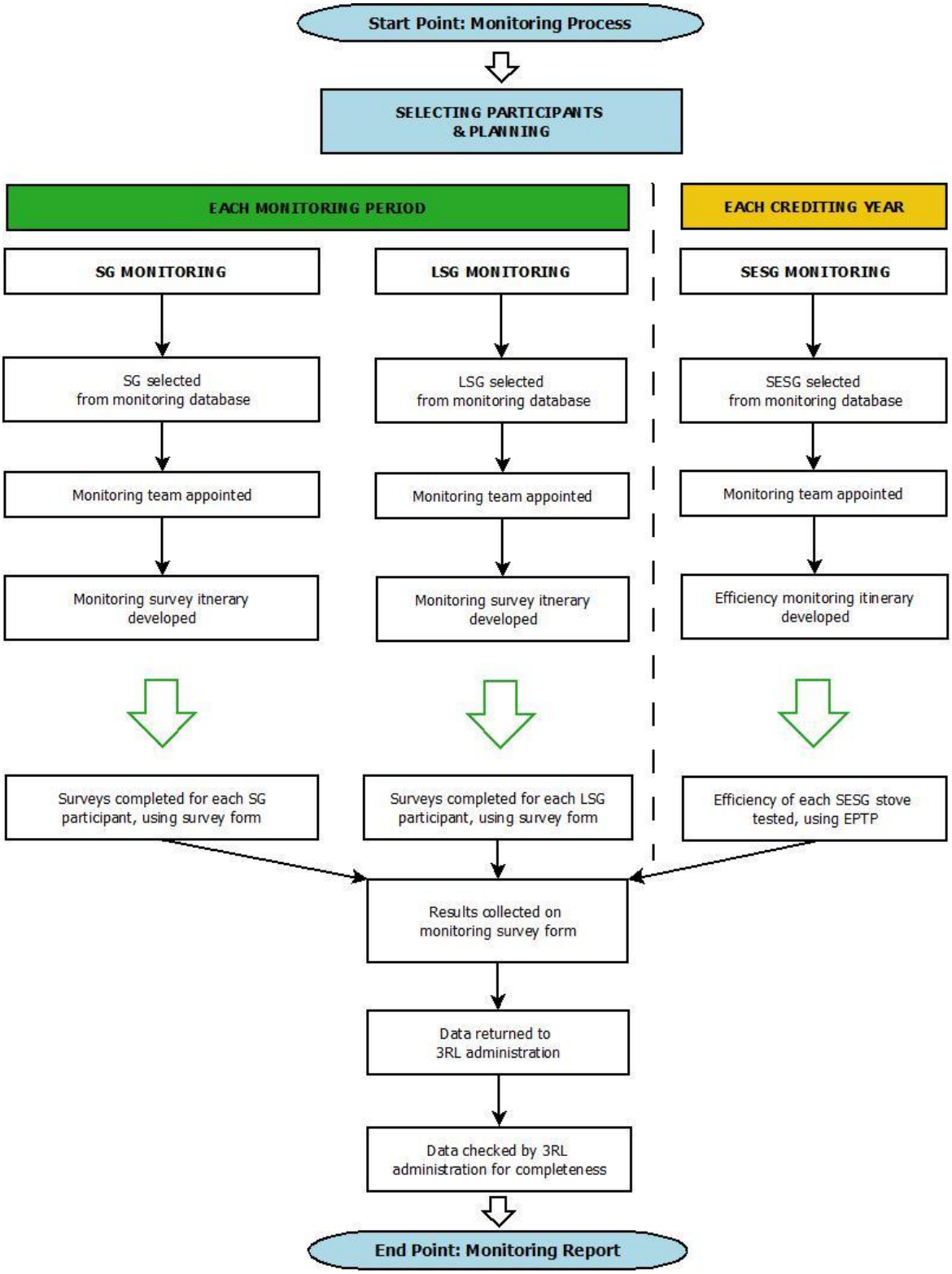
Sample size calculator

What margin of error can you accept? 5% is a common choice	30 %	The margin of error is the amount of error that you can tolerate. If 90% of respondents answer *yes*, while 10% answer *no*, you may be able to tolerate a larger amount of error than if the respondents are split 50-50 or 45-55. Lower margin of error requires a larger sample size.
What confidence level do you need? Typical choices are 90%, 95%, or 99%	90 %	The confidence level is the amount of uncertainty you can tolerate. Suppose that you have 20 yes-no questions in your survey. With a confidence level of 95%, you would expect that for one of the questions (1 in 20), the percentage of people who answer *yes* would be more than the margin of error away from the true answer. The true answer is the percentage you would get if you exhaustively interviewed everyone. Higher confidence level requires a larger sample size.
What is the population size? If you don't know, use 20000	1884741	How many people are there to choose your random sample from? The sample size doesn't change much for populations larger than 20,000.
What is the response distribution? Leave this as 50%	50 %	For each question, what do you expect the results will be? If the sample is skewed highly one way or the other,the population probably is, too. If you don't know, use 50%, which gives the largest sample size. See below under **More information** if this is confusing.
Your recommended sample size is	**8**	This is the minimum recommended size of your survey. If you create a sample of this many people and get responses from everyone, you're more likely to get a correct answer than you would from a large sample where only a small percentage of the sample responds to your survey.

B. Installation Process



C. Monitoring Process



D. Organizational Chart / Monitoring Structure