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Results-Based Financing for Clean Cookstoves in Uganda

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ESMAP
Energy Sector Management Assistance Program

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Acronyms

ACCES	Africa Clean Cooking Energy Solutions (World Bank supported program)
AFTEG	Africa Energy Unit (World Bank)
BoP	base of the pyramid
BEETA	Biomass Energy Efficiency Technologies Association
BLEN	biogas, LPG, electricity and natural gas
BRAC	(formerly) Bangladesh Rural Advancement Committee
CBA	cost-benefit analysis
CDM	Clean Development Mechanism
CER	Certified Emission Reduction (unit)
CREEC	Centre for Research in Energy and Energy Conservation
DALY	disability-adjusted life years
EKN	Embassy of the Kingdom of the Netherlands
ENDEV	Energizing Development Program
ERT	Energy for Rural Transformation
ESMAP	Energy Sector Management Assistance Program
GACC	Global Alliance for Clean Cookstoves
GDP	gross domestic product
GHG	greenhouse gas
GiZ	Gesellschaft für Internationale Zusammenarbeit
HAP	household air pollution
ICS	improved biomass cookstove
ISO	International Organization for Standardization
IPCC	Intergovernmental Panel on Climate Change
IWA	International Workshop Agreement
LPG	liquefied petroleum gas
MEMD	Ministry of Energy and Mineral Development, Uganda
NGO	nongovernmental organization
PREEEP	Promotion of Renewable Energy and Energy Efficiency Programme (GIZ)
PSFU	Private Sector Foundation Uganda
RBF	results-based financing
REA	Rural Electrification Agency
SACCO	savings and credit cooperative
SE4ALL	UN Sustainable Energy for All
UNACC	Uganda National Alliance on Clean Cooking
UNFCCC	UN Framework Convention on Climate Change
USh	Ugandan shilling
VER	Verified Emission Reduction (unit)
WB	World Bank
WHO	World Health Organization

Executive Summary

The fundamental idea behind results-based financing (RBF) is that payments to a service provider are made contingent on the delivery of a pre-agreed result, with achievement of the result being subject to independent verification.

An RBF approach is feasible as part of a broad package of measures to scale up the efficient and clean cooking sector in Uganda – the larger goal being to achieve a range of benefits, including health, in coordination with the government and key stakeholders. Results-based incentives should be combined with robust monitoring and verification arrangements, institutional strengthening, and awareness-raising campaigns to support progress in the sector over time.

What is the context for the design of an RBF approach?

There is an emerging market for improved cookstoves (ICS) in Uganda featuring multiple producers, distributors and technology solutions. We estimate that the combined market size for wood and charcoal ICS in Uganda is about 1.2 million units per year. This compares with current annual ICS production (including imports) of around 0.24 million units. These estimates are based on forecast population data,[1] national survey data and interviews with the main producers of ICS products that are aiming to serve the Uganda market.

The supply of ICS is dominated by one national supplier, Ugastoves, which is currently responsible for around 50 per cent of all sales. Like most of the other larger suppliers, Ugastoves benefits from carbon finance revenues that act as a subsidy for ICS products in the range of 20–40 per cent of the full cost price. They also focus mainly on manufactured ICS products for the charcoal sector, where there is relatively good access to urban and peri-urban markets and where consumers face high fuel costs. They use a mix of approaches for sales and distribution, including "aggregators" such as farmer cooperatives or health service agents. There are some indications that these aggregators will be crucial in the emergence of a larger-scale market over time, particularly when targeting new markets.

Although the sector is expanding thanks to carbon finance incentives, important barriers remain. These barriers in particular impede higher-performance products and fuels that could achieve significant health benefits in future through reduced pollutant emissions. Through close consultation with active market participants in Uganda and internationally, this report identifies the main barriers; Table 1 provides a breakdown by business model.

What is the policy objective?

The policy objective is to stimulate the uptake of efficient and clean cooking solutions that deliver a range of benefits, including health, with an emphasis on facilitating the emergence of a commercial market at scale.[2]

[1] Dataset from World Bank (2013b).

[2] A *commercial market at scale* is defined as a market in which (a) multiple actors serve multiple consumer segments and (b) consumers purchase ICS without intervention.

Table 1: **Market constraints across three business models**

Constraint	Business model			Importance
	Artisanal	Manufactured	Modern Fuels	
Financial barriers Manufacturers	**Limited microfinance**	**Banks loans infeasible** (high cost), capital constraints. **Inability to offer staged payment or financing options**		High
Financial barriers Consumers	**Low ability to pay**, but increases with staged payment options	**Low ability to pay** for ICS over US$8[3] for charcoal ICS. Price limiting market growth	Only top-end consumers	High
Willingness to pay / information barrier	**Limited consumer awareness** of ICS benefits, awareness greater in urban markets. Low ICS costs limit marketing budgets			High
Manufacturing capacity	**Low volume, low quality**	**ICS manufacturing is labour intensive**, largely un-mechanised and slow to scale up. New manufacturers could enter the market	Not applicable: mostly imported and low volume	Medium
Quality and Testing	No **national standard**, varying quality products, affecting consumer confidence, and varying economic, environmental and health benefits. Poor product branding.			Medium

There are three reasons for setting this objective. First, this approach is geared to generating long-term benefits, including health, after any intervention has finished by resulting in a self-sustaining commercial market. Long-term health benefits arise through the deployment and continued use of high-quality ICS which have lower pollutant emissions. Second, by focusing on the uptake of efficient and cleaner ICS, we can use proxy measures to quantify the actual health, environmental and other benefits of ICS deployed, rather than realised or actual benefits – which can be challenging, and for which new tools are being developed. A well-designed RBF scheme of this kind can attach greater financial incentives to ICS that may deliver greater health benefits. Third, it does not prescribe a particular business model, therefore providing the greatest incentive for innovation and sustainable business development in the Ugandan ICS sector.

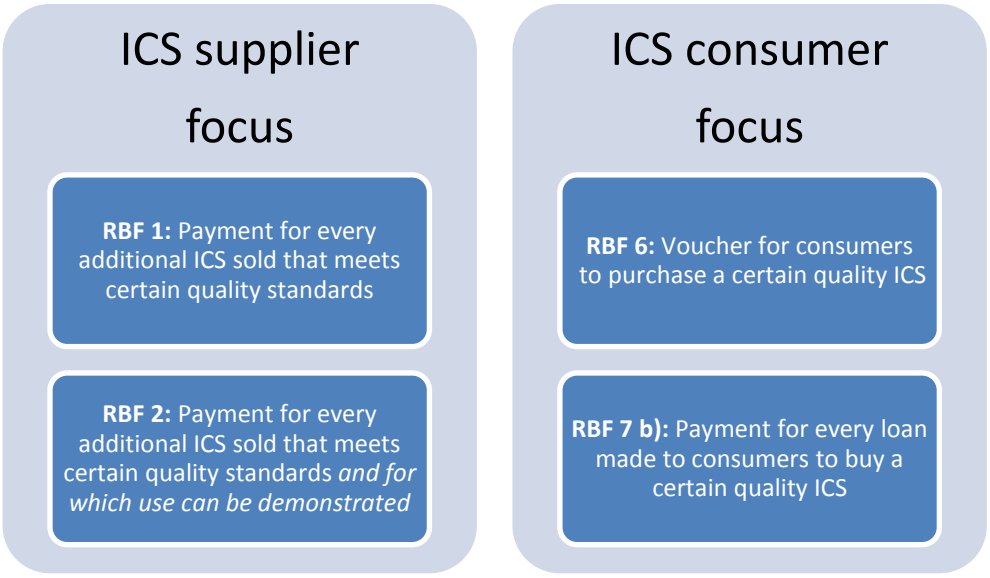
It is our assessment that to achieve commercial sustainability of the ICS market a focus on the relatively well developed urban and peri urban (and higher end rural) consumers (who purchase rather than collect fuel) is required. A subsequent programme that focuses on poorer consumers (typically collecting fuel wood) could follow once the artisan model (or an alternative model) has been validated. The emerging commercial urban and peri urban market may form the basis for addressing more challenging market segments over time.

Which options will best address the identified barriers?

We have screened a long list of possible RBF options against two "pre-condition" criteria and five further screening criteria. Figure 1 shows the four options we consider most likely to be effective.

[3] Based on optimal price of USh 23,000 (TNS 2013)

Figure 1: Shortlisted RBF options: supplier versus consumer focus



How would results be defined?

Assessing the relative performance of ICS products is crucial to determining eligibility for all the shortlisted RBF types. Although many different conceivable "results" could be set, any RBF scheme must not only increase the scale of the market, but also address the question of ICS quality standards if lasting benefits to health, environment and economy are to result.

RBF options targeting different tiers of ICS quality will achieve different outcomes. For instance, placing an emphasis on emerging ICS technologies that have very low emissions will only attend to a small (and typically better off) consumer group with limited potential for achieving commercialisation at scale. A pilot, however, may draw new products into the market and provide a platform for market transformation and longer term health benefits. A scheme that focuses on mid-range technologies that are more widely available might achieve sustained ICS market growth and the desired commercial market at scale; however, is likely to require additional initiatives to attain long-term public health benefits from reduced household air pollution.

The International Standards Organization (ISO) has developed an International Workshop Agreement (IWA) for ICS, which is a first step on the way to establishing ISO global standards. The IWA defines five tiers of performance, ranked from zero (worst) to four (best) in the areas of emissions, fuel efficiency, indoor emissions, and safety. The Global Alliance for Clean Cookstoves (GACC) has subsequently suggested minimum thresholds as tier 2 for efficiency, tier 3 for indoor and total emissions during Phase 1 (2012–14) of its 10-year plan. In Uganda, the existing national standard is being revised and may adopt IWA aspects. Work is also underway through the World Bank ACCES Quality Assurance/Technical support programme[4] to test existing ICS technologies that are available in Uganda. This will help define performance characteristics for ICS products that may subsequently be eligible for RBF support. For the purposes of this report RBF incentives are assumed to be attached to agreed ISO IWA tiers.

[4] Implemented by Berkeley Air Monitoring Group and partners. This work involves customizing existing standards frameworks, test methodologies and quality assessment tools to support market development in Senegal, Uganda and DRC during 2013–14.

What are the main considerations for RBF design and implementation?

The potential market size for a commercial market at scale is approximately 2.5 million households. This is based on 100 per cent of urban and 29 per cent of rural population being in the commercial segment for cookstoves and assumes an ICS penetration rate of 80 per cent. This translates into a yearly demand of 1.2 million ICS.[5]

The high-level estimate of the cost of implementing a full RBF scheme to achieve this market scale is between US$8 million and US$16 million plus administration costs. Scheme costs are based on an incentive level from US$5 to US$10 per ICS and a total number of incentive ICS sales of 3.6 million during the five years of the RBF intervention.[6] In turn, this RBF level is based on an estimated[7] current willingness to pay a price of below US$10 and an average charcoal ICS price of US$12 to US$20.

Other RBF options to address the base-of-the-pyramid market, or higher-tier stoves, can be run in tandem and are not mutually exclusive.

Using these RBF rates, a commercial market at scale should be achievable more quickly. Figure 2 shows one possible trajectory of ICS penetration, with and without the RBF.[3]

The assumption should be against restricting the list of potential agents for an RBF instrument. When more agents are able to participate in an RBF, the likelihood of achieving the desired outcomes increases. The RBF should potentially be open to all participants in the Ugandan ICS market, including ICS suppliers currently engaging in any carbon finance scheme.

The design considerations must address a range of further issues: the trigger or condition for RBF payment; the structure of any RBF payment; the size of the RBF payment; the duration of the RBF intervention and the appropriate exit strategy. Each of these points is considered in turn in the report. In addition, a number of complementary initiatives will be required to ensure that the results-based incentives succeed; the most important will be the establishment of quality standards (and testing arrangements) that will set the level against which the RBF payments will be made. Other complementary measures include national awareness campaigns, policy changes to lower costs and encourage investment, improving access to finance, and technical assistance including business development support services.

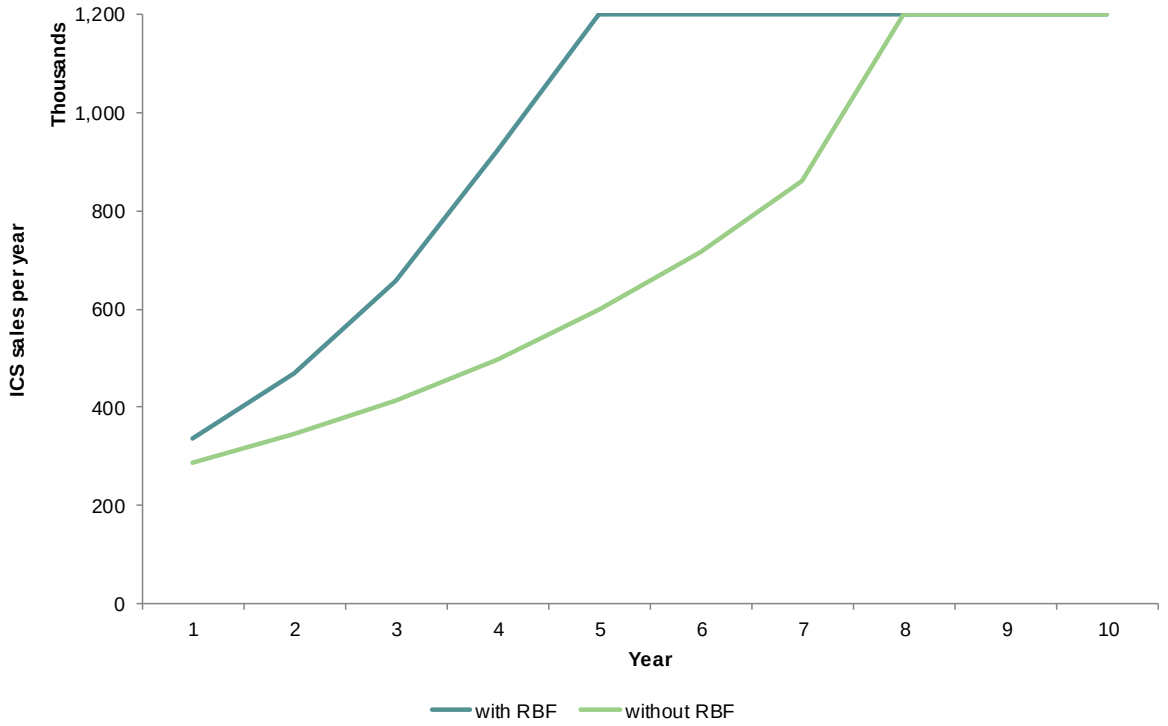
The duration of the RBF program is flexible and depends on the market conditions, the size of the payment and the ability of suppliers and consumers to respond to the RBF incentive – but is approximated at five years. This is based on the use of RBF mechanisms to incentivise up to two-thirds of the full potential ICS market and to double the current ICS market growth rate from 20 per cent to 40 per cent.

Initial calculations suggest that the total potential value for money of the RBF intervention is approximately US$64 million to US$147 million over the five years of RBF intervention and up to approximately US$90 million to US$199 million over the seven years.

[5] Based on an average of 1.5 ICS per household and a replacement rate (ICS "life") of three years.
[6] The lending costs for an RBF have not been identified as there is greater uncertainty over the transmission mechanism from this to increased ICS penetration.
[7] TNS (2013).

Figure 2: ***Scaling up the ICS market***

The RBF scales up the ICS market faster and higher penetration of ICS with an RBF continues for a further three years to produce larger benefits than the assumed ICS market without an RBF intervention.



Note: This graph is based on an assumed growth rate of the ICS market in Uganda of 20 per cent and an RBF incentivised growth rate of 40 per cent as well as a total potential market size of approximately 1.2 million ICS per year.

Source: Vivid Economics.

The government of Uganda and development partners have previous experience that can support a detailed design and implementation process. The government has run a series of output-based aid programs across different sectors, most notably in health and water supply but also in energy. Previous modern energy access initiatives include the solar PV program under the Ministry of Energy and Mineral Development (MEMD) Energy for Rural Transformation (ERT) program, with the involvement of the Private Sector Foundation Uganda (PSFU), Rural Electrification Agency (REA) and other partners. Our assessment is that international partners or government agencies could act as Principal for an RBF program and that a detailed institutional capacity assessment will help determine the optimal arrangements. International partners should take forward their existing plans and integrate aspects of the RBF options following a detailed design and implementation process.

1. Introduction

This report sets out the opportunity for implementing results-based financing (RBF) to support the clean cookstoves sector in Uganda. Commissioned by the World Bank's Africa Energy Unit (AFTEG) under the Africa Clean Cooking Energy Solutions (ACCES) Initiative, the report has been produced to help the ACCES program and other development partners design and implement relevant RBF approaches. Its findings are based on a review of relevant literature and close consultation with relevant international and local stakeholders. The report builds on previous work relating to RBF for the Energy Sector (World Bank, 2013a) and is part of a broader World Bank effort to examine the potential for greater use of results-based approaches in the energy sector in developing countries.

Results-based financing (RBF) approaches are becoming an increasingly popular way to support development objectives and wider public policy goals. The fundamental idea is that whoever is responsible for implementing a development program (a "principal" in the language of this report) makes payments to service providers (an "agent") only upon the delivery of pre-agreed results, with achievement of the results being subject to independent verification. Although RBF approaches have been pioneered in the health sector, there has been increasing interest in whether and how they could be used within the energy sector, and especially on how they might promote private sector investment in low carbon energy sector opportunities (ESMAP, 2012). Previous research has shown that, when applied in the right circumstances and designed appropriately, RBF approaches can deliver strong development outcomes in a cost-effective manner as they (a) transfer risk to those who are most able to control it and (b) leave the market open to respond as it chooses, enabling innovation in markets and service delivery. However, the research also indicates that in the wrong circumstances, or with poor design, RBF can be costly or ineffective, or both (World Bank, 2013a).

The World Bank is exploring RBF as a means of sustaining impact through market-level development. Clean cooking interventions in Uganda are often focused at the project level, such as transitioning cooking solutions at schools. A broader, market-stimulation approach might lead to a sustainable transformation in energy access, reduce environmental pollution and generate health and other benefits.

This study focuses on cookstoves rather than the full value chain (including cooking fuels) because the disconnect between cookstove suppliers and final customers is a key bottleneck in the supply chain. We have focused our analysis on economic agents that might be expected to respond best to incentives, and on the part of the value chain where measurable economic, health and other benefits might be most efficiently achieved. The report does not include, for instance, assessment of the largely informal charcoal and wood product supply chains, including related RBF incentives to support development outcomes, as this level of the supply chain is further away from the disconnect between improved cookstove (ICS) suppliers and final customers and has been judged during stakeholder meetings to be less likely to help overcome the barriers holding back development objectives.

Financing is one of many tools available to support development of the sector. Although the report focuses on RBF in the ICS sector in Uganda, it also considers complementary measures that are likely to be appropriate, such as improved certification and maintenance procedures. These complementary measures could be incorporated into a conventional or RBF approach.

The main body of the report is structured as follows:

- Chapter 2 examines the innovation ecosystem for cookstoves in Uganda. This includes the main actors and activities, the market segments for improved cookstoves and the current penetration of ICS into different geographical zones of the country. It also looks at the different products and business models as well as the barriers to scaling up.
- Chapter 3 identifies various policy objectives and grades various RBF options against a set of screening criteria. The result is a shortlist of RBF options that could usefully be incorporated into future program design.
- Chapter 4 explores initial design considerations for RBF in this context including eligibility, trigger, payment structure, size of payment and exit strategy, as based on the ESMAP report (World Bank 2013b). It covers the possible market responses to the shortlisted RBF approaches and makes a preliminary assessment of value for money. Finally, it considers ways in which RBF approaches might best be implemented on a practical level.
- Chapter 5 outlines the recommendations, summarizing key constraints to scale-up and noting the complementary measures needed to ensure successful RBF implementation.

2. Innovation Ecosystems: the ICS sector in Uganda

In assessing the ICS market and its potential for scale-up, we take an Innovation Ecosystems approach. This approach assesses the full value chain of the ICS, from production through distribution and sales to the end consumer. It also considers co-innovators—other participants that affect the value chain both directly and indirectly, such as fuel agents—and the enabling environment, such as the policy and regulatory regime, financial markets, and the socio-political status of the country.

Up to 30,000 ICS are currently produced each month in Uganda. Because the estimated *commercial* market (see Annex 1) is approximately 90,000 per month, however, there is considerable potential for scaling up. This is consistent with research by USAID under the TRAction Project (USAID, 2012a), which indicates a high willingness to pay among rural communities when presented with the right marketing messages and appropriate financial packages to support purchase—while noting that these are lacking in the current market.

2.1 Main Actors and Activities

The main actors in the ICS sector are divided in to six group types:

1. Government agencies
2. National and international non-government organizations (NGOs)
3. Donors and international organisations
4. National research and testing centres
5. Stove manufacturers and distributors (the private sector and community groups)
6. Financial intermediaries including banks, community-based savings and credit cooperatives (SACCOs) and carbon finance agencies.

The main actors in the six groups identified above are listed in Annex 3, while ongoing activities relating to ICS are detailed in Annex 2.

The nascent Uganda National Alliance for Clean Cookstoves (UNACC) is beginning to play a coordinating role between these actors. UNACC has the objective, as defined in its National Country Platform, to promote clean cooking in Uganda, maximising the benefits of clean cooking among its members and the populace in general.

2.2 Market Segmentation

Consumers of ICS are not a homogenous group. Market segmentation for the sector in this report is based on the World Bank's 2013 report *State of the Clean and Improved Cooking Sector in Sub-Saharan Africa* (World Bank, 2013b). This is summarised in Figure 3.

Figure 3: **Market segments for Sub-Saharan Africa**

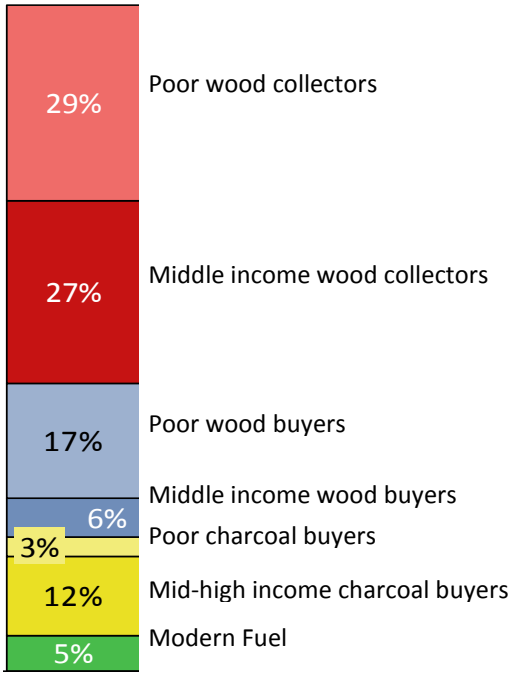
	Segment profile	Segment challenges
Poor wood collectors	• <BoP 500 • 90% rural, 10% urban	• Lack of disposable income to move up ladder • Long collection times /biomass scarcity • High health burden, but minimal awareness
Mid income wood collectors	• BoP 500-1500, • 90% rural, rest urban	• Lack of awareness of harms, but more sensitive to time burden of collection/cooking • No access to quality improved solutions
Poor wood buyers	• <BoP 500, • >60% urban, esp. W. Africa	• High fuel expenditures relative to income • Lack of awareness of harms or access • Can't afford modern energy
Mid income wood buyers	• 95% BoP 500-1500, • 38% urban, 62% rural	• Urban unable to afford move up the energy ladder to available solutions • Rural lack awareness and access
Poor charcoal buyers	• <BoP 500, • 50% urban	• High premiums paid by urban segment (esp. in slums) and very large income share • Low quality of existing solutions
Mid-high income charcoal buyers	• 60% BoP 500-1500, 40% >1500 • 75% urban, rest peri-urban	• High share of income for mid-income urban buyers, but can't afford to move up ladder • Rural/peri-urban have access to cheaper fuels so less incentive to change
Modern fuel	• >95% BoP 1500 • >80% urban	• Danger of moving down energy ladder due to rising modern fuel prices/shortages • Lack awareness of solid fuel harms

Source: World Bank (2013b), Figure 35.

The 2010 National Census for Uganda puts fuel mix at 73 per cent for wood and 22 per cent for charcoal.[8] Although this is broadly similar to the East African averages shown in Figure 4) of 78 per cent for wood and 15 per cent for charcoal, the sizes in Uganda are slightly smaller for wood and modern fuels and slightly larger for charcoal.

[8] Sourced from data sets provided from "State of the Clean and Improved Cooking Sector in Sub-Saharan Africa" team.

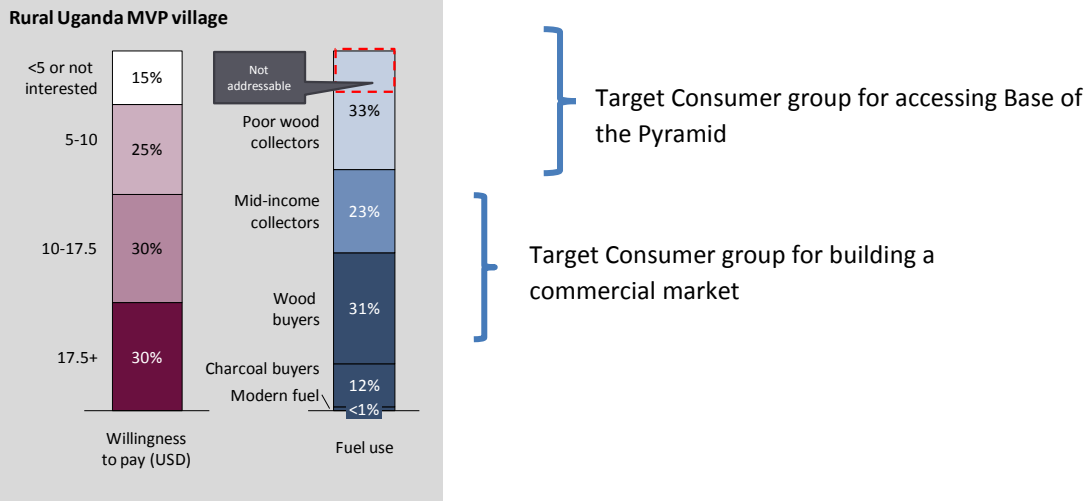
Figure 4: **Population per market segment, East Africa**



Source: World Bank 2013b.

Identifying which segments of the market different RBF approaches might stimulate is a critical part of the RBF assessment, and will depend upon policy choices related to building a commercially viable market and/or targeting the base of the pyramid as represented in Figure 5.[9] The truly un-addressable ICS market segment – those unable or unwilling to pay USD 3–7 for basic ICS – is identified as being less than a third of all households.[10]

Figure 5: **Rural households' willingness to pay for clean cookstoves**



Source: World Bank (2013b). The "not-addressable" segment highlighted is estimated and both uncertain and untested.

[9] The two need not be mutually exclusive. A step-oriented approach to building an economic market would start with targeting those consumers best able and most willing to pay while business models are evolving and strengthening. Targeting BoP would follow as part of a longer-term strategy of an established and viable business.

[10] World Bank 2013b.

2.2.1 Market Size

As discussed in Section 3, we believe RBF schemes should focus on building a sustainable market at scale so as to support the long-term realisation of health benefits. In this analysis we identify the potential *commercial* market to be those households that currently pay for fuel as indicated in Figure 5 above. This includes a mix of wood, charcoal and modern fuel buyers.

Table 2 shows our estimate of market size, by stove fuel type, made on the basis of calculations provided in Annex 1. **This is the potential market size assuming no change in fuel use. Because consumers are known to switch between fuel types or use more than one fuel type (often known as "fuel stacking"), it is best to consider the market size as one figure of just over 103,000 ICS per month.**

Table 2: **Estimated market size by stove fuel type**

Fuel type	Urban market h/h	Rural charcoal h/h	Total charcoal h/h	No of ICS per annum (1.5 per household)	No of ICS per month
Charcoal charcoal	939,046	17,902.83	956,949	478,474	39,872.87
Wood charcoal	234,069.02	1,231,541.44	1,465,610	732,805	61,067
Modern fuels	63,711	1,443.78	65,155	32,577	2,715
Total	**1,236,826**	**1,250,888**	**2,487,714**	**1,243,857**	**103,655**

2.2.2 Cooking Behaviour

There is a significant disease burden associated with household air pollution (HAP). This includes acute lower respiratory infections, including pneumonia, in young children; and chronic obstructive pulmonary disease and lung cancer in women (and to a lesser degree men). In terms of disability-adjusted life years (or lost healthy life years), HAP is the most important risk factor for women and girls in most of Sub-Saharan Africa.[11] The extent to which health is affected by the use or non-use of ICS in Uganda depends on the fuel and cooking technology used as well as consumer behaviour. Although there is no scientific consensus on how it affects health, "behaviour" includes where the cooking takes place and thus who might be most affected by smoke produced. Data on this are provided in Table 3.

Table 3: **Household cooking characteristics in Uganda**

Place for cooking	Urban Households (%)	Rural Households (%)
In the house	22.3	8.8
In a separate building	22.3	66.6
Outdoors	48.8	23.0
No food cooked in the house	6.4	1.5
Other	0.2	0.1

Source: Uganda Demographic and Health Survey 2011.

[11] Lim et al (2012) and Murray et al (2012).

2.3 Geographic Penetration of Current Cookstove Programs

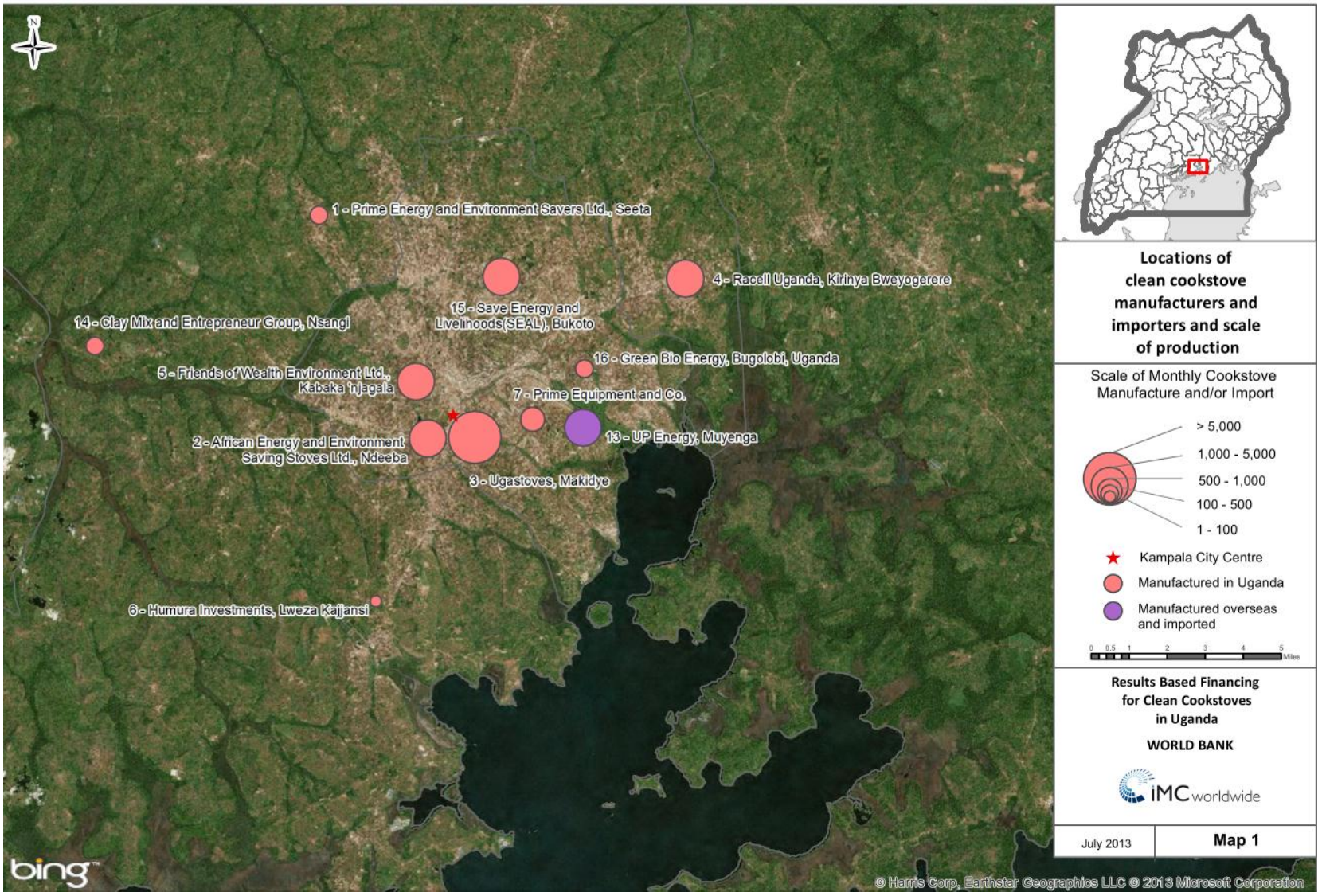
Although there is limited information in the literature on the sources and regional distribution of the ICS market in Uganda, Maps 1-3 illustrate the data we collected from local manufacturers in mid-2013:

- Map 1: Cookstove manufacturers in Kampala and surrounding areas.
- Map 2: Districts in which cookstoves are currently sold.
- Map 3: Population by district.

As Map 1 shows, there is a clear concentration of stove manufacturers and importers in Kampala, with only the International Lifeline Fund manufacturing cookstoves outside of the capital. This does not include small-scale artisanal production of cookstoves through programs such as the Promotion of Renewable Energy and Energy Efficiency Programme (PREEEP) detailed in Annex 2.

As Map 2 shows, distribution is also concentrated in a few key districts around Kampala and Eastern Central Uganda with the exception of Arua and Lira. While other districts to the west and north are represented, the number of manufacturers targeting them is low (three or less).

As would be expected, the population clusters shown in Map 3 indicate some correlation with Map 2, but exact figures on the numbers of stoves distributed by district are unavailable.


N
1 - Prime Energy and Environment Savers Ltd., Seeta
4 - Racell Uganda, Kirinya Bweyogerere
15 - Save Energy and Livelihoods(SEAL), Bukoto
14 - Clay Mix and Entrepreneur Group, Nsangi
16 - Green Bio Energy, Bugolobi, Uganda
5 - Friends of Wealth Environment Ltd., Kabaka 'njagala
7 - Prime Equipment and Co.
2 - African Energy and Environment Saving Stoves Ltd., Ndeeba
13 - UP Energy, Muyenga
3 - Ugastoves, Makidye
6 - Humura Investments, Lweza Kajjansi
bing
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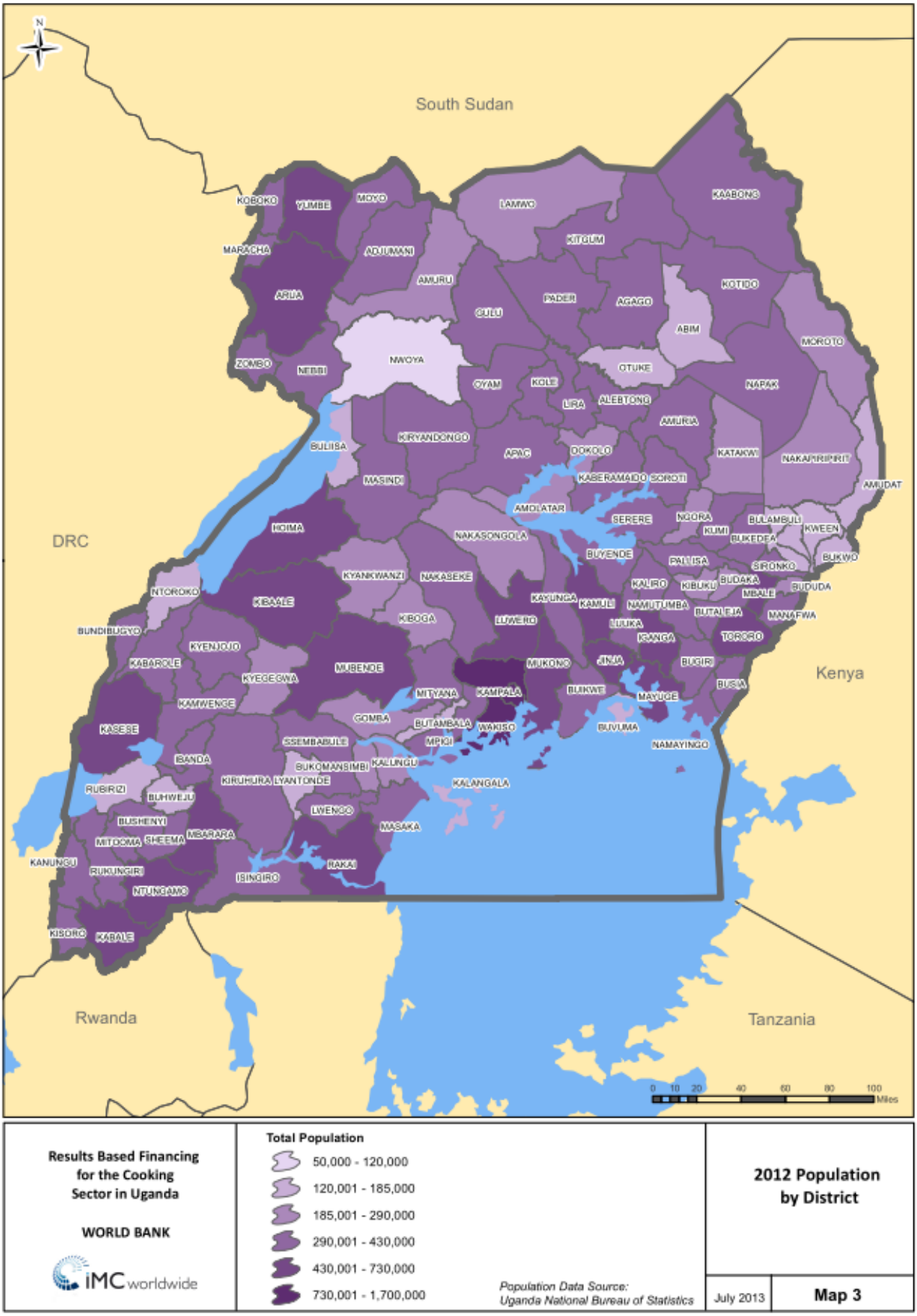
Locations of clean cookstove manufacturers and importers and scale of production
Scale of Monthly Cookstove Manufacture and/or Import
> 5,000
1,000 - 5,000
500 - 1,000
100 - 500
1 - 100
Kampala City Centre
Manufactured in Uganda
Manufactured overseas and imported
0 0.5 1 2 3 4 5 Miles
Results Based Financing for Clean Cookstoves in Uganda
WORLD BANK
iMC worldwide
July 2013
Map 1


South Sudan
DRC
Kenya
Tanzania
Yumbe 6
Arua 1,2,4,9,15
Gulu 8,13
Lira 1,2,8,9,13
Apac 13
Nakasongola 2,13
Kamuli 13
Bukedea 6
Pallisa 13
Mbale 1,2,4,9,15
Kayunga 9
Kiboga 5
Luwero 2,6,9,13
Iganga 4
Mubende 5
Mityana 5,13
Wakiso 1,2,4, 9,14
Mukono 1,2,4, 5,6,13
Jinja 1,2,4,6 9,13
Mayuge 4
Bugiri 4,13
Busia 4
Kasese 1,6
Gomba 14
Butambala 14
Kampala 1,2,3,4, 5,6,7,8, 9,13,15,16
Masaka 13
Mbarara 2,6,15
Rukungiri 6
Kisoro 13
Kabale 6,13
Clean Cookstove Suppliers
1 - Prime Energy and Environment Savers
2 - African Energy and EnviroSaving Stoves & Solars
3 - Ugastove
4 - Racell Uganda
5 - Friends of Wealthy Environment
6 - Humura Investments
7 - Prime Equipment & Co.
8 - ILF
9 - Energy Uganda Foundation
10 - GIZ PREEP
11 - Biolite
12 - Philips
13 - UP Energy
14 - Clay Mix and Entrepreneurship Group
15 - Save Energy and Livelihoods (SEAL)
16 - Green Bio Energy
0 10 20 40 60 80 100 Miles
Results Based Financing for Clean Cookstoves in Uganda
WORLD BANK
iMC worldwide
District in which cookstoves are currently sold
Water body
Ugandan border
Districts in which Cookstoves are currently sold
July 2013
Map 2


South Sudan
DRC
Kenya
Rwanda
Tanzania
KOBOKO
YUMBE
MOYO
LAMWO
KAABONG
MARACHA
ADJUMANI
KITGUM
ARUA
AMURU
PADER
AGAGO
KOTIDO
GULU
ABIM
MOROTO
ZOMBO
NEBBI
NWOYA
OTUKE
NAPAK
OYAM
KOLE
LIRA
ALEBTONG
AMURIA
BULISA
KIRYANDONGO
APAC
DOKOLO
KATAKWI
NAKAPIRIPIRIT
MASINDI
KABERAMAIDO
SOROTI
AMUDAT
AMOLATAR
HOIMA
SERERE
NGORA
BULAMBULI
KUMI
KWEEN
BUKEDEA
NAKASONGOLA
BUYENDE
PALLISA
BUKWO
SIRONKO
KYANKWANZI
NAKASEKE
KALIRO
KIBUKU
BUDAKA
BUDUDA
NTOROKO
KIBAALE
KAYUNGA
KAMULI
NAMUTUMBA
MBALE
BUTALEJA
MANAFWA
KIBOGA
LUWERO
LUUKA
BUNDIBUGYO
KYENJOJO
KRANGA
TORORO
KABAROLE
MUBENDE
MUKONO
JINJA
BUGIRI
KYEGEGWA
KAMPALA
BUIKWE
MAYUGE
BUSIA
KAMWENGE
MITYANA
GOMBA
BUTAMBALA
WAKISO
BUVUMA
KASESE
SSEMBABULE
MPIGI
NAMAYINGO
BANDA
BUKOMANSIMBI
KALUNGU
KIRUHURA
LYANTONDE
KALANGALA
RUBIRIZI
BUHWEJU
LWENGO
BUSHENYI
MASAKA
MITOOMA
SHEEMA
MBARARA
KANUNGU
RUKUNGIRI
RAKAI
ISINGIRO
NTUNGAMO
KISORO
KABALE
0 10 20 40 60 80 100
Miles
Results Based Financing for the Cooking Sector in Uganda
WORLD BANK
iMC worldwide
Total Population
50,000 - 120,000
120,001 - 185,000
185,001 - 290,000
290,001 - 430,000
430,001 - 730,000
730,001 - 1,700,000
Population Data Source:
Uganda National Bureau of Statistics
2012 Population by District
July 2013
Map 3

2.4 Existing Business Models

We have identified nine different interventions currently operating in Uganda in support of the ICS market, as detailed in Annex 2. These interventions support two main types of business model – Artisanal and Manufacturing.

In both cases the business models are propped up by considerable external support from donors or carbon finance. Neither model can be considered self-sustaining or independently viable. Two further business models exist based on biogas and liquefied petroleum gas (LPG); for ease of analysis, these have been grouped into one model entitled Modern Fuels.

To help with targeting the RBF types and assessing the potential response to RBF incentives, we aim to detail each market system both *as it is* and *as it could be*. This includes an understanding of (a) the barriers to getting to scale, (b) the factors affecting the wider market ecosystem, and (c) how far along the market is in terms of the four stages of development outlined in the Monitor Group's 2012 report *From Blueprint to Scale: The case for philanthropy in impact investing.*[12] The four stages are summarised in Figure 6; the overall analysis looks at the prerequisites for achieving the scale needed to "push" products to the base of the pyramid (BoP).

Sections 2.4.1 to 2.4.3 discuss the Artisanal, Manufacturing, and Modern Fuels models in turn.

2.4.1 The Artisanal Business Model

This model is typified by un-mechanised small-scale rural producers that have been trained, via donor programs, to locally produce and sell basic improved cookstoves. The cookstoves are made from locally dug clay and in some cases assembled with metal liners brought in from Kampala. GIZ's PREEEP program currently has about 800 stove producers working in 28 districts, with 260 set up as businesses running commercially in rural districts. Production capacity per production unit varies significantly; the program has computed an average recent production rate of five stoves per production unit per month, giving an average production rate of 4,000 per month, or 48,000 per year.[13] The stoves sell for USh 10,000–15,000 (US$4–6) each, which represents true cost with no subsidy (not including additional support from donors through artisan training and consumer awareness programs). Examples of stove types are shown in Table 4.

[12] Monitor Group (2012).
[13] Interviews and correspondence, June 2013.

Figure 6: ***From Blueprint to Scale: The four stages of market development***

STAGE	1. Blueprint	2. Validate	3. Prepare	4. Scale
	Developing the blue-print for the future business	*Testing and refining the business model*	*Enhancing the conditions required for scaling*	*Rolling out the model to reach large numbers of customers and/or suppliers*
KEY ACTIVITIES	• Understand customer needs • Develop initial customer proposition • Develop business plan • Develop core technologies and/or product prototypes	• Conduct market trials • Test business model assumptions • Refine business model, technologies and/or product as required	• Stimulate customer awareness and demand • Develop supply chains, upstream and downstream • Build organizational capability to scale: systems, talent, plant, etc.	• Move into new geographies and segments • Invest in assets and talent • Enhance systems and processes • Exploit scale efficiencies • Respond to competitors
KEY NEEDS	• Innovation capability • Strategy development and business planning • Talent networks • Seed funding	• Operationalizing the model • Focus on cost, value and pricing • Learning orientation and flexibility • Innovation capability • Funds to facilitate market trials and refinement	• Marketing strategy and execution • Supply chain design and implementation • Systems and processes • Talent and networks • Funds for marketing, supply chain, fixed assets, inventory	• Competitive strategy • Realizing scale efficiencies • Risk management • Formalization of impact standards and expectations • Stakeholder management • Funds to support expansion
END MILE-STONES	• Compelling initial business plan • Demonstrated core technologies and/or product prototype	• Refined business model, technologies, product • Validation of viability and scalability • Indication of customer demand	• Strong customer awareness and demand • Effective supply chains • Organizational systems, talent, assets in place to support scaling	• Sustainably reaching all BoP customers and/or suppliers

Source: Monitor Group (2012).

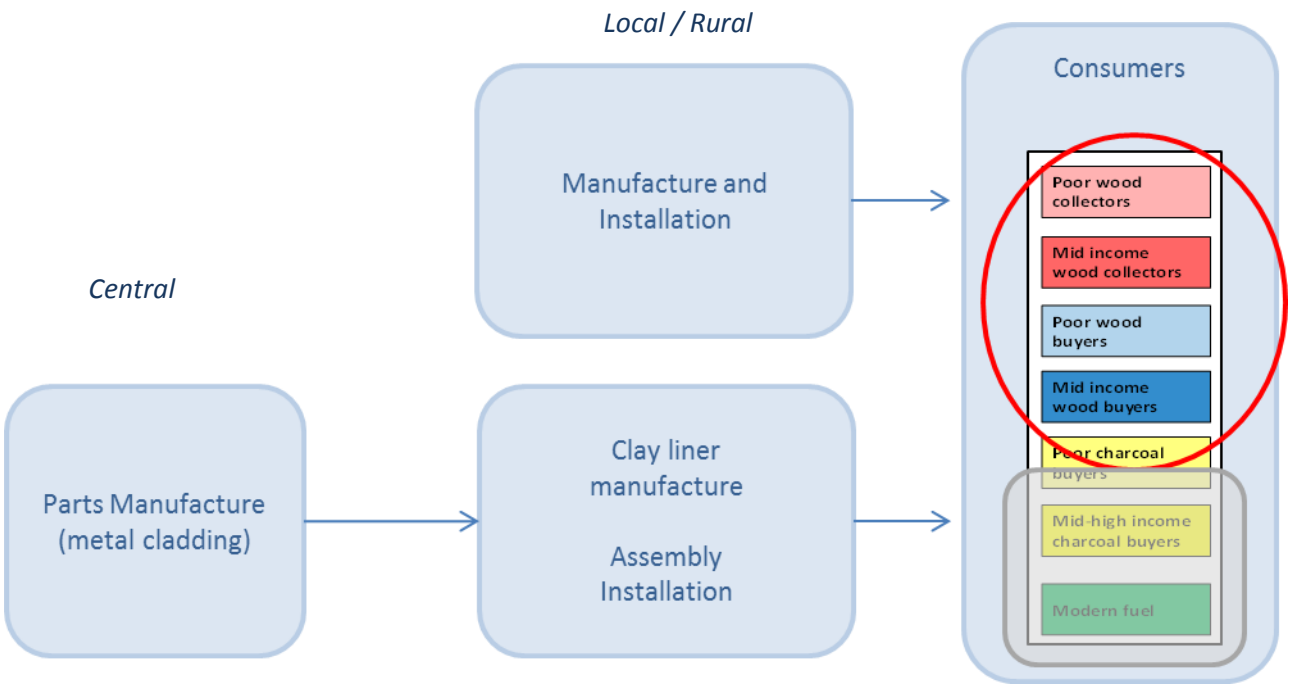
Table 4: **Artisanal stoves**

Type of stove	Manufacturer	Cost Range	Efficiency	Key Features
 Shielded mud fire stove	GIZ-trained producers, various	US$5–20	Unknown	Clay; produced using metallic moulds
 Basic charcoal stove	Various; mainly informal sector	US$1–2	Unknown	Basic ceramic stoves with short lifespan

Source: GACC (2013).

The national market is significant and covers around 4.8 million rural households.[14] The model is represented in Figure 7.

Figure 7: **Artisanal Business Model**



Three main barriers affect the viability of this business model:

[14] 5.6 million rural households, less 15 per cent marked as "un-addressable" in Figure 3.

- **Manufacturing capacity.** Artisans who produce ICS are currently identified and trained by donor programs. As individual small-scale producers, they have limited capacity to scale up production, have very limited access to capital, may be dependent on ongoing donor support, and are usually not perceived as credit-worthy.
- **Quality.** ICS quality is a critical issue if benefits are to be realised by consumers. Low-quality stoves can damage the market through poor reputation and subsequent lower adoption rates. Artisanal models, although overseen by donors through support programs, do not have any formal testing or quality standards, and stove quality may vary considerably.
- **Willingness to pay.** Low consumer awareness of the benefits of ICS, coupled with high levels of poverty in rural areas, can result in a low willingness (and ability) to pay. Although microfinance services in rural areas can offer consumers a way to purchase the cookstoves through staged payments (which have been demonstrated to increase willingness to pay), such services are currently highly limited.[15]

The artisanal model has two advantages:

- **Local production.** Artisanal producers are close to consumers and have a good understanding of their needs and desires. This proximity also avoids costly and difficult transportation. A disadvantage is that the local market can become saturated, impairing long-term sustainability.
- **Low entry costs.** There are very low overheads, ensuring low entry costs and thus enabling new artisans to enter the market.

These key strengths and weaknesses, which represent factors integral to the market system, are summarised and supplemented in Table 5. This table is the output of a workshop organised by UNACC and attended by its members as well as others.

Table 5: **SWOT analysis of the Artisanal ICS Business Model**

Strengths • Can be located anywhere • Long established market • Good knowledge and links to consumers • Producers can organise themselves • Low overheads	**Weaknesses** • No access to capital • Invisible to would be investors • High cost of raw materials • Lack of consumer awareness • Low volume = high price • Marketing • Poor design, quality and workmanship • No mechanisation • Poor customer service • Low consumer willingness to pay
Opportunities • Large number of available artisans • Lots of room for improvement • UNACC, CREEC, BEETA	**Threats** • Lack of support from government • Poor quality products on market • Market distortion from subsidies including carbon credits • Standardisation of products excludes artisans • Manufactured cookstoves flooding the market

Source: UNACC, RBF Workshop 27 June 2013.

[15] USAID (2012a).

The critical issue that arises from this analysis is the potential impact of subsidies on centrally manufactured or imported cookstoves, including those from carbon finance programs. This could result in a high degree of competition for artisans, with knock-on effects on their livelihoods. The nature of the artisanal business model – that inputs are locally readily available and not subject to price fluctuations, and that production and sales are within the local community – means that the business model is less reliant on external markets or co-innovators such as transport agents or fuel providers.

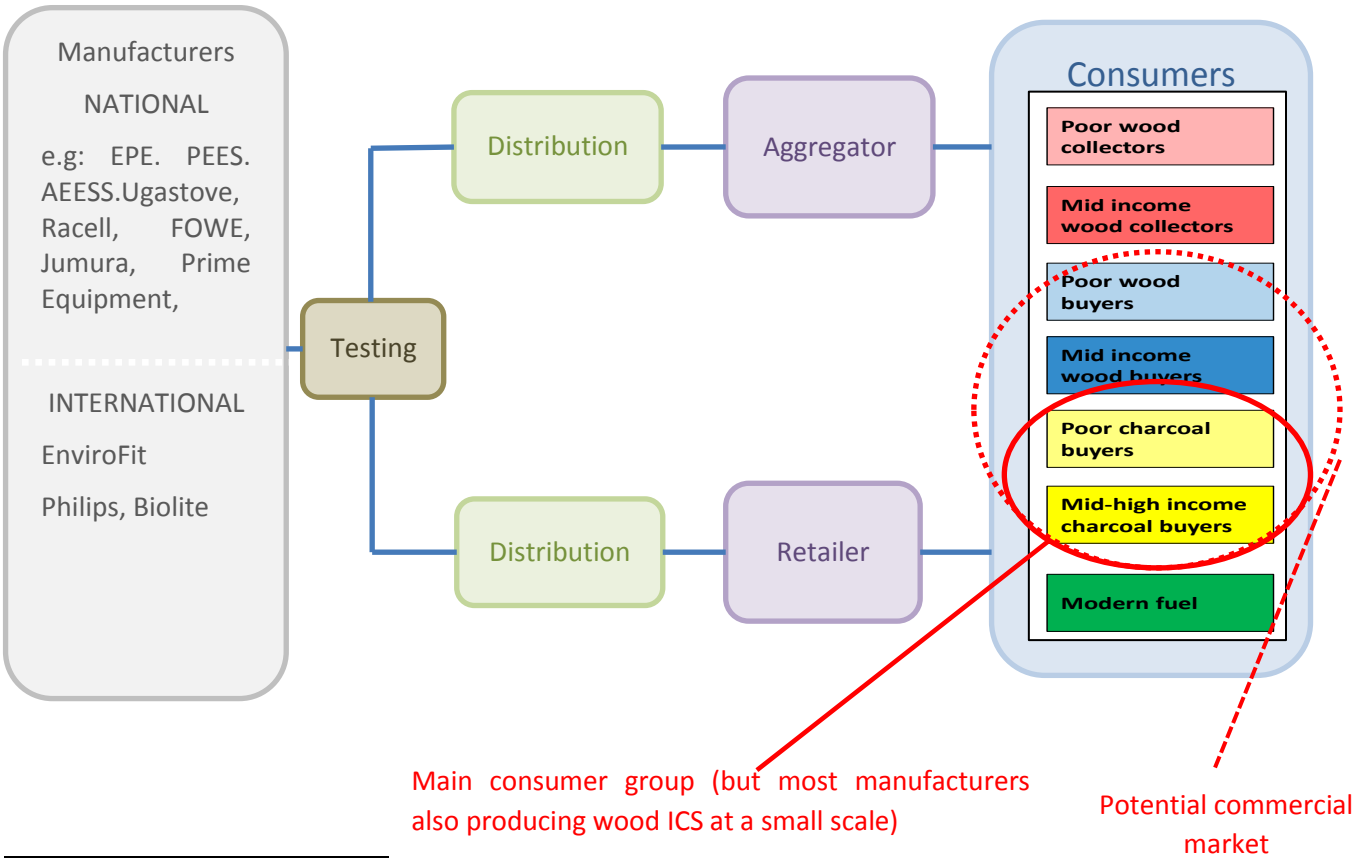
Ability to achieve commercialisation at scale

The target consumer segment is focused on Base of the Pyramid and the business model is currently supported by donor agencies. The long-term commercial viability of this model is still being tested[16] and modified to increase sustainability for artisans, which places the model within the "Validation" stage of the *From Blueprint to Scale* stages shown earlier in Figure 6. It is as yet unclear whether this model has the potential to achieve commercialisation at scale.

2.4.2 The Manufactured Business Model

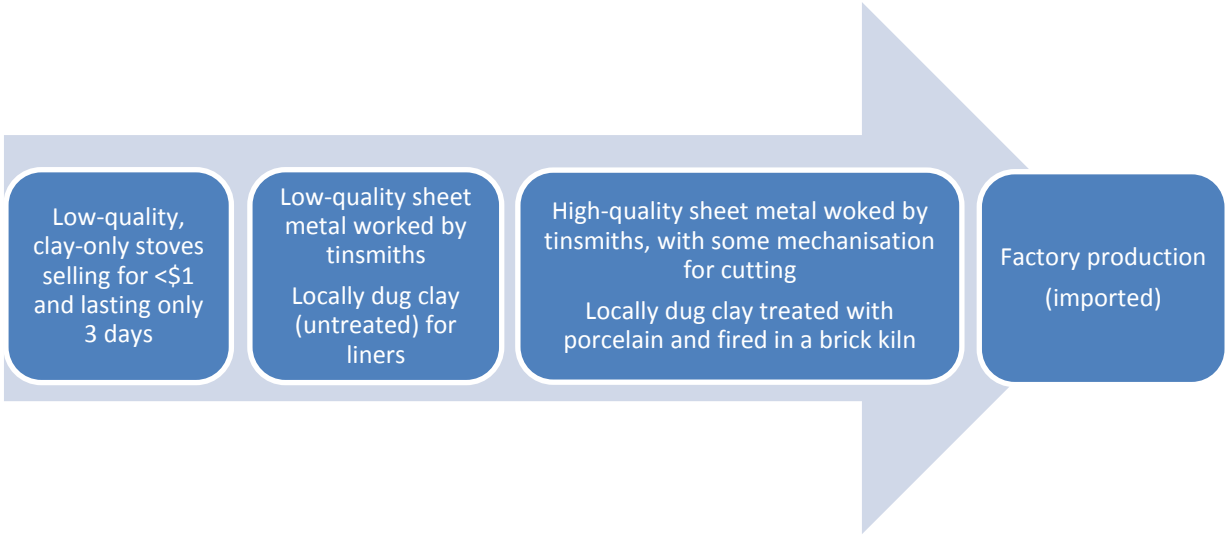
The Manufactured Business Model (Figure 8) is the dominant model in Uganda, with a large number of actors. The model is defined as including all manufacturers producing more than 200[17] ICS per month at a central point for distribution and sale. The model includes everything from low- and no-mechanisation ICS manufacture to highly mechanised manufacture, though the latter is currently represented only by imported models, as shown in Figure 9.

Figure 8: **The Manufactured Business Model**



[16] The PREEEP program is currently trialling a new approach to commercialisation via energy services providers who also promote solar and target a larger consumer group.
[17] Most manufacturers produce more than 500 ICS per month.

Figure 9: **Degrees of mechanisation**



The range in mechanisation and quality of materials used leads to varying degrees of ICS quality. Table 6 shows selected examples of models from some of the larger manufacturers.

This market is dominated by charcoal stoves sold to urban and peri-urban consumers, the exception being imported wood stoves distributed by UpEnergy using carbon finance to help address market barriers and subsidise prices. All the other manufacturers produce mainly charcoal stoves, with a small number of woodstoves produced on demand. Current production of charcoal ICS is between 25,000 and 30,000 per month[18] and production rates for locally produced wood ICS are between 4[19] and 300[20] per month, all on demand; this is to be compared to an estimated total ICS market of 110,000 per month (see Annex 1).

Two new high-performance models are soon to enter the market in Uganda: the Philips Stove and Biolite stove. The latter is supported by GACC's Spark program and plans to distribute approximately 3,000 units in its first year, with the potential to scale up production considerably. The Biolite stove burns wood and biomass and is targeted at rural and peri-urban consumers.

Although factory-level production is currently done outside Uganda – Envirofit in Kenya and China, and Philips in Lesotho, being two examples – potential exists to establish factory production in Uganda under the right conditions. Given sufficient volume and a viable market price, a number of manufacturers of other goods (see Box 1) may also be able to rapidly introduce large-scale factory production of ICS.

[18] Authors assessment based on data collected. We have added the maximum production rates to take account of other small-scale manufacturers not represented.
[19] AEESSS.
[20] ILF.

Table 6: **Example models and manufacturers**

Type of stove	Manufacturer	Cost Range	Effi-ciency	Key Features	Production Capacity (per month)	Distribution Channels
 Improved charcoal stove	Ugastove, Kampala	US$6.5-15	36%	Ceramic liner with metal cladding. First Gold Standard registered cookstove project	10,000–15,000 (2013), currently doubling capacity to 30,000	Sell through branches and retailers
 OkelloKuc stove	ILF, LIRA	US$8-11	37%	Ceramic part made from six bricks with outer metal cladding	Currently around 1,500, increasing with new facility	Sell through network of stove vendors
 Envirofit wood stove	Envirofit (Imported)	US$17	33%	Highly engineered wood stove manufactured in China	Imported from Kenya and China, high production capacity	Promoted by Up Energy under Carbon Credit program
 Local portable wood stoves	Ugastove, Promoters of Efficient Technologies for Sustainable Development (PETSD), various	Various	Various	Main designs follow rocket stove principles, can be metal cladded or made from mud and clay.	Demand-driven; most producers make less than 100	Mainly direct sales
 Local charcoal stove (other)	Many grouped under BEETA network, includes SEAL, EUF, FOWE, Racell, PEES, AEESSS, SELS	US$4-20	Various	Improved charcoal stoves of varying type, Main design have a ceramic liner and metal cladding	• SEAL 2000 • EUF 4000–5000 • FOWE 500–1000 • Racell 800 • PEES 700 • AEESSS 2000–3000 • SELS 200–600	Through direct sales, retailers and middlemen

Source: GACC (2013) and updated by authors.

Box 1: **Can Uganda scale up ICS production?**

Uganda's manufacturing sector is relatively well developed, with the percentage of GDP coming from manufacturing (8 per cent in 2011) broadly average for Sub-Saharan Africa. The sector produces agricultural tools, casements (such as doors and windows), wire and fencing, furniture and steel pipes, and a range of other steel products.

There is interest in the ICS sector as the stoves are known to be relatively straightforward to design and manufacture at scale. The key barrier to new national entrants is confidence in the demand for products at scale of around 1 million units. Manufacturers include Alam Group, Madhavani Group, Mukwano and Roofings.

Distribution: There are two primary routes to distribution in this model: via sales outlets such as hardware stores, or through aggregators such as farmer cooperatives, community groups and other sales agents. Evidence from interviews suggests that the latter approach is gaining momentum and is responsible for the greatest increase in sales in the market (see Box 2).

Box 2: **Living Goods: The aggregator model of distribution**

Living Goods is a non-profit health-focused agency whose mission is to reduce the under-5 child mortality rate in Uganda. The agency, in partnership with BRAC, the largest NGO in the world, follows the "Avon" model of door-to-door distribution and has 1000 women agents selling malaria, diarrheal and pregnancy products. They also sell products that can help buyers earn a living, such as ICS and solar energy products.

Each agent has approximately 100 clients (giving access to 100,000 clients), and they sell with a 20% margin on top of cost price.**Since teaming up with Ugastoves, within a 12 month period sales have increased from 800 charcoal ICS per month to 4000 per month, and cookstoves now account for over a third of all sales revenue.** Living Goods plans to expand distribution volume, contingent on a reliable supply from manufacturers. Living Goods is also benefiting from carbon finance linked to ICS sales, selling approximately 200 wood-burning ICS per month.

Distribution is currently in the following regions: **Jinja, Masaka, Mokono, Mpigi, Nsangi and Kewwempe (Kampala).**

The Uganda Carbon Bureau is establishing similar stove distribution models through their component project activities (CPA) model.[21] Examples include the International Medical Foundation serving Kampala (charcoal) and the Kakira Sugar Fair Trade Farmer Cooperative, whose 10,000 farmer members provide access to several million households.
Although distribution is hampered by poor road infrastructure and high transport costs, this does not appear to be a significant impediment to market growth.

Consumers: This model typically appeals to urban and peri-urban charcoal purchasers, with the exception of some advanced (gassifier) woodstove suppliers. Many manufacturers produce both charcoal- and wood-burning stoves, with the latter typically at a smaller scale and often to order.

Barriers to commercialisation at scale: The SWOT analysis undertaken by the guests of the UNACC's RBF Workshop in Kampala on 24 June 2013 consolidates and confirms the critical issues that affect this business model, as shown in Table 7.

[21] A program of activities (PoA) provides the organizational and methodological framework for CPAs that have the same stated goal. Compared to traditional CDM projects, CPAs have a much shorter time to market and lower costs for project operators who wish to secure carbon finance revenue.

Table 7: **SWOT analysis of the Manufactured Business Model**

Strengths	**Weaknesses**
• Low cost of labour • Good availability of raw materials • Good links to distributors • New actors entering the sector help build awareness and critical mass • Potential new entrants from wider manufacturing sector in Uganda • Potential for new partnerships for distribution	• Lack of machinery and infrastructure among existing producers • Lack of expected standards stalling scale-up • Lack of clarity (with consumers) on different types of stoves • Poor marketing – takes time • Poor links along market chain • Informal operational arrangements • Low access to credit for rural consumers • Gap between stove price and ability to pay in rural areas • Transport costs to rural areas
Opportunities	**Threats**
• Strong demand, market growing • Growing middle classes can afford new stoves • UNACC support to collaborate to solve market problems • Energy efficiency week, government awareness campaigns • Development of standards • Stove testing	• Lack of working capital and high interest rates • Falling carbon prices • Donor funding declining • High solid fuel prices • High raw material prices • Taxes (including on charcoal) • Legislation • Subsidised prices applied to certain market segments and not others • Imported cookstoves

Source: UNACC RBF Workshop 27 June 2013.

The key barriers to this market segment include the following:

- *Consumer awareness and willingness to pay:* Recent consumer research (TNS, 2013) has found that (a) 58–60 per cent of consumers are "not sure" that an ICS saves either time or money and (b) most consumers (70–82 per cent) say that if they really want something they can find a way for paying for it. This indicates that consumer awareness is the critical factor affecting willingness to pay. Further to this, our own interviews with Ugastoves and Living Goods (see Box 3) indicate a high degree of willingness to pay when investment is made in distribution and sales, thereby increasing consumer awareness. Although demand for charcoal-burning stoves is strong at around the US$7 price range for urban and peri-urban purchasers, this is not the case for many rural customers. For higher-price (and higher-quality) stoves there is a gap between cost of production and consumer willingness to pay. However, a price of US$7 does not provide sufficient surplus for marketing and after-sales maintenance, further limiting consumer awareness.

Box 3: **Establishing suitable ICS Quality Standards**

Discussions are ongoing regarding the best way to define standards for improved cookstoves in the developing world. Although national performance-based standards have been developed and implemented in a few countries (including Uganda), no international standard yet contains commonly accepted criteria by which to define "clean" with regard to cookstoves. Such an international standard would significantly enhance efforts to see clean cookstoves adopted at scale.

An International Organization for Standardization (ISO) International Workshop Agreement (IWA) was finalized and affirmed in 2012. The IWA provides guidance for rating cookstoves on four key performance indicators: fuel use/efficiency, total emissions, indoor emissions and safety. For each indicator, it defined five performance tiers, ranked from 0 (worst) to 4 (best). This International Workshop Agreement (IWA) is the first step towards establishing ISO global standards and protocols.

In Uganda, the existing national standard is being revised and may adopt suitable aspects of the IWA. In addition, at the time of writing, the World Bank's ACCES Quality Assurance and Technical Support pillar aims to give the initiative a solid technical foundation to ensure that the cooking technologies promoted are of high quality and provide real benefits both to African families and communities and to the global climate and environment. In year 1, this pillar has four central objectives: 1) assess baseline product, manufacturing, and testing quality and capacity in three countries of engagement (Senegal, Democratic Republic of Congo, and Uganda); 2) customize existing standards frameworks such as the ISO IWA and quality assessment methodologies for use in the ACCES initiative; 3) set quality thresholds for World Bank support in the three focus countries; and 4) design technical support packages for testing centers and manufacturers to support quality improvement.

The ACCES team is led by Berkeley Air Monitoring Group with contributions from Colorado State University, Winrock International and several other technical experts.

- *Access to Finance:* This is a critical constraint mentioned by all market actors along the value chain. The traditional banking sector does not recognise ICS as a bankable business, and lending rates are typically as high as 26–32 per cent per year. This results in a serious capital constraint across all elements of the market system. Banks that target smaller businesses and microfinance, such as Centenary Bank and Opportunity Bank, do not provide loans to start-ups without collateral. On the consumer side, loans made at the point of purchase have greater potential through group loans or for consumers that already have access to credit. The still-nascent mobile banking system could in time allow customers to make staged payments, increasing the willingness to pay (see Section 3.3). This may prove to be the most preferable route in Uganda given that loans are not popular and the culture of repayment is poor.[22] For instance, in 2011, there were only nine borrowers from commercial banks per 1000 adults in Uganda, compared with a Sub-Saharan African average of 45 borrowers per 1000 adults.
- *Stove Quality and Testing:* As with the Artisanal Model, stove quality and testing remain considerable barriers to the market. Small-scale manufacturers have expressed a certain amount of unwillingness to scale up their production capacity until they are fully aware of the future stove standards required. Meanwhile, the high degree of variability in stove performance affects consumer confidence.[23] Testing costs are high, and without a minimum standard for Uganda the

[22] Meeting with Opportunity Bank June 2013
[23] We did not talk to consumers this, statement was made to the team by other market actors

main incentive is to generate carbon finance revenues, which are usually directly linked to ICS efficiency.

- *Mechanisation:* Most Ugandan manufacturers have very low levels of mechanisation. Ugastove, the largest ICS manufacturer, has some metal cutting equipment and has recently invested in a new brick kiln, but production is labour intensive. Existing manufacturers in Uganda cannot easily increase volume of production in response to consumer demand. There is, however, potential for new entrants currently manufacturing goods in Uganda to undertake factory production.

Despite these considerable market barriers, the manufactured charcoal-burning ICS sector is gaining momentum. New actors are emerging and this, coupled with growing demand from a middle class increasingly aware of the benefits of ICS, is strengthening the market. Raw materials are readily available and the cost of labour is low. It is our opinion that the commercial viability of the business model is well tested and that the sector is in the third, "Prepare" stage of the *From Blueprint to Scale* report (see Figure 6) where the focus is on consumer awareness, supply chains and organisational capacity. This business model is close to being ready to roll out to large numbers of customers. What is not known is the potential to scale up wood-burning ICS to rural markets.

As summarised earlier in Figure 8, there are a number of opportunities and threats to the Manufactured Business Model. One of the greatest opportunities for achieving scale (though also a threat to current producers) is the introduction of mechanised manufacturing by factories in Uganda producing other goods. Encouraging new entrants of this kind will require a clear market with sufficient volume (an estimated 1 million households) at sufficient value (about US$10–12 per unit).[24] The role of government is also crucial: government policy and legislation on ICS standards and testing, as well as awareness programs such as Energy Week, could usefully support to the sector. Meanwhile, taxes and tariffs on raw materials and fuels could have a detrimental effect.

A critical co-innovation factor for this market is charcoal and wood production. It is not clear what impact increased used of charcoal ICS would have on demand for charcoal. Promotion of charcoal ICS over wood could have knock-on environmental effects which need further investigation.

In summary, the manufactured charcoal ICS market appears to be on the cusp of commercial viability. Most current manufacturers concentrate on the charcoal ICS sector and receive support from donors and/or carbon finance. But their business models are not entirely contingent on this support. Activities required to "prepare" the market to go to scale are hampered by a lack of both finance and the large-scale awareness-raising required to increase willingness to pay at a commercial level. Although in some cases production levels are increasing rapidly (Ugastove and EUF, for example), the total numbers remain low and manufacturers are not in a position to grow to significant scale without support or incentive. Evidence based on current market activity in Uganda suggests that commercially promoted wood ICS would require a higher incentive than has been available through carbon finance.

2.4.3 The Modern Fuels Business Model

The third and final ICS business model, Modern Fuels, consolidates two separate stove types: those burning biogas and those using liquefied petroleum gas, or LPG. The market for biogas stoves remains small. For example, the Uganda Domestic Biogas Programme built 560 units by June 2011, with 20,000 plants planned by 2013. Waste collection and biogas production systems are generally locally fabricated, using some local

[24] Interview with Alam Group June 2013

materials as well as livestock (and some agricultural) waste and converting it to biogas for cooking on-site. The stoves themselves can be either locally fabricated or imported.

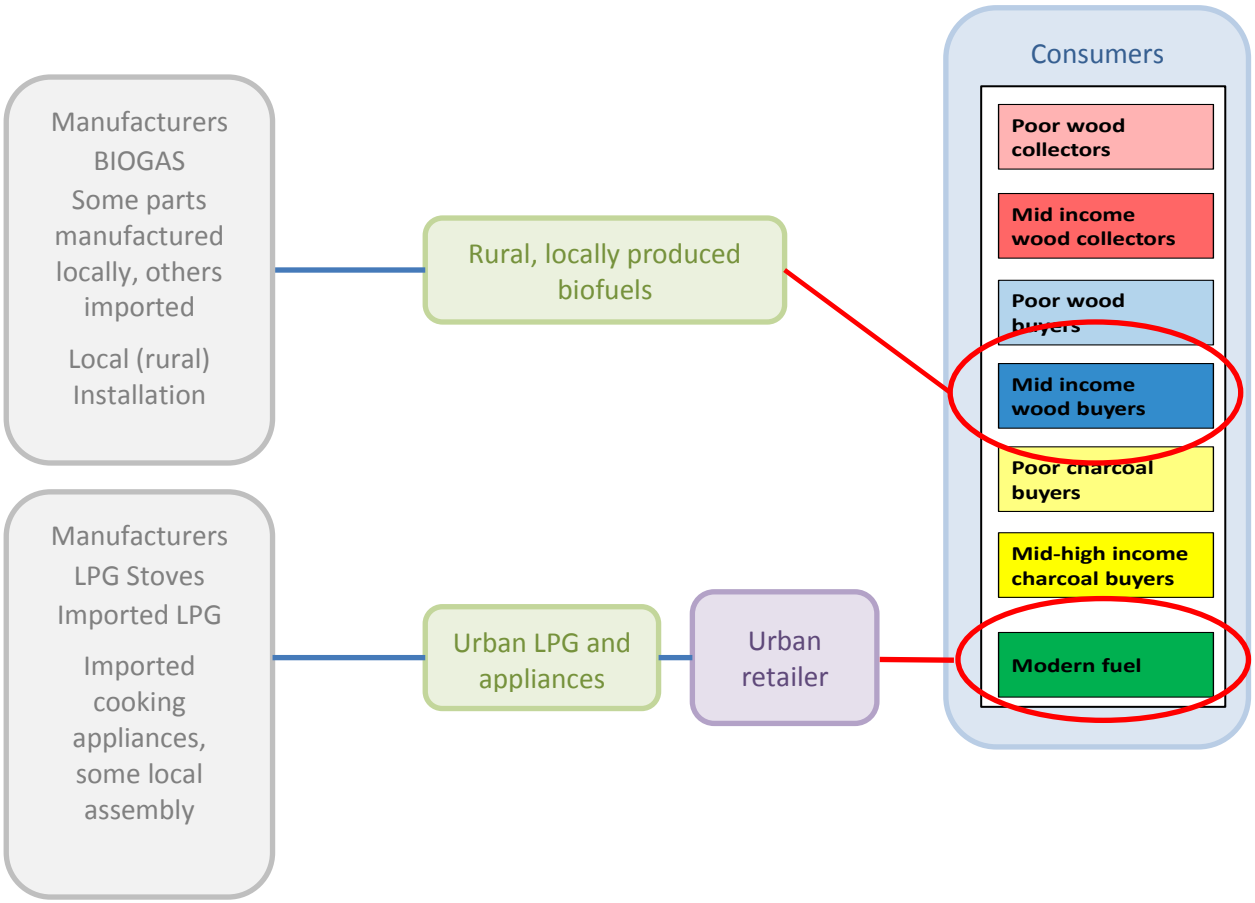
LPG stoves are in a different technology category. These are typically imported from China, India and the European Union. LPG itself is sourced through conventional petrochemical supply chains, largely for the high-end urban market. Examples of stoves are provided in Table 8 and a summary of the markets in Figure 10. The size of the biogas market is unknown, but potential for development exists by targeting cattle farmers in the West of Uganda. The LPG market is estimated at approximately 2000 ICS per month, driven primarily by LPG fuel providers rather than ICS manufacturers.

Table 8: **Biogas and LPG stoves**

Type of stove	Manufacturer	Cost Range	Efficiency	Key Features	Production Capacity	Distribution Channels
 LPG stoves	Imported by local fabrication enterprise	Over US$30	Unknown	Come with different burners and in different sizes	Demand-driven	Through retainers
 Biogas stove	Various — mainly informal sector; others are imported	US$30–60	40–60%	Come with different burners and in different sizes	Demand-driven	Through biogas construction enterprises

Source: GACC (2013).

Figure 10: **The market for modern fuels stoves**



As Table 9 shows, the high quality of modern-fuel stoves, in terms of both emissions levels and product standards, comes at a high price. This in turn limits the customer base, although the size of the middle class consumer group is growing.

Table 9: **SWOT analysis of the market for modern-fuel stoves**

Strengths • Clean cooking solution • Local technical capacity • Artisans trained in biogas installation • Registered POA for accessing carbon finance • Growth through institutional installations	**Weaknesses** • Expensive digester technologies • All imported • Relatively high cost fuels
Opportunities • Growing middle class • Fertiliser production and sale • Subsidies from ABPP • Coordinating associations • Western Uganda cattle markets	**Threats** • Unregulated market • Subsidies for some, not others • Regional instability affecting LPG and parts import • LPG supply chain subject to external forces

Source: UNACC RBF Workshop 27 June 2013.

External factors affecting the LPG market are considerable. Both the stove technology and, more importantly, the fuel are imported. This creates vulnerability to international market price fluctuations as well as import tariffs and levies. Although consumer concerns about the volatility and safety of LPG are being addressed, they still affect consumer confidence.

The biogas ICS market is still nascent and heavily dependent on both raising awareness and the technical capacity to produce on-farm biogas. However, the development of on-farm biogas is supported by a number of donors across East Africa focused on developing technology, supporting installation and leveraging carbon credits. Benefits to farmers, beyond energy access, include fertilizer production and financial returns from selling excess biogas. The large number of cattle farmers in Western Uganda and the range of subsidies and support provided by donors provide potential for the continued growth of this market.

2.5 Summary of the Innovation Ecosystem

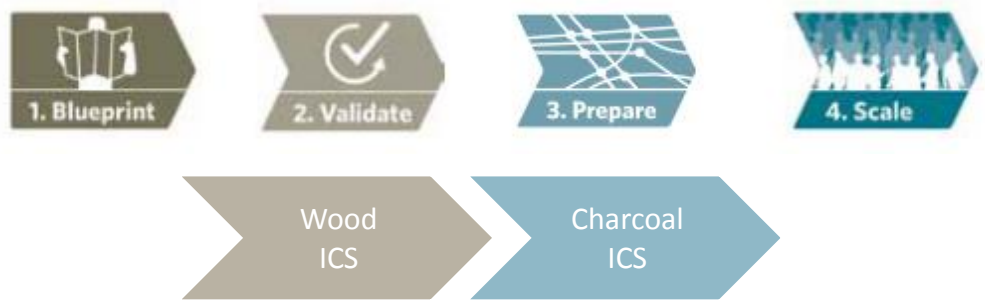
The foregoing assessment of the three business models – Artisanal, Manufactured, and Modern Fuels – indicates the commercial dominance of the urban and peri-urban market for improved charcoal-burning stoves, even though it continues to depend on support from both donors and carbon finance.

Because most charcoal stove manufacturers also make wood stoves (albeit on a small scale), they could respond to increased demand from rural consumers for wood ICS. Stimulation of the woodstove ICS market is underway through both support to artisanal producers and the efforts of carbon credit agencies in promoting the Envirofit and Ezy woodstoves to rural consumers. The long-term commercial viability of the wood ICS market, however, is yet to be validated. (See Figure 11.)

In our view, what the ICS market needs to achieve commercial sustainability at scale (i.e., multiple actors providing multiple products) is a focus on the relatively well developed urban and peri-urban (and higher-end rural) consumers who purchase rather than collect fuel. Then, once the Artisanal model (or an alternative) has been validated, a subsequent program could focus on poorer, typically wood-collecting

consumers. The emerging commercial urban and peri-urban markets may help to build foundations for addressing more challenging market segments.[25]

Figure 11: **Getting the ICS market to scale**



Any efforts to expand the ICS market will need to be overcome the multiple barriers affecting the ecosystem. These are summarised in Table 10.

Table 10: **Summary of market constraints**

Constraint	Artisanal Model	Manufactured Model	Modern Fuels Model	Importance
Financial barriers – Suppliers	Limited microfinance restricting potential for staged payments	Banks loans infeasible (high cost); intense capital constraint to scaling up production. Inability to offer staged payment or financing options at point of purchase		High
Financial barriers – Consumers	Low ability to pay for anything other than the cheapest ICS, willingness to pay increases with staged payment options	Low ability to pay for ICS over US$7 for charcoal ICS in peri-urban and urban markets. Price limiting market growth	Only top-end consumers	High
Willingness to pay / information barrier	Limited consumer awareness on benefits of ICS, awareness greater in urban markets. Low cost of ICS limits ability of manufacturers and sales agents to market products			High
Supplier capacity	Low volume, low quality	Uganda manufacturing is labour intensive and low-mechanisation, and thus slow to scale up	n/a, mostly imported and low volume	Medium
Quality and Testing	No national standard, varying quality products on the market affecting consumer confidence, and varying economic, environmental and health benefits. Low branding of products.			Medium

[25] We have not included the modern fuels market in this assessment due to the low consumer numbers and because demand is dominated by high-income consumers.

For our purposes, we are focusing on the "high" importance barriers and suggest that barriers of medium importance be addressed through complementary measures.

2.6 The Enabling Environment

The enabling environment in Uganda comprises three main elements: policies and regulations, financial markets, and socio-political factors.

2.6.1 Policies and Regulations

The role of policies and regulations on the market is significant. Significant policy drivers include:

- **Import duties on cook stoves** – Imported stoves such as the Envirofit are subject to import duties of 25 per cent.
- **Import duties on metals** – Metal for the cladding on ICS is the greatest material cost, and can represent up to 80 per cent of the stove price.[26] The Import duty on sheet metal is currently 25 per cent.
- **Withholding tax** of 6 per cent.
- **Value Added Tax** – ICS are subject to VAT at a current rate of 18 per cent;[27] other energy products, such as solar products, have been exempted.
- **Cookstove standards and testing** – There are no national minimum standards for ICS.
- **Environmental and Energy Policy** – National policies on deforestation, environmental protection, and energy access all affect the sector. Further investigation of the policy framework is required.
- **Charcoal** – As the predominant ICS fuel, all policies that affect the charcoal market have a knock-on effect on the ICS market. There is currently no direct tax on charcoal, though traders are subject to tax. All policies or regulations that affect the supply and market cost of charcoal and wood will have a knock-on effect on the ICS market.
- **LPG** – As an imported product, LPG is subject to international fluctuations in price as well as import duties. The current import duty is 7 per cent and the import license commission is 2 per cent. It is exempt from VAT.

There has been notable policy progression in the decentralised energy access sector, in particular the current exemption of solar energy products from import duties and VAT.

Although this report focuses on household ICS, it is worth pointing out that policies for institutional ICS could also affect household production, given that the manufacturers are typically the same within Uganda. The Ugandan Ministry of Energy estimates that there are 17,000 schools in Uganda cooking on open fires every day.[28] Policies that promote or legislate for the adoption of ICS within schools will – in addition to the direct social, environmental and financial benefits – help support the household ICS market through greater awareness, strengthening ICS providers in Uganda and promoting inward investment in the sector.

[26] Interviews 2013. Labour for locally manufactured ICS is 15–20 per cent, clay is low cost, metal is 80 per cent of material costs.
[27] Interviews June 2013.
[28] Interviews June 2013.

2.6.2 Financial Markets

The financial markets affect the Ugandan ICS market in four main ways:

1. **Carbon finance** – This currently plays a significant role. For those producers and distributors that are contracted with a carbon finance partner, the effective subsidy is in the range of 20–40 per cent of the final sales price.[29] However, the carbon market is currently very weak and volatile, with voluntary markets offering higher prices than compliance-based markets in recent years.[30]
2. **Commercial loans** – Currently the small-scale energy sector – and in particular the ICS market – are not seen as bankable businesses in Uganda. Loan rates are very high at 25–32 per cent a year and subject to change.
3. **Consumer finance** – Microfinance is available throughout Uganda, particularly through group loans, but is subject to the availability of capital. The poor perception of the ICS market by banks and lending agents also limits potential. Community-based savings and credit cooperatives (SACCOs) play an important role in consumer finance.
4. **Mobile banking** – Considerable potential exists with mobile banking: more than 30 million people in Uganda have phones, whereas only 4 million have bank accounts. Transaction volumes have grown exponentially. Although mobile banking technology is still in its infancy in Uganda – subject to abuse, high transaction costs and consumer uncertainty – experience from across East Africa and discussions in Uganda indicate that teething problems can be overcome.

2.6.3 Socio-political factors

Cultural factors also play an important role in the cookstove sector. Traditional fires affect the taste of the food and it is hard to encourage people to abandon their taste preferences; awareness campaigns, therefore, have an important role to play.

Other factors, such as low loan rates and a poor culture of lending and repayment, are also relevant when considering ways to tackle financial market barriers. Corruption is a particular problem in Uganda, which currently ranks 130th out of 171 in Transparency International's Corruption Perceptions Index.[31] The problem of pervasive corruption will enhance the need for rigorous results testing prior to paying for RBF, with a knock-on effect on costs.

[29] Meetings with various carbon finance and ICS stakeholders.
[30] Uganda Carbon Bureau.
[31] http://cpi.transparency.org/cpi2012/results/.

3. Results-Based Financing

The fundamental idea behind results-based financing (RBF) approaches is that payments that would otherwise be made automatically are made contingent on the delivery of pre-agreed result(s), with achievement of the result(s) being subject to independent verification. RBF approaches were pioneered in the health sector[32] but there has been increasing interest in whether and how they could be used within the energy sector, and especially on how they might promote private sector investment in (low-carbon) energy sector opportunities (ESMAP, 2012).

The main difference between RBF and conventional approaches, such as upfront grants, is the way in which the risk of project failure is allocated between principal and agent.[33] Under a conventional approach, the financial risks of project failure are borne mainly by the principal: if the project fails to deliver the anticipated results, the principal's resources will already have been committed and will be (substantially) unrecoverable. By contrast, under an RBF approach, the risks borne by the principal are reduced: if the project fails to deliver the expected results, the financial resources of the principal are not expended. By corollary, the opposite is true for the agent: under an RBF approach it faces substantially greater risk as if the project fails as it will receive no contribution from the principal; these risks are lessened for the agent under a conventional approach.

The desirability and effectiveness of an RBF instrument therefore depends on whether this allocation of risk is appropriate: when the additional risks placed on agents can be easily absorbed by agents, and they respond to this additional risk by having a stronger incentive to deliver results, then an RBF approach is likely to be a cost-effective way of delivering the desired outcomes. By corollary, when the agent cannot easily absorb and respond to the additional risks, then the RBF may not be appropriate.

The remainder of this section is structured as follows:

- Section 3.1 determines the policy objectives for any intervention in the Ugandan cookstove sector.
- Section 3.2 summarises the current constraints holding back the development of the sector.
- Section 3.3 identifies a range of different RBF instrument design options, and scores them against a range of criteria that help to identify their appropriateness.
- Section 3.4 provides a short list of suitable RBF options which form the basis of the design considerations in Section 4.

3.1 Policy Objectives

Based on discussions with stakeholders, we have identified three possible policy objectives for any intervention in the Ugandan cookstove sector that seeks to deliver lasting benefits:

1. **To stimulate the uptake of efficient and clean cooking solutions that deliver a range of benefits, including health, with an emphasis on facilitating the emergence of a commercial market at**

[32] See, for instance, http://www.rbfhealth.org/rbfhealth/

[33] In this work, the principals are most likely international donors, the government or other large organisations (such as the PSFU) that have interest in, and the institutional capacity to monitor, an RBF agreement to encourage ICS deployment. The agents will depend on the type of RBF used, but are most likely ICS manufacturers, financial institutions or other organisations working in the ICS sector in Uganda. An assessment of their institutional capacity is undertaken for each RBF.

scale.[34] This approach focuses attention on consumers who, although likely to be willing and able to purchase ICS in the future, may need an additional stimulus in the short term. Those consumers who are unlikely to represent a commercial proposition for ICS manufacturers and retailers in the medium-to-long term are neglected by this objective (even if their use of an ICS may deliver significant health or other benefits).

2. **To promote rapid installation of clean cookstoves within a defined timeframe to deliver health benefits**. This objective focuses on areas where ICS use results in the greatest short-term health benefits. Less attention is given to the extent to which some consumers are willing to pay for cookstoves that is close to an unsubsidised market price.

3. **To encourage the emergence of radical and innovative approaches to the manufacture, distribution or retail of efficient and clean ICS**. This approach hypothesises that inappropriate business models are the main constraint to market development, and thus looks to support alternative approaches.

Objective 1 is preferred for three reasons.

First, stimulating a commercial market at scale is probably the best option for generating long-term benefits beyond the duration of the intervention. Benefits in the short and long terms arise from the deployment and continued use of ICS that have better fuel efficiency but, as quality improves, have lower pollutant emissions. There are already local as well as foreign ICS manufacturers active in the Ugandan market (see Section 2.4). An RBF approach that focuses on boosting awareness among those with the greatest ability to pay may help increase demand while allowing manufacturers to realise scale benefits that help them expand their market. The combination might foster the development of a larger sustainable market that can continue to deliver health benefits. The benefits from focusing intervention where there is greatest scope for developing a self-sustaining market – rather than necessarily on rapid deployment of cookstoves – can be seen from experiences in other countries, most notably Kenya (Rai, 2009).

Second, by adopting an approach that places emphasis on whether consumers wish to purchase cookstoves, there is less need to specifically quantify the health and environmental benefits of ICS use, which can be a challenging task. Health benefits may still be realised through an appropriately designed RBF approach that targets low-emissions solutions including LPG, and can be measured through proxies such as air pollutants. A recent systematic review of livelihoods impacts (IOB, 2013) shows the huge potential benefits from ICS deployment. Impact research in Sub-Saharan Africa is underrepresented, however, and studies suggest that it is not the ICS itself but human behaviour that is the dominant factor in determining health and environmental benefits. Given this, concretely tying the RBF objectives to the delivery of these benefits – such as improved health outcomes, as implied by objective 2 – may be very difficult. It should nonetheless be emphasised that the establishment of a commercial market at scale is expected to deliver very real and significant benefits beyond health (see Section 4). Further still, the RBF approach can be designed to incentivise the delivery of these benefits. In particular, it can provide greater

[34] A *commercial market at scale* is defined as a market in which (a) multiple actors serve multiple consumer segments and (b) consumers purchase ICS without intervention.

incentive to the deployment and use of high-quality clean cooking solutions such as advanced ICS products, including LPG stoves, that that correlate with delivering health benefits.[35]

Third, in contrast to objective 3, focusing on the establishment of a commercial market does not prescribe a particular business model but leaves entrepreneurs open to innovate and invent cost-efficient business models, and provides the greatest incentive for innovation and sustainable business development in the Ugandan ICS sector. Objective 3 directly influences the business model and, as such, risks alienating existing suppliers and consumers. Initiatives pursuing similar objectives have failed to generate sustainable long-term benefits in the past, including large donor-driven stove programs in the 1970s and 1980s.

This objective can be mapped onto the three segments of the Ugandan cookstove sector discussed in Section 2:

1. Low-quality, wood-burning artisanal stoves used predominantly in rural areas. Most activity in this area is donor-driven, with an estimated turnover of 4,000 stoves per month;
2. Manufactured, mainly charcoal-burning stoves of medium quality in urban and peri-urban areas. This is where the bulk of the commercial activity is currently focused, with Ugastove and other producers currently supplying about 20,000 improved cookstoves per month;[36] and
3. High-quality cookstoves imported or domestically produced, sold to urban consumers, and fuelled by wood, charcoal and refined fuels.

The objective of creating a commercial market at scale implies primary focus on the medium-quality segment. This reflects where there is the greatest market opportunity, given current willingness to pay among Ugandan consumers. This also offers significant socio-economic benefits including large fuel savings for households. However, an RBF approach can be designed, along with its duration, to encourage either higher-quality cookstoves over time, including those with fewer health impacts, or encourage penetration to poorer rural house-holds typically collecting firewood. These do not need to be mutually exclusive, and different segments can be targeted simultaneously – in other words, an RBF program targeting higher-quality stoves with health benefits could run concurrently with an RBF program targeting lower-tier stoves that will achieve fuel savings and greater market penetration.

While the objective to create a commercial market at scale is expected to deliver the greatest benefits at the lowest costs, other options could be considered depending on the objectives of the donor and principal. One option might be to focus on improved cookstoves for rural three-stone fire users. Likewise, focusing only on health benefits through reduced HAP might imply primary focus on the high-quality segment, which offers the greatest pollutant reductions but will reach a smaller number of people. However, these are not considered further in this analysis.

3.2 The Constraints on Market Development

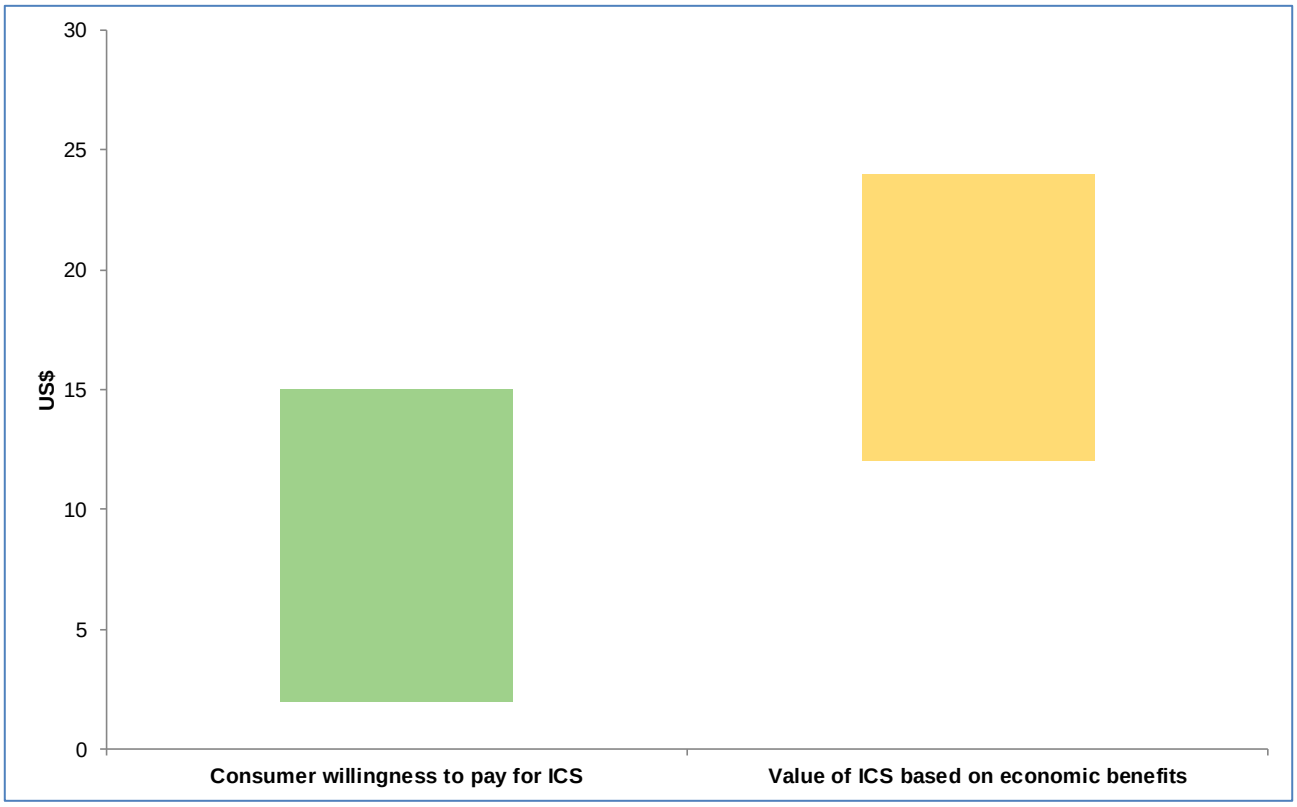
This section distils the main constraints holding back greater penetration of ICS within this market segment to evaluate whether proposed RBF approaches would overcome them. It concentrates on two main barriers: low consumer awareness and lack of access to finance.

[35] ICS products that achieve substantial reduced household air pollution (HAP) commensurate with delivering health benefits are currently not distributed beyond pilot studies in Uganda and come at a high unit cost in the range USD 40–80. (Interviews June 2013)
[36] Interviews, June 2013.

The first main barrier is low consumer awareness of ICS benefits and the corresponding low willingness to pay. Consumers are unaware of the fuel savings and secondary benefits, such as reduced smoke production, derived from ICS use. This results in an overall low willingness to pay for ICS, below the economic benefits, which are mainly fuel savings for charcoal and refined fuels as well as reduced time gathering and preparing fuelwood. (The benefits of ICS use are quantified in Section 4.3 and illustrated in Table 21.) Suppliers are either not interested in advertising the benefits or do not have sufficient capital or capacity for marketing. For example, extra revenues such as carbon finance are used to lower the price of cookstoves rather than for information or marketing campaigns.[37]

Figure 12: **Consumer willingness to pay**

To create a commercial market at scale, stove value must overlap with consumer willingness and ability to pay



Note: The US$ amounts are illustrative but reflect the difference in magnitude between (a) the sale price, which can be justified by fuel savings and stove value, and (b) the willingness of consumers, who are unaware of the economic benefits, to pay for ICS using wood and charcoal.

Source: Project team.

The second main barrier is access to finance for both ICS suppliers as well as consumers, which increases the difficulty of expanding ICS supply operations and constrains consumer's ability to pay. The World Economic Forum's *Global Competitiveness Report* (WEF, 2013) identifies access to financing as the second biggest barrier to business across all aspects of the economy. Commercial credit is mostly unavailable to small and medium-sized suppliers or is available at very restrictive interest rates, for example at 25–30 per cent per year.[38] Consumer lending for small investments, for example below US$30, is virtually non-existent. Group loans have been used before by Ugandan financial institutions and can, together with

[37] Interviews June 2013.
[38] Interviews June 2013.

SACCOs, represent the initial main channel to deliver consumer finance. However, even group loans do not allow for feasible interest rates, especially in light of the lack of consumer awareness of ICS benefits and the resulting low willingness to pay.

Because RBF itself does not entail up-front finance, it does not overcome the initial financing constraints ICS suppliers face. It is reasonable to assume, based on the interview evidence obtained in Uganda in June 2013, that new suppliers will enter the market given sufficient consumer demand. Returns need to be high enough per ICS sold to encourage suppliers to invest in building consumer awareness; the current price point does not allow this and thus suppresses the market. With the carbon price incentive alone, new suppliers have started operations from scratch and it is therefore likely that new small entrants will appear. In addition, large manufacturing or industrial firms in Uganda are willing and able to enter a commercial market at scale, which would lead to the entry of relatively large ICS production capacity. It is reasonable to assume a continuum of new entrants between artisanal suppliers and full-scale manufacturing firms that could enter the Ugandan ICS market and supply ICS of a given quality tier and required pollutant reduction.

Figure 12 above helps to demonstrate how an RBF program targeted at *producers* may help to lower ICS prices, thus lowering the right hand box in the graph, whereas an RBF program targeted at *consumers* may help to raise consumer willingness to pay for an ICS, thus raising the left hand box in the graph.

The remaining obstacles identified in Section 3 can be overcome by complementary measures beyond the scope of the proposed RBF options. The remaining obstacles are minor in comparison with the lack of financing and low consumer willingness to pay and can be overcome by complementary, potentially non-RBF measures. These can build on current initiatives such as ACCES, which seeks to promote enterprise-based, large-scale dissemination and adoption of clean cooking solutions in Sub-Saharan Africa (SSA). Further discussion on complementary measures is provided in Annex 4.

Quality and testing, although not a critical barrier to establishing a commercial market at scale, becomes a critical element in establishing an RBF program, particularly one aiming to increase health and environmental outcomes, because testing will establish the tier at which the RBF is paid**.**

3.3 RBF Options and Scoring Criteria

This section identifies (a) a wide range of potential RBF options for stimulating greater ICS penetration in Uganda and (b) a methodology for filtering the options according to their likelihood of achieving the objective. The selection and scoring is based on internal team discussions and liaison with Ugandan stakeholders and other market experts. This section evaluates whether a long list of nine potential RBFs tackles the main barriers in the Ugandan ICS market and scores each RBF against criteria developed by Vivid Economics for the ESMAP report on RBF in energy projects. (World Bank, 2013a)

The result is a shortlist of four RBF options, which are analysed in detail with regard to their design considerations, implementation modalities, and economics such as value for money. The shortlist includes options for targeting different market actors.

The final design considerations, implementation modalities and economic benefits are based on the current state of research and are to be refined in later stages, beyond this feasibility report. Under the ACCES Quality Assurance and Technical Support Pillar, Berkeley Air Monitoring Group and partners (see Box 3 in Section 2) are testing currently available ICS in Uganda to measure their health, fuel saving and other benefits. The results of this, which are due in 2014 (past the finalising of this report), will be a crucial input into this subsequent phase of work.

3.3.1 Candidate RBF Options

The candidate options can be put into four categories according to their focus – suppliers, consumers, finance providers, and maintenance providers. Under each category a number of different options can be identified.

Suppliers:

1. An RBF payment is made for every additional ICS sold that meets certain quality standards;[39]
2. An RBF payment is made for every additional ICS sold that meets certain quality standards for which continued use can be demonstrated;
3. An RBF payment is made whose value is linked explicitly to the value that the ICS has provided in terms of reducing emissions, improving health or other outcomes;
4. An RBF payment is made to cover the additional transport costs associated with the sale (or continued use) of ICS in a geographically remote area; and
5. An RBF payment is made for the successful certification that a particular stove design meets a specified quality standard.

Consumers:

6. Consumers receive vouchers that can be redeemed against the purchase of a pre-defined high-quality ICS to reduce its cost.

Finance providers:

7. An RBF payment is made to finance providers according to the value of the loans they make to either producers or consumers to finance the production or sale of a high-quality ICS; and
8. An RBF payment is made to finance providers according to the value of the loans they make to either producers or consumers to finance the production or sale of a high quality ICS after those loans have been paid back.

Maintenance providers:

9. An RBF payment is made for every ICS that undergoes a maintenance inspection.

Across all of these different options, there is an important question about how they may interact with existing carbon market activity in the country. This is explored further in Box 4.

Box 4: **The interaction between RBF incentives and carbon markets**

A key over-arching design issue relates to the way in which any RBF incentive relates with current or prospective carbon market activity. The question is whether the sales or use of cookstoves supported by carbon market revenues should be entitled to also benefit from an RBF payment.

We assume that any RBF incentive will be additional to revenues received from the carbon market – in other words, that those benefitting from carbon market revenues will also be able to receive any RBF incentive payment. This reflects the idea that the objective of the RBF program is to develop a self-sustaining market in cookstoves in Uganda so as to promote health and other benefits. There are a number of reasons to suspect that carbon revenues, in isolation, may not deliver these benefits:[40]

[39] This, and options 2, 4, 6, 7 and 8, could be further refined by offering different payments depending on specific stove standards. More detail is provided in Section 4.
[40] Interviews, June 2013.

- As discussed in Section 2, even with carbon market revenues, there is currently insufficiently value being created by the sale of cookstoves in Uganda to undertake the promotional and marketing activity necessary to raise consumer awareness, thereby building a self-sustaining market. The additional resources from the RBF can assist with this. This is particularly important given the current low carbon market prices and concerns over whether this may persist.
- Exclusive reliance on carbon markets to support the development of a cookstove market in Uganda may result in a choice of technologies that do not deliver the greatest health and other social benefits. The RBF can help to support technologies that deliver against a wider range of objectives.

In any detailed design work, careful calibration of the incentive will be required. An expectation will need to be formed about the future evolution of carbon market prices so that the RBF incentive payment is sufficient to incentivise the desired activity but at the same time does not result in unnecessary public resources being wasted. A mechanism may be needed to adjust – on a forward looking basis – the RBF payment in the event that carbon prices diverge significantly from current carbon price expectations. Also, the chosen value of the RBF incentive payment must not jeopardise the demonstration of additionality that is a requirement for carbon credit funding.

Allowing market participants to benefit from both the RBF and carbon market revenues will have important implications for which donors may support the RBF using funds from which sources. Specifically, some donors may be reluctant to use resources allocated to climate finance to support an RBF option that also allows market participants to issue and then sell carbon credits. This is because their public resources will be used to support the sale of the carbon credit that simply offsets an emission reduction that would otherwise be undertaken, under existing legal obligations, in a developed country. In other words, the climate finance resources will have delivered no net emission reductions. However, this critique will not apply to donor financial resources that are allocated to support health or other outcomes.

An additional interaction with the carbon market is to consider using a mechanism similar to the Carbon Initiative for Development (CI-Dev) to encourage ICS deployment, linking the incentive to future Clean Development Mechanism (CDM) projects.[41] As noted in Box 4, international carbon market prices are at historic lows and there is uncertainty over whether and when they may recover. In response to this, the Carbon Initiative for Development (Ci-Dev) plans to use donor funds (currently around US$50 million has been committed)[42] to buy carbon credits at prices that are sufficient to make new CDM projects viable. The Ci-Dev initiative is expected to support around 8–10 projects and it has attracted interest for cookstove project developers in Uganda and throughout East Africa.[43]

Although Ci-Dev may be considered to be a results-based financing mechanism, it and initiatives like it are excluded from the discussion below. This is partly to ensure that the focus is original – detailed design work on the Ci-Dev initiative has already been undertaken (see, for instance, the Carbon Initiative for Development program note of February 2012[44]) – but, also due to a desire to consider RBF mechanisms that might allow more direct focus on the objective of interest. Again, as noted in Box 4, exclusive reliance on rewarding emission reductions may not result in a choice of technologies that delivers the greatest health and other social benefits, or focuses attention on delivering a self-sustaining market. We do, however, pay attention to where and how existing carbon market infrastructure may allow a reduction in the transaction costs associated with different RBF designs.

[41] The Clean Development Mechanism, as defined in the Kyoto Protocol, provides for emissions reduction projects that generate Certified Emission Reduction units, which may be traded in emissions trading schemes.
[42] In addition, a further US$20–25 million has been committed to supporting carbon market readiness activities.
[43] Interviews, June 2013.
[44] https://wbcarbonfinance.org/docs/CI-Dev_Consultation_Note_Feb2012.pdf.

3.3.2 Filtering the Options

To determine the appropriateness of each RBF option, we use two filters:

Filter 1: Does it tackle the main barriers?

Filter 2: Does it lend itself to effective RBF design?

Filter 1 assesses the appropriateness of the intervention against the key barriers to the development of the ICS sector in Uganda, as detailed in Section 2.5 and summarised in Section 3.2. RBF options failing this stage are excluded and do not progress to Filter 2. This ensures that the RBF is tackling the key barriers holding back the development of a commercial market at scale. This does not preclude any additional interventions to address other barriers.

Filter 2 is more specific and evaluates the RBF options on the basis of "precondition criteria" and other factors that influence the attractiveness of using RBF and builds on previous RBF literature (World Bank, 2013a). Each RBF is scored on a relative scale on the basis of desk research and on-ground research in Uganda in June 2013. The options are given one of three scores:

Red (poor)

Amber (limited)

Green (good)

For Filter 2, at least two preconditions must be met:

- The agent[45] must have access to capital consistent with the capital costs of the project; and
- Both principal[46] and agent must possess sufficient institutional capacity.

The agent will need to have access to sufficient financing to cover any upfront costs prior to delivery of results. This largely relates to access to capital markets, although it is possible that agents could finance any upfront costs from their own resources. The importance of this barrier will obviously depend on the scale of the upfront capital costs that are incurred, so that smaller and less capital intensive investments within the cookstove value chain may face fewer challenges, as will RBF instruments that are aimed at larger organisations with greater financial resources.

Lack of capital can often be a very important barrier to the implementation of RBF approaches, especially those that require substantial fixed investment costs to be incurred before there is hope of recouping the RBF payment. In the Ugandan context, a limited form of RBF scheme in the solar PV sector has been implemented before with other measures to increase availability of up-front finance. A grant component was split between payment up front and payment upon verification of solar installations.

Both principals and agents need to have sufficient institutional capacity to, respectively, set up and respond to an RBF incentive. For the principal, this relates to the ability to implement and monitor the instrument and to ensure quick disbursement of resources when agents deliver agreed results. It has sometimes been argued that RBF requires lower technical capacity on behalf of principals than conventional instruments because, for instance, it does not require appraisal of different grant applications. However, a more appropriate assessment may be that administering RBF requires different

[45] The *agent* is defined as the recipient of the RBF payment.
[46] The *principal* is defined as the entity administering the RBF.

technical skills and that, especially in cases where monitoring and verification is not trivial, these may still be substantive. For agents, technical capacity relates to the planning tools and managerial ability that allow them to map out the expected cash flows from an RBF instrument, and to react to the new incentive.

The second key precondition is that the principal and the donor have the institutional capacity to provide and respond to the incentive provided by the RBF.

The principal must be able to design and calibrate the RBF scheme appropriately and to make payments when the results have been delivered. Principals for an RBF in this context may be large international organisations, donors, the Ugandan government or other institutions such as the Private Sector Foundation Uganda (PSFU). The institutional capacity and access to finance differs for the principals but its assessment is beyond the scope of this work.

The agent must also be able to increase the result which is being incentivised by the RBF payment. This is discussed further in the context of each of the RBF options.

In addition to the "precondition criteria," five further conditions make it more or less attractive to use RBF approaches, as laid out in the ESMAP report (World Bank, 2013a):

- Control of outcomes;
- Monitoring costs;
- Within resources of agent;
- Cost base variability – does it require fixed investment or are the costs variable and therefore adaptable to changing market conditions; and
- Duration until payment.

All these factors determine the extent of additional risk placed on agents by the various RBF options – which, as explained at the beginning of this section, is the key to determining their appropriateness.

Tight control of outcomes reduces the risk and costs of an RBF scheme. In cases where the factors that will influence whether or not the results are delivered by the agent are largely under the agent's control, the premium an agent would need to justify bearing the additional risk from the RBF scheme will be lower. For example, placing an RBF instrument on sold units of ICS would be less costly than placing it on the demonstrated usage of ICS, as the former is largely under the control of ICS manufacturers while the latter is driven by the customer side, especially in relation to actual use of ICS products.

Risk-driven cost increases are lower when both principal and agent have a clear "line of sight" to the result against which results-based payments are made, and both parties can trust the monitoring and verification arrangements. If all parties are able to easily observe the relevant results (and know this in advance) and there is no contractual ambiguity, then agent's risk will be lower. In addition, as the disbursement of funds depends on the monitoring and verification arrangements, insufficient trust in monitoring and verification arrangements will increase the agent's perceived risk. On the principal's side, trust in monitoring and verification procedures is essential in avoiding the risk of overpaying and/or the possibility of gaming by the agent. Monitoring the sale of ICS is potentially easy to verify, whereas monitoring and verifying the usage would depend on the ability either to set up independent agencies or to combine usage monitoring with the existing procedure for verifying carbon finance emissions reduction.

Risk-driven cost increases are lower when the additional investment required to deliver the results does not entail a significant proportion of the agent's (potential) resources. If the activities associated with the RBF instrument represent a small proportion of the overall firm's resources, then the success or failure of the project will have little or no impact on the viability of the agent – and hence on the willingness of capital providers to provide capital to the agent. Correspondingly, there should be little or no change in the

terms on which that firm can access finance. By contrast, if the RBF instrument is linked to a substantial proportion of the agent's activities, then this makes success in delivering the results critical to the agent's financial viability.

Risk-driven cost increases are lower when the agent's costs depend on the results delivered. In cases where the cost base of an agent varies as the amount of results increases or decreases, then the agent has a natural "hedge" against poor performance; although its revenues are lower, so are its costs, muting the impact on its overall profitability. By contrast, an agent that has very substantial fixed costs (high "operational gearing") will be much more affected by poor performance: its revenues will fall but its costs will be unaffected. This factor will be particularly important when not all of the factors influencing delivery of the results are within the control of the company. For manufacturers of ICS, this entails investment in new equipment – a fixed cost – or scaling up the inputs used with current equipment – increasing variable costs. For consumers, the investment in ICS is mainly fixed because the one variable cost, which is fuel, would also be incurred for unimproved cookstoves or three-stone fires.

Risk-driven cost increases are lower the shorter the time horizon for RBF payments. The further out into the future an RBF payment is promised, the more risk an agent faces before it receives the payment. Consequently, an RBF instrument might be preferable for assets with shorter operating lives, and a short-duration RBF instrument may be preferable over a longer-duration RBF instrument.

The last step is to evaluate the feasibility of the exit condition of each RBF. The exit condition must be able to be clearly defined and monitored if the intervention is to have a credible outcome.

3.3.3 Assessing the Options

This section summarises the results of filters 1 and 2 for the "long list" of nine RBF options. As will become apparent, of the nine options identified, four appear to be particularly strong candidates that should be explored further.

Discussion is divided into each of the four categories of RBF outlined above: **suppliers, consumers, finance providers, and maintenance providers.**

A. Suppliers

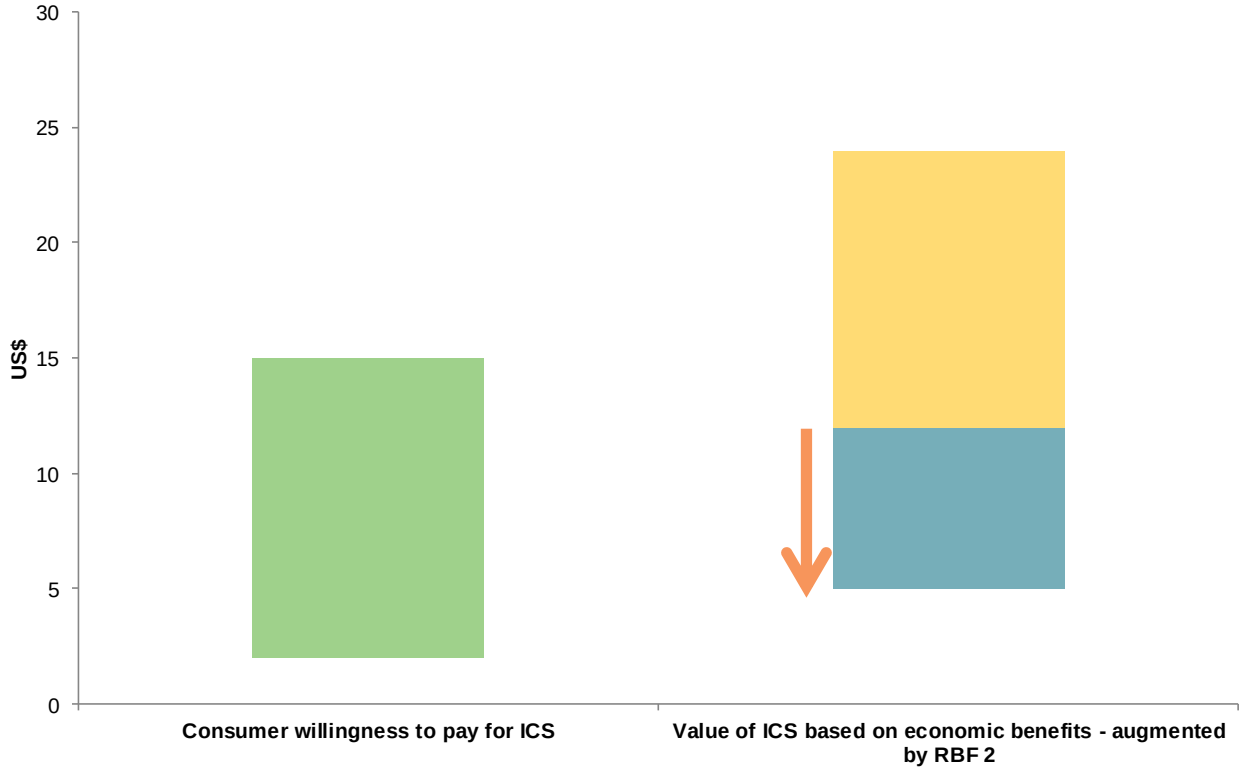
As Figure 13 shows, RBF options aimed at suppliers allow ICS prices to be reduced to levels that overlap with consumers' current willingness to pay. However, to create long-lasting benefits, the consumer willingness to pay for ICS would need to *rise* to levels sufficient for ICS suppliers to recover their costs after the RBF has exited.

RBFs aimed at suppliers are likely to increase marketing, sales and distribution, thereby increasing consumer awareness as well. The main constraints on currently low marketing and sales efforts are a lack of funding and awareness of the benefits of ICS. By providing additional funding and tying the total amount of funding received (in part) to ICS sales, efforts to increase sales via marketing of ICS benefits, better distribution channels or sales services are incentivised. In turn this will create increased consumer awareness and, over time, help raise consumer willingness to pay.

The following evaluates each of the five supplier-focused RBF options against Filters 1 and 2.

Figure 13: **RBF options focusing on suppliers**

RBF options targeted at ICS supply potentially lower the stove prices to levels that coincide with consumer willingness to pay. However, to be sustainable, that willingness must rise to levels at which ICS suppliers have sufficient margins for future investment.



Note: The value of ICS based on economic benefits is derived from Section 2 and Section 4. The consumer willingness to pay is assumed to be lower due to the lack of awareness of the benefits and to current ICS market conditions in Uganda.

Source: Vivid Economics.

Option 1: Payment for every additional ICS sold that meets certain quality standards

This RBF provides a payment for each ICS sold into the target market that meets pre-defined quality standards. Payment to manufacturers could vary by quality standards, correlating to expected health benefits, allowing for the quality standards needed to trigger payment to increase over time. The goal is to either (a) lower the price of ICS to levels that match the willingness to pay for consumers or to (b) increase the amount manufacturers spend on marketing as a way to increase consumer awareness and their willingness to pay.

Filter 1

RBF 1 could help to address the key barriers holding back the cookstove sector in Uganda. The additional financial resources provided by the RBF would provide a stronger incentive for producers to raise the awareness and benefits of purchasing high-quality ICS. They may also be persuaded to reduce the purchase price of ICS, thereby reducing the lack of access to finance that consumers currently face. The RBF may also encourage manufacturers to overcome deficiencies in their business model and to improve the quality of ICS they offer as well as to diversify what they offer to match customer needs and expectations.

Filter 2

Table 11 provides an initial assessment against the key criteria.

Table 11: **Initial assessment of RBF1 against the key criteria**

RBF 1 is the easiest production RBF in terms of control, monitoring and exit but provides fewer long-term incentives to use ICS.

Criteria	Notes	Score
Access to finance	There are different market segments. Large or international producers have reasonable access to finance, whereas small or local (artisanal) producers may not. Nevertheless, new entrants manufacturing ICS have entered the market in response to the prospect of carbon revenues, so they appear able to overcome financing problems.	*Amber*
Institutional capacity for the RBF	The RBF is targeting manufacturers. Most of those that are already in the market have the ability to monitor the targets and disburse funds. New entrants face significant financing barriers, but large manufacturing businesses such as Alam Group have shown interest in entering the market.	*Green*
Control	Producers are best placed to control the quality and other aspects of the stove design to make it attractive for consumers to purchase. All efforts to promote cookstoves directly influence sales, although some might increase the sale of competitors' stoves. All manufacturers, large or small, have the ability to control the result.	*Green*
Monitoring costs	Monitoring costs vary by manufacturer. For medium-to-large manufacturers, records of the sale of an ICS are already kept as warranty cards are issued. The principal can track and audit the sales reasonably easily – especially when the ICS manufacturer is participating in carbon finance, as carbon finance already requires the monitoring of individual ICS sales.	*Green*
Within resources of agent	There are existing producers with existing distribution channels, some them nationwide, as with Ugastoves. Scaling up is required to create a sustainable commercial market at scale, and this is most likely financed by equity or retained earnings. This might be more difficult for small and medium-scale manufacturers, especially when ICS are their core or only business area, but it is relatively easy for large manufacturing businesses with other activities beyond ICS.	*Amber*
Cost base variability	For large players, the cost base is relatively variable because metal bending, kilns and other equipment is most likely in place. For small and medium players, additional investment in equipment such as kilns might be needed, which would be a large fixed cost.	*Amber*
Duration until payment	The payment would be relatively near the point of sale. However, depending on the principal's institutional capacity, payment might be delayed for several months. Discussion during the workshop indicated that this would not be a problem for medium and large ICS manufacturers, but might be troublesome for artisanal stove makers.	*Green*

Source: Vivid Economics.

RBF 1 fares well overall. Institutional capacity, control, monitoring and duration until payment all score relatively well. However, the key concern is that by only placing the incentive on the sale of the ICS, there will be no incentive for continued use and hence the long-term benefits anticipated from such use cannot

be assured. This might result in lower health, carbon and other benefits than anticipated. Experience from the PV RBF program indicate that linking the RBF to the point of sale can reduce long-term sustainability as providers race to installation with less concern for standards and maintenance.[47]

The exit condition can be a certain number of stoves in each quality segment, based on later design considerations. The exit condition can be very clear and monitored at low cost, resulting in a credible and inexpensive RBF scheme.

In summary, RBF 1 is selected for a shortlist and analysed further in Section 4 to determine its design, implementing modalities and economics.

Option 2: Payment for every additional ICS sold that meets certain quality standards for which continued use can be demonstrated

This option is a modification of RBF 1, with part of the payment made only when it is verified that the ICS continues to be used after a certain time from the date of sale. This may be between six months and two years. Manufacturers participating in a carbon finance scheme currently receive no upfront payment and full payment of carbon credits after six months or one year, upon verification of use during that year. The additional incentive to encourage long-term use might generate more health, carbon and environmental benefits than RBF 1, but does so at additional costs because the continued use must be controlled, monitored and verified. As with RBF 1, the size of RBF payment could vary according to the quality of the cookstove, and expected health benefits, anticipated from the stove use.

Filter 1

As this is a variant of RBF 1, it potentially offers the same benefits in terms of overcoming the current market barriers. The additional financial resources provided by the RBF would provide a stronger incentive for producers to raise the awareness and benefits of purchasing high-quality ICS. They may also be induced to reduce the purchase price of ICS, reducing the significance in the lack of access to finance that consumers currently face. The RBF may also encourage manufacturers to improve both their business model and the quality of ICS they offer, as well as establish appropriate maintenance and user-support arrangements.

Filter 2

Table 12 summarises the Filter 2 assessment.

RBF 2 fares fairly well overall, although it favours larger suppliers – in all likelihood, those already engaged in carbon finance[48] – due to the increased costs, the need for usage monitoring and the demands on institutional capacity. It incorporates the same mechanisms as RBF 1 but adds a long-term component of continued use. This ensures that related benefits such as in health and carbon are more likely to be generated throughout. However, this RBF also increases monitoring costs and is harder to control than RBF 1, and the RBF payment is delayed further than for RBF 1.

[47] Interviews June 2013

[48] Where detailed monitoring requirements are already in place. If suppliers are not part of a Program of Activities in carbon finance, additional investment in monitoring is required.

Table 12: **Initial assessment of RBF2 against the key criteria**

RBF 2 targets the benefits better than RBF 1 but is harder to monitor and control.

Criteria	Notes	Score
Access to finance	There are different market segments. Large or international producers have reasonable access to finance, whereas small or local (artisanal) producers may not. Nevertheless, new entrants manufacturing ICS have entered the market in response to the prospect of carbon revenues, so they appear able to overcome financing problems.	*Amber*
Institutional capacity for the RBF	The RBF is targeting manufacturers that are already in the market and have the ability to monitor the targets and disburse funds. Current players and new entrants have the general ability to monitor sales, but the additional monitoring requirements of usage may increase the demands on institutional capacity.	*Amber*
Control	All manufacturers have the ability to control the effort to promote sale of cookstoves. Therefore, the first payment upon sale can be directly controlled by the agent. However, manufacturers would only receive the second payment upon verification of continued use of the ICS. Although this is partly in the control of manufacturer, there may be other factors (such as changes in household income or preferences) that they cannot control.	*Amber*
Monitoring costs	Monitoring costs are low for sale but potentially high for verifying the continued use. These costs can be reduced in cases where monitoring and verification capacity for carbon credit generation is already in place, but this may favour agents who have already established, or otherwise have access to, this infrastructure.	*Amber*
Within resources of agent	There are existing producers with existing distribution channels, some them nationwide, as with Ugastoves. Scaling up is required to create a sustainable commercial market at scale, and this is most likely financed by equity or retained earnings. This might be more difficult for small and medium-scale manufacturers, especially when ICS are their core or only business area, but it is relatively easy for large manufacturing businesses with other activities beyond ICS.	*Amber*
Cost base variability	For large players, the cost base is relatively variable. For small players, additional investment might be needed and hence the cost base is rather fixed. In both cases, equipment and surveys to monitor use will consist or primarily fixed costs.	*Amber*
Duration until payment	Payment is based on continued use of ICS and therefore later than for RBF 1.	*Amber*

Source: Vivid Economics.

There are a number of ways to mitigate some of these downsides. Monitoring costs can be lowered by tying it to existing monitoring infrastructure as required, for instance, in carbon finance verification – although care would be needed to ensure that this did not lead to the exclusion of potential agents who did not already have this infrastructure in place. Alternatively, or concomitantly, the payment for this RBF can be phased to mitigate the cost of tying the RBF payment to the demonstration of continued use.

The exit condition can be a certain number of stoves in each quality segment, based on later design considerations. The exit condition can be a certain number of stoves which were sold and are in continued use. Because this is a very clear condition, it can be monitored easily at a low or moderate cost.

RBF 2 is shortlisted and will be analysed further in the following sections.

Option 3: Payment for additional value created by high-quality ICS, with health or other factors as defined targets

This RBF differs from RBFs 1 and 2 as the payment (trigger and amount) is linked to delivery against certain outcomes. For instance, the RBF would be set at a certain amount per reduction in the risk of respiratory illness or alternative outcomes. This RBF would directly target certain benefits instead of relying on the co-creation of such benefits by encouraging the sale and use of ICS. This directly supports the achievement of these benefits. However, the downside is that it will place incentives to extend cookstove uses in certain ways and areas that maximise the realisation of these benefits (for instance in areas where three-stone fires are the norm), but which may not correlate well with the creation of a commercial market at scale.

Filter 1

In principle, this RBF addresses the key problems. An additional incentive would help overcome the low consumer awareness of benefits and financing challenges in a similar manner to RBF options 1 and 2. It appears to score sufficiently well against this filter to warrant further investigation against the second filter.

Filter 2

Table 13 shows that RBF 3 scores less well against a number of the criteria in Filter 2.

RBF 3 scores poorly on institutional capacity as measurement of most of the possible metrics (other than carbon) is either technically impossible or prohibitively expensive. In particular, targeting specific health outcomes such as a reduction in disability, adjusted lifetime years lost due to HAP or even merely a reduction in HAP greatly reduces the control of the agent as the use of the stove depends on the consumer and would be prohibitively expensive to monitor and verify.

Targeting specific health outcomes or achieved pollutant reductions would require complex monitoring technology that, even in the unlikely event that it could be implemented in Uganda, would be prohibitively expensive. While targeting carbon can clearly be achieved, this would limit the ability of the RBF to achieve results other than those that will already be achieved by carbon markets (such as, for instance, incentivise stoves that deliver greater health benefits) and as noted above is already covered by existing initiatives.

RBF 3 is excluded from further analysis under the current objective of creating a commercial market at scale to encourage long-term benefits (including health as a co-benefit) after the RBF has exited.

Option 4: Payment for every additional high-quality ICS sold, used, or generating benefits in a geographically remote area

This RBF is designed to encourage the distribution of ICS to remote areas. Although conceptually similar to RBFs 1 and 2, it provides funding only for ICS in remote areas and is therefore not encouraging an “oil stain”-type market growth (i.e., growing outward from one or more central points) based on Uganda’s existing urban and peri-urban market. This RBF would also most likely target ICS using fuelwood as this is the dominant fuel in rural regions.

Table 13: **Initial assessment of RBF3 against the key criteria**

Criteria	Notes	Score
Access to finance	There are different market segments. Large or international producers have reasonable access to finance, whereas small or local (artisanal) producers may not. Nevertheless, new entrants manufacturing ICS have entered the market in response to the prospect of carbon revenues, so they appear able to overcome financing problems.	*Amber*
Institutional capacity for the RBF	Large, medium and small ICS manufacturers are unlikely to be able to track benefits. Even for carbon, it will most likely be large and medium ICS manufacturers which are able to track the benefits.	*Red*
Control	The manufacturer will have some control over the payment e.g. by constructing high-quality stoves, particulate matter reductions can be realised, but factors such as the way in which the cookstove is used or the number of people in the room when cooking reduces control for health and environmental benefits.	*Amber*
Monitoring costs	While it is possible to monitor the carbon reductions achieved, building on existing carbon market verification infrastructure for health and environmental benefits, the costs of monitoring appear prohibitively high as only a few sophisticated mechanisms are in place so far, in Uganda or other countries.	*Red*
Within resources of agent	For carbon, manufacturers currently participating in carbon finance projects have the equipment in place, so it is within their resources. For manufacturers not participating in carbon finance, this might be an obstacle, which nevertheless can be overcome. For health and other benefits, the additional measurement equipment needed is most likely beyond the means of all but the very largest ICS manufacturers.	*Red*
Cost base variability	Any additional equipment needed to monitor carbon or health benefits requires significant investment and thus adds to the fixed costs. In addition, this equipment will not be needed upon exit of the RBF.	*Amber*
Duration until payment	Payment of this RBF would be contingent upon delivery of long-term benefits. This can be annual or biannual, as is done under carbon finance, and will most likely be annually or biannually for health and environmental benefits as these benefits accrue over time. The long duration until payment can be acceptable for medium and large ICS manufacturers, but is less likely be acceptable for small ones.	*Amber*

Source: Vivid Economics.

Filter 1

It is doubtful whether this RBF would support the objective of creating a sustainable commercial ICS market at scale and associated health benefits. The mechanism would focus on the delivery of ICS in rural, isolated areas which, even with support, may fail to provide the economies of scale needed to make large-scale entry into the market for improved cookstoves in Uganda attractive. During the early phases of the development of a market in Uganda, it may be more prudent to focus on larger population bases, where per capita incomes are higher, and to focus on more remote locations only when the market is more mature. Nevertheless, if the objective is to increase carbon, health and environmental benefits as well as fuel savings in rural regions, this RBF is well suited to the task.

RBF 4 appears to fail Filter 1 and is excluded.

Option 5: Payment based on certification of high-quality ICS

This RBF option makes a payment for every cookstove design that is designated to reach a particular quality and pollutant reduction standard. The cost and effort of quality certification for new stove designs has been identified as a barrier in the Ugandan ICS market. The payment of this RBF would be focused largely on helping to reduce the costs associated with certification – although higher payments may be possible for higher-quality standards including pollutant reduction levels (even if the certification costs do not differ by quality standard) to provide an incentive to increase cookstove quality.

Filter 1

RBF 5 aims to tackle the barrier wherein manufacturers face limited incentives to produce high-quality, low-polluting stoves. It does this both directly, by reducing the costs associated with bringing a certified high-quality stove to market ; and indirectly, by increasing the penetration of higher-quality cookstoves on the market. In this way it can increase consumer awareness about such stoves. However, a number of other barriers are not addressed by this intervention. For instance, it does little to improve ICS suppliers' or consumers' access to finance and only indirectly tackles consumers' low willingness to pay.

RBF 5 could be a supplementary measure to the shortlisted RBFs. However, on its own, it is unlikely that it will deliver long lasting health, carbon, environmental or economic benefits – and is therefore excluded from the shortlist.

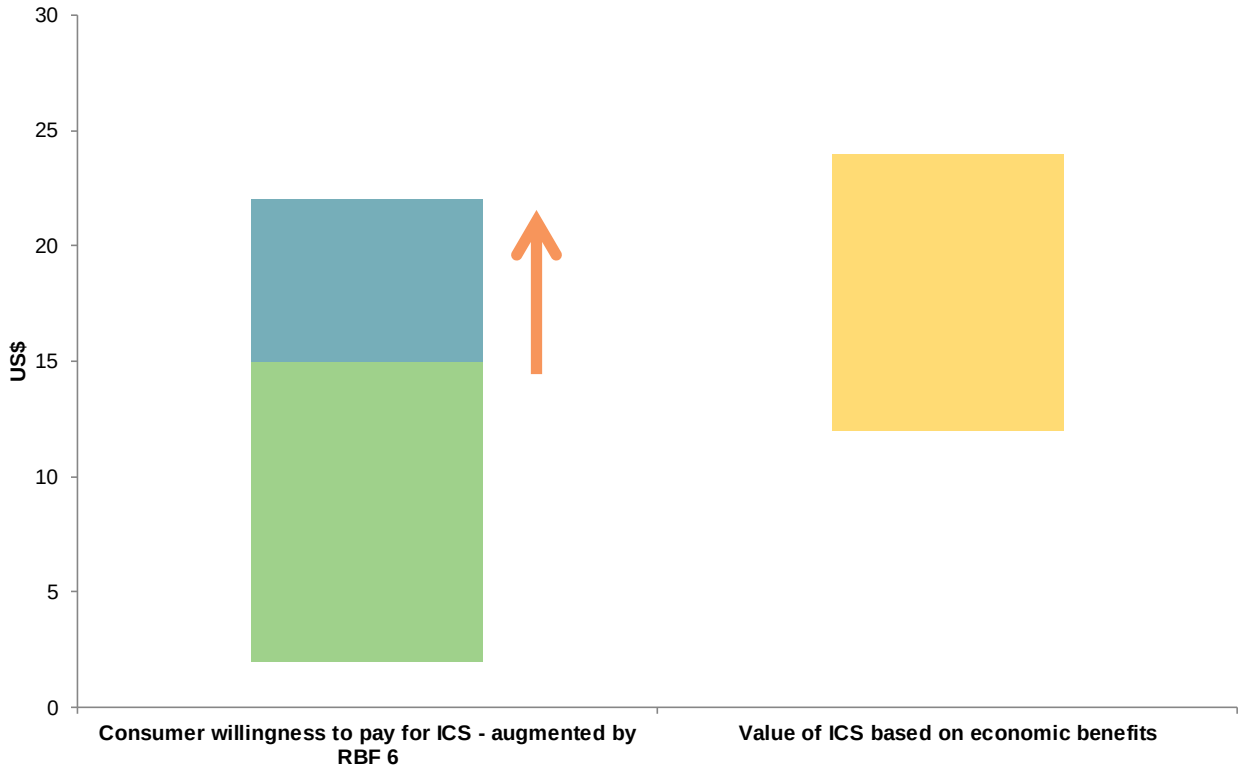
B. Consumers

Option 6: Vouchers to discount the purchase price of a pre-defined high-quality ICS

This RBF would provide vouchers to consumers who would be able to redeem such vouchers in order to reduce the purchase price of an improved cookstove. The value of the voucher could differ according to the cookstove for which it constitutes part-payment; by ICS quality standard, geographic area, or over time. Conceptually, this RBF is equivalent to RBF 1. However, it has significantly different transaction costs, with the costs of distributing vouchers to eligible households, and safeguarding against fraud expected to be considerably higher than the cost of monitoring sales. On the other hand, this RBF has the benefit of not reducing the quoted stove price observed by the consumers, but rather providing a one-off part payment against that price. This would create/maintain awareness that the true value of stoves is the current market price as shown in Figure 14, rather than (as is the risk with RBF 1) establishing an expectation among consumers that the "true" ICS price is the subsidised one. In addition, the value of the voucher can differ by stove quality, region or over time and therefore be targeted more specifically to achieve the desired outcome. The voucher itself can also be used to further highlight ICS benefits, e.g. by stressing the fuel savings. The experience of using vouchers to promote health outcomes in Uganda supports the view that vouchers can play an important educational role (see Box 5).

Figure 14. **RBF options targettting consumers**

Consumer RBF options leave the sticker price of ICS unchanged but reduce the costs to consumers and therefore raise their willingness and ability to pay



Source: Project team.

Box 5: **Marie Stopes HealthyLife and HealthyBaby Voucher Schemes in Uganda**

There is a strong track record of using vouchers to promote development outcomes in Uganda: the HealthyLife program provides vouchers in relation to the testing and treatment of sexually transmitted infections and has been running since 2006, while the HealthyBaby system provides vouchers to promote safe delivery, prenatal and postnatal care. Both programs are managed by Marie Stopes International and receive support from the Global Partnership on Output Based Aid (GPOBA).

The evidence from randomised evaluations appears to suggest that these programs have delivered a number of the immediate results anticipated. In particular, an evaluation of the HealthyBaby program found that it significantly contributed to increased deliveries in private facilities and that this was accompanied by significant reductions in public facility as well as in home based births.[49] Although assessing health impacts is more difficult, a study found that one year after the start of the HealthLife program, there was a demonstrated reduction in the prevalence of syphilis, with a greater reduction among those living near voucher-contracted facilities.[50]

[49] http://www.rhvouchers.org/wp-content/uploads/2012/04/Bellows-2012-Uganda-safe-motherhood-voucher-impact-evaluation.pdf

[50] https://www.kfw-entwicklungsbank.de/Download-Center/PDF-Dokumente-Diskussionsbeitr%C3%A4ge/2012_03_Voucher_E.pdf

The programs also appear to have raised awareness of the benefits of the services offered. For instance surveys found that the ability of individuals to list two or more STI symptoms increased 18 per cent in the year after the start of the HealthyLife program.[51]

However, it is also clear that the costs of running the voucher programs in Uganda have been significant. Administrative costs appear to have accounted for around 80 per cent of the total costs of the HealthyLife program in the initial years, although they subsequently dropped to a little less than 20 per cent.[52]

These costs may be partly linked to concerns over fraud and mismanagement of resources. Reports from reviews of the Uganda (and similar Kenya) schemes have identified a number of malpractices, such as voucher distributors and service providers forming a coalition to redeem vouchers without the provision of services; clients/patients forming an alliance to reclaim vouchers without providing services; providers making false claims; and providers asking for money from voucher holders. A number of recommendations are made to combat practices of fraud, including specialised training, external scrutiny and active prevention/detection measures.[53]

The agents in this RBF are most likely to be the ICS suppliers because they have to collect and possibly redeem the vouchers. To incentivise the collection and redemption of vouchers, and therefore their acceptance, the voucher value for consumers has to be lower than the redemption value producers receive upon handing in the voucher. This premium could vary by region, fuel or other factors. Additional safeguards, such as linking vouchers and sales with ICS serial numbers, are important to reduce potential abuse.

Filter 1

This RBF would appear to tackle some of the key barriers in the sector at present. By reducing the effective purchase price of the cookstove, the need for consumers to access finance, and/or the costs associated with repayment of that finance would fall. Furthermore, it may be expected that the explicit provision of a voucher to consumers might encourage greater awareness about the role and benefits of ICS. Evidence strongly suggests (USAID, 2012a) that once consumers are aware of the benefits of ICS, they are willing to purchase it at market prices. Vouchers can persuade consumers to purchase ICS more effectively than subsidies as they raise awareness for the product and its benefits. They also provide the feeling in the consumer of having made a "saving" on the purchase whereas a subsidised price would raise less awareness.

Filter 2

Table 14 shows the assessment of this RBF against the key criteria. A key concern with RBF 6 is whether the monitoring costs can be kept low.

RBF 6 fares relatively well on Filter 2. Monitoring costs and the institutional capacity of ICS suppliers might be the biggest constraints but these may be overcome by adequate technology. Section 4 elaborates further on the design and implementation modalities.

[51] Ibid.

[52] Ibid.

[53] http://www.rhvouchers.org/wp-content/uploads/2012/04/Fraud-Control-in-Voucher-Programmes-.pdf

Table 14: **Initial assessment of RBF6 against the key criteria**

Criteria	Notes	Score
Access to finance	By reducing the cost of ICS purchase, the need for consumer finance would fall. Manufacturers have different abilities to finance any expansion to meet an increase in demand and to collect vouchers for reimbursement: international, large and medium sized manufacturers may find it easiest while artisanal manufacturers are capital constrained.	*Amber*
Institutional capacity for the RBF	Large and medium sized manufacturers are most likely able to collect vouchers via intermediaries and prove the manufacture as well as of sale of ICS. Artisanal manufacturers most likely lack the institutional capacity. Principals might require new technologies to distribute and track vouchers, such as using a mobile money scheme to track transactions. However, based on existing experience in using vouchers in Uganda, the overall ability of potential principals to administer a voucher RBF is deemed sufficient.	*Amber*
Control	Suppliers can directly control how much marketing and other activities they undertake to increase the demand for their own ICS. In addition, if payment or other factors differ by stove quality or supply region, suppliers have direct control to respond to varying incentives.	*Amber*
Monitoring costs	Based on existing Ugandan experience, monitoring costs, together with fraud prevention, may be high, especially in early years, unless such an RBF can be integrated in a mobile money scheme or any other system tracking and verifying transactions.	*Red*
Within resources of agent	Large and medium sized manufacturers are most likely able to collect vouchers via intermediaries for a low if any additional investment. Artisanal manufacturers most likely do not have enough resources to set up collection of vouchers.	*Amber*
Cost base variability	For large players, the cost base is relatively variable as metal bending, kilns and other equipment is most likely in place. For small and medium players, additional investment in equipment such as kilns might be needed, which would be a large fixed cost. There may also be extra fixed costs borne by suppliers to handle the reimbursement of vouchers.	*Amber*
Duration until payment	Payment, if administered correctly, can be very timely to the moment of ICS sale.	*Green*

Source: Vivid Economics.

RBF 6 can have a clearly defined exit condition, for example a certain amount of distributed or redeemed vouchers. The monitoring of this, however, might be difficult. If the exit condition is the distribution of a certain number of vouchers, the actual amount redeemed and therefore the delivered benefit is uncertain. If a certain number of redeemed vouchers are being monitored, care needs to be taken to avoid issuing too many vouchers and therefore alienating ICS consumers by voiding their voucher after the desired amount of ICS has been sold.

RBF 6 is included in the shortlist and is analysed further in Section 4.

B. Finance providers

Option 7: Payment for every loan made to suppliers or consumers[54] to finance a high-quality ICS

RBF 7 can be split into RBF 7 a), which is focused on suppliers; and RBF 7 b), which targets consumers; both have distinct advantages and disadvantages.

RBF 7 a) for suppliers provides fewer benefits and has a lower probability of achieving the desired outcomes than RBFs 1 and 2, which target suppliers directly. Bank loans are currently available only at prohibitively high interest rates (25– 30 per cent) and with substantial collateral. Evidence during the interviews in June 2013 in Uganda suggests that banks are unwilling to grant new loans to suppliers unless up-front finance or a credit line is provided to the banks or financial institutions granting the loans. Further, to bring the high interest rates down to a practical level for suppliers to borrow against would require a very high value of RBF incentive. For this reason, and given that the provision of a credit line is more practical, an RBF for loans to suppliers is considered infeasible and is not considered further.

Credit lines might be a complementary measure to encourage ICS deployment and supplement any RBF as the analysis of RBF 7 a) shows credit lines can increase lending to the sector and supplement any RBF, such as supplier focused RBFs 1 or 2 or consumer focused RBFs 6 and 7 b), to increase their effectiveness.

RBF 7 b) for loans to consumers is likely to achieve similar outcomes as a voucher scheme.

Section 2 identifies the important role that aggregators are increasingly playing in extending the penetration of the ICS market. Aggregators such as farmers' cooperatives and health agencies may already have loan arrangements with banks that can be extended to enable them to provide credit via deferred or staged payment to consumers purchasing ICS. The provision of this deferred or staged payment for an ICS will be the trigger for RBF payment. The benefits of this RBF are that it lowers the consumer willingness to pay barrier while strengthening the role aggregators and other intermediaries play in the market. The transaction costs will vary depending on who responds. The extension of existing credit lines may keep costs feasible, while the costs of testing creditworthiness of new lines may be prohibitively high. This may in turn limit the scope to consumers linked to existing credit lines. Another constraint to this RBF are the number of possible hurdles associated with monitoring and verifying such small-scale credit arrangements though this may be addressable through design.

Filter 1

RBF 7 a) has been found infeasible and is not considered further.

The effectiveness of RBF 7 b) depends on the level of competition in the lending market. With sufficient competition, it may be expected that there could be a significant expansion in lending activity. In turn this could encourage the development of high-quality ICS and distribution channels as well as competition in these markets to reduce costs and purchase price. If competition in the banking sector is less vigorous then the impact of this RBF on the key market barriers will correspondingly be lower.

Filter 2

Table 15 shows that RBF 7 b) scores relatively well.

[54] This could be through Microfinance Institutions, SACCOs or suppliers that implement a credit system

Table 15: **Initial assessment of RBF 7 b) against the key criteria**

Criteria	Notes	Score
Access to finance	There are a number of experienced banks and SACCOs providing microfinance to urban and rural consumers via group loans. The extent of their access to increase their credit lines at practical interest rates to stimulate ICS sales is unclear	*Amber*
Institutional capacity for the RBF	Banks and SACCOs have the capacity to administer loans via group finance. It is unclear the expertise and experience that aggregators have in providing and accounting for staged and deferred payment for products in order to administer the RBF.	*Amber*
Control	Aggregators typically have close relationships with their consumer base enabling them to maintain reasonable control. Other consumer credit providers might face difficulties controlling on what their clients spend their loan.	*Amber*
Monitoring costs	The costs of monitoring small-scale loans may be prohibitively high unless design arrangement can be found to aggregate or address this.	*Red*
Within resources of agent	The relative small size of individual or group loans means this RBF is most likely within the bank/SACCO or aggregator resources. However aggregators may have different capital constraints even small ICS loans might exceed the resources of some.	*Amber*
Cost base variability	Each additional has small variable costs but the accumulation of many loans might result in higher overall fixed costs for banks, SACCOS and aggregators, as overall borrowing costs for the loan providers or their risk exposure increases.	*Amber*
Duration until payment	The payment coincides with granting the loan and verification that an ICS has been purchased and can therefore be very prompt.	*Green*

Source: Vivid Economics.

The table shows that the RBF scores well against the main criteria listed and should therefore be considered further. The exit condition for RBF 7 b) is clearly defined and can be easily monitored.

RBF 7 b) is shortlisted and further analysed in the following sections; RBF 7 a) is not.

Option 8: Payment for every loan made – and paid back – to producers or consumers to finance a high-quality ICS

This RBF is conceptually the same as RBFs 7 a) and 7 b) but adds the long-term component of loan repayment. For the same reasons as given for RBF 7 a), RBF 8 a) is excluded from the analysis. RBF 8 b) for consumers, however, is considered further and evaluated against the two filters below.

Filter 1: RBF 8 b) incorporates a long-term focus by adding the condition that the loan must be fully repaid before the payment is made to the financial institution. It addresses the same barriers – and with the same caveats - as RBF 7 b).

Filter 2: Table 16 shows the scoring of RBF 8 b). Ultimately, RBF 8 b) mitigates potential problems with RBF 7 b) but scores slightly worse on the criteria.

Table 16: **Initial assessment of RBF 8 b) against the key criteria**

Criteria	Notes	Score
Access to finance	There are a number of experienced banks and SACCOs providing microfinance to urban and rural consumers via group loans. The extent of their access to increase their credit lines at practical interest rates to stimulate ICS sales is unclear	*Green*
Institutional capacity for the RBF	Banks and SACCOs are able to administer loans via group finance. It is unclear the expertise and experience that aggregators have in providing and accounting for staged and deferred payment for products in order to administer the RBF.	*Amber*
Control	Aggregators typically have close relationships with their consumer base, enabling them to maintain reasonable control. Other consumer credit providers might face difficulties controlling the purchases their clients make using their loans. Control is slightly worse for this RBF than for RBF 7 b) as part of the payment is tied to repayment of the loan. This implies that, in addition to the risk of non-repayment of the loan, the agent might forgo part of the incentive payment. Although agents would ensure the same standards for loans in this RBF as in RBF 7 b), the financial loss of non-repayment is larger.	*Amber*
Monitoring costs	The costs of monitoring small-scale loans may be prohibitively high unless design arrangement can be found to aggregate or address this.	*Red*
Within resources of agent	The relative small size of individual or group loans means this RBF is most likely within the resources of the bank/SACCO or aggregator. However, aggregators may have different capital constraints: even small ICS loans might exceed the resources of some.	*Amber*
Cost base variability	Each additional loan has small variable costs, but the accumulation of many loans might result in higher overall fixed costs for banks, SACCOS and aggregators, as overall borrowing costs and risk exposure increase.	*Amber*
Duration until payment	The payment is deferred until (part) of the loan is repaid and is therefore longer than for RBF 7. The loan duration (deferred or staged payments) is expected to be short: one to three months.	*Amber*

Source: Vivid Economics.

RBF 8 b) fares poorly on Filter 2. Monitoring costs and control are particularly bad and institutional capacity to administer loans is only achieved with relative ease in the case of banks which are less likely to participate in such a scheme. **The exit condition for RBF 8 is clearly defined and can easily be monitored.**

RBF 8 b) is excluded due to the poor scoring and RBF 8 a) is excluded on the outset for the same reasons as RBF 7 a).

D. Maintenance providers

Stakeholders have expressed concern that the failure to adequately maintain ICS is lacking and that this reduces the health, environmental and other benefits of ICS. To generate lasting benefits and to encourage consumers to purchase ICS, the quality and maintenance of ICS has to be sufficient. Currently, small, medium and large ICS suppliers offer warranty schemes, although consumers and retailers might be unaware of them.[55] Furthermore, most of the maintenance requires the exchange of certain cookstove parts, and this is sometimes done via the established distribution channels.

[55] Interviews June 2013.

Option 9: Payment for every successfully completed yearly maintenance of high-quality ICS

Filter 1

Although RBF 9 does not address the main challenges in the ICS market in Uganda, it can be a supplement to RBFs 1, 2, 6 and 7 in ensuring the long-term benefits of ICS. That said, it does not overcome general financing barriers on the supply and demand sides of ICS and does not encourage a sustainable commercial market at scale. A further concern with this RBF is that it may encourage unnecessary maintenance activity, such as maintenance activity that is undertaken only to receive the RBF payment.

Given these concerns, it may be better to concentrate on other RBFs that can help to overcome this concern – either by only providing the RBF in relation to cookstoves that have a longer-than-expected average lifetimes or by linking payment to continued use.

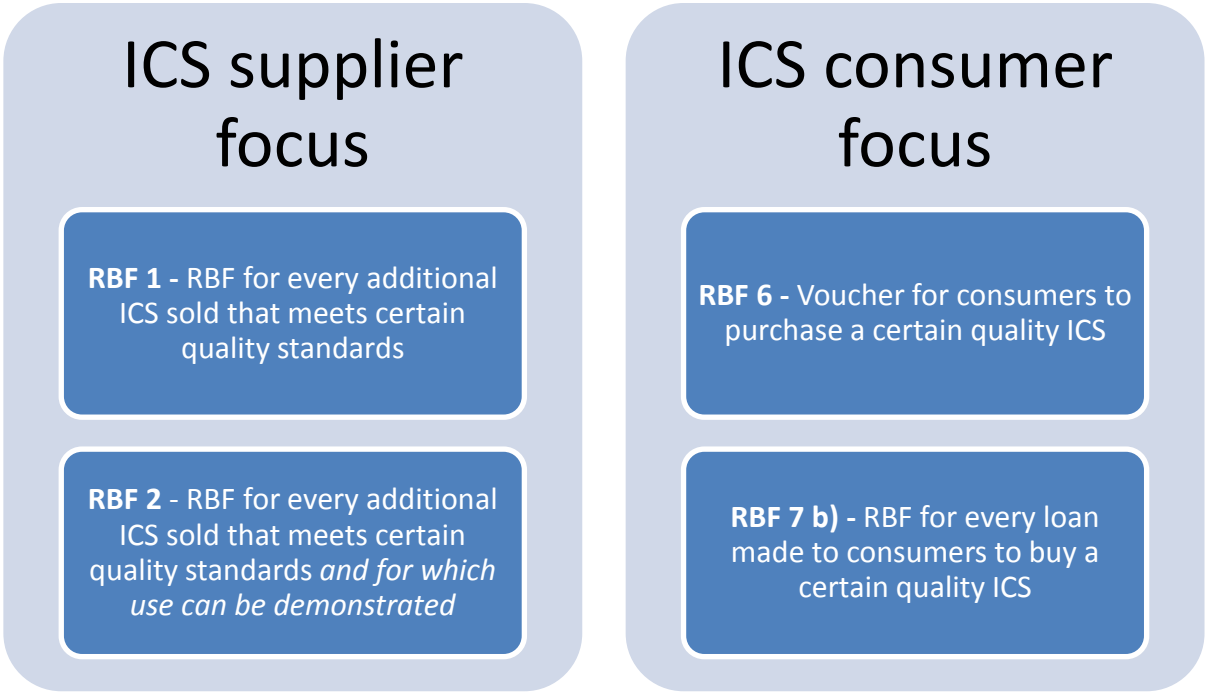
RBF 9 is excluded from the shortlist but included in the suggestions of complementary measures to increase the benefits of RBF in the Ugandan ICS sector.

3.4 Shortlist of RBF Options

RBFs 1, 2, 6 and 7 b) are shortlisted as they tackle the right problems and score well against the identified criteria.

The shortlisted RBFs are divided into two groups: one aiming at ICS suppliers and one aiming at financial institutions. Figure 15 shows this split of the four RBF options into two categories.

Figure 15: **Shortlisted RBF options: supplier versus consumer focus**



Note: RBF 6 and RBF 7 b) are focusing on consumers – the demand side – but the agents are financial or other institutions for RBF 7 and, possibly, ICS suppliers for RBF 6.

Source: Project team.

3.4.1 Summary of Options

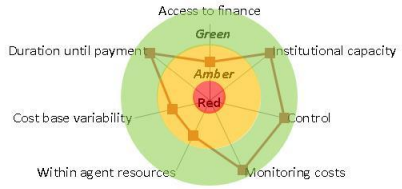
Figure 16 summarises the shortlisted RBFs and other RBFs which passed Filter 1. The diagrams allow comparing each RBF against seven screening criteria and show that:

- All but RBF 1 (the RBF for suppliers for each ICS sold) fare moderately or poorly on monitoring.
- RBFs 6 and RBF 7 b) score similarly, with a good – that is, short – duration of payment but difficult monitoring, while addressing different agents: RBF 7 b) addresses financial institutions, whereas RBF 6 bypasses them and relies on ICS consumers and suppliers.

Figure 16: **Screening results against Filter 2 criteria showing red/amber/green scoring**

Of the six RBF types that passed Filter 1, four are shortlisted.

SHORTLISTED RBF 1: for every additional ICS sold that meets certain quality standards



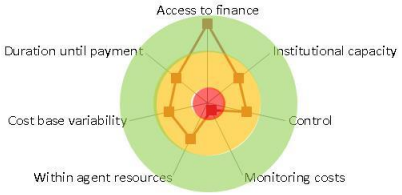
SHORTLISTED RBF 6: Vouchers to discount the purchase price of a pre-defined high quality ICS

SHORTLISTED RBF 2: for every additional ICS sold that meets certain quality standards for which continued use can be demonstrated

SHORTLISTED RBF 7b: for every loan made to consumers to finance a high quality ICS

RBF 3: for additional value created by quality ICS with, health or other factors as defined targets

RBF 8b: for every loan made – and paid back – to consumers to finance a high quality ICS



Source: Project Team.

4. Design Considerations and Implementing Modalities

This section discusses:

- The design considerations for the four shortlisted RBF options;
- The anticipated market responses, including supplementary measures;
- A tentative estimate of the Value for Money of an RBF intervention in the Ugandan ICS market; and
- An overview of the implementing modalities.

4.1 Design Considerations

Design considerations are structured around five key questions:

a. Who should be eligible to receive an RBF payment?
b. What should be the trigger or condition for payment of an RBF instrument?
c. What should the structure of any RBF payment be?
d. How should the size of the RBF payment be determined?
e. What should the duration of the RBF intervention be, and what is the appropriate exit strategy?

The following examines each question in turn, adding detail for each option as appropriate.

a. Eligibility

Wider eligibility increases the potential benefits because ICS quality can be determined on the outset. When more agents are able to participate in any of the four shortlisted RBFs, the likelihood of achieving the desired outcomes increases. However, a crucial caveat to this is that the agent(s) must be using the RBF to promote cookstoves of a sufficiently high quality to generate satisfactory health and environmental benefits. This can be achieved through certification for ICS that achieve certain pollutant reductions or efficiency levels using the results of the ongoing benchmarking through the ACCES program (see Box 3 in Section 2), with an option to keep the door open to new entrants who improve their quality and meet the required standards.

As discussed in Section 3, the supplier RBFs should potentially be open to all participants in the Ugandan ICS market supplying stoves of a sufficient quality, including ICS suppliers currently engaging in any carbon finance scheme. Carbon finance continues to be one of the main drivers of the Ugandan ICS market and, excluding suppliers participating in carbon finance, not only restricts the choice of current suppliers but also means that to gain the interest of these suppliers, the RBF incentive would have to outweigh the incentive set by carbon finance. This could create additional costs. It is likely to be preferable to focus on exploiting synergies between carbon finance and any RBF incentive so as to support an ICS market that delivers both emission reductions and other health and environmental outcomes.

Eligibility does not vary between RBFs 1 and 2. Both schemes are aimed at ICS suppliers, the main difference being that RBF 2 requires continued monitoring of use.

For RBF 6 – consumer vouchers – the eligibility of suppliers does not vary either from RBFs 1 and 2 (subject to meeting any stove certification requirements); however, it might be possible to restrict the access to vouchers by geography or income group. In particular, restricting the eligibility of vouchers could reduce the risk that the RBF leads to some consumers switching from higher-tier BLEN (biogas, LPG, electricity and natural gas) stoves to lower quality (but RBF-subsidised) charcoal or wood ICS (see Box 3 for further discussion). However, monitoring and enforcement may be difficult.

For RBF 7 b) – loans to consumers – eligibility is more difficult to define and will need careful consideration in the design phase if such an RBF is to be implemented. The RBF is targeted at all actors in the market ecosystem that might lend to consumers or offer a line of credit to purchase a cookstove. A number of non-commercial actors, such as NGOs or donors, may lend either directly to consumers or through intermediary groups. These agents may be considered inappropriate for RBF funding.

C. Trigger

For the shortlisted RBF options, the trigger for the RBF payment is variously defined as the sale or purchase of ICS (for RBFs 1 and 6, respectively), the sale and verified use (for RBF 2), and purchase of ICS with a loan (for RBF 7). Whereas RBFs 1, 6 and 7 b) have a single trigger, RBF 2 has multiple triggers because use is monitored at set intervals and payments are in part linked to use.

Annex 4 discusses an alternative design featuring a trigger based on reaching a certain level of sales, rather the sale of a single cookstove.

All trigger conditions can be monitored and verified, which provides agents and principals with feedback on the take-up and success of the RBF.

D. Structure of RBF Payment

The ESMAP paper identifies three questions that help to determine the structure of an RBF payment:

In all four cases, it seems likely that all of the additional incentives provided by an RBF would be paid after the result has been achieved: for RBF 1 and 6 this would be soon after the sale of the cookstove, for RBF 7 b) soon after the provision of a loan while for RBF 2 there would be an ongoing structure of payments, with some proportion likely to be paid immediately after the sale of the cookstove, and additional payments every (x) years subject to ongoing use. Proportions would be determined during detailed design. While this means that the RBFs will not address financing challenges faced by the agents themselves, the challenges are expected to be relatively small (in the case of RBF 7, or RBF 1 and 6 in the case of larger suppliers) or addressable by other interventions. In addition, the provision of the RBF subsidy in the cases of RBF 1, 2 and 6, or the loan in the case of RBF 7 b), is expected to reduce the consumers' consumers' need to seek consumer financing.

In all cases the RBF would at least partly be linked to a market outcome: the purchase of an ICS in the case of RBF 1, 2 and 6; and the making of a loan for purchase in the case of RBF 7. In the case of RBF 2, the ongoing payments for continued use would not be linked to a market transaction.

In all cases where the RBF is linked to market outcomes, it is anticipated that the structure of the RBF would be to provide a fixed amount of incentive payment for each eligible market transaction (rather than, for instance, using the RBF to provide a "top-up" to achieve a certain price). This will be the simplest option from an administrative standpoint, and will reduce the risk of gaming (for example, agents suggesting that a transaction took place at a different price in order to increase the value of the RBF payment). As discussed further below, RBFs 1, 2 and 6 may need a mechanism that periodically adjusts the value of the RBF incentive on a forward-looking basis to account for fluctuations in carbon prices.

In each case, the RBF could be structured in conjunction with a complementary awareness-raising campaign. Box 6 illustrates how this might work for RBF 6.

Box 6: **Design option for RBF 6: a prize draw**

This RBF tackles two main barriers: consumer finance and consumer awareness. Prizes are a very effective tool for generating consumer buzz and raising overall awareness, and are popular among consumers.

The voucher scheme could be run along the lines of a prize draw, with winners receiving either a cookstove or a voucher to purchase a cookstove at a discounted rate. For example, a radio awareness campaign could highlight the benefits of cookstoves and offer a free cookstove or voucher via a prize draw; consumers could enter by sending a text message from their phones. This could be run weekly and have one or more winners per week.

The campaign would further benefit by being able to trace, via the winners' phone numbers, where the cookstoves has been distributed, and could extend its general reach by sending a text message to all numbers that entered the prize draw.

Some careful thought will need to go into addressing the distribution aspects of such a scheme. It could start small, addressing a particular area, then scale up to a national prize draw. An example of a similar scheme run in Kenya is ONSPEED, discussed in Annex 4.

E. Size of RBF payments

The size of the RBF payment has to be large enough to provide an incentive without creating windfall profits or other market distortions, especially in light of the presence of carbon finance as discussed in Section 3.3.1. In the case of RBFs 1, 2 and 6, the RBF payment has to bridge the gap between consumers' willingness to pay and the price of ICS that allows for future investment by ICS suppliers. This will need to take account of expected future carbon prices.

The size of the RBF payment may need to be adjusted over time. This can provide flexibility to account for changes in market variables such as the cost of cookstove manufacture or carbon market prices. It is crucial to undertake these reviews in a way that maintains market confidence; they should be announced well in advance, and any changes in the RBF payment must apply only to subsequent cookstove sales/loan transactions.

The size of the RBF payment can be adjusted to encourage further health benefits or increasing health benefits over time. The payment can be tied to specific reductions in HAP or other pollutant emissions from ICS to increase the incentive to provide better health outcomes.

It is likely that the value of the RBF incentive will need to be set administratively. The alternative would be some form of auction mechanism but this would be either difficult to reconcile with the desire to keep many different suppliers/loan providers in the market (in the case of RBF 1, 2 or 7 b) or administratively very challenging (in the case of RBF 6). In addition, the institutional capacity of agents and principals to hold successful and verifiable auctions is doubtful.[56]

Preliminary research indicates that a payment size of between US$5 and US$10 might be sufficient for urban and peri-urban users and will most likely result in the increased uptake of charcoal ICS. The exact size of the payment should vary by the delivered benefits of different quality tier ICS and to be modified over time to increase the overall quality of ICS in use in Uganda. The initial estimate of US$5 to US$10 is based on the current low willingness to pay prices above US$10 versus the average charcoal ICS price of US$12 to US$20.

[56] Interviews June 2013.

The size of payment is likely to be higher for RBFs 2 and 6. In the case of RBF 2, this will reflect an additional premium for delaying the payment after verification of use. For RBF 6, ICS suppliers may need to be compensated for the increased administrative costs as well as for delaying part of their cash flow. Payment for RBF 7 b) (the loan scheme for consumers) can be tied to be between US$5 and US$10 as well, and therefore correspond to RBF 1.

F. Exit Strategy and Duration

The exit strategy for RBF options 1, 2 and 7 b) is readily identified as a certain amount of ICS sold or purchased.

For RBF 6, it can either be the number of distributed vouchers or the numbers of vouchers used. If the exit condition is the number of distributed vouchers, the final sales of ICS are uncertain but can be estimated based on past evidence of what percentage of vouchers has been used in similar schemes. If the number of vouchers used is the exit condition, there needs to be clear communication regarding the remaining eligible vouchers and reduction of voucher distribution to avoid having too many invalid vouchers in circulation.

The number of ICS sales or purchases before exit should be estimated to be high enough to encourage a commercial market at scale; the potential size of this market is estimated to be at a total of 3.15 million ICS. Section 2.2 and Annex 1 describe the market size in detail and are based on population projections for 2015. Since the incentive for the supplier -- that is, the agent collecting the total number of purchases and reporting it to the principal in all RBFs – is to report all purchases as soon as possible to receive the RBF payment, the total amount of incentivised ICS can be tracked relatively easily.

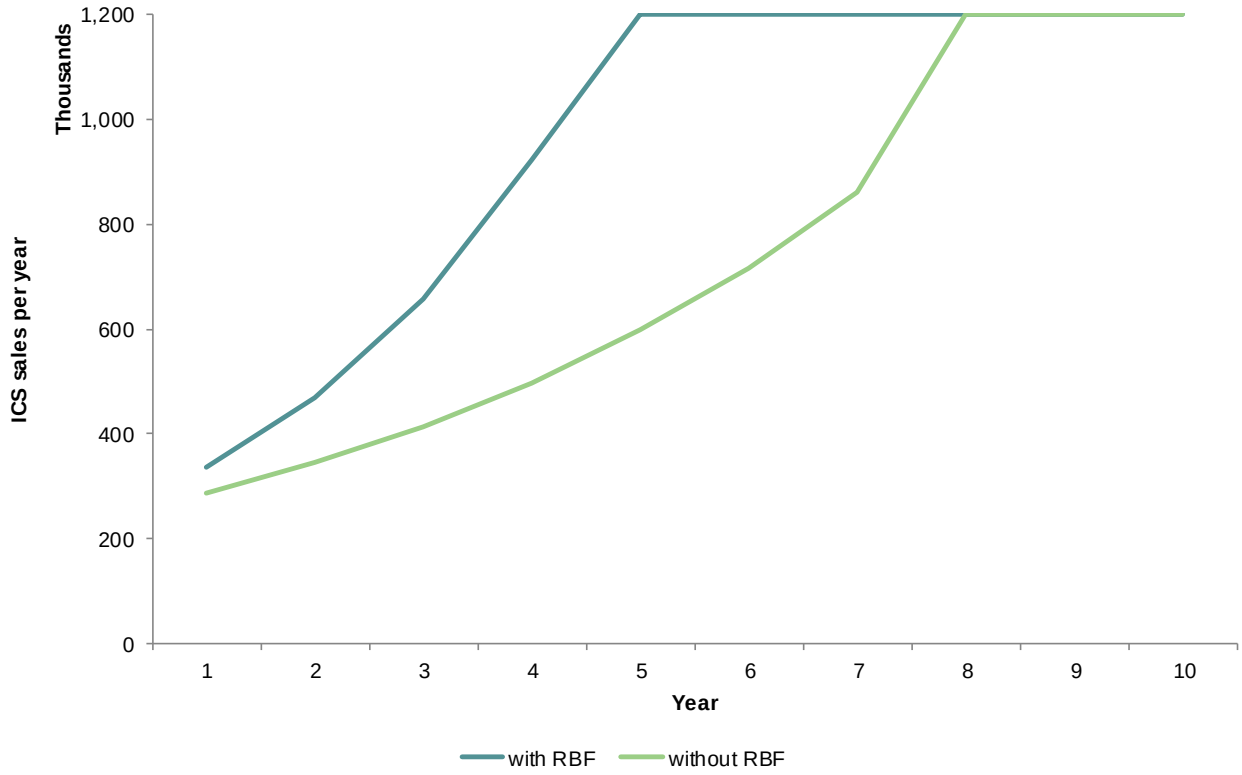
The duration of the RBF is flexible and depends on the market conditions, the size of the payment and the ability of suppliers and consumers to respond to the RBF incentive but may be approximately five years. This assumes a total market size of 3.15 million ICS in use and a doubling of the current ICS market growth rate from 20 per cent to 40 per cent.

Figure 17 shows the increase in the ICS market growth and the difference to the assumed business-as-usual scenario.

Table 17 summarises the design considerations across the four shortlisted RBFs options.

Figure 17: **Scaling up the ICS market**

When compared to an assumed ICS market without an RBF intervention, the RBF scales up the ICS market faster, and the higher ICS penetration continues for a further three years to produce larger benefits..



Note: This graph is based on an assumed growth rate of the ICS market in Uganda of 20 per cent and an RBF incentivised growth rate of 40 per cent as well as a total potential market size of approximately 1.2 million ICS per year.

Source: Vivid Economics.

Table 17: **Design considerations for the shortlisted RBF options**

Variable	Supplier focus		Consumer focus	
	RBF 1: RBF for every ICS sold	**RBF 2: RBF for every ICS sold and demonstrated use**	**RBF 6: Voucher for ICS purchase**	**RBF 7 b): RBF for every loan made to consumers**
Eligibility	All ICS suppliers	All ICS suppliers	All ICS consumers but can be restricted by geography and type of ICS	Definition needs to be done carefully but could potentially be open to all consumers
Trigger	Sale of ICS	Sale and verified use	Purchase of ICS	Purchase of ICS with a loan for RBF
Structure of RBF payment	One payment soon after sale	Ongoing payment based on use with an initial payment soon after sale	One payment for agents (ICS suppliers) soon after consumer purchase	Ongoing payment based on repayment of loan with an initial payment soon after loan for ICS has been granted and ICS has been purchased with this loan
Size of RBF payment	Size of the payment can be adjusted to avoid negative effects and to encourage higher-quality or less-polluting ICS over time	Same considerations as for RBF 1 but with a higher incentive to compensate for the lower initial payment and delay until payments for verified ICS use arrive	Same considerations as for RBF 1 but with a higher incentive to compensate for the administrative burden placed on ICS suppliers of collecting vouchers	Same considerations as for RBF 1 but with a higher incentive to compensate for the additional administrative costs associated with handing out consumers loans
Exit strategy and duration	Number of ICS sold	Number of ICS sold and used	Number of certain quality tier ICS purchased with vouchers	Number of loans granted for ICS and ICS purchased

Source: Project team.

4.2 Market Response and Complementary Measures

Now that the main design considerations have been established, this section considers how the market might respond, focusing in particular on RBF 1, 2, 6 and 7 b). It also identifies gaps in the stimulation of the market ecosystem and the remaining hurdles that will require complementary measures. It should be stressed that no detailed engagement with stakeholders to verify how the market might respond has been undertaken as part of this study; rather, this section is based on a series of broad assumptions that will need testing during the design phase.

RBF 1 and 2: For 1) every additional ICS sold that meets certain quality standards and 2) for which continued use can be demonstrated

Respondents for RBF 1

Primary Respondents: This RBF will stimulate all distributors and sales agents of ICS, be they manufacturer or sales and distribution agents. Depending on the quality standards applied to the RBF some ICS manufacturers will be better placed to respond than others.

Respondents for RBF 2

Primary Respondents: The agents best able to respond quickly and effectively to this RBF will be those already involved in carbon finance who (a) have established, or are preparing, mechanisms for ongoing monitoring of cookstove use and (b) are distributing cookstoves that meet certain quality testing criteria. This includes both manufacturers and intermediary actors, such as sales agents. RBF conditions on quality, and in particular pollutant emissions effecting health, may require the adoption and distribution of different cookstoves[57] by these actors.

Secondary Respondents: Sufficient incentive could have a "pull effect" of bringing in new intermediaries to act as distribution and sales agents.[58] This could help target new districts and increase penetration where sufficient profits and/or social benefits are perceived.

Tertiary Respondents: Increased demand for cookstoves from sales agents or other intermediaries will give manufacturers an incentive to respond in any way they choose. This will only occur once the quality and associated benefits of products have been deemed sufficient to achieve the RBF, and are therefore dependent on functioning quality and testing arrangements.

[57] For example, current high standards in environmental efficiency are not directly proportional to health benefits, and to achieve equally high standards for health benefits may require some adaptation.
[58] Interviews, June 2013.

Table 18: **Impact of RBF 1 and 2 on market barriers, and complementary measures required**

Constraint	Response	Complementary measures required
Suppliers **Financial barriers** Consumers	Does not tackle issues of lack of credit and upfront finance Increased income overtime could improve balance sheet RBF payments and requirements for ongoing monitoring of use could stimulate closer engagement with consumer groups and thus financing options to boost sales Pre-financing hurdle not directly addressed	Policy advocacy to bring down the import duties and taxes on imported models that are currently making up to 50 per cent of imported stove price Support for investment to scale up such as training courses, business advisory services To enhance the RBF, support to pre-finance consumers could be considered, such as a revolving fund targeted at distribution and sales agents
Willingness to pay / information barrier	Increased incentive at the point of sale provided by the RBF will increase incentives for sales agents to advertise the benefits of cookstoves and find ways to increase willingness to pay. However, the extent of agents ability (financially and technically) to do this is limited.	National awareness campaigns
Supplier capacity	Agents will experience higher demand, but capacity will not be directly improved by RBF	Technical and business support to stove manufacturers. In the cases of RBF 2 in particular, this may need to focus on supporting the development of, and access to, monitoring and verification infrastructure
Quality and Testing	Agents will be highly stimulated to develop quality stoves that have been tested; however the barriers to this, principally in the quality of the stoves and costs of testing, have not been explicitly addressed.	A prerequisite for success is a comprehensive package of support for quality standard and testing

RBF 6: Vouchers to discount the purchase price of a pre-defined high-quality ICS.

Respondents

Primary Respondents: This RBF is specifically targeted at consumers; vouchers are intended to increase both ability and willingness to pay, thus increasing the volume of cookstoves purchased. The RBF may target different consumer groups or geographic areas, but it will be difficult to establish distinct boundaries, and vouchers are easily transferred.

Secondary Respondents: Depending on the size of the voucher scheme, both cookstove manufacturers and distribution and sales agents will be required to respond to meet increased demand. The type of stove purchased could be at the discretion of the principal (i.e., they select a certain stove for the voucher to be linked to) or the consumer (if the principal provides a range of cookstoves that may be purchased under the scheme – all meeting certain quality standards). The latter would be more consistent with supporting a commercial market at scale, leaving both the manufacturers and distribution and sales agents to respond to market demand.

Table 19: **Impact of RBF 6 on market barriers, and complementary measures required**

Constraint	Response	Complementary measures required
Suppliers **Financial barriers** Consumers	Does not tackle issues of lack of credit and upfront finance Increased income overtime could improve balance sheet Reduction in price reduces consumer financial barriers, although no direct impact on consumer credit markets	Policy advocacy to bring down the import duties and taxes on imported models that are currently making up to 50 per cent of imported stove price
Willingness to pay / information barrier	Voucher scheme likely to come with media buzz directly addressing this barrier. Existing evidence from Ugandan voucher schemes supports view that vouchers can increase awareness.	Voucher scheme to work in tandem with (or as integral part of) national awareness campaigns
Supplier capacity	Agents will experience higher demand, but capacity not directly improved by RBF	Technical and business support to stove manufacturers
Quality and Testing	Early stage stimulus could be provided to manufacturers by setting standards for joining the scheme. Leaving the scheme open to new entrants though out implementation could maintain this stimulus. However even with the stimulus the high costs of testing mean that addition support is likely to be required if a good number of Ugandan manufacturers are to be included.	Support to quality and testing required

RBF 7 b): RBF for every loan made to consumers to finance a high-quality ICS

This is the most difficult of the RBF options for which to gauge a response. One of the key advantages of results-based financing is that it leaves the market free to respond, and this RBF in particular could throw up some unexpected and innovative funding arrangements. The uncertain nature of the response makes this RBF particularly difficult to design – which ultimately may be a reason to reject it from the shortlist of RBFs.

Respondents

Primary respondents: The agents best placed to provide loans to consumers are ICS sales and distribution agents who may be in a position to coordinate group loans or provide staged payments for consumers through their own financial arrangements. They are in close proximity to the consumer.

Secondary respondents: Manufacturers may provide their own lines of credit by staged payment arrangements if they can secure sufficient cash flow, but this is unlikely for most manufacturers

Tertiary respondents: Microfinance agencies and SACCOs may provide loans for ICS purchase via established savings and credits groups with which they are linked.

Who exactly is eligible for the RBF must be clearly defined; it is likely that consumers are receiving support from multiple directions, and it needs to be clear which funders are eligible – including investors, crowd funders, NGOs, faith groups, SACCOs, banks, and other actors.

Each of these respondents present potential difficulties when verifying loan provision and may make this RBF infeasible. However, this problem could well be overcome in the design phase, for example by allowing for aggregation and sample verification.

Table 20: **Impact of RBF 7 b) on market barriers, and complementary measures required**

Constraint	Response	Complementary measures required
Financial barriers Suppliers	Does not address financial barriers for manufacturers	Policy advocacy to bring down the import duties and taxes on imported models that are currently making up to 50 per cent of imported stove price
Consumers	Directly addresses this barrier for consumers	Support for investment to scale up
Willingness to pay / information barrier	Effect of loans may be passed down the chain to provide staged payments for consumers	No complementary measures required but may need to be reconsidered once market response is better understood
Supplier capacity	Loans to manufacturers should enable expansion but technical capacity will still need support, this may be arranged by lending agent to secure the loan.	Unknown, loans to manufacturers may come with business support services to help secure the loan.
Quality and Testing	Not addressed	Support to quality and testing

Some initial design ideas for complementary measures are provided in Annex 4.

4.3 Estimate of Value for Money

Any estimates of the value for money associated with the RBF approaches discussed above are only approximate. The exact benefits are difficult to quantify (although the forthcoming ACCES Quality Assurance and Technical Support Program should significantly improve data availability; see Box 3 in Section 2). The RBF scheme costs are based on initial estimates rather than an in-depth RBF design study that would need to follow this feasibility report.

The potential RBF costs consist of both the RBF incentive of between US$8 million to US$16 million and scheme administration costs. Scheme costs are based on an incentive level of between US$5 and US$10 per ICS and a total sales figure of 3.6 million ICS during the five years of the RBF intervention. Administration costs require design work beyond this RBF feasibility report but can be estimated as approximately 20 per cent of the incentive costs, or between US$1.6 million and US$3.2 million. This would, therefore, yield a total RBF cost of US$9.6 million to US$19.2 million. All costs and benefits are discounted at 14 per cent according to the current Bank of Uganda 2-year Treasury bond yield.[59,60]

The potential RBF benefits include:

- Fuel savings;
- Health benefits;
- Carbon reductions; and
- Environmental benefits.

Of these benefits, fuel savings and carbon reductions can be quantified whereas environmental and health benefits are difficult to estimate. They are, therefore, beyond the scope of this feasibility report given the absence of more detailed data. Ongoing work is taking place to estimate disability-adjusted life

[59] Retrieved on 18 July 2013 from https://www.bou.or.ug/bou/collateral/tbond_forms/CurveData_TBonds/TBondsTable.html.

[60] Discounting the scheme and administrative costs at the Bank of Uganda 2 year T-bond yield might overstate the discount rate. The benefits described later in this section are incurred in Uganda are discounted at the same rate, which may be slightly too low given that fuel savings and carbon credits are distributed to Ugandans. The rationale for using the same discount rate is to have a comparable base of costs and benefits.

years (DALYs) associated with HAP, which in time will help quantify benefits and deepen linkages between health and cookstove initiatives.

The benefits may be reduced by like-for-like substitution of ICS, which is estimated at approximately 15 to 20 per cent of all incentivised stoves. Some consumers, who already have an ICS, will benefit from the RBF incentive and purchase another ICS when their current ICS is obsolete. On the assumption that these consumers would have replaced their ICS without an RBF incentive, this represents a deadweight loss from the scheme. We estimate that this reduces the potential benefits by approximately 15 to 20 per cent, based on the current number of ICS in circulation and an average replacement period of three years.

In addition to like-for-like substitution, there is the low possibility of trading down – that is, that the RBF discourages some consumers from buying higher-quality ICS than those incentivised by the RBF. Box 7 discusses why this has a low probability and what measures can be taken to further lower its occurrence. Trading down is not included in the value for money analysis.

Box 7: **Mitigating against "trading down"**

The stoves that might attract RBF support are just a subset of the total cookstove options available to Ugandans. The reality of energy access in the Uganda domestic context is that households have a range of technologies to choose from. These include everything from unimproved three-stone fires up through several tiers of cooking device and finally up to a high-performance BLEN stove.

It is possible that, as a result of an RBF incentive, someone who may have been a candidate to purchase a high-quality BLEN stove instead chooses to purchase a low-quality, but subsidised, charcoal stove. There are three key considerations here:

1. The quality level identified for RBFs – and the incentives attached to each – can be tailored to reduce the likelihood of "trading down" by setting RBF levels that encourage purchase of higher-quality ICS.
2. The choice of RBF itself can offer some protection. For example, a voucher scheme (RBF 6) could potentially be used through limiting eligibility for receipt of vouchers and by setting differentiated incentives according to the type of stove purchased.
3. The proportion of Uganda households using BLEN level stoves is very small: around 5 per cent of all households now use a modern fuel for cooking. Therefore any such effect will likely be small.

This suggests that the likely impact of "trading down", especially if accompanied by careful RBF design, is low.

Whereas fuel savings happen at a relatively low tier improvement of ICS, health and carbon benefits depend on the exact characteristics of stoves. Although all ICS in Uganda will greatly improve fuel efficiency over unimproved cookstoves, the difference in fuel savings between mid-tier and higher-tier ICS is relatively small.

In aggregate, fuel savings can be substantial since quality cookstoves reduce fuel consumption by approximately 50 per cent. Currently, urban and peri-urban households spend US$20–50 per month on charcoal for cooking.[61] More fuel efficient ICS can reduce this by about 50 per cent, depending on the stove efficiency, and therefore cut fuel costs between US$10 and US$25 per month on average. This produces

[61] The consumption rate is between two and six weeks per bag of charcoal, according to a large ICS manufacturer and evidence from the workshop respectively. Charcoal prices, which are volatile, are here assumed to be US$25 per bag.

fuel savings worth between US$36 and US$73 million over the five years of the intervention above what the market would have created on its own.[62]

The benefits of ICS using wood are mainly in reduced time spent on gathering and preparing fuel wood and on cooking. The preliminary findings of the cooking sector study (TNS, 2013) shows that consumers believe that ICS both save time in cooking and gathering fuel, the latter being less important for those who purchase fuel. Thus higher fuel efficiency does not produce monetary fuel savings directly for the majority of households that cook with gathered wood. Less time spent gathering fuel wood and fewer collection trips, along with less time spent cooking, however, contribute indirectly to monetary effects by freeing household members to participate in gainful activities. The exact amount of derived benefits depends on household preferences and no previous studies have estimated this effect for Uganda. Our focus on the consumer segment that purchases fuel wood limits the benefits that can be realised from time saved in gathering fuel wood.

Fuel savings, like all other benefits, will continue to accrue beyond the RBF intervention period. Figure 17 at the beginning of this section illustrates that scaling up the ICS market faster with an RBF intervention continues to produce more benefits during the five years of the RBF intervention as well as over the ensuing three years. During this time the ICS market operates at its potential capacity of approximately 1.2 million ICS per year. Without an RBF intervention, the potential market at scale is assumed to reach 1.2 million ICS per year in seven years. This difference will continue to produce additional benefits which are accounted for in the value for money analysis.

Health benefits are hard to quantify and depend on the emissions reduction of each ICS tier. Although the burden of disease associated with HAP is well documented, there is much less evidence on the health impact of ICS. Above a certain level of technical performance, ICS can reduce HAP by approximately 50 per cent as compared with unimproved stoves, depending on the tier of ICS (GACC, 2013). But the current evidence base is too weak to draw firm conclusions about the correlation of reductions in particulate matter and disability-adjusted lifetime years lost due to solid fuel combustion. Nevertheless, health benefits are most likely to be achieved with high-performance ICS or stoves using refined fuels, such as LPG. Since the aim of this RBF is to create an ICS market at commercial scale, the approximate subsidy level is set to achieve this objective. This subsidy level is likely to be too low to achieve large uptake of high performance stoves or LPG as these are more than three times more expensive than ICS using charcoal. Given the current state of the cookstove market in Uganda, it is questionable whether an LPG market would be sustainable after an RBF exit. This does not preclude that any well targeted RBF would improve ICS quality in the market over time. The RBF can provide the right incentives to move from unimproved stoves to ICS to LPG over time, which would reduce the required subsidy for high-performance ICS and LPG stoves in the future.

Although there certainly are health benefits, the current evidence base does not allow for quantification of health benefits (in dollar terms)to be included in the value-for-money analysis. Reduced HAP may lead to a decline in disability adjusted lifetime years lost, but the magnitude of benefits is dependent on social factors such as on how often the stove is used, where it is used, how it is used and who is present during and after cooking. The current evidence base for these factors is insufficient to estimate specific health benefits in this feasibility report.

Carbon reductions can be priced using either the projected value of carbon credits or the estimated social cost of carbon. The value of carbon credits provides an estimate of the payment received for reducing

[62] The calculations assume a discount rate of 14 per cent and a replacement rate of charcoal ICS of three years.

carbon emissions. The value of carbon credits has been volatile in the past and is assumed to be US$7 in this report, which is lower than the social cost of carbon. The social cost of carbon captures all externalities associated with carbon emissions. Although the range of estimates for the social cost of carbon are very wide (Yohe, 2007), a recent US study suggests a value of between US$22 and US$36 per tCO_2 (US Environmental Protection Council, 2013).

Using the market price of carbon to value the emission reductions over the five years, the RBF is projected to achieve a benefit of about US$26 million. In addition, the carbon reductions continue to be higher due to the RBF presence as the commercial market at scale is reached earlier and over seven years; the additional carbon reductions accumulate to US$35 million. This assumes three carbon credits per ICS per year at a carbon credit value of US$7 and that all new ICS are eligible and apply for carbon finance.

Using a range for the social cost of carbon of US$22–US$36 per tCO_2 over the five years, the RBF is projected to achieve a benefit of between US$27 million and US$44 million. This is greater than the value of carbon because of the higher social cost of carbon. However, if the carbon credits are used to offset emissions in other parts of the world, the overall benefit of the carbon reductions are reduced proportionally to the amount of offsets sold. In addition, the carbon reductions continue to be higher due to the RBF presence as the commercial market at scale is reached earlier and over seven years, the additional social cost of carbon reductions accumulate to between US$34 million and US$59 million.

Environmental benefits, such as reduced soil erosion or less deforestation, are controversial and excluded from this value-for-money calculation. Past studies failed to find a conclusive answer on reduced deforestation and soil erosion due to ICS. (USAid, 2012a) To arrive at a prudent estimate for potential RBF benefits in the ICS market in Uganda, we have therefore excluded environmental benefits.

The RBF intervention's total potential value for money is approximately US$64 million to US$129 million over the five years of RBF intervention, and up to approximately US$91 million to US$175 million over the first seven years; both estimates use the market price of carbon.[63] When the social cost of carbon is used instead, the value for money rises to approximately US$65 million to US$147 million over the five-year RBF intervention and approximately US$90 million to US$199 million over the first seven years.

Overall, the RBF creates benefits of approximately 6 to 10 times as much as it costs in incentive payments and administration costs. All costs and benefits are summarised in Table 21.

In addition to the value for money, the return on investment – defined as the additional stoves sold due to the RBF intervention divided by the incentivised ICS – is approximately 0.6. This calculation is based on 3.6 million RBF incentivised stoves over five years versus the projected growth rate of the ICS market without an RBF intervention.

However, the return on investment as defined above does not capture how the ICS market reaches a commercial scale much faster with an RBF intervention than without and that it continues to create health and carbon-related benefits.

[63] The low estimates use low benefits and high scheme and administration costs, and vice versa.

Table 21: **RBF costs, benefits and value for money**

	Variable	US$ millions	Note
Costs	RBF incentive payment	8 to 16	The incentive payment is based on a 40 per cent ICS market growth rate under the RBF and an incentive payment between US$5 and US$10 per ICS.
	RBF administration	1.6 to 3.2	Administration costs are assumed to be 20 per cent of the RBF incentive payment.
	Fuel savings	57 to 113[1]	Fuel savings over seven years[2] are approximately US$75 million to US$150 million.
Benefits	Health	Not quantified	Health benefits occur by reducing household air pollution (HAP). The exact quantification in terms of reduction in disability-adjusted lifetime years lost will depend on a range of socioeconomic factors as well as the targeted ICS tier.
	Carbon	Value of carbon: 26 Social cost of carbon: 27 to 44	The value of carbon benefits over seven years[2] is approximately US$35 million. The social cost of carbon reductions over seven years[2] is approximately US$34 million to US$59 million.
	Environmental	Not quantified	Environmental benefits are uncertain to occur.
Value for money	Over five years[3]	64 to 129 using the value of carbon 65 to 147 using the social cost of carbon	The low estimate uses the lowest benefits and highest costs. The high estimate uses the highest benefits and lowest costs.
	Over seven years[2]	91 to 175 using the value of carbon 90 to 199 using the social cost of carbon	The low estimate uses the lowest benefits and highest costs. The high estimate uses the highest benefits and lowest costs.

[1] Discounted at 14 per cent over five years of RBF intervention.

[2] Seven years is the entire period over which the RBF intervention produces benefits over the assumed development of the Ugandan ICS market without an RBF intervention.

[3] The projected lifetime of the RBF intervention.

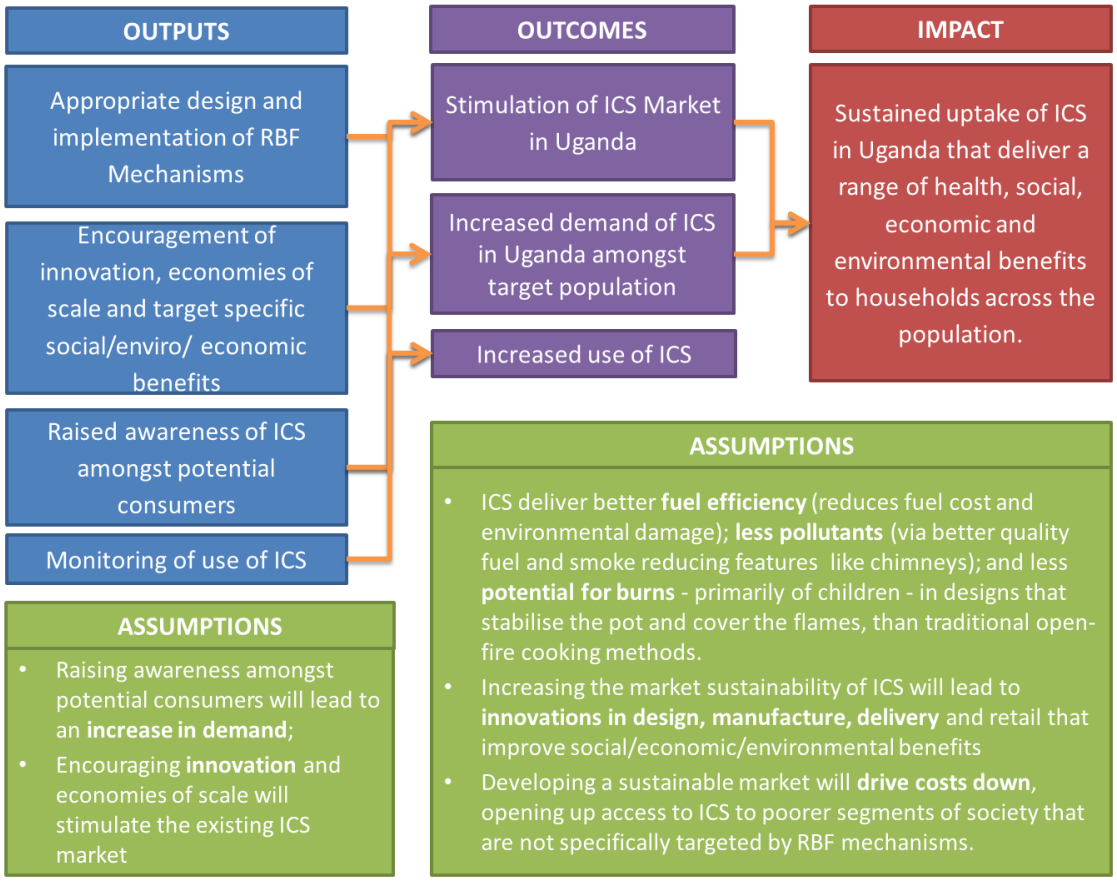
Source: Vivid Economics, based on project team data.

4.4 Monitoring and Evaluation Considerations

In formulating a system for measuring outcomes, and then for defining a causal chain between outputs, outcomes and impacts, a theory-based approach is recommended. The following discussion (a) makes use of Theory of Change to capture the intended pathway of change, (b) defines a set of assumptions on which this is based, and (c) provides a framework to identify indicators and monitoring requirements.

Figure 18 shows an overarching Theory of Change for employing RBF mechanisms in the ICS sector in Uganda. The intended **impact** is "sustained uptake of Improved Cookstoves in Uganda that deliver a range of social, economic and environmental benefits to households across the population". This captures the policy options outlined in Section 3.1 aimed at achieving health, social, environmental and economic benefits relating to ICS. However, by declaring this at the "impact level", it is assumed that there are factors that could influence the achievement of the result that are beyond the control of the intervention.

Figure 18: **Theory of Change links outputs to outcomes and finally to impacts**



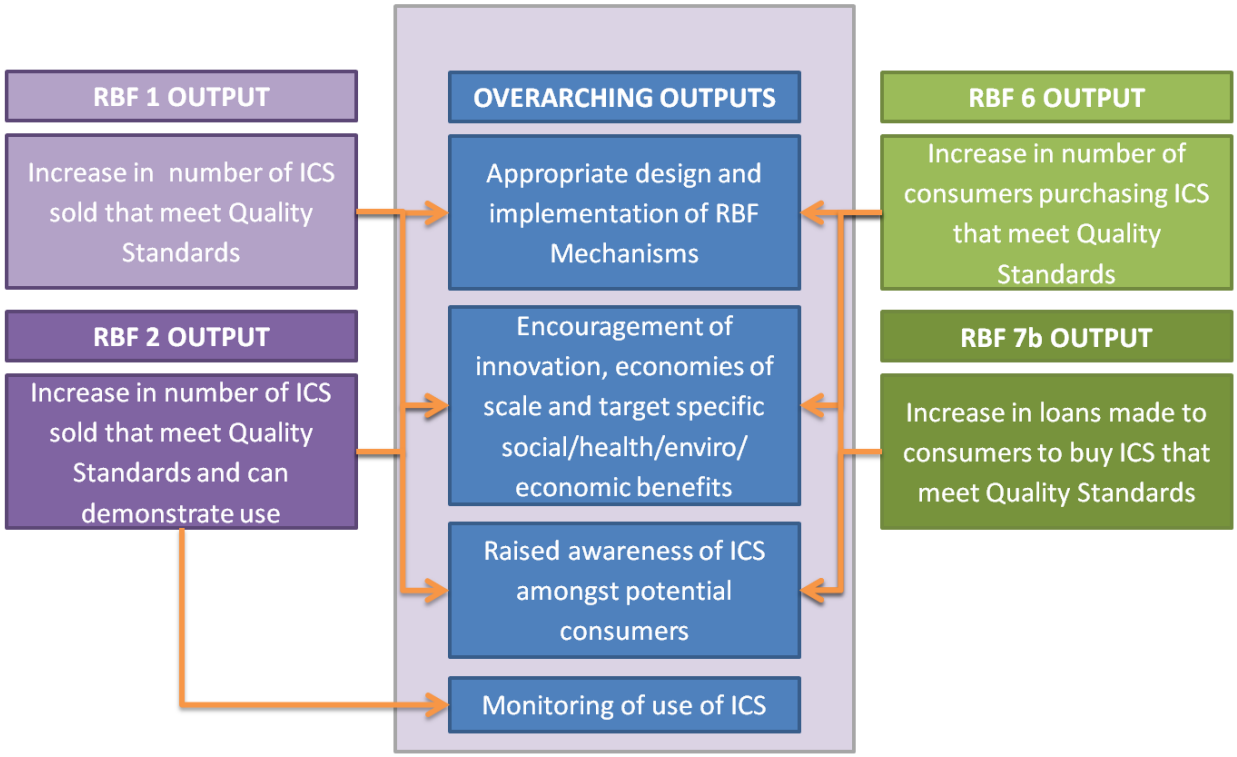
Source: IMC.

The assumptions listed in the bottom of Figure 18 describe the causal linkages between outcomes and impact. In carrying out future evaluations, which is recommended as part of a theory-based approach, a key component would be to challenge the assumptions upon which the theory of change is based. For example, this theory of change assumes that there is a causal linkage between encouraging innovation and economies of scale among ICS producers, and stimulating the ICS market. Although assumptions are often based on supporting evidence, every intervention can be seen as a way to test the assumptions, the better to strengthen the knowledge base and understand how and why interventions work. Continuing this example, there may be extenuating circumstances that, despite strong and appropriately targeted encouragement, prevent the ICS market from being stimulated. Investigating this, using "realist approaches" to understand contextual influences, would then provide useful lessons about the RBF mechanism and the assumptions underpinning it. Figure 18 outlines the assumptions underlying the linkage between outputs and outcomes (on the left) and then between outcomes and impact (on the right).

The **outcomes** of such an intervention capture the real purpose of an RBF intervention in the ICS sector, namely, stimulation of the ICS market, increased demand for ICS in Uganda among the target population, and increased use of ICS. The RBF, if appropriately designed, will contribute to these outcomes if the underlying assumptions are valid. The **outputs** of an RBF intervention are under the control of the RBF, and are the direct outputs of the activities undertaken.

Because the four shortlisted RBF options have different modes of delivery, they differ in their outputs. These can be seen to be "nested" within the overarching Theory of Change, each with its own output that contributes to the delivery of the various overarching outputs as displayed in Figure 19.

Figure 19: **Outputs differ across shortlisted RBF options**



Source: IMC.

After linking RBF options to outputs, the next stage is to design indicators and monitoring and verification tasks for each output. A set of example indicators can be found in the Table 22, along with the Trigger or Means of Verification (MoV) and monitoring tasks that will need to be carried out. Importantly, indicators such as "quality" and "level of use" will need to be defined in order to be rated, with criteria for the range of scores also defined and agreed with various stakeholders. This will enhance the transparency and consistency of monitoring and verification. For example, "quality" may be defined by reference to objective technical standards according to the stove model. This would require awareness amongst suppliers of the details of the technical standards in use for monitoring and verification purposes. In defining *level of use*, a helpful reference is Kirk Smith and his colleagues' work at the Household Energy, Climate, and Health Research Group, UC Berkeley,[64] and may include a combined rating that includes frequency of stove use, the amount of time spent preparing each meal, and the number of hours the stove was lit at each meal time. This would capture initial adoption, sustained use and seasonal variability. Stove use monitors are seen to be the most precise (and costly) measurement tool, while recall questionnaires among a sample of stove users may be sufficient.

[64] "The introduction of a new cookstove into the household often leads to the "stacking" or use of multiple fuels and stoves. Rather than fully switching from their traditional fuel stove combinations to the new ones, households tend to use every combination for the tasks that best fulfill their needs, increasing the portfolio of cooking options for the home. Therefore, measuring the levels of use during the initial adoption and sustained use or disadoption of the new and traditional stoves is as important as monitoring other technical specifications of the cooking devices to assure the sustainability of the benefits from cookstove programs." I. Ruiz-Mercado, E. Canuz, J.L. Walker and K.R. Smith, "Quantitative metrics of stove adoption using stove use monitors", *Biomass and Bioenergy* (2013).

Indicators in use by international agencies in the cook stoves sector are mainly focused at the impact level of our theory of change. These would therefore not inform the payment trigger but could be used during future evaluations. Relevant indicators at impact level are summarised in Table 23.

Table 22: **Indicators, triggers and monitoring tasks are matched to the outputs of each RBF**

Output	Indicators	Trigger/MoV	Monitoring Tasks
RBF 1 Increase in number of ICS sold that meet quality standards	Number of ICS sold Quality of ICS sold	Proof of sale, Proof of adherence to quality standards	Define the quality standards into a ranking system with scoring criteria Verification of proof of sale and quality of ICS; Monitoring of location, seller, model, price
RBF 2 Increase in number of ICS sold that meet Quality Standards and can demonstrate use	Number of ICS sold Quality of ICS sold Number of ICS in use Level of usage	Proof of sale, Proof of adherence to quality standards, proof of use	Define the quality standards and usage (e.g. daily, weekly, monthly, never) into a ranking system with scoring criteria Verification of proof of sale, quality and usage; Monitoring of location, seller, model, price,
RBF 6 Increase in number of consumers purchasing ICS that meet Quality Standards	Number of consumers who have been allocated vouchers Number of consumers who have used vouchers Quality of ICS bought	Proof of purchase, Proof of adherence to quality standards	Define the quality standards into a ranking system with scoring criteria Verification of proof of purchase and quality; Monitoring of location of consumer, model, price
RBF 7 b) Increase in loans made to consumers to buy ICS that meet Quality Standards	Number of consumers who have made loan applications Number of consumers who have used a loan to buy an ICS Quality of ICS bought Number of consumers paid loans	Proof of loan, Proof of purchase, Proof of adherence to quality standards	Define the quality standards into a ranking system with scoring criteria Verification of proof of loan and proof of purchase, and quality; Monitoring of location of consumer, model, price

Source: IMC.

Table 23: **Indicators in use by international agencies**

Indicator	Definition	Agency
Population with access to non-solid fuels Annual investment in non-solid fuels	Reliance primarily on non-solid fuels	SE4ALL
Number of a) new household connections to off-grid renewable energy sources, and b) households with more efficient cookstoves, solar lanterns or other clean technologies which generate energy	People with improved access to clean energy as a result of ICF projects	ICF
Purchase costs of fuel Fuel savings	Use of "improved energy source" for cooking:- consumption of fuel and the resulting purchase costs and/or time for fuel wood gathering are reduced	ENDEV
Sales by emissions, efficiency, and safety tiers Extent of adoption and use Laws and policies that promote clean cookstoves as part of energy strategies	People at the bottom of the pyramid adopting clean cookstoves and clean fuels and wider national policy influence	GACC
Percentage share of modern fuels in total residential sector energy use	Household access to clean cooking facilities instead of traditional biomass	IEA
17 indicators across financing, policy and capacity	Focuses on a spectrum of cooking solutions according to emissions (indoor and overall), fuel use, safety and health impacts	Practical Action: *Poor People's Energy Outlook*

Source: IMC.

4.5 Implementing Modalities

4.5.1 Principals and their Competencies

The *principal* is defined as the organization that manages the RBF scheme and would usually be a donor agency or government department. Although there is a range of potential principals, those most likely to act as an RBF principal might be either national or subnational governments or development agencies (World Bank, 2013a). Principals and their competencies from the perspective of an RBF scheme for ICS in Uganda are discussed below.

G. Government of Uganda

The Renewable Energy Policy for Uganda of 2007 aims to increase the use of modern renewable energy. The Ugandan Government through the Ministry of Energy and Mineral Development (MEMD) is implementing plans to increase the use of modern renewables from 6 to 61 per cent by 2017. This policy highlights the need for mass adoption of improved cookstoves to reduce demand for biomass energy resources. MEMD, together with the Ministry of Water and Environment and local governments, has also supported the development of ordinances in districts where charcoal is produced. These are expected to regulate charcoal production and trade in an attempt to ensure sustainable supply. The government is also developing a new Biomass Energy Strategy with a focus on increasing the use of efficient biomass energy technologies. In 2009 a Climate Change Secretariat was established and capacity building measures for the Clean Development Mechanism in Uganda were undertaken, chiefly by the Norwegian Agency for Development Cooperation (NORAD) and the UN Development Programme. Although there are no specific incentives for investing in cookstoves and fuels manufacturing, Uganda's fiscal incentive package for both domestic and foreign investors provides generous capital recovery terms (GACC, 2013). There is, therefore, a supportive strategic policy environment, although dialogue is ongoing over increasing support for ICS policies and measures.[65]

Sector coordination is improving through the new Uganda National Alliance for Clean Cooking (UNACC), with the Biomass Energy Efficient Technologies Association also playing a manufacturers' coordinating role. UNACC – set up in 2013, linked to GACC and supported by the Ministry of Energy – is currently establishing a secretariat and has developed a Strategic Planning Matrix.

There is experience in the Rural Electrification Agency (REA) and the Private Sector Foundation Uganda (PSFU) in supporting sustainable energy technology, in particular through the national solar program supported by the Energy for Rural Transformation (ERT) project described in Box 8. Support is also being planned for the clean cooking sector under the ongoing ERT project, with PSFU and MEMD implementing activities such as business development and consumer awareness.

[65] Interviews June 2013.

Box 8: **The Energy for Rural Transformation program for Solar Home Systems and ICTs**

The Government of Uganda has received funding from the World Bank to implement the second phase of the Energy for Rural Transformation (ERT) project. This project, following a first phase begun in 2002, aims at scaling up investments in rural electrification as well as information and communication technology. Under the project, the Rural Electrification Agency will implement the solar photovoltaic (PV) Targeted Market Approach, whose main focus is to promote consumer credit and provide consumer subsidies for PV to targeted markets. This is expected to result in the installation of 20,000 PV systems in four years, starting in 2013. PV installations will be subject to audit and verification before disbursement of subsidies to consumers, much as is anticipated under the ICS RBF option 2 described in this report.

A similar programmatic approach to the ICS sector might be taken in Uganda, and indeed agreements are already in place between the World Bank and the Ministry of New and Renewable Energy to implement ICS components, including through Private Sector Foundation Uganda.

In addition to the Rural Electrification Programme, the government of Uganda has experience in implementing a range of output-based aid programmes, most notably in the health and water sectors.

H. Donors and International Organizations

There are a number of potential principals in this category. The most active is GIZ, which has key ongoing roles in the cookstoves sector.

Along with BMZ and the government of the Netherlands, GIZ is implementing a major program on policy, strategy and capacity development across the energy sector. This includes decentralization and energy feed-in tariffs. GIZ is also driving a program funded by EnDev to train stove builders in 17 Districts of Uganda. The Uganda Country Action Platform (GACC, 2013) indicates other donor agencies that may be considered to have the competency to act as principal (Table 24).

Table 24: **Donor competencies**

	Coordinate Program	Provide Funding	Coordinate Project (Region)	Marketing, Operations, Finance
GIZ	+ +	+ +	+	+
EKN	+ +	+ +	+	
DFID	+ +	+ +	+	
UNDP	+ +	+ +	+	
UNEP	+ +	+ +		

Source: Adapted from GACC (2013).

Although they have very limited experience in the cookstoves sector, there are also health sector donors that could also have an important role to play given the potential public health benefits. The relative experience of potential health sector principals with interests and experience in Uganda suggests that their role might be confined to that of program funding.

In conclusion, there is capacity for the program to be run by government or donor agencies, and a detailed institutional capacity assessment would help determine the right principal. There is most likely a need for technical assistance in a number of specific areas, as previously identified in Section 4.2.

4.5.2 Agents and their Competencies

An *agent* is defined as any organisation or individual that attains the desired RBF result and applies for RBF funding.

The various manufacturers and other agents that may respond to an RBF scheme are identified in Section 3 and the likely market response, including the response of agents, in Section 4.2.

As discussed in Section 3.4, different levels of RBF incentive can be set for different levels of technology performance, so the range of agents responding to the scheme will be dependent both on the policy objective and on the RBF design. This is most likely to include locally manufactured ICS, especially if the focus of the RBF scheme is on the expanded distribution of quality ICS products. International and high-performance technologies such as gasifier stoves are likely to best meet the objective of delivering health benefits.

In terms of the competency of agents there is a considerable variation in the scale of operations, levels of management capability, quality control and technical performance. Complementary Technical Assistance to support expanded operations will be needed for some agents. In particular, some consideration must be given to the fact that existing carbon market agents will have significant capacity to monitor results, providing a platform for meeting measurement, reporting and verification (MRV) requirements for RBF implementation.

5. Conclusions

5.1 The ICS Innovation Ecosystem in Uganda

Section 2 described the ecosystem for improved cookstoves in Uganda, including its current scale and potential market size. There is a nascent ICS market, with a range of small and medium-sized suppliers of improved cookstoves.

This report has identified the main barriers that must be tackled with the objective of supporting a commercial market at scale. These are shown in Table 25.

Table 25: **Summary of market constraints across three business model types**

<table>
<tr><th rowspan="2">Constraint</th><th colspan="3">Business model</th><th rowspan="2">Importance</th></tr>
<tr><th>Artisanal</th><th>Manufactured</th><th>Modern Fuels</th></tr>
<tr><td>Manufacturers</td><td>Limited microfinance restricting potential for staged payments</td><td colspan="2">Banks loans infeasible (high cost) intense capital constraint to scaling up production.

Inability to offer staged payment or financing options at point of purchase</td><td>High</td></tr>
<tr><td>Financial barriers

Consumers</td><td>Low ability to pay for anything other than the cheapest ICS, willingness to pay increases with staged payment options</td><td>Low ability to pay for ICS over US$7 for charcoal ICS in peri-urban and urban markets. Price limiting market growth</td><td>Only top-end consumers</td><td>High</td></tr>
<tr><td>Willingness to pay / information barrier</td><td colspan="3">Limited consumer awareness on benefits of ICS, though awareness is greater in urban markets. Low cost of ICS limits ability of manufacturers and sales agents to market products</td><td>High</td></tr>
<tr><td>Manufacturing capacity</td><td>Low volume, low quality</td><td>Uganda manufacturing is labour intensive and low mechanisation and thus slow to scale up. New manufacturers could enter the market</td><td>Not applicable. Mostly imported and low volume</td><td>Medium</td></tr>
<tr><td>Quality and Testing</td><td colspan="3">No national standard, varying quality products on the market affecting consumer confidence, and varying economic, environmental and health benefits. Low branding of products</td><td>Medium</td></tr>
</table>

5.2 The Way Forward: RBF for Improved Cookstoves in Uganda

Out of nine candidate options presented, we have identified four feasible options for implementing a results-based financing program for improved cookstoves in Uganda. These options tackle the main barriers to the sustained scaling up of the commercial ICS market and can address health objectives if RBF incentives are set appropriately. One or more of these RBF options could be implemented, depending on the results of future detailed design work. The four shortlisted options fall into two general categories depending on supplier or consumer focus, as shown in Figure 20.

One or more of these different RBF options can be considered as candidates for a future national cookstoves program that follows a policy objective of delivering health benefits by the private sector, with an emphasis on facilitating the emergence of a commercial ICS market at scale.

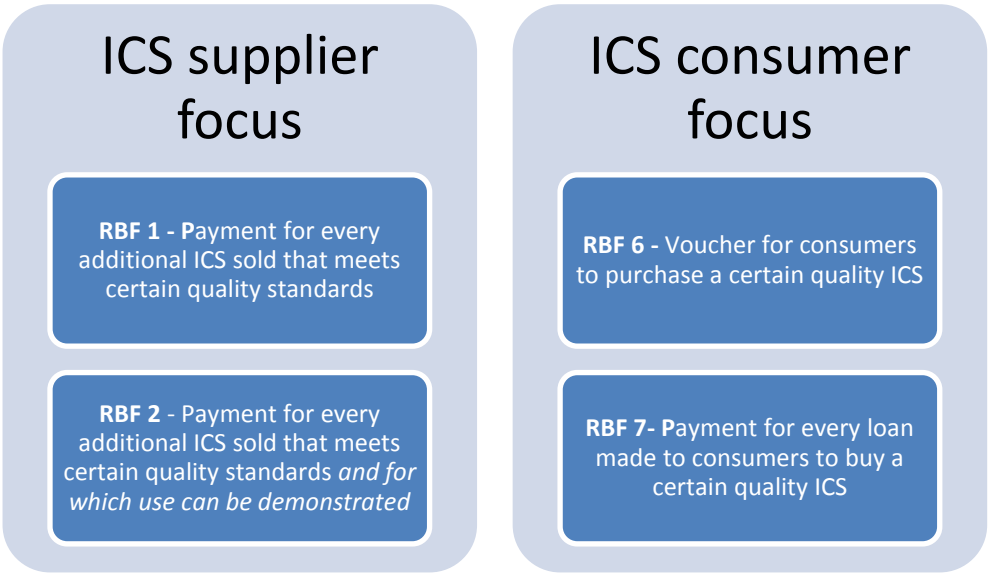


Figure 20: **Shortlisted RBF options: supplier versus consumer focus**

An RBF program in Uganda will not be successful without complementary interventions to address those barriers that the RBFs themselves do not address. These interventions have been detailed for each RBF in Section 4. Producers and distributors receive other forms of technical support from development partners, without which the quality and scale of production is at risk.

The complementary measures that are needed to ensure that the results-based incentives succeed include: national awareness campaigns, policy changes to lower costs and encourage investment, access to finance, technical assistance including business development support services, and a national quality assurance and testing program.

The total potential value for money of the RBF intervention is approximately US$64 million to US$129 million over the first five years and up to approximately US$91 million to US$175 million over the first seven years; both estimates use the market price of carbon.[66] When the **social cost of carbon** is used instead, the value for money rises to approximately **US$65 million and US$147** million over the five-year RBF intervention and approximately **US$90 million and US$199** million over the first seven years.

5.3 Implementation

The Government of Uganda and development partners have already implemented alternative energy access initiatives, notably the solar PV program under the MEMD Energy for Rural Transformation program, with the involvement of the PSFU, REA and other partners.

Our assessment is that international partners or government agencies could act as principal for an RBF program and that a detailed institutional capacity assessment will help determine the optimal arrangements. International partners should take forward their existing plans and integrate aspects of the shortlisted RBF options following detailed design.

This report shows that there are a number of capable agents that would likely respond well to a future scheme, but that technical assistance for some agents would increase the likelihood of successfully

[66] The low estimates use low benefits and high scheme and administration costs, and vice versa. See Section 4.3.

expanding the distribution of high-quality improved cookstoves. The agents of an RBF scheme in Uganda would include mainly ICS manufacturers, distributors and financing partners.

Annex 1: The Market Size for Improved Cookstoves

Calculating Market Size

Basic Data

	Population (forecast 2015)	Average household size	Number of households	Charcoal[67]	Firewood[68]	Modern fuels[69]
Rural	32,360,510	5.2	6,223,175	77,167	5,308,368	6,223
Urban	6,751,991	3.9	1,731,280	1,173,808	292,586	79,639
Total	**39,112,501**		**7,954,455**	**1,250,975**	**5,600,955**	**85,862**

Sources: Population figures from SSA WB Dalberg Report,[70] household size and fuel mix from UBOS Household Survey 2011.

Working Assumptions are as follows:

- That 29 per cent of the rural population constitute the "commercial" ICS market (See Section 3.2)
- That maximum penetration rates into any given market are 80 per cent
- That most households will purchase between one and two ICS[71]
- That each household will replace an ICS every three years

This gives us a total market size by Urban and Rural populations as follows:

	Urban[72] market h/h	Rural charcoal[73] h/h	Total charcoal h/h	No of ICS per annum[74] (1.5 per household)	No of ICS per month
Charcoal charcoal	939,046	17,902.83	956,949	478,474	39,872.87
Firewood charcoal	234,069	1,231,541	1,465,610	732,805	61,067
Modern fuels	63,711	1,443.78	65,155	32,577	2,715
Total	**1,236,826**	**1,250,888**	**2,487,714**	**1,243,857**	**103,655**

Note: This is the potential market size assuming no change in fuel use. It is highly possible that fuel purchasers may switch between fuel types and use both fuel types, thus it is best to consider the market size as one figure of just over 100,000 ICS per month.

[67] Charcoal: 67 per cent of urban households and 12.4 per cent of rural households.
[68] Firewood: 16.9 per cent of urban households and 85.3 per cent of rural households.
[69] Modern fuels: (electricity, LPG, natural gas, biogas) 4.6 per cent of urban households and 0.01 per cent of rural households.
[70] World Bank 2013b, data set.
[71] Research is still ongoing to identify a suitable estimate of ICS per household; figures may need to be amended accordingly.
[72] Equals number of urban households multiplied by 80 per cent penetration. Assumes 100 per cent commercial market.
[73] Equals number of rural households multiplied by commercial market size (29 per cent) and 80 per cent penetration.
[74] 1.5 ICS purchased every three years, equals total household market multiplied by 1.5 and divided by 3.

Annex 2: Ongoing and Planned Initiatives in the Cookstove Sector in Uganda

Ongoing and Planned Initiatives in the Cookstove Sector in Uganda

As of June 2013, there are a number of other existing and planned initiatives to stimulate the cookstove sector in Uganda:

1. Promotion of Renewable Energy and Energy Efficiency Programme (PREEEP), implemented by GIZ with BMZ and ENDEV funding.
2. Increasing the Provision of Clean Energy in Uganda, implemented and funded by the World Wildlife Fund (WWF).
3. Breathing Space, Implemented and funded by Shell Foundation.
4. Capital Access for Renewable Energy Enterprises (CARE2), implemented by GVEP with SIDA funding.
5. Uganda Efficient Stove Programme, implemented by Impact Carbon and financed via carbon credits.
6. Improved Cookstoves in East Africa (ICSEA), implemented by the Uganda Carbon Bureau and financed via carbon credits and multi-donor seed funding.
7. Biolite HomeStove Programme, implemented by Impact Carbon, funded by GACC Spark Fund.
8. UNDP – greening the charcoal sector and microfinance.
9. Incubation Centre, funded by the Nordic Climate Facility.

Each program is described in turn below.

1. Promotion of Renewable Energy and Energy Efficiency Program (PREEEP)

Donor	Dates	Key Elements / Description	Target points in the value chain
BMZ with Netherlands government co-financing and the German BNU[75]	June 2008 – May 2014	Policy Strategy and Capacity Development across the energy sector including decentralization and energy feed in tariffs	
EnDev	June 2008 – May 2014	Access to energy services using a market-based approach. Includes: • Training of household stove builders in Northern Uganda • Training of energy service providers (multi-technology) in the construction, maintenance and promotion of clean technology (including household cookstoves); ongoing advice and support • Operational in 17 districts • Also does awareness raising with consumers	All areas from production to consumer awareness and monitoring of use

[75] German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety.

2. Increasing the Provision of Clean Energy in Uganda

Donor and Implementing Agency	Dates	Key Elements / Description	Target points in the value chain
World Wildlife Fund (WWF)	Runs until 2016	Covers all renewables – cookstoves, hydro, solar. With regard to cookstoves the program: • Links household cookstove manufacturers[76] with partners in Kasese district. • Builds capacity of community based organizations to build and sell liners. • Provides grants to CBOs to buy stoves;[77] CBOs then allow householders two to three months to pay.	Production Distribution Finance

3. Breathing Space

Donor	Dates	Key Elements / Description	Target points in the value chain
Shell Foundation	Unknown	Provides financing support to overcome working capital constraints (partly funded by carbon credits) to support the manufacture of Envirofit stoves (manufactured in China and more recently Kenya). The program also provides for stoves to be sold below cost recouping money from future carbon revenues. Distribution is undertaken by UpEnergy by door to door selling and via farmer cooperatives.[78] Distribution support is in the form of subsidizing of the sale price.	Provision of financial support to manufacture and distribution (via sale price)

[76] UpEnergy (Envirofit) andUgastove. Prime Energy for liners. (Ugastove have own tracking system for carbon finance monitored via warranty cards.)

[77] Stoves are purchased at wholesale price, bulk purchase and delivery to the community reduces marginal transport costs. Sale price in Kasese is equal to market price in Kampala

[78] In Kenya Shell Foundation are piloting a project to brand the stoves with RoyCo (part of Unilever) a common household name

4. Capital Access for Renewable Energy Enterprises (CARE2)

Donor and Implementing Agency	Dates	Key Elements / Description	Target points in the value chain
SIDA implemented by GVEP	Sept 2012 – Aug 2015	Institutional Cookstove Programme targeting 300 Schools. Three areas of activity: i) **Technical assistance** to cookstove manufacturers (eight selected,[79] of which seven also do household stoves). ii) **Pipeline development**: identifying and raising awareness with schools on the benefits of institutional cookstoves. iii) **Financial linkages**: a programme providing a loan[80] guarantee facility covering 50 per cent of potential default and a negotiated lending rate of 18 per cent (against market rates of 25–30 per cent) with second-tier financial institutions.[81] The facility covers both cookstove manufacturers and briquette makers.	Financial agents Producers and consumers

5. Uganda Efficient Stove Program

Donor	Dates	Key Elements / Description	Target points in the value chain
Financed via Carbon Credits and implemented by Impact Carbon	Ongoing (not time bound project)	Provides up-front financing to five manufacturers[82] to purchase quality materials upfront for the production and distribution of clean cookstoves. Using Carbon finance to subsidize cookstove price. Cost of transport is high due to high weight and low volume but program sells at the same price to remote communities by subsidizing cost from carbon financing (Gold Standard). Production focused in Kampala due to focus on quality and the need for high temperature firing of the liners. Impact carbon provide hand holding support to the manufacturing and distribution industry.	Manufacturing and distribution[83] Financing

[79] Efficient Process Equipment Ltd, Prime Energy and Environment Savers Ltd (PEES), African Energy and Environment Saving Stoves and Solars Ltd, Uganda Stove Manufactures Limited (UGASTOVE), Racell Uganda, Friends of Wealthy Environment Ltd (FOWE) (Kampala), Humura Investments, Prime Equipment & Co. Ltd

[80] No maximum loan size. Seed-funding average for manufacturers is US$6,000 per year for each business, which provides the working capital for between five and eight school projects. The programme also provides loans of up to 70 per cent for schools to purchase stoves.

[81] As yet does not engage with fully fledge commercial banks, but with “opportunity banks”

[82] Ugastoves, Energy Uganda Foundation (EUF), Save Energy Saving Stoves for Africa (SESSA), African Energy Stoves (AES) Friends of the wealthy environment (FOWE)

[83] Ugastoves distribute via 700 retailers across the country (hardware stores and the like). Other distribution models include the “Avon Model” using health professional networks.

6. Improved Cookstoves in East Africa (ICSEA)

Donor	Dates	Key Elements / Description	Target points in the value chain
Principally financed via Carbon Credits and implemented by Uganda Carbon Bureau, with supplementary support from: NCF, DFID, GIZ and Care	Aug 2012 – ongoing (not time bound project)	Provides carbon finance access for cook stove supplier organisations across East Africa. Ensures continued compliance with the CDM and Gold Standard. CDM Program of Activities (PoA) that allows unlimited CDM Project Activities (CPAs) partners to distribute ICS products and establish monitoring systems for use and maintenance of the cookstoves. Emphasizes transfer of carbon revenue to from purchaser to ICS users. Umbrella membership systems minimizes CDM registration and monitoring costs for CPAs, with 100 per cent of carbon credits going to the CPA projects.	Distribution Financing

7. Biolite HomeStove Program

Donor	Dates	Key Elements / Description	Target points in the value chain
Global Alliance for Clean Cookstoves	Just awarded (30 May 2013).	Establishment and support to a national network of distribution and retail partners to implement a full-scale product launch of BioLite's HomeStove, a new fan stove that reduces HAP while enabling phone and light charging. The programme includes: • Innovative marketing campaigns to establish product awareness • consumer finance programs to drive adoption and long-term usage	Distribution and consumers Financing

8. UNDP greening the charcoal sector and microfinance

Donor	Dates	Key Elements / Description	Target points in the value chain
UNDP	Unknown	The UNDP is working in Uganda firstly on the biomass supply side, including improvement of charcoal production technology and also with microfinance institutions.	Unknown

9. Incubation Centre funded by the Nordic Climate Facility[84]

Donor	Dates	Key Elements / Description	Target points in the value chain
Nordic Climate Facility	Unknown	The Renewable Energy Incubator is established at Makerere University, to support the development of local Renewable Energy (RE) companies and promote cooperation between entrepreneurs, SMEs, financing institutions, authorities, universities and others	(Not clear yet what role if any they play/ will play in the clean cookstove sector)

[84] No discussion as yet had with this facility.

Annex 3: Main Stakeholders in the ICS Sector

Main Stakeholders in the ICS Sector

Government Agencies

- Ministry of Energy and Mineral Development (MEMD)
- Ministry of Water and Environment (MWE)
- National Forestry Authority (NFA)
- Private Sector Foundation Uganda (PSFU)

Donors and International Organisations

- Deutsche Gesellschaft Fűr Internationale Zusammenarbeit (GIZ)
- ENDEV[85]
- Global Alliance for Clean Cookstoves (GACC)
- Shell Foundation
- German Federal Ministry for Economic Cooperation and Development (BMZ)
- Nordic Climate Facility (NCF)
- UNDP
- World Bank (WB)

National / International NGOs and Associations

- Biomass Energy Efficiency Technologies Association (BEETA)
- GVEP International
- Practical Action
- SNV
- Uganda National Alliance for Clean Cookstoves (UNACC)
- World Wildlife Fund (WWF)

National Research and Testing Centres

- Centre for Research in Energy and Energy Conservation (CREEC)
- Uganda National Bureau of Standards (UNBS)
- Center for Integrated Research and Community Development (CIRCODU

Manufactures and Distributors

National

- Africa Energy and Environment Saving Stoves (AES)
- Awamu Biomass Energy
- Clean Energy Partnership

[85] ENDEV is a multi-donor program under GIZ in partnership with the Dutch Ministry of Foreign Affairs (MFA NL), the German Federal Ministry for Economic Cooperation (BMZ), the Norwegian Ministry of Foreign Affairs (MFA No), the Australian Agency for International Development (AusAid), the UK Department for International Development (DFID) and the Swiss Agency for Development and Cooperation (SDC).

- Community groups and other agents (for example, CDM Program Activity (CPA) implementing partners working with the Uganda Carbon Bureau and agents working with Impact Carbon such as LivingGoods)
- Efficient Process Equipment Ltd
- Energy Uganda Foundation (EUF)
- Friends of Wealthy Environment Ltd (FOWE) (Kampala)
- Green Bio Energy
- Humura Investments
- International Lifeline Fund (ILF)
- Prime Energy and Environment Savers Ltd (PEES)
- Prime Equipment & Co. Ltd
- Promoters of Efficient Technologies for Sustainable Development (PETSD)
- Racell Uganda
- Safe Environment Conservation Management (SECOM)
- Save Energy Saving Stoves for Africa (SESSA)
- UpEnergy
- Uganda Stove Manufactures Ltd (UGASTOVE)

International (operating in Uganda)

- Biolite
- Burn Design
- Envirofit
- Philips

Financial Intermediaries including carbon finance organisations

- Ci-Dev
- Climate Care
- Centenary Rural Development Bank Ltd
- Development Microfinance
- FINCA Uganda Ltd
- Impact Carbon
- NEFCO
- Opportunity Bank Uganda Ltd
- Community savings and credit cooperatives (SACCOS)
- Uganda Carbon Bureau

Annex 4: The Potential for Innovation Prizes to Stimulate the Cookstove Sector in Uganda

The Potential for Innovation Prizes to Stimulate the Cookstove Sector in Uganda

Innovation Prizes are both a potential tool for delivering RBF and a possible complementary measure. The options are discussed briefly here.

Consumer Awareness:

Prizes are an effective tool to generate consumer buzz and raise awareness, and are popular among consumers. Given that consumer awareness is a major hurdle in the cookstove sector, a prize approach appears to be an appropriate area for further investigation. RBF Option 6 (vouchers to discount the purchase price of a pre-defined high-quality ICS) presents an option for using a prize as the implementation modality, building on experience from other initiatives in East Africa such as ONSPEED in Kenya (see box). A simplified adaptation of this approach for RBF 6 is discussed in Section 3 of the report.

Example: ONSPEED East Africa

In 2006-07 an internet company called ONSPEED decided to expand into East Africa. A sales and marketing plan was designed in partnership with a local software distribution company in Kenya to promote both the software and the brand into the East African market.

The sale and marketing plan had two parts: offline media and scratch cards. The offline media part of the plan involved creating a competition wherein free copies of the software were given to a limited number of entrants, the point being to collect mobile numbers that ONSPEED could then use to offer discounts and promotions in the future.

More specifically, ONSPEED ran free or paid radio advertisements targeting commuters, asking them to send a text message to a specified number; each week 10 random users were selected to receive a free copy of the software. The marketing team then used the mobile numbers that did not win for sending marketing information, including an option to opt out of receiving future messages. The platform was very simple: a SIM card installed into a laptop, plus software to process the messages. ONSPEED targeted particular areas over time rather than spreading its campaign over the entire region.

The scratch card model was a system whereby people received free scratch cards with newspapers and magazine sellers. A limited number of scratch cards gave free copies, but all gave discounts and ONSPEED worked with the partner company to have local distributors in major cities.

Source: Jonathan Slater was the technical director of ONSPEED before changing careers and joining InnoCentive as Director of Business Innovation.

Quality and Standards

There are various options both for incentivising improvements in cookstove quality and undertaking and verification of standards. This is an approach that has been used successfully at a regional level for off-grid lighting under the Lighting Africa program, supported by the International Finance Corporation. Options include, but are not limited to, prizes for:

- All stoves that pass a certain level of quality or performance criteria within budget, mid-range and premium pricing categories;
- The most improved stove manufacturer; and

- The best quality cookstove wholly produced in Uganda[86]

The first two are arguably better dealt with through technical assistance and support towards covering the cost of stove testing; the first because it is focused on getting multiple manufacturers to improve standards rather than identifying a single clear winner, and the second because it lacks appeal as a marketable award. The third, which features a clear winner, presents the greatest potential for media buzz. The prize could be non-financial – marketing and promotional support, for example, for the prize winner and a given number of runners-up. This would need to be supported with clear product branding and labelling. If linked with RBF Option 6, the prize for the manufacturer could be having the winning stove model become an approved cookstove for the voucher scheme.

Best Practice

Innovation prizes are often used to help identify and support best practice through business plan competitions. These prizes are typically focused on highlighting innovative start-up or small-scale businesses for inward investment. In Uganda, low levels of inward investment for cookstove companies may limit potential, though options do exist for prize winners to receive advertising on crowd-funding sites such as Kiva, for example.[87] This could potentially help with the funding barrier for some smaller scale manufacturers and distribution and sales agents.

Should RBF 1 or 2 be implemented, the market may respond in any number of ways, and some may be more innovative or successful than others. To identify and highlight best practice, a small-scale prize may be established part-way through RBF implementation to highlight successful RBF agents and approaches. This would be intended as a showcase to others, revealing how they might improve market penetration.

Technology Development

Most innovation prizes focus on technical innovation, where their advantages and benefits are well understood. Beyond establishing and meeting common standards (as discussed above), technology is not a priority hurdle to the development of the ICS market in Uganda. This is not a static position and could be revisited once the market is better established; in our opinion, further growth in consumer demand precedes further donor-stimulated technology development. For example, once a commercial market at scale is established, it may be appropriate to stimulate further technology development as a way to continue to raise standards among existing stove users, or bring down costs to target the currently non-commercial market.

Market Stimulation

So-called “grand challenges”, although relatively rare, show evidence of being able to stimulate significant change within markets. Typically featuring prize purses of over US$1 million, their use in nascent commercial markets has brought about rapid expansion including technology development, the establishment of functioning supply chains, and increased consumer awareness and demand.[88] Market stimulation prizes by their nature depend (in the view of this report) on commercial markets and are not appropriate for social or environmental goods that lack commercial financial return. They are also best

[86] We suggest a country-level prize rather than a global one if the prize is designed to raise local quality. A global prize would present an alternative proposition on a much larger scale and would require clear specification to ensure appropriateness for the Ugandan market.
[87] At least one Uganda distributor has recently benefited from KIVA funding. See http://www.kiva.org.
[88] Examples include the Ansari “XPRIZE” (www.xprize.org)and the historic Orteig prize, which have played important roles in the space and air travel industries.

applied where a significant technological breakthrough is required, with the prize awarded based on a clear point of achievement (e.g. the first flight across the Atlantic).

Given that the ICS market we are targeting in Uganda is commercial, a design option for RBFs 1 and 2 could be the award of a significant prize purse upon reaching a specific sales (or sales in use) target; however, we do not think this approach is appropriate in the Ugandan context. Firstly, because there are a large number of suppliers in the market, a market stimulation prize that rewards just the first-past-the-post would limit support to just one supplier – strengthening a monopoly position rather than supporting multiple actors.

Secondly, although there is benefit to be attained from improved technical performance of ICS – and there have been suggestions of a global ICS technology prize[89] – there is no particular technical hurdle that needs to be overcome at this point, with high-end ICS already being available from international suppliers, and continued technical innovation better harnessed globally rather than nationally.

Thirdly, indications from recent grand challenges[90] suggest that large prize purses that reward first-past-the-post can lead to "gaming," where corporations seek to maximise output to win the prize rather than focusing on long-term commercial success

[89] "We propose that a multimillion-dollar innovation prize should be set up, funded by governments or private philanthropy, to rapidly bring cleaner, more efficient and affordable stoves to poor people." http://www.cleancookstoves.org/media-and-events/news/nature-an-innovation-prize.html.
[90] For example, the Haiti Mobile Money Initiative.

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