# Thematic Fiche No. 4

# Improved Stoves as a Means to Increase Efficient Use of Energy

It is generally recognized that poverty reduction has to take place in the context of sustainability. This relates to the many aspects of development but specifically the use and availability of energy. Energy is seen as necessary not only to drive economic development, but also to secure sustainable environmental conditions which are crucial for the achievement of the Millennium Development Goals (MDGs)[1].

The main environmental challenges in countries where the ACP-EU Energy Facility is providing support, for example, Ethiopia, Kenya, Malawi, Rwanda, Tanzania and Uganda, are summarized as[2]:

- Land degradation
- Deforestation
- Declining fisheries and fish stocks
- Reducing biodiversity
- Insufficient access to safe and clean drinking water
- Declining total water resources
- Insufficient access to sanitation
- Growing urban slums
- Increasing energy demands
- Climate change

From this list, it is clear that many of these factors are interlinked and need to be addressed as large, complex paradigms, which extend far beyond the energy sector. For example, deforestation links to land degradation and biodiversity, which in turn is linked to the pressures placed on the environment by growing urban slums and increasing energy demands. However, in an attempt to address these issues in manageable, simplified segments, the energy sector can contribute to addressing some of these issues by encouraging sustainable practices in the quest to meet the demand for energy.

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1 http://www.undp.org/environment/index.shtml
2 http://mdg.ei.columbia.edu/east/?id=programmes_environment

The predicament of being poor is that choice is a luxury and decisions are based on affordability, accessibility and necessity. As a result, to fulfil their energy needs, many poor families rely heavily on wood and charcoal, which are generally the easiest and most affordable fuels to access (UNDP, 1997). To provide an idea of the scale of the demand, in 2005 2.5 billion people relied on traditional biomass for cooking and heating globally, with biomass consumption accounting for over 90% of residential energy consumption in sub-Saharan Africa[3] (IEA, 2005).

The graph below illustrates how the consumption of woodfuel in Least Developed Countries (LDCs) has increased dramatically over a 10-year period up to 2009. This increase represents an 11% rise in the *collection of wood in the rough* (from trunks, and branches of trees) to be used as fuel for purposes such as cooking, heating or power production.

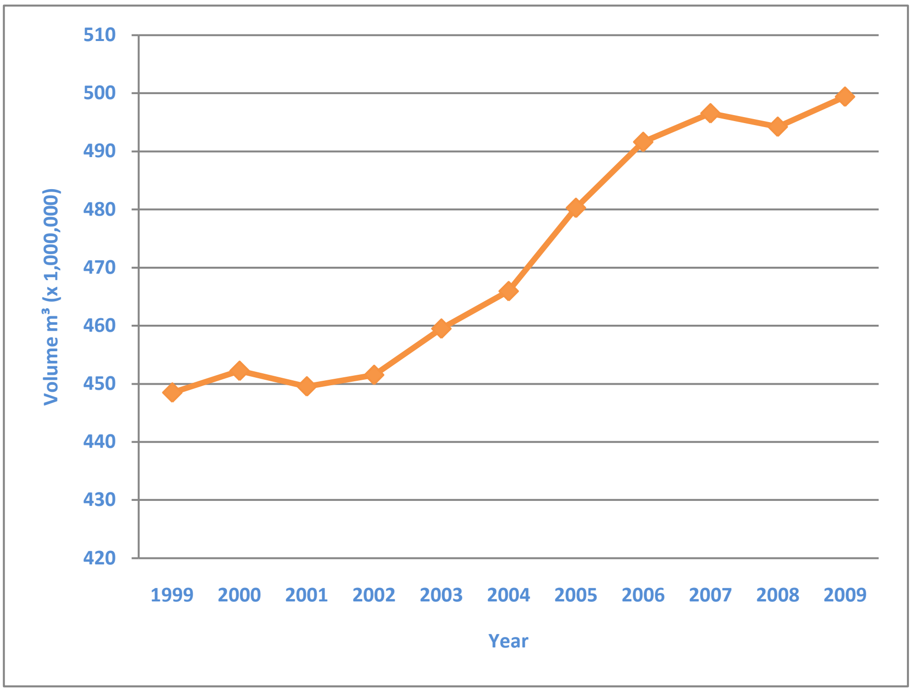


**Figure 1 – Collection of Woodfuel in Least Developed Countries**[4]

The average annual population growth rate of the LDCs is approximately 5%, 50% of whom live on less than $1 per day and are therefore reliant on fuels that are affordable (or free) and accessible, such as wood, charcoal and animal waste[5]. Consumption of wood as a fuel is a major contributor to the degradation of forest cover (the third greatest[6], the first being agricultural expansion), most notably in the vicinity of densely populated urban areas or in arid areas such as the Sahel.

Table 1 below illustrates that the global consumption of woodfuel is projected to reduce. However, on a regional level, woodfuel consumption is anticipated to increase in Africa and South America.

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[3] http://www.iea.org/weo/slide_library.pdf

[4] http://faostat.fao.org/site/626/DesktopDefault.aspx?PageID=626#ancor

[5] http://www.unohrlls.org/UserFiles/File/Publications/Factsheet.pdf

[6] http://ec.europa.eu/environment/enveco/biodiversity/pdf/deforestation_drivers_report.pdf

| Actual and projected woodfuel consumption, by region (million m³ per year) | | | | | |
|---|---|---|---|---|---|
| Region | Actual | | Projected | | % change between 2005 and 2030 |
| | 1990 | 2005 | 2020 | 2030 | |
| Asia | 852 | 740 | 630 | 550 | -26% |
| South Asia | 336 | 369 | 362 | 339 | -8% |
| East Asia | 283 | 205 | 155 | 127 | -38% |
| Africa | 365 | 463 | 526 | 545 | 18% |
| South America | 96 | 104 | 115 | 122 | 17% |
| North and Central America | 170 | 167 | 142 | 162 | -3% |
| Europe | 127 | 122 | 104 | 96 | -21% |
| **World** | **1612** | **1605** | **1558** | **1502** | -6% |

**Table 1 - Actual and Projected Woodfuel Consumption, Source: Mead, 2005**[7]

Woodfuel and charcoal remain the main sources of energy for the poor in the ACP region. The demand for these fuels is on the increase and the supply is not always able to respond sustainably, putting pressure on both sides of the equation. One of the most simple and immediate remedies to the problem, in the absence of global access to modern energy, is to make the use of woodfuel and charcoal more efficient.

As the primary use of woodfuel in the developing world is for cooking, it seems natural to establish mechanisms to make the combustion and transferral of heat from woodfuel and charcoal more efficient, thereby reducing the consumption of the fuel and demand for wood. Almost 3 billion people use inefficient, polluting modes of cooking[8]. In an attempt to improve the energy efficiency of more traditional cooking methods, such as the three-stone fire, emphasis has been placed on the development of suitable, energy efficient or “improved” cooking stoves. There are five key advantages to the use of improved cooking stoves:

1. Less pressure on forest and energy resources;
2. Reduced concentrations of smoke and indoor air pollution. Indoor air pollution is responsible for 2.7% of the global burden of disease causing 1.9 million premature deaths annually as well as pneumonia, emphysema, cataracts, lung cancer, bronchitis, cardiovascular disease, and low birth weight;
3. Money and time saved in acquiring fuel. Based on an economic evaluation of a stoves programme in Uganda in 2007, the estimated time saved is 25% and the fuel saving rate is 55%. The Internal Rate of Return is calculated to be 1,158%[9];
4. Reduced greenhouse gases; and
5. Skill development and job creation in the community[10].

[7] http://www.fao.org/docrep/013/i1756e/i1756e05.pdf

[8] http://cleancookstoves.org/

[9] http://www.gtz.de/de/dokumente/en-cost-benefit-analysis-uganda-2007.pdf

[10] http://www.hedon.info/Improvedcookstove

## ACP-EU Energy Facility Funded Improved Stove Projects

As part of an extensive initiative, the ACP-EU Energy Facility has provided support to eight projects that incorporate the production of improved stoves in their design. These projects have been under implementation since 2008 and have therefore gained experiences which can inform stakeholders regarding the successes, challenges and lessons to be learned from improved stove implementations.

To collate this vital information, projects funded by the Energy Facility were invited to submit responses to a questionnaire detailing the types of technologies employed, their approach, and the successes, challenges and lessons they have identified. This information was combined with previous progress reports and site visits to summarise in this fiche the fundamental observations which could improve the successes of ongoing and future projects.

## Models of Improved Stoves Used in ACP-EU Energy Facility Funded Projects

Within the ACP-EU Energy Facility, a combination of improved stoves technologies has been used and to some extent, the technology employed is dependent on the users' needs. For example, household needs and the needs of schools and hospitals differ dramatically in scale.

The following table summarises the models used, the materials, and the consumers.

**Table 2– Stove Models**

| Model | Components | Materials | Consumers | Fuel requirements compared to open wood fire | Durability |
|---|---|---|---|---|---|
| **Mandeleo Jiko** | Pot rests<br>Fire box | Clay | Domestic | Up to 50% (usually around 35%) | 5 years |
| **Ceramic Jiko/ Chitetezo Mbaula** | Pot rests<br>Fire box<br>Air inlet | Clay<br>Scrap metal | Domestic, Institutional (schools, prisons, hospitals) | Up to 50% | 2.5 – 3 years |
| **Jiko Janja** | Fire box<br>Chimney | Bricks<br>Cement | Domestic, Institutional (schools, prisons, hospitals) | Up to 50% | 5 years |
| **Rocket** | Fuel magazine<br>Combustion chamber<br>Chimney<br>Heat exchanger | Metal<br>Clay | Domestic, Institutional (schools, prisons, hospitals) | Approximately 50% | 3-5 years |

The models of stoves vary in complexity depending on purpose, frequency of use, volume of pot required, and investment cost. The simple ***Mandaleo Stove***[11] is based on the production of a ceramic liner which is placed into a clay and stone wall used as insulation, reducing heat loss. This model of stove does not require any additional materials apart from clay and stones. It is therefore very easy to implement in rural settings for domestic purposes. Maintenance is minimal, only requiring clay and stones to repair cracks.


**Figure 2 - Mandaleo Stove**

**Figure 3 - Chitetezo Mbaula**

The ***Chitetezo Mbaula*** ("protective stove")/ ***Ceramic Jiko*** portable clay stove is practical as it is versatile for indoor or outdoor cooking, dependent on weather conditions. It does not require cooking facilities to be built. It is made using a simple mould and measuring tools to cut out the air inlet and place the handles and pot rests. The basis of the design is to protect the fire, reduce smoke and direct the flames and hot air up to the pot.

An alternative design commonly referred to as the Kenya Ceramic Jiko (KCJ) uses the same principle but based on a metal cladding with a ceramic liner. The current design of the KCJ was developed based on the Thai bucket stove which was unstable and overheated. This metal-clad version was developed by a women's community group who suggested that the hourglass shape would be safer to use. Less vermiculite was added to the clay so as to regulate the cooking temperature, preventing metal fatigue and reducing overheating.[12]

Jikos in general can be either wood or charcoal fuelled.

**Figure 4 - The Kenya Ceramic Jiko**

[11] http://www.gaia-movement.org/documents/Manual%205e%20%20Simple%20Stove%20Jika.PDF

[12] http://kammen.berkeley.edu//cookstoves.html

The more advanced stoves employ metal, bricks and cement and are generally used for fixed stoves. The most popular type of fixed stove is the “rocket stove”. The design of the rocket stove was developed by the Aprovecho Research Centre. It is scaleable and comes in a multitude of forms, all using the same principle and adapting it to the capacity requirements and purpose of the stove.

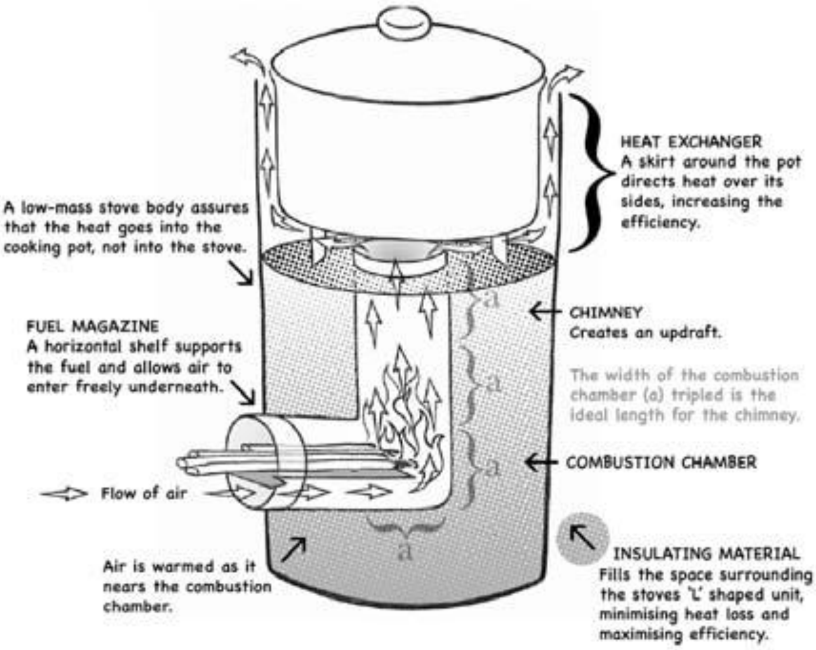


**Figure 5 – Rocket Stove** (Source: Accessing Carbon Markets for Improved Stoves, GIZ)

The principle of the rocket stove, as shown above, is a narrow combustion chamber in the form of an elbow which sucks in air at the bottom, heats it, and as it is heated, it rises up out of the top of the chamber directly onto the pot. If a “pot skirt” is used, the heat can be made to also go up the sides of the pot, further increasing the rate of heat transferral. The woodfuel is placed on a shelf at the base of the stove, using only the ends of the wood making fuel consumption more economical. This principle is applied in various different models.

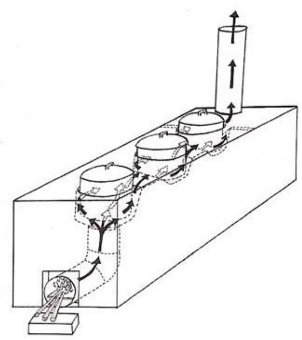

**Figure 6 - Rocket Lorena Stove**

The ***Rocket Lorena*** is a domestic clay-based, wood-fired stove which can be made to take more than one pot (Figure 6). The benefits of the model are that all smoke is expelled out of the indoor area through the chimney; it also cooks efficiently, cutting down fuel consumption. The Rocket Lorena can also be fuelled using briquettes made from animal dung. The ***Jiko Janja*** is similarly designed but constructed using brick and cement.

The rocket stoves in Figure 7 can be made simply from a 5 litre metal can and used for domestic purposes, or can be elaborated as shown in Figure 8 for institutional purposes.

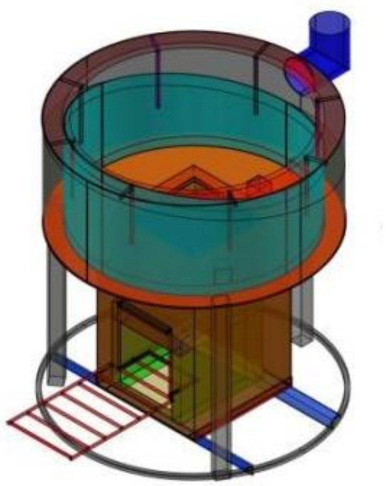

Figure 7 - Rocket Stove

Naturally, the investment costs increase the greater the complexity but, according to the Ugandan Ministry of Energy and Mineral Development, the payback period for the design in Figure 9 can be as short as half a year due to the dramatic reduction in woodfuel consumption.[13]

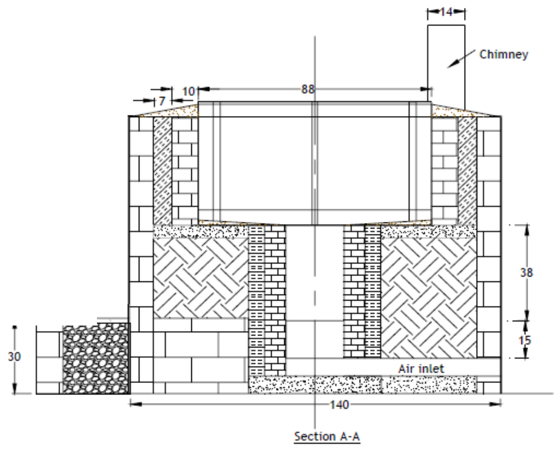


Figure 8 – Fixed Institutional Rocket Stove

13 http://www.rocketstove.org/

## Modalities of Production within the ACP-EU Energy Facility

Figure 9 - Somalia Energy and Livelihoods Project – Ceramic Jikos produced by Women's Group

The modality of production is dependent on the nature of the target beneficiaries. Broadly, the stove projects are focused on rural areas and production is left to women groups who are self-managing. Activities are focused on village communities, with production taking place either at the producers' home or on designated grounds with basic firing and storage structures.

Community involvement is encouraged in most cases. Several projects used the local traditional and government authorities to support the impetus to switch to improved stoves.

Figure 10 – PAMENU, Uganda – Preparing Domestic Charcoal Stoves

Figure 11 - Somalia Energy and Livelihoods Project – Metallic Rocket Stove

In the case of the PAMENU project in Uganda, the metallic charcoal stoves and SME Baking Ovens are produced by private enterprises. The process has been completely commercialised. These stoves are supplied to mainly urban and peri-urban areas.

Figure 12 - PAMENU, Uganda - SME Baking Ovens

## The Cost of Stoves

The cost of stoves across the projects funded under the ACP-EU Energy Facility differs dramatically. Different models of stoves are produced requiring differing amounts of raw materials and labour. The table below provides a summary of the stoves produced by specific projects and the selling price.

| Stove Type | Ave. Cost/ Unit (EUR) | Ave. Selling Price/ Unit (EUR) |
|---|---|---|
| **Ceramic Jiko** | 0.70 - 2.81 | 1.41 - 8.08 |
| **Domestic Rocket (Wood)** | 0.53 - 1.06 | 0.59 - 1.76 |
| **Domestic Rocket (Charcoal)** | 2.36 | 4.42 |
| **Institutional Rocket** | 883 | 1,045 |
| **SME Rocket** | 3,533 | 3,827 |

**Table 3 – Average Costs and Prices of Stove Models**[14]

Naturally, the lower the profit margin, the higher the turnover required to ensure that the business is sustainable; on the other hand, the lower the selling price, the more affordable the technology.

## Improved Stoves under the ACP-EU Energy Facility – Successes and Challenges

The introduction of improved stoves forms a component of a number of Energy Facility projects. The projects include complimentary activities, such as reforestation, and the introduction of renewable energy sources such as solar, wind and biogas. During the implementation of the stoves component, significant achievements have been made, but it has become clear that the simple solution is not without its challenges.

The projects have generally had positive experiences of introducing improved stoves. At present, almost 248,171 stoves of various types (mostly ceramic jikos) have been sold through the Energy Facility projects and 10,900 producers have been trained. However, there are four fundamental **successes** which have played a significant role in these outputs:

I. For those projects that have opted for the domestic clay stoves, the **choice of technology** has focused on simple technologies taking into consideration the availability of raw materials, the capacity of the producers, low cost production and cultural acceptance of using clay.

II. Positive results have been attained where the project has **included the local authorities**, such as the local government or traditional leaders. Community acceptance has been greater and the use of forums for marketing of products has been encouraged, such as local trade fairs.

III. Marketing the products has required some innovation, specifically as the target market is poor. Appointing **promoters** as middle-men has alleviated the struggle of

[14] For which adequate data was provided

both producing and marketing the stoves. The stoves can then be sold wholesale to the promoters who add their commission for the retail market.

IV. 60% of the projects responded that stove production was a **viable business** for rural communities. Whilst turn over needs to be high for the domestic stoves, if the leadership exists within the community group, a profit can be made which makes a difference to individuals' income.

Despite this success, several challenges have been noted as affecting the efficiency and effectiveness of the projects related to the technology, the logistics, the producers and the market.

**Technology**:

a. The quality of the stoves is not always consistent, resulting in customers being dissatisfied with the product. Internal quality assurance can be encouraged but provided there is no sense of competition, there can be difficulties in regulating it.
b. The selected technologies have not been considered appropriate for several reasons. The first is that the capacity of producers may not be high enough to produce the more complex stoves which require construction skills. Secondly, the availability of raw materials is not always guaranteed, specifically in the case of the clay stoves which require significant amounts of water. In Rwanda, clay is under an environmental protection order making it a difficult material to obtain. Anthill soil is a preferred type of soil to use, but which may require some transportation to get access to.

**Logistics and Finance:**

a. It is necessary to have adequate production and storage facilities, specifically if the producers are selling their goods. Storage, drying and firing facilities need to be large enough to accommodate the required turnover. As drying is a time consuming process and can take from 1 week to 3 weeks, this limits the capacity of the producers. Not using specific premises for production requires that individuals produce in their homes, thereby allowing for an even lower turnover.
b. Capital investment is limited for the purchase of materials and facilities to boost production, specifically in the case of the more complex design of stove.
c. A significant enough production of stoves has been a challenge to achieve in some cases, thereby affecting the transition from the introduction of an income-generating activity to the development of a viable and sustainable business.
d. Transportation of the bulky and delicate stoves has proven to be a challenge and projects have provided their own vehicles to facilitate this. However, this is not sustainable.

**The Producers & the Market:**

a. Whilst it is recognized that the use of community groups made up primarily of women is a productive approach, it is suggested that their marketing skills may need to be enhanced. In addition, the community groups may not be very skilled in business management, thereby reducing their effectiveness.

b. As mentioned above, the capacity of some of the selected producers is not suited to the production of the types of stoves selected, which require a high level of technical skills to build.

c. The market is very challenging because they have very limited buying power, and have many competing priorities for sparse funds. In the case of a project in Uganda, they are used to receiving handouts as it is a post-war context.

## Lessons Learnt

Based on the challenges and successes mentioned above, there are some clear guidelines which could be followed in the implementation of improved stove projects. Primarily, the issues do not revolve around whether the technologies increase energy efficiency.

| Condition | Concept | Project applications |
|---|---|---|
| **Affordability** | The technology adopted should ensure that the stoves are affordable for the target market. | Although this may be an obvious statement, as mentioned by some projects, there is strong competition between priority expenses, such as food, education, transport, etc. The more complex the technology, the less affordable it is for the poorest strata. |
| **Appropriateness of Technology** | The technology selected needs to fill market needs but should take into consideration whether it can be delivered in the quantity and of the quality necessary. | There are several issues to take into consideration when deciding on a suitable technology in terms of efficiency, price and versatility. This should be combined with: the capacity of producers, a study of the availability of natural resources to support production (mapping of clay deposits and availability of recyclable materials), whether any additional structures or equipment are needed (such as shelter for the stove), laws which may affect use of raw materials or land, whether adequate storage facilities can be established to ensure sufficient turnover.<br><br>In order to address the variance between the capacity of community groups making domestic stoves and the type of stove design selected, the use of traditional or local techniques should be employed where possible.<br><br>Quality assurance mechanisms, such as benchmarking between projects or an internally regulated system, should be incorporated into project design to ensure consistency of standards. |

| Condition | Concept | Project applications |
|---|---|---|
| **Participation** | Local government and traditional authorities are encouraged to support projects and lead by example. | The inclusion of local authorities has greatly supported the projects where this has been encouraged. Where possible, traditional leaders should play a role in convincing the communities to adopt the technology. Where local government objectives are aligned the project, involvement and support may be easier to attain. |
| **Capacity Building** | Capacity building should not be restricted to the production of stoves but also to the business management and marketing. | It seems that the development of cooperatives or recognised groups who are self-governing contributes to the sense of ownership and responsibility. This should be further enhanced by assisting in providing financial and operational management training (dealing with topics such as reinvestment of capital and purchasing assets as well as production capacity and targeted turnover) in the simplest terms. |
| | The capacity building of producers requires both the relevance of the technology and the quality of the training provided to be considered. | The selection of producers and technology need to be addressed simultaneously. Where more technically demanding technologies are used, it is essential to consider the capacity of the producers to learn the techniques required. If necessary, a basic understanding of the technology could be a prerequisite, such as in the case of electrical installation.<br><br>This should be further supported by providing suitably qualified trainers to undertake the capacity building activities. |
| **The Market Approach** | What began as a community development initiative has expanded to become enterprise development. The project should be treated as such and consider the commercialisation of the process. | In commercialising the process and recognising that there is a supply chain which has limitations, action can be taken to remove the current barriers. This includes establishing mechanisms for product marketing and distribution, using such innovations as having "promoters" from different villages who buy stoves wholesale.<br><br>Marketing tools which are appropriate to the target group should be considered when promoting the stoves. Examples of successful, cost-efficient devices have included encouraging existing customers to recommend the product and suggesting to women good sales arguments to convince their husbands to purchase one. |

## Project Feedback

The table below provides some excerpts from the projects who are implementing improved stoves projects.

| |
|---|
| ***Best Ray (Bringing Energy Services to Tanzanian Rural Areas), Tanzania***<br>***Type of stove: Jiko Janja***<br>***Stoves sold***: *220*<br>***Price per stove:*** *€35-42*<br>***Contract Number:*** *2007/195-964*<br>***Link:*** *http://www.energyfacilitymonitoring.eu/index.php/index.php?option=com_acpeu_contacts&id=38*<br>***Contact:*** *Rossella Rossi, info@istituto-oikos.org*<br><br>"This reveals that by using janja stove the user is able to save one to two bundles of firewood each week" (out of three to four)<br><br>"This indicates that the user of janja stove is able to save at least Tshs 2,000 per week" (out of Tshs 3,000)<br><br>"..the project was not so able to make the woman cooperative able to manage different technologies at the same time with the same quality level"<br><br>"To be successful, it is necessary to diversify the offer of stoves to meet the beneficiary requirements in term of efficiency, price, and versatility. Within the same project area you may find very different tribes …with different habits and cultural behavior, and within a tribe you may find a complex social structure" |
| ***Community assisted Access Sustainable Energy in Rwanda (CASE), Rwanda***<br>***Type of stove: Rocket Stoves***<br>***Stoves sold:*** *22,000*<br>***Price per stove:*** *€1.40-2.11*<br>***Contract Number:*** *2007/195-975*<br>***Link:*** *http://www.energyfacilitymonitoring.eu/index.php/index.php?option=com_acpeu_contacts&id=70*<br>***Contact:*** *Angelika Scherzer, angelika.scherzer@care.at*<br><br>"The Project registered an exceptional support from local government as stove dissemination was in their plans. They perceived the project as their own project and provided all the support required."<br><br>"Testimonies of stove users confirm reduction of biomass used comparing to 3 stones traditionally used in Rwandese rural households."<br><br>"Business around stoves in rural areas of Rwanda is difficult; because of poverty people have other priorities and need an intense behaviors communication. The solution for seeing people using stoves had been to let people contribute raw material and pay a little money for labor/making."<br><br>"Clay… is sometimes restricted to be extracted due to environment protection measures." |

***Msamala Sustainable Energy Project***
***Type of stoves: Ceramic Jiko***
***Stoves sold:*** *9,013*
***Price per stove:*** *€1.41*
***Contract Number:*** *9 2007/196-002*
***Link:*** *http://www.energyfacilitymonitoring.eu/index.php/index.php?option=com_acpeu_contacts&id=62*
***Contact:*** *Robin Todd, robin.todd@concern-universal.org*

"There has been overwhelming support from the local leadership in community mobilisation and awareness campaigns. This has translated into community buy-in and increased adoption of the energy efficient stoves (9,013 stoves adopted by 31st December 2010)."

"The marketing model employed by the project is that there are stove production groups which act as local cottage industries. These production groups sell the clay ceramic stoves to promoters within the community and this accelerates adoption. The set up ensures continuous production and marketing of the stoves."

"The production period takes about 7 weeks before the stove can be sold, which limits continuous flow of income to production groups."

"The stove is bulky (about 10 kg) which poses transport challenges from production groups to the ultimate users."

***PAMENU, Uganda***
***Type of stoves: Ceramic Jiko and Rocket Stoves***
***Stoves sold:*** *189, 466 households*
*177 social institutions*
*45 SMEs*
***Price per stove:*** *€0.59 – 3,827*
***Contract Number:*** *2007/195-984*
***Link:*** *http://www.energyfacilitymonitoring.eu/index.php/index.php?option=com_acpeu_contacts&id=20*
***Contact:*** *David Otieno, david.otieno@giz.de*

"Institutions and SMEs that adopted the stoves and ovens reported high financial savings and the use of the oven reduced dependence on electricity for baking.  70-90 % woodfuel savings"

"The programme facilitated creation of jobs to the youth and women"

"Scarcity of some raw materials; in the northern region unlike other parts of Uganda, sticky soils (Apac district has sandy soils not suitable for stoves) and banana stems were difficult to find"

"Generally most of the rural households lack permanent kitchens which are necessary to accommodate and protect stoves"

***Somalia Energy & Livelihoods Project***
***Type of stoves: Ceramic Jiko***
***Stoves sold:*** *27,250*
***Price per stove:*** *€5.62-10.54*
***Contract Number:*** *2007/195-974*
***Link:*** *http://www.energyfacilitymonitoring.eu/index.php/index.php?option=com_acpeu_contacts&id=23*
***Contact:*** *Joel Echevarria, j.echevarria@adrasom.org*

"Stoves as a viable means of livelihoods - The cookstove business has proven to be a viable means of livelihood, and majority of the groups have continued to re-invest funds received from the sale of stoves into the production of more stoves, which is an indicator that the business can be self sustaining"

"Local retailers are willing to stock the stoves in their shops and market stalls, and have confirmed that the stoves are a good product which moves fast. The advantage of the charcoal cook stoves compared with the traditional metal cook stove is principally in terms of energy efficiency with 20-50% reduction in charcoal use depending on the use and cooking practices"

"At marketing and end user levels, producers, who also double as marketers, have not been able to meet the growing demand for stoves. There is high demand for stoves, currently estimated at 700,000 household stoves. This demand will not be fulfilled under the current rate of production of around 1200 stoves per month"

"Quality control is a challenge, as there is no proper system for certifying quality in goods produced locally"

## What are the Developments Affecting the Implementation of Improved Stoves Projects?

There are currently a multitude of innovations which are taking place in a sector which recognises the urgency of the need for action. This section describes five approaches:

**Addressing Supply as well as Demand**

1. Increasing sustainability of supply of woodfuel
2. Producing charcoal more efficiently

**New Stove Innovations**

3. Gasification technologies

**Combining Interventions**

4. Combining health initiatives with energy initiatives

**Commercial Sustainability**

5. Accessing the Carbon Markets

**Approach 1:** Many projects combine the reduction of demand with an increase of supply, thereby encouraging the same communities who are producing improved stoves to undertake reforestation and sustainable woodland management activities. The principle behind this is that a great deal of energy is expended in swimming against the tide or attempting to reverse it. The practice of logging and creating charcoal is going to continue as there is no tenable alternative. Several projects have adopted an integrated approach and have assisted villages in mapping forest areas, reforesting, introducing by-laws and establishing forest management bodies who oversee the concessions to log and maintenance of the forest. This is often done with the full support of the district authorities and the Forestry Department, as it is usually aligned to their plans. One key aspect to this is ensuring that land and tree tenure is secure and not subject to unpredictable change.

**Approach 2:** The charcoal statistics in Table 4 below illustrate that charcoal production is a valuable contributor to the economy in Kenya, Malawi, Mozambique, Tanzania and Zambia. As charcoal production is a key source of income and provides significant support to the domestic economy in some countries, reducing unemployment, it is debatable as to whether the approach adopted should be to stem the production or to make it more sustainable[15].

| | Amount of charcoal produced (t) | Value Million EUR/ year | Charcoal producers* | People involved in the charcoal trade* |
|---|---|---|---|---|
| ***Country*** | | | | |
| **Kenya** | 1,600,000 | 289 | 200,000 | 500,000 |
| **Malawi** | 231,177 | 30 | 46,500 | 46,300 |
| ***Urban areas*** | | | | |
| **Maputo** | 130,000 | 9 | 20,000 | 20,350 |
| **Dar es Salaam** | 440,000 | 32 | 54,000 | 71,200 |
| **Lusaka** | 250,000 | 18 | 37,000 | 40,700 |

*By including the dependents in each household, the amount of people being supported by the charcoal business can be at least quadrupled

**Table 4 - Charcoal Statistics for Kenya, Malawi, Mozambique, Tanzania and Zambia (2010)**
*(Source: Wood Energy Talking Points, GIZ. Value amounts have been converted from USD to EUR using an average rate for 2010 of 1.38586)*

In an attempt to enhance the sustainability of charcoal production, there are a number of projects which aim to produce charcoal more efficiently or by using agricultural by-products. One such approach has been implemented by GERES in Cambodia. The Yoshimura Kiln developed in Japan produces a higher quantity of charcoal in half the time, using 30% less wood[16]. In addition, a charcoal by-product (wood vinegar) is being used as fertilizer, pesticide or compost catalyst.

The Developing Energy Enterprises Project East Africa (DEEP EA), supported by the ACP-EU Energy Facility, are producing briquettes from charcoal dust, saw dust, bagasse, coffee husks, maize cobs and wheat/ beans/ barley straw. There are several factors which are taken into consideration when defining the "recipe" for the briquettes, such as burning time, calorific value, ash content and smoke levels. Carbonisation of the raw materials prior to compacting can result in an almost smokeless fuel. Using agricultural waste products and charcoal dust reduces provides an effective solution.

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[15] http://www.gtz.de/de/dokumente/gtz2010-en-wood-energy-talking-points.pdf

[16] http://www.geres-cambodia.org/pdf/Project%20Sheet-Green%20Charcoal.pdf

**Approach 3:** The use of "gasification technologies" to produce a much *cleaner* (environmentally) and more efficient cooking stove is a relatively new concept. GIZ (former GTZ) are very active in investigating the potential for the use of gasifier stoves. Using a micro-gasifier, solid biomass is converted into wood gas which burns when mixed with oxygen and ignited. If the amount of heat and oxygen is optimum, only carbon dioxide and water vapour is expelled and biochar remains at the base of the stove which can be used for other purposes or as fertilizer. Figure 13 below illustrates the principle behind the design[17].

Hedon (Household Energy Network) has designed a model which is as efficient as an electric or gas cooker with the introduction of a forced draught using a 3W blower (inverted down-draught gasifier). This can be used indoors, without the need for a chimney and without any odour of burning wood. It can be made from simple materials (e.g. metal cans) and the draught can be powered by bellows, solar PV or an up-draught generator[18].

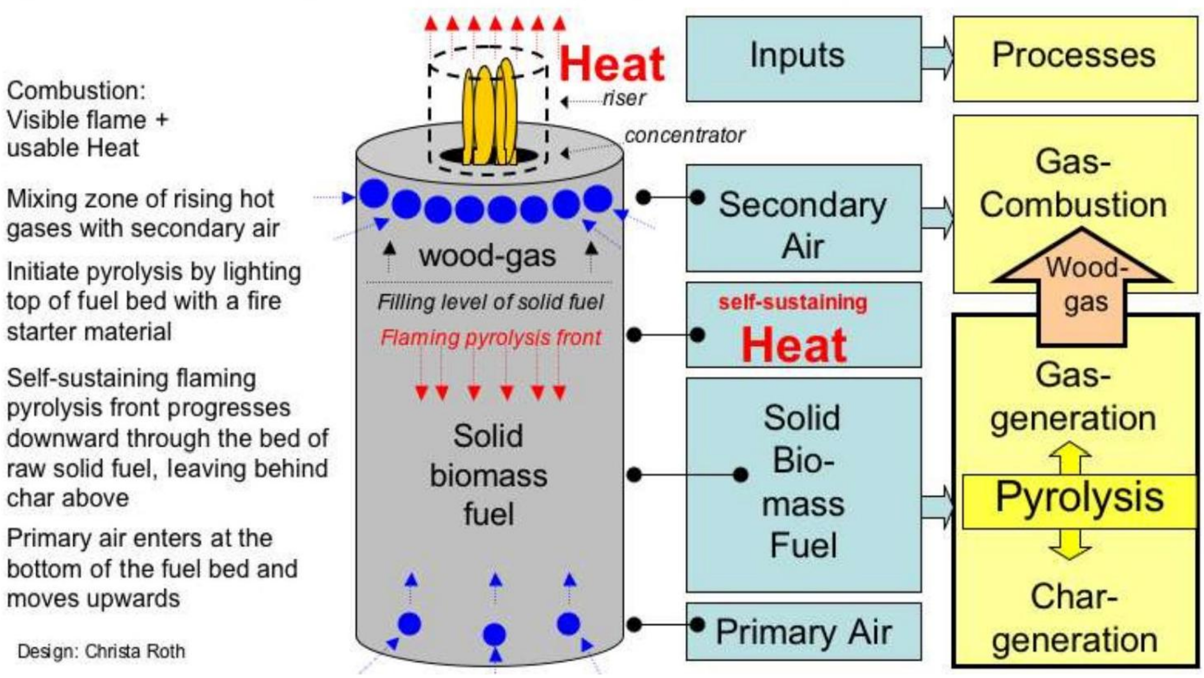


**Figure 13 - Design of a Top-Lit Up-Draft Microgasifier** (Source: Hedon)

**Approach 4:** The World Health Organisation (WHO) has taken a novel approach to combating two key health issues in Africa: the effects of indoor pollution and unsafe drinking water. The pilot was undertaken in Cameroon and Kenya and involved the promotion of the use of improved stoves with water treatment practices in an integrated household intervention. The key results of an evaluation of the approach undertaken at the end of 2009 were:

- Acceptance by beneficiaries
- Consolidation of inputs and increased efficiency for implementers
- Time saved on the part of target population as well as a more holistic understanding of health issues

[17] http://www.gtz.de/de/dokumente/giz2011-en-micro-gasification.pdf

[18] http://www.hedon.info/TheTurboWood-gasStove?bl=y

- The use of community health professionals helped bridge the divide between the project and the beneficiaries as they were known and trusted
- There are different motivation factors which affect behavior change in terms of the use of an improved stove and healthy water treatment and storage. However, the two concepts were grouped under the theme of "the kitchen" which worked well. In fact, there was some evidence that the approach was more effective when combined[19].

**Approach 5:** The final approach mentioned here is to make the business more sustainable by attaining a secondary income. Cooking stove technology is recognised a viable commodity on the global carbon market. Under the Clean Development Mechanism (CDM) and the Gold Standard (GS), a methodology for micro-scale projects based on improved cooking stoves has been developed and published. GS is a non-profit organisation that established a quality benchmark which certifies that the carbon credits gained from the reduction of greenhouse gases for the compliance and voluntary offset markets. Once certification is achieved, the GS logo and brand name can be used when marketing carbon credits.

There is a great deal of motivation and incentive to access this untapped income. There are currently 37 improved stove projects across 13 African countries in the GS database, 4 of which have had the certificate issued and 8 which are registered.

There are however strict monitoring requirements, which require skilled personnel to provide assistance, making it potentially costly at the outset. The first certificate which can then be sold on the carbon market takes approximately two years to achieve. A guide to the process to be completed has been developed by GIZ and can be found at:
http://www.gtz.de/de/dokumente/giz2011-en-carbon-markets-for-improved-stoves.pdf

Further to international experts, an increasing number of local or regional organisations are now able to provide the support required. An example of this is the Uganda Carbon Bureau, which has taken great strides towards supporting companies and projects interested in carbon trading across East Africa, providing technical assistance to get projects registered for carbon trading and facilitating the process.

The boxes below provide examples of improved stoves project for the carbon market.

[19] http://www.who.int/household_water/resources/HWTSIndoorAirV3.pdf

**Case 1: Thailand**

A 'greenhouse gas stove project' would differ from a conventional one in that the criterion for success would be the reduction in a known quantity of greenhouse gases.

For example: in Thailand, the Department of Energy Development and Promotion wishes to introduce five million improved stoves, but does not have the funding to do so. The stove project would consist of the following activities:

- Emission data would be established for traditional and improved stoves.
- A 'baseline' study would be implemented showing current stove use in the region.
- Stove producers would be compensated for the extra costs of producing the improved stove (€1.8 per stove extra) on the understanding that they charged the traditional stove price. The agreement would also require the manufacturers to cease production of the traditional type.
- During start up production and marketing, records and regular checks would be made by project experts for stove quality.
- During the 'payback' period where the stoves need to be used; this could be ascertained by the project team. A realistic figure should be set for improved stoves to be still in use after two years - say 75%.

**Conclusion**

A stove programme of this sort would cost about 2.37 million EUR and take about five years to complete. This estimate of costs includes expertise, training, travel and publication campaigns. It would result in about 1 million stoves being introduced into NE Thailand, with consequent emission reductions of about 2.25 million tonnes of $CO_2$, at a cost of 1.1 EUR/tonne $CO_2$ prevented.

Source: Extract from http://www.hedon.info/CarbonTrading-ANewRouteToFundingImprovedStoveProgrammes

**Case 2: Ghana**

E+ Co, a US-based “non-profit impact investor” invested $270,000 in the production of the Toyola stove, a Ghanaian version of the Jiko. Toyola Energy Limited went through the two-year registration process, costing almost $200,000, and attained GS certification.

The process included surveying 125 typical users, and conducting independent "kitchen performance tests" to precisely measure how fuel use changed once a household started using a Toyola stove. A climate change auditor licensed by the United Nations was required to do a sample to verify E+Co's findings. Independent annual audits are done to verify stove sales and the carbon credits. Each stove has an identification number to trace when it was produced and sold.

Toyola thus far has received revenues from the sale of 51,230 tons of carbon credits for stove use between August 31, 2007 and September 8, 2009. That's roughly equivalent to the carbon dioxide emissions of 10,000 Toyota Camrys, driven 19,300 kilometres each.

Goldman Sachs bought the credits estimated to be approximately $20 per stove, over its estimated five-year life span. The stoves sold in previous years continue to accumulate credits as long as they are still in operation. There is however a lag in getting the carbon financing.

Source: http://news.nationalgeographic.com/news/energy/2011/02/110215-cookstoves-sustainable-development-ghana/

## Useful Links

**Aprovecho Research Centre,** http://www.aprovecho.org/lab/pubs/arcpubs

**EU/ SFE/ GIZ, Stove Images,** http://www.gtz.de/de/dokumente/en-stove-images1-1995.pdf

**GIZ, Manual for building a Jika,** http://www.gaia-movement.org/documents/Manual%205e%20%20Simple%20Stove%20Jika.PDF

**GIZ, Accessing carbon markets for improved stoves**, http://www.gtz.de/de/dokumente/giz2011-en-carbon-markets-for-improved-stoves.pdf

**The Gold Standard,** https://gs1.apx.com/mymodule/mypage.asp

**HEDON**, http://www.hedon.info/TheTurboWood-gasStove?bl=y

**HERA**, http://www.gtz.de/de/dokumente/gtz2010-en-models-energy-saving-stoves-HERA.pdf

**HERA, Africa's Green Future**, http://www.youtube.com/watch?v=UMPaTPjvAy0

**Rocketstove.org**, http://www.rocketstove.org/index.php?option=com_frontpage&Itemid=1

**Uganda Carbon Bureau**, http://www.ugandacarbon.org/services/information-and-publications

**UN,** Global Alliance for Clean Cookstoves, http://cleancookstoves.org/

**WHO**, http://www.who.int/household_water/resources/HWTSIndoorAirV3.pdf

**Thematic Fiche No. 4.** "Improved Stoves as a Means to Increase Efficient Use of Energy"

**European Union Energy Initiative (EUEI)**
http://www.euei.net

**ACP-EU Energy Facility**
http://ec.europa.eu/europeaid/energy-facility
E-mail: EuropeAid-Energy-facility@ec.europa.eu

**Monitoring of the ACP-EU Energy Facility - 1st Call for Proposals**
http://www.energyfacilitymonitoring.eu
E-mail : acp_eu_energy_facility@danishmanagement.dk



Technical assistance by
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