UPS 5: Using Improved Firewood Cooking Stoves and its Implica tions for rural livelihoods in Tanzania

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Key Objective **The objectives of establishing this technology is to reduce the demand for fuelwood, improve the economy of rural citizens, and ensure environmental sustainability.**

FVC component(s); key constraints addressed

This UPS focuses on the natural resources and energy supply. The key constraints addressed are forest degradation and deforestation to supply wood fuel, high reliance on wood fuel (fuel wood & charcoal) as the main source of energy.

Description

The Improved Cooking Stoves (ICS) improves the utilization methods of fuel-wood aiming at achieving higher cooking efficiency, improved health via reduced smoke, and time savings for women. Different types have been explored in field trials. An ICS was chosen as most advantageous for rural areas. The ICS were manufactured by experienced trainers within the village. Materials used (clay, iron and bricks) as well as the design and functionality are still being improved and adapted, thus "improving the improved stoves."

Construction training: Three to 8 individuals from each sub-villages were trained on how to construct stoves, prepare firewood (storage and drying), and how to provide the service of stove construction to other households. The training of trainer concept was established to share, disseminate, and sustain knowledge among the village households. In Tanzania, like many other sub-Saharan countries, communities use traditional cooking stoves for cooking and heating (Eleri and Eleri, 2009; Belward, 2011). Traditional stove cooking technology has adverse affects not just on the citizen's health, livelihoods, and local environment, but also on climate change via the excessive burning of biomass. The use of improved firewood cooking stoves will contribute much to the economic wellbeing of the community, by reducing firewood consumption, thus reducing time spent on firewood collection and cooking, while also reducing pollution emissions (Lusambo, 2009).

Proven success of UPS in and beyond the study area in Tanzania

Table 1: Number of ICS stoves in CCS villages and implementation status between January of 2015 and 2016.

Village name	ICS group members	Adopters	Total
Ilolo	25	38	63
Idifu	23	80	103
Changarawe	35	0	35
Ilakala	15	17	32
Total	98	135	233

Proven success in TZ and beyond

TaTEDO Centre for Sustainable Modern Energy Expertise has more than twenty years' experience in sustainable energy development projects in rural areas. The ICS success was proven in four selected villages of Kilosa and Chamwino in Tanzania. In Kenya the Energizing Development Kenya Country Programme has improved the health situation of women and children with modern cooking devices in comparison to an open fire reducing emissions up to 70% (Bollen and Brink, 2012).

ICS technology has also helped reduce poverty among both the users and producers: Time and money are especially saved during cooking, while income generation benefits stove producers, builders, and vendors (Schilmann, et al., (2011). The preliminary results of an on-going study in the Kilosa and Chamwino districts, Tanzania, under Trans–SEC, show that ICS is successfully saving time by about 65%, reducing emissions by about 68%, and reducing firewood consumption by about 52%. The improved stove technology is being proven as economically viable in the communities where it is being tested.

In addition, Kirk R. Smith, et al., (2000) and (Adrianzen, 2010) find that ICS technology reduces firewood consumption by 40% and 61%, respectively, which also results in improved environmental conservation because less fuelwood is needed for cooking and heating.

Results from Trans-SEC

The specific test on firewood consumption revealed that ICS technology consumes 67% less firewood than the traditional stove (Figures 1 & 2). These findings are similar to those of Adkins et al. (2010), which showed fuelwood savings of 46%.

Measurements of the emission level of harmful gases and micro-dust particulate matter showed a reduction of produced CO and CO_2 of 65% (Figure 3). ICS is responsible for this improvement, which reduces the pollutants that cause respiratory related illness (Malinski, 2008). Accordingly the money saved could be directed to other expenses (Figure 4).

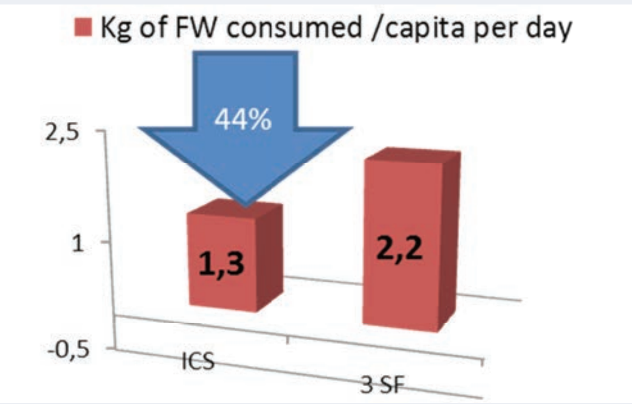

Figure 1: Kg of FW used per capita per day

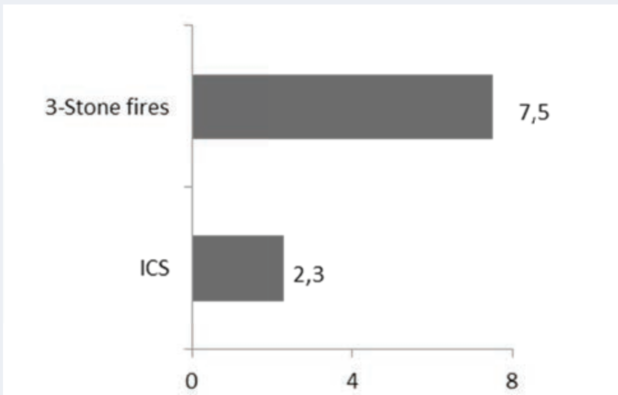

Figure 2: Kg of FW used per hr/ cooking

Figure: Results for firewood consumption derived from the monitoring activities by Trans-SEC UPS group members after ICS implementation versus traditional 3-stone-fire (3SF) users.

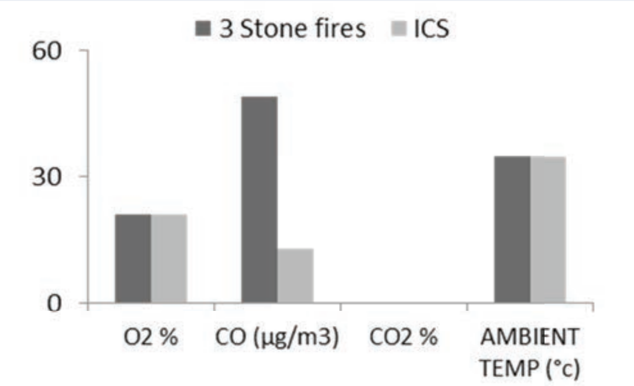

Figure 3: CO performance, 3 stone fires and Salama stove compared

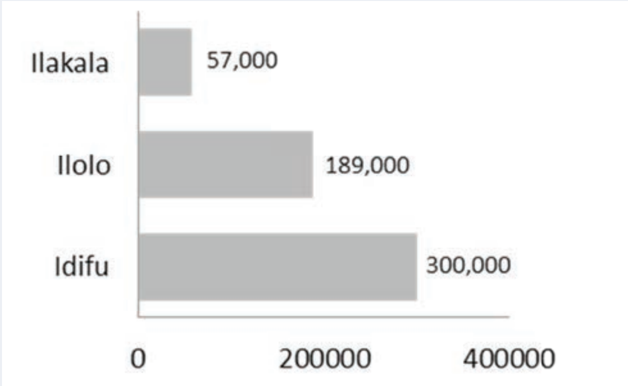

Figure 4: Income (Tshs) generated from ICS construction

The control cooking test showed significant improvement (at 95% level) in the specific fuel consumption of 34% and in the cooking time of 24% from the ICS compared to the traditional three stone fire. The results reveal that ICS technology results in more efficient firewood usage and cooking time than 3 stone fires.

Type of food crops applicable

All type of food crops to be cooked are applicable: UPS is not limited to specific crops or type of food.

Technical specifics, dimensions

These are designed for small scale household use with one, two, or three holes, which are constructed based on the size of the households to be served; there are also specific designs for large scale cooking stoves for commercial institutions (e.g. schools; breweries). ICS Stoves can be based on mud, mud bricks or a combination of mud bricks and cement. Material and sophistication depends on size, intended use, and costs.

Construction training: 2-3 individuals from sub-villages will be trained on constructing stoves and selling their services in stove construction to other households.

Possible limitations

Labour costs of the improved stoves, inadequate diffusion of knowledge on construction of improved cooking stoves, inclusion in existing buildings with exhaust system, that some materials for the stoves are difficult obtain, including clay soil, insulators (dried grass, rice husks/groundnut shells), and mud bricks.

It is crucial that the UPS is NOT only emphasizing the utilization of wood: technologies focusing on utilization of other biomass have to be preferred.

Linkage to other FVC components

Consumption, nutrition. Well-cooked food enhances human nutrition, unlike poorly cooked food, in which children may lose their appetite easily and/or suffer from malnutrition related diseases. The application of ICS technology helps reduce fuelwood usage, hence it is environmentally friendly as it will reduce the severe forest deforestation and encourage regeneration of remaining natural forests. This technology also reduces level of smoke that is emitted during the cooking/heating process, which results in the reduction of harmful gases that contribute to respiratory related diseases like TB, asthma, and eye itching.

Considerations & criteria for UPS outscaling

High demand and self-motivation of neighbouring villages/districts (existence of new champions that show interest in adopting the UPS) is crucial. The ICS technology reduces cooking time and firewood usage, thus providing extra time to the targeted community to perform other economic activities. Additionally, expenditures on firewood used for cooking/heating will be reduced. Health wise, the ICS are better than the 3 stone fires. It is important to make sure that the materials used in the construction of stove, such as loamy-sandy soil, insulation materials, and mud bricks, are widely available in order to minimize the costs of out scaling. Measures to monitor the success of the implementation are needed, e.g. the principle of weighting piles of firewood before changing from 3-SF to ICS usage to easily demonstrate the saving benefits for new adopters. Ensure that firewood shortage does not create pressure on the few remaining tree species. The distance to collection point contributes highly to time wastage. Communities must understand the consequences of spending time collecting firewood instead of performing other economic activities.

Key lessons learned

ICS technology is economically viable, socially acceptable, and environmentally friendly as it efficiently uses fire wood and reduces time consumption. It also highly reduces green house gases.

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