

Impact Report 2010

Extracts focusing on the Stoves Programme



Facilitating lasting improvement in people's lives"

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Assessment Team:

Mehretab Medhanie: Research Expert

Dr. Iyassu Ghebretatios: Head, National Agricultural Research Institute (NARI)

Dr. Semereab Habtetsion: Energy Expert, Ministry of Mines & Energy

Dr. Zemenfes Tsighe: Director, Bureau, IH Administration & International Linkage, National Board for Higher Education
Ghebremedhin Haile: MBA (Marketing), Business & Social Consultant
Ghirmai Mesgina: Msc (Economic Planning & Development), Planning & Budget Expert, MoF
Yohannes Fessha: MA (Economics), Lecturer, College of Social Sciences
Yosief Teweldemedhin: BA (Business Administration), Consultant

The Purpose of the Impact Assessment

The objectives of the impact assessment are to (i) guide Vita's direction and strategy in Eritrea, and ii) to demonstrate our accountability and transparency to donors and partners (including the community) regarding the impact of the work we have been doing on their behalf.

Vita has been active in Eritrea since the year 2000 implementing over 25 development projects worth £12,504,362 and reaching to over 80,000 beneficiaries in over 30 communities. Until recently, however, Vita has done very little to document the impact of its projects on the livelihoods and capacity of the communities. As part of Vita's endeavours to improve its Programme quality, it had identified this as a matter on which it would like to work further. Following the outcome from successive consultation workshops with partners and communities, followed by considerable field interactions, this document presents the results of the participatory impact assessment. Different tools are used, in the assessment, but it is primarily based on the approach of Most Significant Change (MSC).

Measuring the impact of various projects with distinct yet interrelated objectives is a complex and challenging process. However, to be credible as an organisation, Vita understands that it has to demonstrate the impacts of its projects. Today stakeholders, including funding organizations are increasingly demanding that organisations demonstrate, and are held accountable, that their programmes have "impacts". It is expected of every organisation that it is aware how the knowledge generated through impact assessment is used, at a minimum, and to do what it can to increase the likelihood that its programmes has an impact. This relatively new paradigm/ expectation to show results has-over the last decade- substantially changed the way in which projects are designed, implemented and assessed. While VITA has been always proud of the quality of its work and the role its projects played in improving the livelihoods of the ultimate beneficiaries, it initiated rigorous efforts to formalize impact assessment procedures during 2008/09. This was first highlighted in Vita Eritrea's 2008-2010 Strategic Plan which clearly demonstrated the need for such a system, not only to improve its internal management and priority setting process but also to ensure that its projects meet the needs of stakeholders (especially beneficiaries) donors, and other partners.

This report discusses the impact of Vita's projects in Eritrea, This is discussed through an in depth impact assessment of three interventions- "the promotion of fuel efficient

stoves for rural female headed households” which was mainly implemented in Anseba and Gash Barka regions; “development and capacity building of Fruits and Vegetables Producers association” which was implemented in the Debub and Anseba regions and “Women’s Enterprise Development and Nutrition” implemented in Gash Barka and Anseba regions”. Building on the current exercise, Vita will attempt to carry out a comprehensive impact assessment of the other projects in due course. While this is the very first exercise, the lessons learned will be incorporated in forthcoming impact assessments for the other projects. In the meantime though, a summary of Vita’s programme impact is provided to give the reader a broad understanding of what Vita have been doing in Eritrea since it first came to Eritrea in 2000.

What do we mean by impact?

For the purpose of this report Impact is defined as “the changes in the lives of people, as perceived by them and their partners at the time of assessment, plus sustainability-enhancing change in their environment to which the project(s) has contributed. Changes can be positive or negative, intended or unintended.”

We value impact as an integral part of our accountability and it forms one of the organisation’s five core values. By accountability we refer to both upward and downward accountability. On the one hand we strive to meet donors’ important needs to understand that tax payers’ money is being invested in meaningful activities, and have confidence that they are being used effectively and appropriately. This is often linked to learning about the efficacy of our interventions, with a view to informing future practice to all our partners.

On the other hand, we relentlessly work to ensure that all our activities are deeply rooted in local circumstances and are owned by local people themselves. We understand that we cannot ‘develop’ other people; and that development has to come from within. Hence we work to promote partnership with local organisations. We can build infrastructure and provide goods and services, but these do not contribute to lasting change if local people do not assume full ownership of the interventions. This relationship between Vita and its beneficiaries is widely seen as the foundation of effective interventions, with lasting impact on the lives of the people we strive to work with.

Impact assessment Framework and Approaches

Conceptual Basis

This assessment used the concepts of the sustainable livelihoods approach as the grounding of its work. This ensured that the assessment recognised the complex nature of livelihood activities undertaken by individuals within both a rural and urban setting. It also allowed for a focused discussion of programme impacts around the changes in beneficiaries’ assets and the wider policies, institutions and practices that affect the capacity of beneficiaries to achieve sustainable livelihoods.

Approach

To ensure that the impact assessment provided is of use to Vita and other interested parties it is essential for it to not only identify levels of impact but to also understand how and why this impact occurred. The assessment thus uses the “Most significant Change” approach within the conceptual basis of sustainable Livelihoods. In this regard this impact assessment covers the following key elements:

- The changes in the lives of the beneficiaries, their families and communities, intended or unintended - as they perceive them at the time of the assessment-to which Vita interventions have contributed, as well as the likely sustainability of changes.
- The extent to which the project objectives are consistent with the beneficiaries and their communities’ perceptions of their needs, potential and aspirations, as well as any changes in the social and economic environment.
- The extent to which major objectives were achieved or are expected to be

- achieved.
- Finally the probability of continued, long-term benefits from social and economic community development interventions is evaluated for its potential sustainability.

Other key features of this assessment are the emphasis on cross-checking multiple types of data (qualitative and quantitative, subjective and objective) and on assessing both local-level and higher-level (regional, national) influences on livelihoods.

Measuring Change

All definitions of impact involve the concept of change which can be positive or negative. Measuring this change is a challenging task with several levels of complexity. The current assessment has sought to measure change within a dynamic environment across a series of activities. This presented serious challenges to effective data collection with the extent and attribution of change being almost impossible to isolate.

This assessment has thus used an approach based on that of Participatory Impact assessments (PIAs)- which is quite similar to Concern Universal's 'Community First Impact Tool' (C-FIT). The PIA acknowledges local people, or program beneficiaries as experts and capable of identifying and measuring their own indicators of change. Through this approach the communities have been placed at the centre of the assessment and it is their perception of change and what has created it that is measured.

In this impact assessment, change is measured through the application of the "Most Significant change" tool and at times referring to the "Body of Evidence". The MSC "process provides a simple means of making sense of a large amount of complex information collected from many participants across a range of settings. Crucially, it does not presuppose any standard of literacy or numeracy."¹

Methodology

The impact assessment consisted of two main elements:

- A desk based review of program achievement- body of evidence
- A field based assessment of beneficiaries' status using both qualitative and quantitative techniques- Most significant change tool

The second of these two methods forms the majority of the assessment with the background desk based review being used to frame the context of the assessment as well as provide more in depth information on specific projects where applicable.

Scope and Coverage

Although Vita has implemented over 25 projects since it came to Eritrea in 2000, this impact assessment focused on three impact areas as defined in section 2.8 below (Impact Matrix). Three projects were taken to represent these impact areas following a series of staff brainstorming sessions. Given the country office context a project by project impact assessment of the 25 projects was not possible at present and the ToR focused specifically on three livelihood projects which were believed to represent the complexity of Vita's operational environment.

¹ Peter McEvoy; Notes on Most Significant Change (undated)

Impact area	Project Assessed	Year Implemented	Region
Improved household cooking efficiency	Fuel Wood Efficiency, and Forestry Nutrition Project	2006-2010	Anseba, Gash Barka
Improved income and livelihoods for FHH	Bakery, Hollow Blocks and Handcraft cooperatives	2004 for the bakery and hollow bricks 2006-2010 for the handcraft	Anseba, Gash Barka
Improved food security and sustainable livelihoods	Capacity building for FVPA and Introduction of Irrigation techniques	2005-2007	Anseba, Debub

Impact Matrix

This matrix summarises the impact of our work for the past 8 years. Overall, Vita enabled 80,000 people to improve their lives and shape their own futures during the years at a cost of £ 12,504,362.

Im pa cts	Improved food security and sustainable livelihoods	Improved Health and sanitation	Improved income and livelihoods for FHH	Improved delivery of Extension services	Improved household cooking efficiency
	(= numbers of people achieving these particular goals with Vita support)				
Th rou gh	Agricultural development, irrigation, nurturing natural resources, and enabling access to markets.	Access to safe water & sanitation, improved nutrition, & action on HIV and AIDS.	Empowerment of women, children and other vulnerable groups.	FAS strengthening and training to farmers	Fast track response to emergency needs of IDPs and refugees
Ou tco me s	12,000 people with improved crop and livestock yields	4,200 people with access to safe water	580 women whose incomes are improved	15 villages getting improved FAS extension services	12,000 people enabled to rebuild their lives post-disaster
	658 people no longer experiencing 'hungry months'	2,250 people with improved sanitation and hygiene	15,000 children experiencing good nutritional status	50 people adopting new technology	10,000 people enabled to safely make through the critical periods through cash for work
	1,974 people that have been able to engage in sustainable irrigation		20,000 women experiencing better health and cooking services		
Ou tpu ts	658 people trained in new agricultural techniques	07 water points provided or rehabilitated	1,160 participants in income generation	15,000 members of the FAS extension system selected	2,000 participants training
	3,120 kg of horticultural produce sold	450 people trained on sanitation and hygiene	200 advocacy and awareness events	110 FAS agents trained	15,900 recipients of emergency relief-including seeds and tools
	146 hectares irrigated	05 WATSAN committees established	6 number of businesses established for women	28,852 farmers in other training	1,800 recipients of reconstruction/rehabilitation support
	4.9 million trees planted of which 550,000 are Moringa seedlings	people enabled to access safe water	09 fuel efficient stoves provided to xxx women		30,000 participants in cash for work for transitional income

	85 ha of land treated with soil water conservation activities		19,500 women receive training in stove construction and food demonstration		
Inputs	£4,963,000	£1, 895,200	£4,298,400	£200,000	£1,147,762
	£12,504,362 total project expenditure since 2000				

Strategic Focus

The impact assessment has revealed that despite significant investments made so far the Eritrean society and especially the population in the target groups continue to suffer from lack of capacity to either use their resources adequately or mobilise required resources to embark on their further development. In the context of development and in line with the Government's strategic focus, Vita has learned that it has much to do in the areas of yield maximisation, access to markets, environment and water supply. The introduction of new technology, particularly irrigation technology, complemented with necessary training programmes stands out at the top of the development agenda.

Hence, Vitas food security strategy will have to be built on 6 Key Pillars which act as a focus to its work.

These are:

1. Crop Production
2. Livestock Production
3. Improving the Environmental context
4. Access to Markets
5. Access to Water
6. Access to Capital

FIELD BASED IMPACT ASSESSMENT RESULTS

Setting

This impact assessment was carried out between the months of March and April in four communities where RTI/Vita has been active for a long time. These months are among the critical drought periods in many of the project boundaries. Hence, assessment results might have been affected by the time context.

The assessment adopted CU's Community-First Impact Tool (C-FIT) based on the "Most Significant Change (MSC) technique, with certain adaptations. The assessment was led by RTI's standing consultant and the process of facilitating focus group discussions was done by Vita programme staff and MoA partner experts. In order to complement the qualitative results of the MSC technique additional structured interviews were also administered. Two types of questionnaires were administered for RTI beneficiaries and Non-beneficiaries for the structured interviews. The structured interviews were administered in 237 respondents (identified by MoA and RTI programme staff) out of which the 90 were non-beneficiary groups.

Six project areas were covered:

1. Adi Tekeliezan and Barentu for the Fuel Efficient stoves and Forestry Nutrition
2. Gizgiza and Haikota for the 'women income generation schemes'
3. Geza Keren, and Gadmai for the Irrigation schemes (Drip and Furrow) and strengthening of farmer associations

Participants were separated into groups comprising representative residents (women, elders, government employees, teachers, elders, young people and local leaders) and asked to discuss and prioritise the 'Most Significant Changes' in their lives in recent years, for each of the above mentioned domains. Often questions were formulated as 'What is the most significant change for you in your community in relation to [domain] in the last two years?' The community responses highlighted changes due to a range of factors, not just Vita's work, emphasising the importance of considering all development programmes in context.

Since all changes might not be ascribed to Vita's efforts the impact assessment subscribed a holistic participatory approach; one that considers the wider inputs and actions of other stakeholders and one that considers the impact of RTI programmes in context.

Fieldwork

The study was divided into a quantitative and qualitative component. These were structured in such a manner as to complement each other and with each using a combination of structured and semi-structured interview schedules. To familiarize the enumerators with the different sets of research instruments developed for both qualitative and quantitative research, the consultant conducted two-day training.

The field work was conducted in six villages which were covered by Vita's projects in different years.

Qualitative Assessment

The qualitative assessment consisted of focus group discussions, key informant interviews, case study interviews, participatory rural appraisals, and informal interviews. Respondents falling within the categories listed were requested by the assessment team. The respondents were then organised into groups of 10-15 and were made to be presented at appropriate locations upon the teams' arrival. These groups discussed the change witnessed due to the inputs of certain programme or project applying the approach of the Most Significant Change.

Essentially, the process involved the collection of significant change stories and the systematic selection of the most significant of these stories by panels of stakeholders. Once changes were captured, the group of people sat down together, read the stories aloud and discussed in detail the value of these reported changes. The process recognised the relative significance of 'externalities' (factors above and beyond the level of the project) which impinge on peoples' quality of life.

Quantitative Survey Samples

The quantitative assessment covered two categories of respondents namely: **Vita beneficiaries** and **Communities** (non-beneficiaries). Two sets of interview instruments were developed for the quantitative assessment, the first being modularized for the beneficiaries and the second for the community (non-beneficiaries). The structure of the beneficiary questionnaire was based upon "before project" and "after project" method in order to allow the analysis to reflect on any time-line changes.

In total, 147 beneficiary members and 90 non-beneficiary community members were interviewed to collect the quantitative information.

Economic Context of the Respondent Population

Almost all the participants identified the economic situation as having deteriorated over the past two years. This deterioration was blamed on a combination of factors:

- Poor harvests for the years 2008/2009 had made life difficult for many by decreasing household resources while causing an increase in the price of basic food stuffs.
- Increasing prices of imported and stable goods had put additional pressure on household expenditure.
- Increasing prices of traded goods and particularly imported goods, combined with poor harvests and thus a lack of demand had caused small businesses to struggle.
- The slowdown in business had also impacted on the number of jobs in the local economies reducing the capacity for individuals to gain wage labour to supplement subsistence agriculture.
- The large number of young, predominately male, community members in the army was seen to have reduced the available work force, and leaving female headed households that struggled to support themselves.

The severity of these problems varied by location, with some participants identifying the situation as being the worst that it had ever experienced.

Nevertheless the deteriorating economic situation has impacted on all of the society; within this context RTI beneficiaries confirmed relatively better economic transition than the non-beneficiaries. Over 28% of RTI project beneficiaries (typically of stoves, income generation, and irrigation) confirmed that their household economic status has seen improvement in the past two years as opposed to only 14% of the non-beneficiaries. On the flipside, 45% and 40% of the non-beneficiaries reported that their household economic status has either worsened or has seen no improvement in the past two years respectively see table 1.

Table 1 Improvement in economic status of households

Improvement in economic status of household in the past two years	Type of respondent					
	RTI beneficiaries		Non Beneficiaries		Total	
	Count	Col %	Count	Col%	Count	Col%
Improved	42	28.57%	13	14.44%	55	23.21%
Worsened	54	36.73%	41	45.56%	95	40.08%
No change	51	34.69%	36	40.00%	87	36.71%
Subtotal	147	100.00%	90	100.00%	237	100.00%

Despite the low performance of the national economy, many RTI beneficiaries, especially those engaged in irrigation and income generation, were seen to have done well over the last two years and the ‘irrigation’ and ‘income generation’ focus group participants confirmed that their economic situation has improved considerably relative to the wider communities. They attributed improvement in their economic status to the support available to them through various programmes – in particular those support received from the MoA and RTI. Moreover key informants identified RTI projects as having supported IDPs and refugees in rebuilding their financial assets and providing them with opportunities to re-engage in economic activities. This was seen as particularly true for female headed households whose opportunities were more limited and who often had a smaller financial base.

Social Context of the Respondent Population

Respondents noted that Eritrean society is still very strong and is based on a sense of community bond and support. This was supported by respondents providing evidence of both formal and informal structures for community cooperation. Participants within focus groups and PRAs also participated effectively across religious and economic lines with few indications of social divisions and/or exclusions.

When asked if the current economic and drought related difficulties were causing frictions within communities all responses were in the negative with many respondents identifying it as causing increased cooperation within communities. Some respondents did however confess that in times of severe shortage the most vulnerable suffered as households had nothing to give.

The impact assessment provided evidence of a number of schemes that had been developed at community level to support vulnerable community members. Income sharing schemes within the Cash for Work programme for soil and water conservation

were mentioned in each of the six assessment areas. In all these places a proportion of participants' pay from the soil and water conservation activities was deducted and redistributed to those unable to participate in the scheme. All respondent groups also identified localised support systems such as assistance in the ploughing of disabled people's fields and assistance with transport.

Vita's use of formal community structures were seen to be effective in managing the community development projects. Village administrations were credited with distributing information on programmes, managing their implementation including the identification of the vulnerable, and in the majority of cases initiating appropriate management structures to ensure the sustainability of programmes. VA's and programme committees were also seen to be made up of a range of community members with different groups such as the NUEW, Youth Groups and different religious leaders included in these decision making bodies. There were also seen to be a range of religious and community structures active to varying degrees within communities in the planning and execution of all RTI projects. In this regard Focus Group participants commended RTI as having strengthened existing community structures by investing in them through meetings, awareness raising campaigns and various training. Particularly important was the strengthening of income generation cooperatives and farmer association which are discussed in more detail both in their own sections.

With particular regard to IDP's and refugee communities, key informants confirmed that RTI projects were instrumental in facilitating the reintegration and rehabilitation of these vulnerable groups. Community representatives and key informants identified social reintegration of IDP's and refugees as having been facilitated by a strong sense of community, and family. Community members did not identify difficulties in hosting refugees and IDPs, were positive about their return, and the support they were provided by the RTI programmes.

Improved Stoves: household cooking efficiency

Overview

Improvement of household cooking efficiency is one of Vita's core values through which Vita strives to improve the quality of life for women and children. For this reason Vita has been implementing the Fuel Efficiency, Forestry Nutrition and Enterprise Development Project since 2006 in two regions of Eritrea (Gash Barka and Anseba regions). The project aims to empower communities and regional governments to reverse the trend of deforestation and to provide women with the means to enhance food security and livelihoods from their forestry resources. In essence the project aims to bring sustainable improvement in the nutritional and livelihood status of 85,000 women and households in the Anseba and Gash Barka regions of Eritrea through enhanced household and community management of forestry resources.

The main expected Results (R) of the project as reflected in the project document are:

R1: Decrease in unsustainable demand for fuel wood.

R2: Increase in household consumption of Moringa and nutritious forest products.

R3: Increase in household income from forestry products and enterprises.

R4: Development of local and regional forestry planning and management systems.



The project embraces three components i) fuel wood efficiency- with a target of providing 10,000 female headed households with the fuel efficient stoves, ii) forestry nutrition- with a target of reaching 70,000 household beneficiaries through provision of Moringa saplings and food demonstration training; and iii) enterprise development- with a target training of 5000 women.

This section of the assessment focuses on the first two components i.e. the fuel efficient stove, and forestry for nutrition. The impact of the enterprise development component is addressed along with other similar projects in order to have consistency and coherence of results.

As already indicated, the technique applied was the Most Significant Change, complemented with quantitative methodology and body of evidence. Participants discussed and prioritised the 'Most Significant Changes' in their lives in recent years as a result of the provision of the fuel efficient stoves and distribution of Moringa seedlings. The potential domains of impact were always raised by the facilitators to encourage discussions and brainstorming. The question was always 'What is the most significant change for you in your community in relation to [domain] in the last two years?' The community responses highlighted changes due to a range of factors, not just RTI's work, emphasising the importance of considering all development programmes in context.

Key Impact Results

As per the MoA reports, presently over 100,000 fuel efficient stoves² have been distributed nationwide through RTI's project and other partners, of which 12,177³ were distributed by the RTI project. As per an independent assessment of the EU's ROM mission (Results Oriented Monitoring Mission) most of the targets with respect to achieving the outputs in the two Zobas of Anseba and Gash Barka are met to a significant degree. The number of the fuel efficient (Adhanet) stoves installed has reached 12,177, already exceeding the target of 10,000 as of January 2010. Nearly 4 million Moringa seedlings have been raised in five MoA tree nurseries and distributed to beneficiary households, schools, health centres and other institutions, but indications are that at household level the survival rate is only about 30% because of insufficient awareness/commitment at the outset of the project. Only 20,000 women have received direct training on the use/cooking of Moringa and other nutritious forest products compared with the target of 70,000 women (these 20,000 are now being supported to train a further 40,000 women). "Green Clubs" have been established in 12 schools of the two regions, each with as many as 700 members.

Evidence through household surveys and interviews suggest emphatically that there has been a decrease (by as much as 70%) in the unsustainable household demand for firewood through the introduction of over 12,000 Adhanet stoves.⁴ Moreover, there has been substantial increase in household consumption of *Moringa* by direct beneficiaries when compared against the results of the baseline survey. About 59% of the beneficiaries reported that they eat *Moringa* at least twice a week as their daily meal compared against only 47% who were willing to eat *Moringa* leaves in 2007 when the baseline survey was conducted. However, the target of eating 20 grams of *Moringa* per day seems quite ambitious to be attained within the short-medium terms.

² Hadas Eritrea, Use of Alternative Energy sources on the rise in rural areas; Vol. 2009; May 1 2010.

³ Results Oriented Monitoring on the 'Fule wood Efficiency and Forestry Project' by an independent EU mission; January 2010

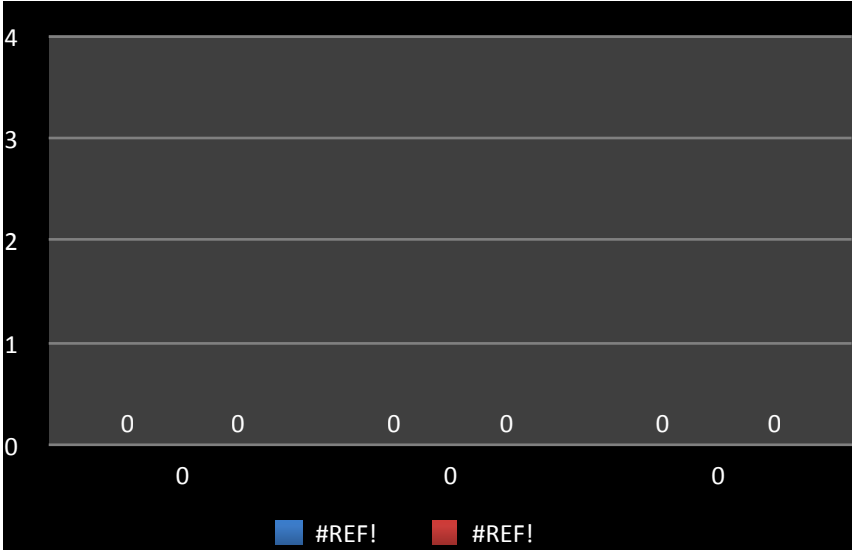
⁴ *Ibid-4*

There is a very high level of ownership of the intervention by the target communities, the local administration, the MoA and NUEW, because it is embedded in local structures. There is a strong national commitment to the fuel-efficient stove and there are clear indications that this will remain a policy priority in Eritrea. Early indications are that private investment in *Moringa* production will bolster local commitment to the product and make it more widely acceptable. Once there is a “demand” for *Moringa*, the MoA tree nurseries should become more sustainable as they can charge a nominal price for seedlings (as they currently do for citrus trees).

Improvements in health of households:

Nearly all households in rural Eritrea possess the simple home-manufactured oven and a *Mogogo* stove made of clay used for cooking the cereal dish *Injera*. The cultural attachments of the people with the *Mogogo* baking, of *Injera*, is so strong that people are not expected to get rid of it in the short term. Thus, dependence on biomass is expected to exist for the foreseeable future. One serious disadvantage is that the *Mogogo* consumes considerable quantities of firewood, estimated to be at least 50% of the biomass energy consumption per household per year.⁵ The stove is constructed mostly within the main house, although about 44% of the fuel efficient stove has now been able to have a separate kitchen (see Chart below). Due to the dense smoke in the kitchen and low level construction, children and women often suffer from respiratory and eye diseases.

Chart 1 Location of Stoves



Health impacts essentially include the changes in health related quality of life, including improvement in life expectancy associated with the intervention. According to various health studies, exposure to Indoor Air Pollution is associated with a number of respiratory diseases, in particular Acute Lower Respiratory Infection (ALRI), Chronic Obstructive Pulmonary Disease (COPD) and a weak link with lung cancer. However, health effects are not due to the smoke per se. The participants in the study have also identified incidences of burns and scalds from open fires and unsafe cooking

⁵ Ministry of Energy, Project Design Document for Eritrea Dissemination of Improved stoves Programme; 2003-01

arrangements. Moreover, women participants mentioned risks from carrying heavy loads and dangers from mines, snakebites and violence during fuel collection.



Reduction in diseases associated with Indoor Air Pollution

During the impact assessment the consultant has visited several households using either the traditional and/or fuel efficient stoves. In both of these dwelling units the consultant observed, black soot covering the walls of the dwellings. Perhaps, the fuel efficient stove is a new introduction to the rural communities and in most cases is built by demolition of the traditional stove. So the black soot signs still remain. Accumulation of the black soot holds a negative health effect to children and compromises the hygiene and sanitation of entire households.

During the impact assessment the participants emphatically noted that the most significant change of the fuel efficient stoves are improvement in their health. Participants mentioned the following health problems as being reduced when they started using the Adhanet stove: 'eye irritation' (*Saha Ayni*), 'drowsiness/difficulties waking-up early in the morning', headache/Migraine (*Merzen/Himam ri'esi*), 'emitting black mucus' (*Xelim N'gual*), respiratory problems during the night (*xegem mistinfas*) as well as 'irritating smell' (*Hmak Chena Nebsi*). It is believed that the high emission of smoke from the traditional stove and accumulation of extreme soot in dwellings is often the cause of such problems. This belief is shared by the local health experts where they confirmed that the incidence of acute lower respiratory infections (ALRI) in children younger than 5 years and chronic obstructive pulmonary disease (COPD) in women and men older than 30 years is lower in users of the fuel efficient stove; though they still need to have a proper recording of such incidences.

Moreover, discussions with key informant indicated pneumonia as being one of most important child killer in the rural areas. Infants are often carried on the mother's back while she is cooking, or kept close to the warm hearth in rural Eritrea. Consequently, they spend many hours breathing polluted air during their first year of life when their developing airways and their immature immune systems make them particularly vulnerable. Indoor smoke is one of the underlying causes and to blame for about one third of child deaths annually in each of the study areas (Haikota and Adi Tekelezan).

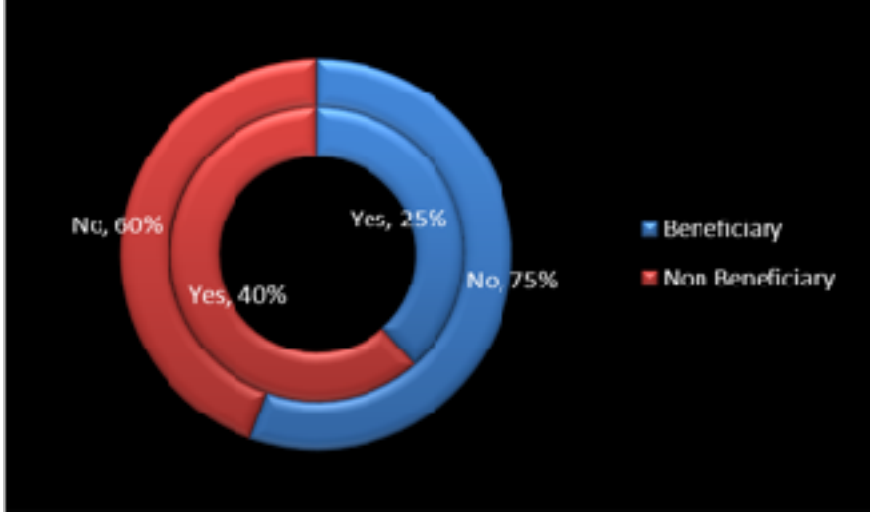
Yet one of the serious flaws of this impact assessment was the non-availability or total absence of health records classified by disease types for the different stove users. At the project management level there are very scant systematic monitoring records against which impact indicators can be measured. The log-frame in itself ambitiously drawn without adequate baseline is not that suitable for assessments at the level of impact. Under the circumstances the consultant has used proxy studies to substantiate the impact on “Reduction in diseases associated with Indoor Air Pollution”.

Although the types of the fuel efficient stoves might vary from country to country; the WHO has published the relative risk of different diseases among people exposed to indoor pollutants and those less exposed. For instance, the likelihood incidence of Chronic Obstructive Pulmonary Diseases among men aged 30 and above is twice higher for people exposed to indoor air pollution than those not exposed. According to the WHO, use of the fuel efficient stove might bring as much as about 35% reduction in personal exposure to ill health. Generally, the use of the fuel efficient stove relieves the household from the pollutants in the black soot, as well as many invisible pollutants in the air, that women and children breathe in for many hours every day. These fine particles (which the WHO estimates might have a diameter of up to 2.5 microns) are able to penetrate deep into the lungs and appear to have the greatest health-damaging potential. It is known that these particles can cause inflammation of the airways and lungs and impair the immune response. Yet the precise mechanism by which exposure to indoor air pollution translates into disease is still unknown. The study also confirmed that inhaling indoor smoke doubles the risk of pneumonia and other acute infections of the lower respiratory tract among children under age five. Women exposed to indoor smoke are three times more likely to suffer from chronic obstructive pulmonary disease (COPD), such as chronic bronchitis or emphysema, than women who cook with cleaner fuels.

There is also an interesting relationship between using the fuel efficient stove and the number of days someone has to stay home sick. The study has found out that users of Adhanet stoves reported less incidence of staying at home sick because of illness related to indoor pollutants (cooking or making fire). Although the majority of respondents reported that they have never stayed sick at home; a good percent of them (32.5%) did so. There is marked difference between users of the Adhanet stove and non-users, with about 40% of the non-users reporting that they did stay ill at home quite frequently in the past two years (see Chart 2).

Participants also agreed that the impact of improved health has a bearing on children's school attendance. Three school teachers represented from the three schools of each village confirmed that children who rather wear smoky smelling clothes feel the daily isolation from those who wear cleaner clothes.

Chart 2 stayed ill due to illness or burning related to the stove?



With about 67% efficiency if made properly, the fuel efficient stove which has been nicknamed as ‘Adhanet’ (Saviour) by the local people is now considered as a treasure in even the remote areas of the country. Moreover, the health impact of the improved stove is well established even by international standards. The Ministry of Energy estimates that it reduces indoor pollution by some 67%; hence, the proxy analysis will tell that those using adhanet are less likely to be exposed to such disease than those not using it.

Table 2 Relative Risk of Indoor Air pollution to different diseases

Health impact	Evidence ¹	Population	Relative risk ²	Relative risk (95% confidence interval) ³
Acute Infections of the lower respiratory tract	Strong	Children aged 0-4	2.3	1.9-2.7
Chronic Obstructive pulmonary disease	Strong	women aged ≥ 30yrs	3.2	2.3-4.8
	Moderate I	men aged ≥ 30yrs	1.8	1.0-3.2
Lung cancer	Moderate II	women aged ≥ 30yrs	1.5	1.0-2.1
Asthma	Moderate II	Children aged 5-14	1.6	1.0-2.5
	Moderate II	adults aged ≥ 15	1.2	1.0-1.5
Cataracts	Moderate II	adults aged ≥ 15	1.3	1.0-1.7
Tuberculosis	Moderate II	adults aged ≥ 15	1.5	1.0-2.4

1. Evidence
 - Strong Evidence: Many studies of solid/biomass fuel use in Developing Countries
 - Moderate I: strong evidence of specific age/sex groups
 - Moderate II: Limited Evidence

2. The relative risk indicates how many times more likely is the disease to occur in people exposed to air indoor pollution than those unexposed
3. The confidence interval represents an uncertainty range. Wide intervals indicate lower precision; narrow intervals indicate greater precision.

Impact on mitigating other health related risks

The burden of collecting fuel wood rests on women and young girls in most of the households interviewed (77%). Moreover, for closer to 63% the main source of wood is from the hilly mountains located at about 1.5 hours walking distance from their villages on average. A PRA exercise revealed that snake bites in the bushy mountains occurs especially during the early periods of the rainy season. A woman recalled of her son's death from a snake bite some eight years back. Women revealed the drudgery of suffering a backache from carrying heavy loads of wood which they have to do at least twice in a month (for about 57% of them). Incidentally, about 53% of the women admitted that they did suffer from backache in the past couple of years; they attribute it to excessive household responsibility including wood collection, fetching water and helping in the farmland.

Now the participants indicated that by using the *Adhanet Mogogo* they no more have to travel that far (the impact on time is treated separately in the sections to follow) as they can work with simple tree twigs and branch or farm residues which they get it around their homesteads. This alleviates the risk of diseases associated with wood collection. Good health is crucial as household livelihoods rely on the health of family members. Being ill or having to care for sick children reduces earnings and leads to additional expenses for health care and medication. Broken bones, backache and snake bites endured during fuel collection add to the problem. Although not confirmed during this impact assessment; stories from some villages provide sad testimony of girls and women being assaulted when they leave the relative safety of their homes to collect fuel.

Women are in charge of cooking in all the nine ethnic groups in Eritrea-both urban and rural. Day after day, and often throughout the course of a lifetime, they spend many hours in the vicinity of the fire or stove. The acrid smoke depositing soot in their lungs is responsible for ill health and death mainly due to COPD. National statistics is lacking but WHO reports indicate that the acrid smoke depositing soot accounts for 511 000 of the 1.3 million deaths due to COPD among women worldwide per year.⁶ In contrast, only 173 000 of a total of 1.4 million deaths from COPD among men are due to indoor smoke. Efficient household energy practices are of particular significance to the health of pregnant women: carrying heavy loads during fuel collection brings about prolapse during pregnancy, and exposure of the developing embryo to harmful pollutants leads to low birth weight as well as stillbirth.

Future Action Recommended

The health impact of the fuel efficient stove is well recognised by the people and the health personnel. Yet, RTI should have considered including a health education component with the project. Certainly, the involvement of the Ministry of Health seems quite low. In essence too, although observation and key informant discussions confirmed the health impact of the improved stove, a more detailed health study appears to be

⁶ Fuel for life, Household Energy and Health; the WHO, 2006

more appropriate to establish the exact extent of reduction in in-door air pollution by the stove and hence on the reduction in relative risks to the different diseases mentioned above. Perhaps the WHO model could be taken as a starting point to establish accurate cause and effect links of indoor pollution.

Impact on reduced expenditure

Two types of impact were identified as most significant within this domain; i) Reduced household expenditure due to improved health; and ii) reduced expenditure on purchase of wood and dung.

Impact on Reduced Health Expenditures

The impacts on health of changes in household energy practices are associated with changes in expenditures for preventive and curative (treatment) health care. This has also an impact at national levels since health expenditures in Eritrea is highly subsidised by the government. Hence, the cost of medicines and care-giving are reduced at the national health care systems as well. This was particularly mentioned by the health experts in each of the health facilities in the target areas. In addition to expenditure on health for patients, other economic impacts are associated with treatment- seeking, such as income loss or productive time loss. More indirectly, health expenditures – if they reduce mortality or disability – are associated with extended life expectancies.

Disease cases as a result of using the traditional stoves could not be easily retrieved from available health facilities; hence, estimation of the cost saving per case of diseases averted could not be done. Yet, the participants have indicated that health expenditures account for about 30% of their total household expenditure. However, it was not clear what percent of this is attributed to expenditures related to use of the traditional stove *per se*. On the flipside, more of the Adhanet users reported reduced health expenditures (30%) over the past two years compared to the traditional stove users (see table 3). General increase on health expenditures as reported by the respondents is attributed to a combination of factors which the most notable could be due to poor dietary intakes as a result of drought in 2009/2010.

Table 3 changes in Household expenditure in two years' time

What change have you observed on household health expenditure over the past two years	Type of stove used					
	Adhanet Beneficiary		Traditional		Subtotal	
	Count	Col %	Count	Col %	Count	Col %
Increased	8	40.00%	9	45.00%	17	42.50%
decreased	6	30.00%	4	20.00%	10	25.00%
No change	6	30.00%	7	35.00%	13	32.50%
Subtotal	20	100.00%	20	100.00%	40	100.00%

However, the beneficiaries noted that the reduced health expenditure is only the fourth most significant change from among the changes attributed to the Adhanet stove.

Reduced expenditure on purchase of wood and dung

The improved Adhanet stove requires an amazingly low amount of a burning catalyst compared to the traditional stove. A research by the Energy and Training Center of the Department of Energy has shown that an efficiency of 23% for the improved stove, in contrast to the efficiency 6-8% of the traditional stove. Overall the improved stove has an over 50% advantage of efficiency over the traditional.

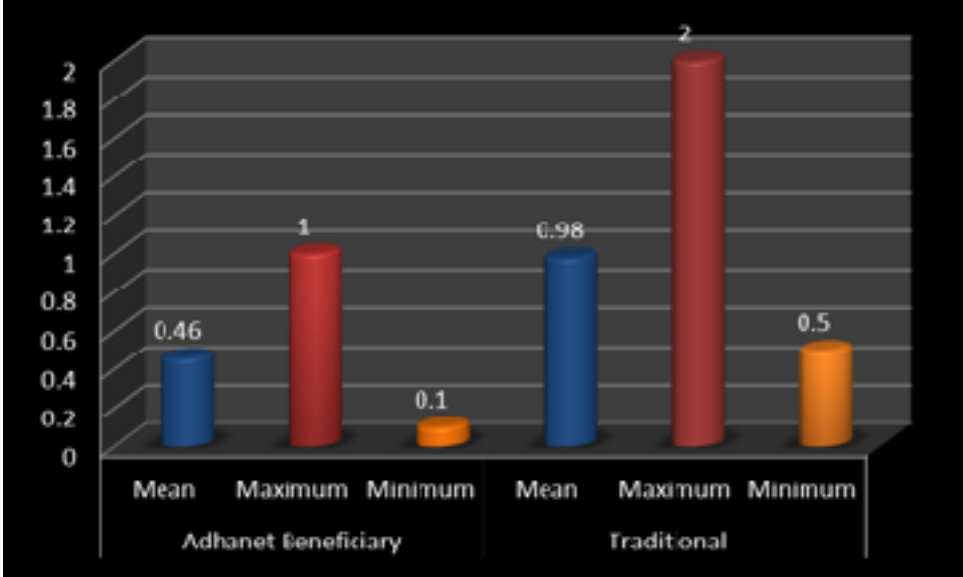
This has also been confirmed by a laboratory and field based studies; a typical of which is that done by Dr. Robert Van Buskirk:

“There is substantial variability between the traditional mogog and the improved one, but the difference is large enough to be measurable with confidence on average. For typical cooking amounts [in the range of 3 to 4 kilograms of injera produced per cooking session], the fuel savings is slightly greater than 1.5 kilograms of wood per cooking session on average.”

A Mid Term Review carried out by RTI Eritrea office states; “for a typical family of five the average amount of fuel wood consumed using the traditional stove/oven is two loads of donkey per month. The same amount of wood (2 donkey loads) can serve for over two months if the improved stove is used.”

The participants equally noted that the use of the improved stove induces big money save for the household. The average amount of wood burned per household per month is 46kg for Adhanet users and 98kg for users of the traditional stove; but of course dependent on household size (see chart 3). Similarly, the average price per kilogram of wood is 2.5Nfa (250Nfa/quintal). Taking these assumptions we find out that the Adhanet beneficiaries save the equivalent of about 1560ERN annually; which they can invest it in sending their children to school and complementing other household necessities.

Chart 3 Wood Burned for traditional users per Month in quintals



At a project level, the total amount of expenditure saved from the purchase of wood by the 12,177 beneficiaries is 18,996,120 Nakfa annually. This is excluding expenditures on dung.

On the negative side, participants noted that the improved stove deprives households of the benefit of getting charcoal for making coffee and warming food stuffs- as it works by use of tree branches and small twigs. On this issue the majority of the Adhanet beneficiaries indicated that they buy charcoal from the local markets while users of the traditional stove get it from their hearths (see table 4).

Table 4 source of Charcoal for HH use

source of charcoal	Type of stove used					
	Adhanet Beneficiary		Traditional		Subtotal	
	Count	Column N %	Count	Column N %	Count	Column N %
market	11	55.0%	2	10.0%	13	32.5%
HH hearth	4	20.0%	13	65.0%	17	42.5%
both	5	25.0%	5	25.0%	10	25.0%
Subtotal	20	100.0%	20	100.0%	40	100.0%

Impact on productivity gains and income

People confirmed that productivity gains due to the stove efficiency, improved health as well as time saved are considered to be among the most significant changes witnessed in their lives. Depending on the fuel source, households noted that they used to spend considerable time collecting, preparing and using fuels. The impact on time required for fuel collection relates mainly to changing from wood and dung, which are mostly collected (and prepared in the case of dung cakes) by households from the local environment. These fuels are also collected and sold to generate income. Depending on demand and local availability, people used to travel for hours (on average 1.5hours) every week to collect sufficient amounts of fuel. In terms of time required for fuel use – mainly for cooking – they noted that the traditional stoves/hearths burn less completely and generate less heat than the Adhanet stoves, thereby increasing cooking times. Indoor air pollution deposits soot on pots and walls. Anecdotally they suggested that women regard the Adhanet stove highly as it keeps their environment soot-free thus reducing the time they have to spend cleaning.

The health impact of the improved stove also has implications for the number of days lost from daily activities. Such daily activities include income earning activities (formal employment, informal employment or self-employment), other productive activities in the household or on the land (e.g. subsistence agriculture or childcare), leisure time or school attendance (for children). The realization of these impacts is both immediate (e.g. income) and distant (e.g. the impact of school attendance on educational attainment).

People noted that girls now have more time to attend school regularly; although the school teachers described this claim as being only anecdotal. The school teachers confirmed that because of low access to other social services (e.g. water supply and household chores) girls usually do use the time saved in assisting their mothers fetch water or tend petty family shops. In fact the school teachers confirmed that girls' attendance in schools did not see any improvement even during the two years of the project life. A sort of change like this is normally expected due to a cumulative effect of integrated programmes.

However, young boys who participated in the PRA exercise mentioned that they feel more comfortable to stay at home and study due to the less concentration of smoke in their houses. Equally, boys and girls who do attend school indicated that those who use the improved stove have more time to study at home than those with the traditional stoves.

Generally, people noted that the Adhanet stove alleviates the drudgery of collecting fuel far from home and eases the task of cooking thus frees women's time for productive endeavours, education, child care and relaxation. With less time wasted on collecting wood and being ill, children have more time available to attend school, do their homework and enjoy childhood.

Finally, in addition to the direct impact on productive days gained due to an episode of illness avoided, there are also longer-term effects on production and income from the extended years of life-which could not be easily articulated during the PRA exercise. A cost benefit analysis done by the WHO in selected sub-Saharan African countries including Eritrea revealed that the introduction of the fuel efficient rural stoves the benefit per person (taking total population as denominator) reaches \$13.00 annually.⁷ Assuming this scenario as a base of analysis the net benefit per person earned from RTI's distribution of 12,177 stoves is \$158,301.00

On the income side, the impact is related to the opportunities opened-up as a result of the time saved for wood collection and cooking. Moreover, MoA records indicated that currently about 10,000 women have assumed the skill of making the improved stove. Close to 300 of these women have transformed themselves into social entrepreneurs through constructing new improved stoves, selling parts of the improved stove, and maintaining broken stoves for their village folks. These women have improved their income and been able to provide their children with basic necessities including school materials.

Environmental impact

Over 80% of the Eritrean people rely on biomass energy (wood and dung) for cooking and lighting. Eritrea presently consumes an estimated 1.29 million metric tons of fuel wood annually. The Eritrean government has a six-year target to distribute 500,000 fuel-efficient improved stoves to households across the country covering 2,500,000 people or 70% of Eritrea's entire population. Adoption of the fuel conserving stoves by 500,000 families is looking increasingly likely and would result in a reduction down to 500,000

⁷ Evaluation of the costs and benefits of interventions to reduce indoor air Pollution; WHO, 2005

tons annually and a restoration of Eritrea’s wood lands. The fuel efficient stove has local and National environmental benefits. We start with the local benefits

Local environmental benefits

Local environmental benefits come from the use of the Adhanet stoves (about 67% efficiency) lead to less consumption of biomass. At the national level deforestation due to unsustainable firewood use can lead to soil erosion, desertification, and, in hilly areas, landslides. Rather than trying to place a value directly on these downstream effects, it appears logical to ask “what it would cost to avert these possible adverse effects; in other words, we ask the cost of replacing the trees that are cut down. The replacement cost comprises the labour cost plus the cost of the tree sapling, adjusted by a wastage factor (percentage of saplings planted that do not mature). MoA forestry experts noted that the average cost per tree replaced as \$0.80 in Eritrea.

PRA participants noted that since the introduction of the fuel efficient stove tree cutting has been reduced to a great extent. A more scientific study would do justice to estimate the exact change in the regeneration of forest clothing. However, the fact that there is a reduced tree cutting by the Adhanet users substantiates to the anecdotal claim of improved forest clothing. Improvement in the forest clothing and thus the environment obviously has spiral effect on agricultural productivity as there will be improved nitrogen fixation. MoA records however indicate that tree cutting has however increased in the lowland of Eritrea over the past two years; thus undermining the positive records registered in forest recovery take-off. According to the PRA participants in Adi Tekeleizan on average six to seven trees are cut down for every tree planted. The reasons for this are complex but are largely attributed to the fact that more people are now engaged in wood selling as their source of income to compensate for the rising food stuff prices and declining national economy.

On the other hand PRA participants were divided into two when asked ‘who do you think is more likely to sell wood from among the Adhanet users and non-users’. The users pointed out that since their knowledge about tree cutting is improved they are less likely to cut trees. In contrast the non-users claimed that “we do have very little time and labour left to sell wood before satisfying our own households with sufficient wood. For the Adhanet users, since they need very little wood for their households they are more likely to sell wood. ” MoA experts indicated that the number of illegal wood traffickers has in fact increased over the past two years. This is an issue of perception, where the majority of the Adhanet users feel that tree cutting has gone down since the start of the project; while the traditional stove users report to the contrary (see table 5).

Table 5 Changes on the extent of Tree cutting

What change have you observed on tree cutting in your community over the past two years	Type of stove used					
	A d h a n e t Beneficiary		Traditional		Subtotal	
	Count	C/ N %	Count	C/ N %	Count	Column N %
Increased	12	60.00%	4	20.00%	16	40.00%

Decreased	2	10.00%	11	55.00%	13	32.50%
No change	6	30.00%	5	25.00%	11	27.50%
Subtotal	20	100%	20	100%	40	100%

In general however most people noted that a positive take-off in the forestry cover in the Gash Barka region; especially after the termination of the 1998-2000 border dispute with Ethiopia. As per the records of the MoA about 65,612 hectares of land have been burnt between 1993 and 1998 in the Zoba, and more than 1,600 hectares of forestland was set on fire and suffered permanent damage. Of the total area of 3,700,000 ha only 708,200 hectares is considered as a forest and woodland (19%)-of which 32,085 hectares (5%) is enclosure. The forest take-off for energy in the region has generally seen improvement from about 2% in 1995 to about 1.25% at the present time. A lot of factors contribute to this impact one of which is the distribution of the Adhanet stove and nursery support by RTI project.

The effort within this component was not simply to distribute the improved fuel efficient stoves. RTI and partners understood from the beginning that biomass energy source cannot be sustainably harvested at the existing rate of take-off relative to the stock. Hence, proper management practices were introduced. Development of biomass resources was carried forward through i) large-scale levels reforestation and afforestation programmes including mobilisation of about 350,000 people for planting over 4 million different sapling types; ii) community level through establishment of about 5 community woodlots in different areas; and iii) individual level as a homestead approach where over 70,000 target beneficiaries were provided with three tree sapling each. These efforts were assisted by the removal of barriers to proper tree management like water and soil conservation, tree species selection, alternative uses of land, etc are believed to have led to a success in regenerating the dwindling forest resource in the region. In this respect the majority of the study participants admitted that they feel that their land is greener and more fertile now compared to three years ago (see 6).

Table 6 Changes on Forest Cover

What change have you observed on the forest cover of your village land over the past three years	Response	
	Count	Column N %
Increased	19	47.50%
Decreased	8	20.00%
No change	13	32.50%
Subtotal	40	100.00%

Participants also confirmed that run-off from the hilly mountains as well as soil erosion has decreased as a result of the cumulative impact of the project activities i.e., provision of improved stoves, forestry development as well as soil and water conservation. In this respect, although annual yields of farmlands have decreased over the past two years soil

fertility seems to have improved as per the PRA participants. The decrease in yield is associated with poor rains rather than poor soil fertility (see table 7 below).

Table 7 Changes on Soil Fertility and Run-off Control

What change have you observed on soil fertility over the past two years	Response	
	Count	Column N %
Increased	17	42.50%
Decreased	12	30.00%
No change	11	27.50%
Subtotal	40	100.00%
What change have you observed on catchment run-off and soil erosion over the past two years		
Increased	12	30.00%
Decreased	15	37.50%
No change	13	32.50%
Subtotal	40	100.00%

Improvement in soil fertility is also associated with increased use of dung on farmlands as fertilisers. In the absence of the Adhanet stove many households would be tempted to use the dung as fuel rather than fertiliser. In contrast to the traditional stove efficiency of 10%, the improved stoves have measured efficiencies of 20-25% or more. This translates directly into reduced fuel wood, agricultural residue, and dung burning at the household level. The unburned fuel wood is left in the environment for longer, and the unburned dung is either left uncollected (to fertilize the ground) or is used to add extra fertilizer to the agricultural fields. This increases the biomass stocks through both increased soil fertility and increased residence time of biomass in the ecosystem.

National environmental benefits

The national environmental benefits are related to reduction in CO₂ reduction. Consequently, this section is entirely based on the works of literature and expert opinions.

The burning of biomass fuels in poor homes does not convert all fuel carbon into CO₂ and water. Open fires and traditional stoves tend to be highly inefficient and lose a large percentage of the fuel energy as so-called products of incomplete combustion. These include the potent greenhouse gas methane (CH₄), which stays in the atmosphere for decades. When combining the emissions of CO₂ and other greenhouse gases in a single index, wood, crop residues and dung score much higher than fossil fuels, such as kerosene and liquefied petroleum gas (LPG). This holds true, even where biomass fuels are renewably harvested. Notably, to deliver the same amount of energy, dung used in a

biogas digester produces only 1% of the greenhouse gas emissions of those produced by dung burnt in a traditional stove⁸.

The Dissemination of Improved Stoves Program has enabled the rapid increase in efficiency use of energy by poor households in Eritrea by resolving a market imperfection in improved efficiency investments. The revenues from the sale of the Verified Emissions Reductions (VER) make it possible to finance the non-local cash costs of improved household efficiency which is the main barrier to the purchase of materials and equipment necessary for the improved stove construction. The target groups have extreme shortages of cash resources (due to a shortage of cash labour opportunities in rural areas) but have ready availability of labour and local materials resources. The financing of cash costs combined with local labour and materials contributions make the conversion to high efficiency stoves economically feasible and highly desirable for rural Eritrean households.

Field tests in Eritrea have shown that in many areas, improved stoves are enthusiastically accepted and desired by rural Eritrean households. Village by village market transformation experiments have attained 100% conversion rates and unanimous acclaim from rural households in areas with fuel shortages. The savings obtained with improved stoves, while large, consist of savings in non-cash household expenditures and costs (i.e. firewood and dung collection and preparation time, and women's respiratory health and comfort). Because of the extreme shortage of cash in the rural economy, it is not economically feasible for rural households to finance cash expenditures with non-cash cost savings.

The local labour and materials can be financed with non-cash contributions that are within the economic capacity of rural households to make. The non- local materials expenditures which is estimated to be USD15 needs to be financed in ways that give cash credit to rural household for the national and international environmental benefits they are producing. Thus, in order to cover this shortfall in financing the fuel efficient stove, the Department of Energy has looked to benefit from carbon trading for the saved CO₂ emissions of 0.6 tonnes/stove/year at a net return c. USD 6/tonne of CO₂. Based on this calculation about USD43,837 could be obtained from the 12,177 stoves distributed by RTI alone assuming a 100% conversion rate. The money obtained from the sale of the VERs would be used to finance that portion of improved stove expenses that cannot be financed by rural households on their own. In the absence of future VER revenues, it will be difficult for the government of Eritrea to cover expansion of this initiative.

Already as a result of its wider acceptance and energy efficiency the Adhanet stove has received international awards including the Ashden Award and the Green Apple Award. It is now a candidate for the Golden Apple award; and if it receives this award the trading-off for the CO₂ emission will increase multi-fold.

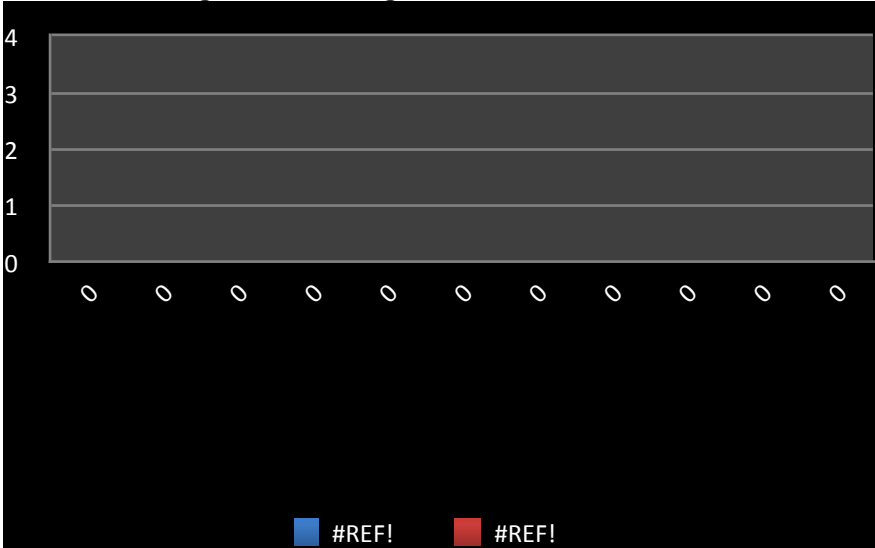
Summary of the Most Significant Changes

The most significant benefit of the fuel efficient stove according to the users is associated with reduced smoke in the household and the feeling of comfort the entire household enjoys-this is especially true for the stove beneficiaries in Adi Tekeliezan. This has more

⁸ Fuel for life, Household Energy and Health; the WHO, 2006

to do with the perception of the households but substantiated the fact that the majority of them do not have a separate kitchen for their stoves. Most significant benefit is indeed slightly different for users in Adi Tekeleizan and Haikota. The money saved from the stove might be more appreciated by the users from Adi Tekeliezan while those in Haikota might appreciate the reduction witness on the hours of travel they have to make to collect wood. Adi Tekeleizan beneficiaries get their wood mostly from the markets while those in Haikota have to collect it from the upper hills.

Chart 4 Most Significant Change



Income generation and Employment

Production of improved wood fuel saving stoves has been one way of generating income and employment for trained artisans, village technicians and women and it is a business, which was appreciated and adopted by them. On the other hand, only about 30 small entrepreneurs are engaged in the production and selling of parts of the efficient wood fuel stoves in the major towns in the country (notably Asmara and Keren). In semi-urban commercial entities especially restaurants (injera vending, and baking), use of improved fuel wood saving technologies decreased the energy input costs by 65% and move towards: i) Increased overall profitability, which means more income is earned to the entrepreneurs; ii) Increased viability of the enterprise and subsequent more employment opportunities.



Monetary Savings

Due to their high efficiencies, improved fuel wood saving technologies consume less wood simultaneously generating enough heat, and thus less money will be spent in purchasing wood fuels. Energy efficiency for rural SME's (injera venting, baking and sometimes local liquid dishes) is also desirable for financial reasons. Financial reasons focus on the profitability and potential growth of the enterprise through funds saved from efficient stoves.

Furthermore, the monetary savings by using an improved stove can be divided in two parts, first the investment savings and second the fuel savings. The use of the improved stove saves otherwise extra fuel expenditures for households. The average amount of wood burned per household per month is 46kg for Adhanet users and 98kg for users of the traditional stove; but of course depends on household size. Similarly, the average price per kilogram of wood is 2.5Nfa (250Nfa/quintal). This simple financial construct indicates that the Adhanet beneficiaries save about 1560ERN annually, which they can invest in sending their children to school and complementing other household necessities.

Time Savings

Women and children are the main suppliers of firewood accounting for 77%; men account for 23%. The average time and walking distance for fetching and transporting firewood in many areas is 1.5 hours and 6 Kilometres per week respectively. This shows that household members, particularly women, invest a considerable amount of time and energy in searching for firewood. This intervention has reduced time needed for cooking and fetching for firewood by 50%. Time saving will be achieved through an increased heat capacity of the stoves and thus the increased efficiency. The time gained can be spent for other family productive and social activities.

Forest Conservation

The introduction of improved wood fuel saving stoves has reduced quantity of wood fuel used in household. A household using the traditional stove consumes around 1176 kg/year of firewood. According to this study, through the use of improved firewood stove consumption is around 552 kg/year/household, annual saving is around 624kg/household (equivalent to more than 10 trees/year).

Health Improvements

A better burning process in improved stoves reduces the emission of smoke and associated toxic gases (e.g. Carbon monoxide, Hydrocarbons, Nitrous Oxides, Sulphur Oxides, etc). Due to low emission of harmful gases and heat through the wall, the stoves provide better health conditions to users and reduce the risk of burning. Another benefit of the improved insulation is reduction of undesired space heating in the kitchens. The quality air in the kitchen and households to make more people use more improved wood fuel saving technologies thereby less exposure to indoor pollution and consequently reduced respiratory diseases.

Gender Equality Improvements

Women are responsible for collection of wood fuels in rural and peri -urban areas. Although, some can be bought from the vendors but this is responsibility of women and children. The collection and use of fuel-wood are related with heavy and often low-productive time-consuming work. For instance, the average time and walking distance for fetching and transporting firewood in many areas is 1.5 hours and 6 kilometres per week respectively. This shows most of women's time is spent in searching firewood. Furthermore, women are exposed to health hazards from smoke and carbon dioxide and other poisonous gases, generated by using inferior stoves. Therefore, adoption of wood fuel saving stoves has minimized the frequencies of collecting wood fuels by less than 2 times per week. These stoves have also reduced the hazards of in-door air pollution by reducing smoke in the kitchens.