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Improved Cookstoves (ICS)

Con Cuong District, Nghe An Province, Vietnam

Evaluation Report



May 2014

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PROJECT SUMMARY

Project Name: Lowering Emissions in Asia’s Forests (LEAF)

Project Duration: 5 years from 20-Jan-2011 to 20-Jan-2016

Implementing Partners:

- Winrock International (WI)
- SNV, Netherlands Development Organisation (implementer of the ICS activity)
- Climate Focus (CF)
- The Center for People and Forests (RECOFTC)

Implementing Partners for the Improved Cookstoves Activity

- USAID LEAF Vietnam
- SNV Renewable Energy Team
- Women’s Union at District, Commune and Village Level in Con Cuong

ACRONYMS

CCT	Controlled Cooking Test
CDM	Clean Development Mechanism
CF	Climate Focus
DARD	Department of Agriculture and Rural Development
GHG	Greenhouse Gas
ICS	Improved Cookstove
LEAF	Lowering Emissions in Asia's Forests
LPG	Liquefied Petroleum Gas
QC	Quality Control
RECOFTC	The Center for People and Forests
SCCT	Simplified Controlled Cooking Test
SNV	Netherlands Development Organisation
USAID	United States Agency for International Development
USAID RDMA	United States Agency for International Development Regional Development Mission for Asia
VFD	Vietnam Forests and Deltas Program
WI	Winrock International
WBT	Water Boiling Test
WU	Women's Union

EXECUTIVE SUMMARY

BACKGROUND

Nghe An Province in Vietnam possesses a large forest area, which has been undergoing deforestation and degradation. The landscape is representative of Northern Vietnam and Indochina sub-tropical forests. The province borders Laos and forms transboundary ecoregions. Con Cuong District is in South-central Nghe An. It is a mountainous area where 88 percent of the total land is forest. The district is populated by three main ethnic groups: Thai, Khin and Dan Lai. Poverty rate is high at 37 percent in 2010 with a decreasing trend. Within Con Cuong, Mon Son and Yen Khe communes are populated by 3,212 households in 23 villages. They are mostly farmers who rely on forest resources, including firewood.

DEVELOPMENT PROBLEM AND USAID LEAF'S RESPONSE

In Vietnam, a significant portion of the population relies on wood and other biomass for fuel. In the target area, the majority use firewood as the main fuel for cooking. Almost all of the firewood is collected from the forest, plantation or orchards with a small percentage being purchased.

USAID LEAF's Improved Cook Stove (ICS) was targeted at replacing the traditional iron bar for cooking large pots of rice wine and animal feed. It was aimed at reducing firewood consumption, hence lowering the rate of firewood extraction from the forest. With this overall aim there are two groups of expected benefits: environmental and social. Reducing the amount of firewood collected from the forest would address one of the major drivers of forest degradation in the area. Presumably this would decrease GHG emissions. At the same time when less fuel is required, the households would no longer need to spend as much effort collecting firewood or money to pay for it. Other livelihood benefits are also expected, including job creation for the local masons, health benefits from reduced exposure to smoke and capacity building for local organizations.

USAID LEAF, SNV Renewable Energy Team and the Women's Union at district, commune and village levels collaborated to introduce 100 ICS in Mon Son and Yen Khe communes. The stoves were built locally by trained masons with USAID LEAF subsidizing the labour cost. The households themselves paid for the construction materials. The small scale was meant to be a proof of concept: an economically viable product which people would buy in order to save their labour, improve their health and protect the environment.

PURPOSE OF THE EVALUATION

OBJECTIVES OF THE EVALUATION

1. Determine whether the objectives of the ICS activity have been met
2. Assess the nature and extent of the ICS activity's outcomes on the beneficiaries' livelihoods and forest resource consumption
3. Identify lessons learned and provide recommendations for future up-scaling

EVALUATION QUESTIONS

1. Have the following objectives of the ICS activity been met?
 - a. Reduce firewood consumption for cooking within the target households
 - b. Enhance livelihood opportunities of the target households
 - c. Contribute to reducing pressure on the forest resources in the targeted district
- 2.1 How have the target households' livelihoods (both the households using the ICS and the local masons) been affected by using the ICS model?

2.2 How has the target households' behaviour changed regarding forest resource consumption?

3.1 What lessons can be drawn from the experience of implementing the ICS activity?

3.2 How can the ICS activity be improved for up-scaling in other communes in Nghe An in the future?

RESEARCH DESIGN AND EVALUATION METHODOLOGY

The evaluation combines summative and formative elements, looking into both the outcomes and room for improvement. The overarching framework for data collection and analysis is a mixed-method approach that takes advantage of both quantitative and qualitative study. The quantitative part involves a household survey that was conducted with all 100 target households while the qualitative method entails project documents review, in-depth interview with a selection of households, project staff and local partners.

FINDINGS

A. PROCESS

Site, Activity and Beneficiary Selection: A thorough site selection process resulted in an appropriate target area through a set of well-defined criteria, some of which were: high rate of forest cover change, representativeness of the landscape (to facilitate future replication), having clear opportunities to address drivers of deforestation and degradation and prospects of improving local livelihoods. Past threats to the forest were analysed and projected into the future. Firewood extraction was revealed as a major cause of forest degradation so the ICS activity was designed to address this issue. A provincial government official and a local authority staff made positive comments about the relevance of the ICS activity. In contrast, beneficiary selection was open to all interested households to facilitate wider reach.

Participatory Approach: A high level of participation took place for the ICS design, testing and implementation. Local community members were consulted with during the preliminary field visit and survey. They received 10 pilot ICS for testing and provided feedback and some helped with the Controlled Cooking Test (CCT). Participation resulted in appropriate technology being introduced and accepted by the target communities.

Women's Union, the Local Partner: The role of the Women's Union (WU) stood out as being a critical point of contact. The USAID LEAF staff members recognize WU as the direct implementer or leader on the ground. The Vice Director of Department of Agriculture and Rural Development (DARD) in Nghe An Province believes the structure of WU (vertical linkage from district to commune to village level), its broad membership base and ongoing meetings and activities facilitate ICS promotion and implementation. WU's role in the ICS activity included information dissemination, conducting several surveys, logistic support for the CCT, scheduling ICS construction, arranging purchase, pickup and distribution of construction materials and monitoring the ICS quality. Many WU staff stated that they have learned new knowledge and skills from this experience.

ICS Design and Scientific Testing: USAID LEAF conceptualized, tested and provided technical leadership on the production of 100 ICS. The design was based on the DK model developed by Population, Environment and Development Center (a Vietnamese NGO), but significant improvements were made and tested before 10 pilot models were introduced in Mon Son and Yen Khe. After the households used the pilot stoves for two weeks they provided feedback that informed the next stage of design improvements. Six new models were designed and tested in the lab, then the most promising model, DK-TK06 was built in the field for further testing. However, the DK-TK06 models built for field testing did not meet the original specification so

the test showed it was less efficient than the pilot stove. Because of this, the pilot stove was chosen for full implementation.

Implementation: After the final design was selected, proven in the field and awareness-raising conducted, 100 ICS were built in the selected villages. The households paid for the materials and USAID LEAF subsidised the labour cost for the local masons. The materials for the stove were bought in bulk due to the long distance to the supplier of some materials. Coordination for this was undertaken by the WU. After all the construction was completed, quality control checks were performed before money was wired to the local WU for paying the masons.

B. OUTCOME

1) *Firewood Consumption:* While the estimates by respondents may vary and could be sometimes exaggerated, they consistently showed that the ICS uses less fuel than the iron bar (traditional stove). This is confirmed by three data sources. The CCT showed a 33 percent decrease in fuel use. The survey respondents estimated a 48 percent decrease, which equates to a savings of 176,800 kilograms of firewood per year for 100 households. The in-depth interviews also confirmed the reduction. Overall, the ICS has decreased firewood consumption of the target households, therefore meeting the corresponding objective.

2) *Livelihoods Opportunities:* The target households' livelihoods have been improved as a result of using the ICS. Changes include reduced time spent on collecting firewood, cooking and tending the fire. The extra time gained was used for income generation, caring for the family and recreation. A smaller percentage saved money that would have been spent on firewood. Other positive changes include less exposure to smoke, particulates and chance of having accidents such as burns. Four of the masons have built ICS for their own use so they too have experienced these benefits. The payment for building the ICS is positive for the short term but the learned skills on construction techniques could turn into a long term benefit if applied. Overall, the objective of enhancing livelihood opportunities has been reached for 89 target households and 8 masons' households, totalling 97 households.

3) *Reducing Forest Degradation:* The target households are cooking with less firewood and adjusted their behaviour accordingly by decreasing their visit to the forest to gather firewood or buying less firewood. From this it is inferred that there has been a decrease in firewood extracted from the forest. Hence the ICS has contributed to reducing pressure on the forest in the target district and reducing greenhouse gas emissions. However, it should be noted that no physical measurements of the forest or fuel consumption have been taken for this evaluation.

4) *User's Satisfaction, Suggested Improvement and Durability:* Most of the target households were either 'pleased' or 'very pleased' with the ICS while seven percent gave it a 'fair' rating. For those who were happy with the ICS, the reasons they provided were very similar to the description of how ICS affected their daily life. The suggestions made by the households were to enable use of different pot sizes or using more than one pot at the same time, improve the look and finish, increase the size of the combustion chamber, make the air holes bigger and most importantly to prevent the ICS from cracking. Some of these suggestions can be incorporated into future models, while others such as increasing the size of the combustion chamber would potentially decrease the stove efficiency and require further testing.

Despite all the positive benefits from the ICS, the biggest concern is the development of cracks only after a short period of use. Only a small percentage of households reported that the ICS is without any crack. 63 of the households reported small cracks on their ICS that do not affect

cooking and 11 households stated that the cracks are large enough to affect cooking performance.

CONCLUSION

The ICS activity has resulted in all three of its objectives being met, which are reduced firewood consumption, improved livelihoods and reduced pressure on the forest. The reason for this high performance can be attributed to multiple factors, including effective situation analysis and planning, appropriate activity selection, strong collaboration, adherence to participatory approach, and well executed implementation.

Despite all the benefits, one issue that could potentially unravel the positive outcomes is the cracks that are developing on the ICS. At the moment, there are different points of views on the cause and solution and these have not yet been narrowed down and fixed. Lastly, this ICS effort has taken the form of a project activity as a proof of concept. It was not designed as a full-scale ICS enterprise development. In the future a local business model could be developed to take advantage of the demand for ICS and support expansion into neighbouring villages, communes or even districts and provinces.

RECOMMENDATIONS (FOR USAID LEAF)

Find the root cause, fix and prevent cracks; apply the solution to the current stoves as well as the model design for future application.

Develop and implement an exit strategy handing over the task of building a local business model, up-scaling and replication to another project or organization.

Finalizing the ICS design and providing guidance to facilitate scaling up and replication by other organizations. Because the DK-TK06 model built for field testing did not meet the intended design specifications, the test showed that it was less efficient than the pilot stove. However, according to previous lab tests, DK-TK06 is the most advanced model which is not only the most efficient but also have improved designed from users' feedback. Therefore, the design for DK-TK06 should be handed over for re-testing and replication.

Also while USAID LEAF is still active in Con Cuong, it could maintain an advisory role to provide guidance to the Women's Union and other agencies that may undertake scaling up or even assist with resource mobilization.

USAID's Vietnam's Forests and Deltas (VFD) Program has expressed interest in replicating the ICS in other areas of Nghe An and Thanh Hoa Provinces. USAID LEAF should share the information on the design, the lessons learned and experience with VFD to maximize potential impact from replication in other districts or provinces.

LESSONS LEARNED (FOR REPLICATING ORGANISATION)

Problem analysis: the ICS activity was highly relevant to the target area due to careful decision making based on comprehensive information on the target area and extensive analysis of the drivers of deforestation and degradation. When the right driver has been identified and realistic solution proposed and committed to, there is a higher chance of success if the intervention is executed properly.

Encourage participation: the level of participation in designing the ICS was notable. This has ensured the technology is appropriate and well received. In order to replicate the ICS model, it may be worthwhile to do similar piloting with new communities, particularly if they are ethnically or culturally different.

Work through and enhance local capacity: as a local partner, the Women's Union members mentioned that they had learned tremendously from implementing this activity. The masons are also trained not only on how to build stoves but how it works. Another step that should be taken by a replicating organization is to build local entrepreneurship in order to sustain the production to meet increasing demands as more people learn about the benefits of ICS.

Gender equality: The ICS activity addressed both gender practical needs, resulting in less burden, more leisure time and safer and healthier working environment for women, and strategic needs by having both women and men influencing the ICS design and activity as well as empowering the Women's Union to lead this technical activity. This is a contrast to the organization's usual role of working on "women-only" social issues. The ICS activity shows that strategic gender needs such as women's leadership and empowerment can be addressed by integrating them into the design and implementation of technical environmental interventions through a tailored gender-responsive design.

Create enabling environment: Although working through local authorities and Women's Union has resulted in the introduction of ICS in their official agenda, in operational terms, there is no financial resource from the government for this activity. A strategy to address this could be at the policy level where decisions on resource management take place. Mobilizing resources from other sources should also be considered.

Promote flexibility: ICS activity looks simple, but successful implementation requires time, thoroughness and flexibility, said the USAID LEAF Country Manager. To combat the multiple challenges, a longer timeframe and a more flexible plan would benefit ICS activity implementation.

Shape environmental minds: People's main motivation for acquiring the stove was livelihoods, rather than environmental benefits. This is not uncommon in development work where the most pressing issue of poverty takes precedent in people's decision making. So through livelihoods as an entry point, there is a potential for building environmental awareness and this should be taken full advantage of.

Accept adaptation: When a new technology such as ICS is introduced, no person or organisation really owns the design. Already, some community members are experimenting with alternative fuel such as farm residue, sawdust and straw. Moreover, only after three months, an imitation stove has already been built and being used. It was not a simple imitation but was rather adapted so that what the builder saw as the weak points of the original ICS design were improved. The redesign stove is proof of people's ingenuity. Nonetheless small changes in design can make large difference in efficiency and emission performance. Also agricultural residues or other fuel may emit pollution when burnt on a stove that is not design for them. To be certain, the new design and the use of alternative fuel should be tested and sound advice from the tests should be provided to the target communities.

I. BACKGROUND

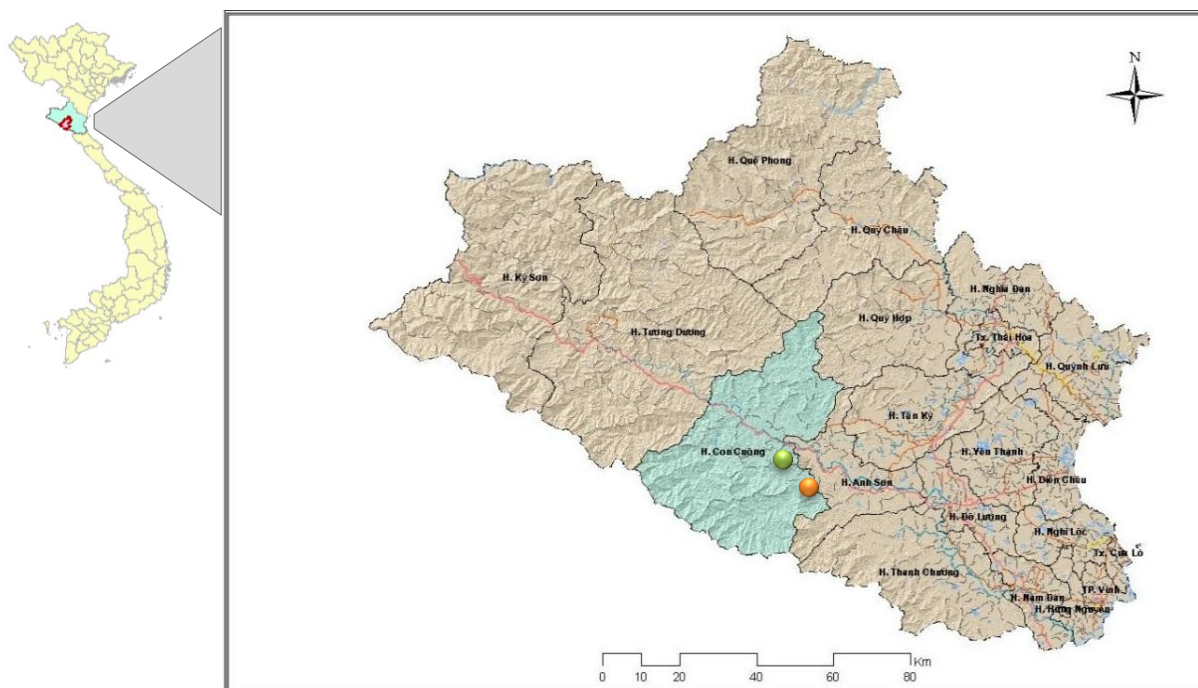


FIGURE 1: MAP SHOWING THE TARGET COMMUNES: YEN KHE (GREEN DOT) AND MON SON (ORANGE DOT) IN CON CUONG DISTRICT (LIGHT BLUE), NGHE AN PROVINCE

Nghe An Province is situated in the North Central Coast region of Vietnam. It possesses a large forest area of 8,993 km², and has been experiencing both high levels of deforestation and degradation at 414 km² and 319 km² respectively for the period of 2001-2008¹. Nghe An's landscape is representative of Northern Vietnam lowland rain forest and Northern Indochina sub-tropical forest. The province is part of transboundary eco-regions shared with adjacent provinces in Laos. These characteristics contributed to Nghe An being selected as a USAID LEAF landscape to support the project's goal, taking into account transboundary characteristics and replicability into other areas in Vietnam and other countries in Asia.

Con Cuong District is in South-central Nghe An. It is a mountainous area with 154,179 ha (88 percent of the total area) of forest². The district is populated by three main ethnic groups: Thai, Khin and Dan Lai. The poverty rate in Con Cuong is at 37 percent in 2010 with a decreasing trend. However, in some communes the rate remain as high as 42 percent.

Mon Son and Yen Khe Communes comprise 3,212 households in 23 villages. The combined population for these two communes is 12,793 people. In regarding the right to manage the forest, all of the forest in Mon Son is owned by Pu Mat National Park, but in Yen Khe the forest is owned by the State Forest Company or households. People in Mon Son and Yen Khe are mainly farmers who grow wet rice along with a variety of other crops. Swiddening agriculture, plantation and livestock husbandry are also common practices. Some are engaged in collecting NTFP, hunting as well as logging for timber and firewood.

¹ JICA (2009) as cited in LEAF (2012) Commune Identification and Selection in Nghe An and Lam Dong Province, Vietnam

² DONRE (2010) as cited in LEAF (2012) Commune Identification and Selection in Nghe An and Lam Dong Province, Vietnam

II. DEVELOPMENT PROBLEM AND USAID LEAF'S RESPONSE

A. PROBLEM STATEMENT

In Vietnam, a significant portion of the population relies on wood and other biomass for fuel. This is particularly true of Mon Son and Yen Khe Communes where the baseline³ showed that out of the 100 surveyed households, 94 use firewood as their main fuel for cooking. Per month, most households consume more than 200 kg of firewood and roughly half reported using more than 500 kg. Almost all of the firewood is collected from the forest, plantation or orchards with a small percentage being purchased. The purchased wood is also gathered from the same sources. USAID LEAF Vietnam identified firewood extraction as one of the main drivers of forest degradation in Con Cuong District.

Not only does the need for firewood lead to forest degradation, it also demands labour for collecting or money to purchase. Most of the target households said they spend half to one day gathering firewood and this is done between one to three times per week for half of the households. Possibly due to stricter enforcement of laws and decreasing availability of firewood, some local people expressed that they are either going further into the forest to collect firewood or paying more to purchase from the market.

In the target area, two factors contribute to the large demand for firewood. First, a lot of fuel is required to cook traditional rice wine and animal feed. Both of these involve boiling a large pot, for the duration of between one to a few hours. Secondly, for these fuel intensive cooking tasks, the most common type of stove being used is not a stove but a three or four-legged iron bar, which effectively means an open fire. Even though some families have adopted the use of liquefied petroleum gas (LPG) for cooking their meals, due to the higher price, it is safe to assume that gas will not be replacing firewood in the near future for the fuel demanding tasks of rice wine and animal feed cooking.

Women generally are responsible for cooking so a part of their job is to keep the fire burning throughout the long cooking time. They are exposed to smoke and possibly accidents while cooking with an iron-bar. Moreover although the task of collecting firewood is shared between men and women, often it is the women, girls or boys who spend a significant amount of time traveling to the forest or plantation, gathering the firewood and carrying it back to the house.



PICTURE 3: THREE LEGGED IRON BAR TYPICALLY USED IN MON SON AND YEN KHE COMMUNES



PICTURE 4: A COMMON LARGE POT USED FOR COOKING RICE WINE OR ANIMAL FEED



PICTURE 2: IMPROVED COOKSTOVE FROM A PREVIOUS PROJECT. MOST OF WHICH ARE NOW BROKEN OR NO LONGER IN USE

³ SNV Renewable Energy & LEAF (2013) Baseline Survey Report on Cook Stove Usage and Firewood Consumption, Vietnam

B. USAID LEAF'S INTERVENTION IN RESPONSE TO THE PROBLEM STATEMENT

DESIGN

USAID LEAF's Improved Cook Stove (ICS) was targeted at replacing the traditional iron bar for cooking large pots of rice wine and animal feed. It was aimed at reducing firewood consumption, hence lowering the rate of firewood extraction from the forest. With this overall aim there are two groups of expected benefits: environmental and social. Reducing the amount of firewood collected from the forest would address one of the major drivers of forest degradation in the area. Presumably this would decrease GHG emissions. At the same time when less fuel is required, the households would no longer need to spend as much effort collecting firewood or money to pay for it. Other livelihood benefits are also expected, including job creation for the local masons, health benefits from reduced exposure to smoke and capacity building for local organizations. These expected results are in line with USAID LEAF Vietnam's action to test initiatives for emissions reduction through sustainable land management. Furthermore they can be captured under the following LEAF indicators:

P.1 Quantity of greenhouse gas (GHG) emissions, measured in metric tons of CO2 equivalent, reduced or sequestered as a result of USG assistance

4.2.1 Number of households with improved well-being through sustainable natural resource management as a result of USG assistance

4.1.1 Number of hectares of biological significance and/or natural resources under improved natural resource management as a result of USG assistance

IMPLEMENTATION

USAID LEAF, SNV Renewable Energy Team and the Women's Union at district, commune and village levels collaborated to introduce 100 ICS in Mon Son and Yen Khe communes. The stoves were built locally by trained masons with USAID LEAF subsidizing the labour cost for building the stoves. The households paid for the construction materials. The small scale was meant to be a proof of concept: an economically viable product which people would buy in order to save their labour, improve their health and protect the environment.

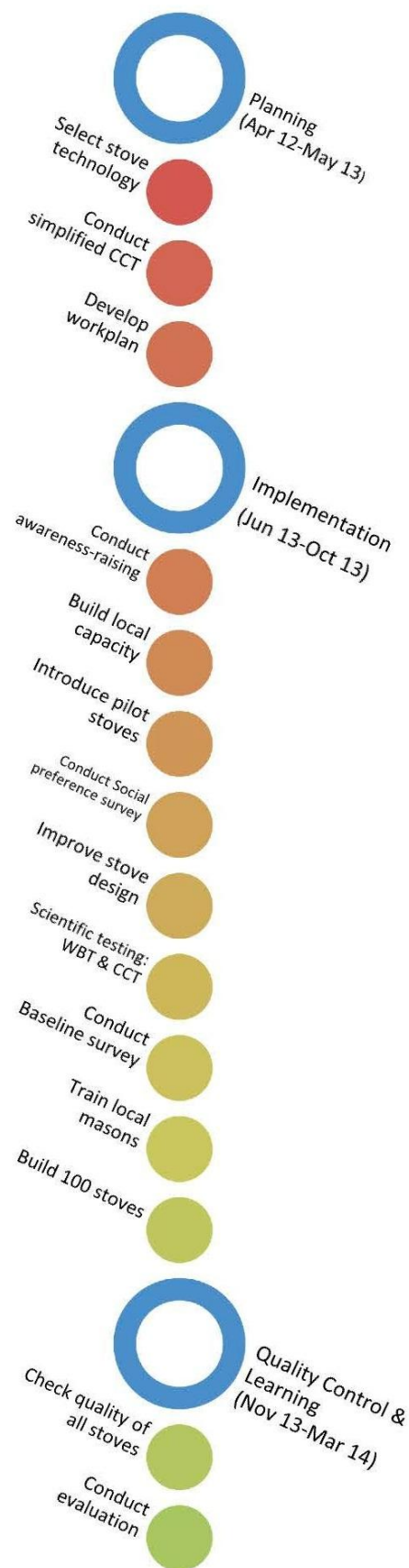


FIGURE 5: ICS IMPLEMENTATION PROCESS

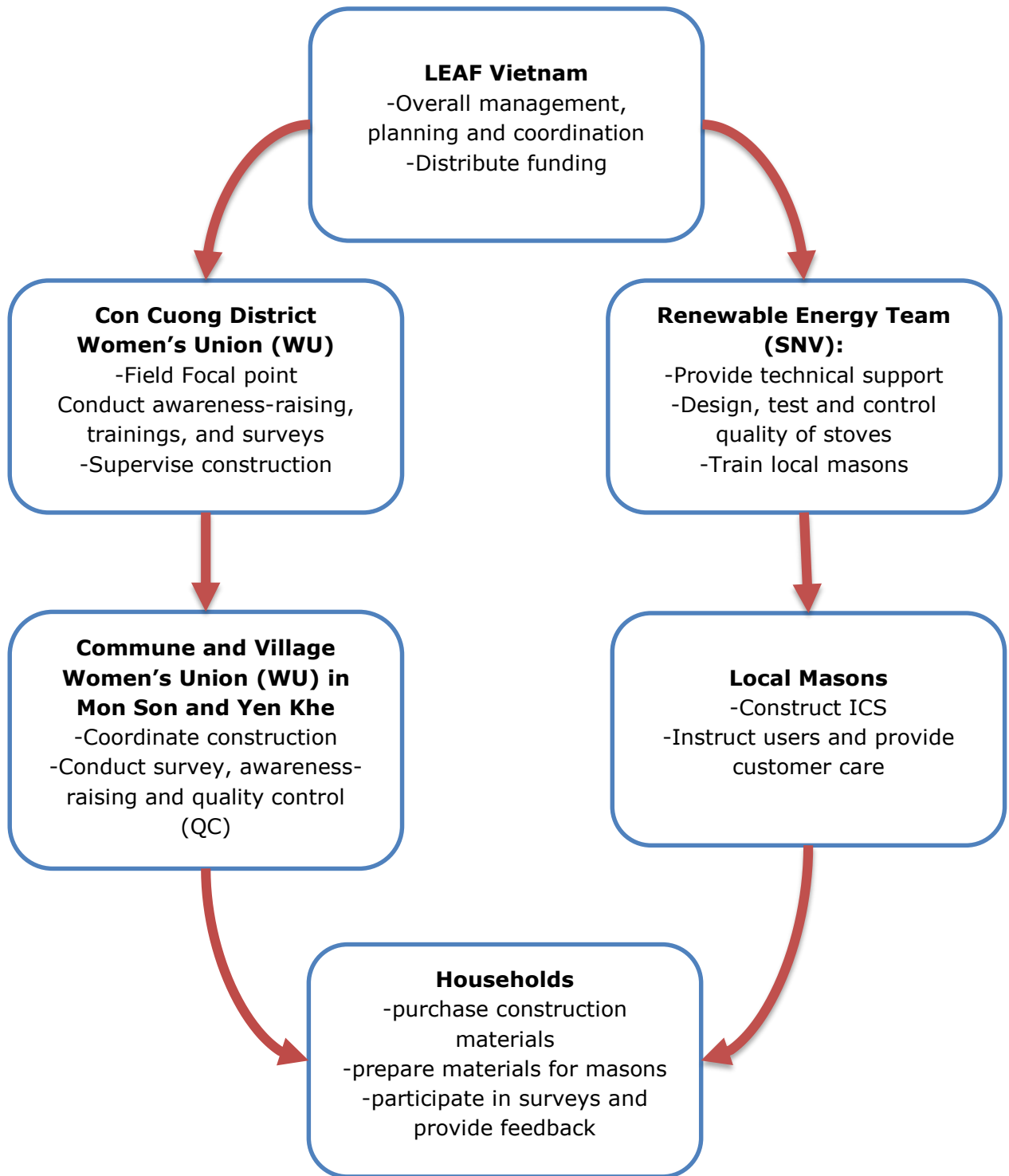


FIGURE 6: ROLES AND RELATIONSHIPS

III. PURPOSE OF THE EVALUATION

OBJECTIVES OF THE EVALUATION

1. Determine whether the objectives of the ICS activity have been met
2. Assess the nature and extent of the ICS activity's outcomes on the beneficiaries' livelihoods and forest resource consumption
3. Identify lessons learned and provide recommendations for future up-scaling

EVALUATION QUESTIONS

1. Have the following objectives of the ICS activity been met?
 - a. Reduce firewood consumption for cooking within the target households
 - b. Enhance livelihood opportunities of the target households
 - c. Contribute to reducing pressure on the forest resources in the targeted district
- 2.1 How have the target households' livelihoods (both the households using the ICS and the local masons) been affected by using the ICS model?
- 2.2 How has the target households' behaviour changed regarding forest resource consumption?
- 3.1 What lessons can be drawn from the experience of implementing the ICS activity?
- 3.2 How can the ICS activity be improved for up-scaling in other communes in Nghe An in the future?

USES OF THE EVALUATION FINDINGS

1. For beneficiaries: learn from other households and communities on how their livelihoods and forest resource consumption has been affected by using the ICS.
2. For project implementers, partners and potential replicating organizations: understand the intended and unintended outcomes of the ICS activities and how to improve the activity for up-scaling
3. For USAID: discover how its investments have produced outcomes on the ground

IV. RESEARCH DESIGN AND EVALUATION METHODOLOGY

The evaluation combines summative and formative elements. The investigation of outcomes under evaluation questions one and two can be classified as summative. On the other hand, much of the lessons learned captured by evaluation question three is concerned with formative assessment focusing on processes for improvements in the future.

The overarching framework for data collection and analysis is a mixed-method approach that takes advantage of both quantitative and qualitative study. Quantitative data was collected through a household survey, which asked the respondents on both their experience before and after using the ICS. Although a baseline was conducted earlier, not all of the data is comparable to the endline because of different response categories and how estimations provided by the respondents may vary from one survey to another. Therefore, the Evaluation Team decided the household survey would ask the respondents' views on both the ICS and the traditional

stove. This allows the respondents to compare their experience within the final survey and the baseline was used to check for consistency. Because the scale of the project is fairly small with 100 households involved, it was possible to survey all of the target households rather than applying statistical sampling. The quantitative component provides a broad picture of change.

On the qualitative side, in-depth interviews were conducted with a selection of households through purposive sampling to include both those who are satisfied and unsatisfied with the stove. The interviews were used to triangulate data from the survey and contributed deeper understanding and insights of the outcome. Lastly, interviews focusing on the processes and potential for improvement were conducted with key implementers and partners. The informants included staff of USAID LEAF and SNV Renewable Energy Team, Department of Agriculture and Rural Development (DARD) of Nghe An, local Women's Union staff in Con Cuong, local authorities at communal level of Mon Son and Yen Khe, the local masons and a representative from Vietnam Forests and Deltas (VFD) Programme.

All of the in-depth interviews were transcribed and categorized into themes under the relevant evaluation questions. The household survey was carried out by the local WU staff, who interviewed the households and entered the results into a database for further analysis by the Evaluation Team.

LIMITATIONS

- This evaluation was conducted only three months after the households had been using the ICS. The reason for this was the need to inform the next steps in ICS implementation in Nghe An immediately due to the critical timing for managing limited resources and to inform other organizations which may replicate this activity. Hence, durability, take-up and disuse rates cannot be fully explored at this point.
- This evaluation was conducted internally by USAID LEAF. Therefore, a positive bias towards the outcome is possible. However, to mitigate this bias the evaluation team agreed beforehand to attempt to remain impartial to ensure the evaluation findings will best inform decision-making and potential replicating organization. During the interview, the team actively sought out those who were experiencing problems and not satisfied with the ICS and not only focus on the positive outcomes.
- From the interviews and surveys, the measurements of firewood consumption were estimated by the households. Although this does not provide a precise measure, it gives us an idea of the degree of change. These estimates are also compared with the test results, which were rigorously measured.

V. FINDINGS

A. PROCESS

SITE, ACTIVITY AND BENEFICIARY SELECTION

USAID LEAF Vietnam has shown a tremendous effort to plan, implement and control the quality of the ICS activity. Even before the ICS was conceptualized, careful site selection was carried out to find the most appropriate province, district, communes and villages. Some of the criteria used included high rate of forest cover change, representativeness of the landscape (to facilitate future replication), having clear opportunities to address drivers of deforestation and

degradation and prospects of improving livelihoods of local people. Other more practical determinants include support and capacity of local authorities and government agencies and commitment from the communities.

The target area is then matched with the ICS activity. Past threats to the forest were analysed and projected into the future using GIS technology. The three main drivers of deforestation and degradation were identified as illegal logging, legal logging and firewood extraction. The first two drivers are being addressed through other complementary USAID LEAF activities while firewood extraction was tackled by introducing ICS to the target district.

Nguyen Tien Lam, the Vice Director of DARD in Nghe An Province made a comparison of USAID LEAF's ICS activity to another ICS project in the past and reflected that "LEAF has a stronger assessment process, identified the right people [with high demand for firewood] and the right stove [for fuel intensive cooking of rice wine and animal feed]." He mentioned that these were the objectives that DARD had assigned to USAID LEAF. Hence there is alignment with the agency's framework. Ngan Thi Ha, Mon Son Commune Chairwoman expressed the relevance of ICS to the commune under her supervision as following:

Our commune has a large area of forest but people have limited income ... Seeing this ICS could bring good benefit for the people like saving labour, energy [and] release burden of hard work for the women. These are why I think the ICS model is very appropriate to our commune.

In contrast to the multiple criteria used to select the sites from province down to village level, beneficiary selection was an open process based on household interest and ability to pay for material. The ICS activity was not designed as a poverty reduction activity but for broader reach. Basically five pilot stoves were introduced in each of the two target communes along with promotion workshops and other forms of information dissemination. After the community members saw the benefits of the ICS, any interested households could register to participate in the activity with the Women's Union representatives.

PARTICIPATORY APPROACH

All three SNV staff interviewed spoke separately that the participatory approach is one of the best processes of the ICS activity. Ms Hai Ly Thi Minh, USAID LEAF Country Manager, said that respecting the behaviour and custom of local people encouraged the beneficiaries to use the ICS and be comfortable with it. She explained the approach as involving a preliminary survey and field visit, which resulted in the targeting of the rice wine/animal feed stove. Then the ICS were piloted with 10 households who were asked for feedback. Consultation meetings were also held with the villagers, local authorities and organizations. Apart from this, Ms. Nguyen Thi Khanh Van, USAID LEAF Field coordinator alluded to the baseline survey on stove usage and firewood consumption and the Controlled Cooking Test (CCT). The survey was designed to gain an understanding on the people's behaviour regarding cooking and fuel consumption while the CCT involved local cooks preparing meals with local ingredients in the field. On the technical side, Quang Nguyen Thanh, Renewable Energy Advisor credits the social preference survey with the function of informing the stove design adjustments to fit with local expectations, promoting acceptance. Participation resulted in appropriate technology being introduced. This was mentioned by the Vice-Chairwoman of Con Cuong District Women's Union, who said USAID LEAF analysed problems and causes, especially by involving local people and listening to their

feedback. This encouraged people to use the new technology and the ten pilot ICS were living proofs of how this works, she added.

WOMEN'S UNION, THE LOCAL PARTNER

While more than one organization was responsible for implementing the ICS tasks, the role of the Women's Union (WU) stood out as being a critical point of contact. The USAID LEAF staff members recognize WU as the direct implementer or leader on the ground. Because issues relating to stoves and kitchen are seen as directly linked to women's working condition, WU was seen as the most appropriate unit to take up this task. Mr Lam, DARD believes the structure of WU (vertical linkage from district to commune to village level), its broad membership base and ongoing meetings and activities facilitate ICS promotion and implementation. WU representatives who worked on ICS were involved with information dissemination, conducting surveys, logistics support for the Controlled Cooking Test (CCT), scheduling ICS construction by coordinating with the masons and the households, arranging purchase, pickup and distribution of construction materials and monitoring the ICS quality. When asked how she felt about these challenging tasks, a WU representative from Yen Khe Commune replied, "I feel this is part of the local Women's Union responsibility."

Several WU staff reported having learned and gained new experience from implementing the ICS activity. For example, Ms Kha Thi Tim, ex Con Cuong WU Chairwoman who was recently promoted to be Vice-Chairwoman of the district, responded to the question on what she has learnt from the ICS activity by saying:

A lot, [I learnt] new skills on communicating about environmental protection and raising people's awareness about forests. Before we only participate in workshops run by other project. But for this project, I run the workshops. I chair it and I have strong confidence on this. We learned more. We know more. Also it was the first time for me to talk about the harmful effect of traditional stove, the benefits of ICS and the role and protection of the forest.

Other WU representatives said that they had learned something new such as on gender equality, effective planning, training techniques, community mobilization, interviewing and surveying. These skills and knowledge are learned through working on the ICS activity and participating in USAID LEAF's Gender Integrated Planning Workshop.

ICS DESIGN AND SCIENTIFIC TESTING

After identifying the target area, the cause of forest degradation, and the source of the problem, USAID LEAF contracted the SNV Renewable Energy team to conceptualize, test and provide technical leadership on the production of 100 ICS in Mon Son and Yen Khe Communes. The design was based on the DK model developed by Population, Environment and Development Center (a Vietnamese NGO), but significant improvements were made and tested using Simplified Controlled Cooking Test (SCCT) before 10 pilot models called DK-TK were introduced in Mon Son and Yen Khe. The 10 pilot stoves were used by the households for two weeks. Feedback from their experience using the stove in a real life setting informed the next stage of design improvement. Six new designs named DK-TK01 to DK-TK-06 were then built in response to the

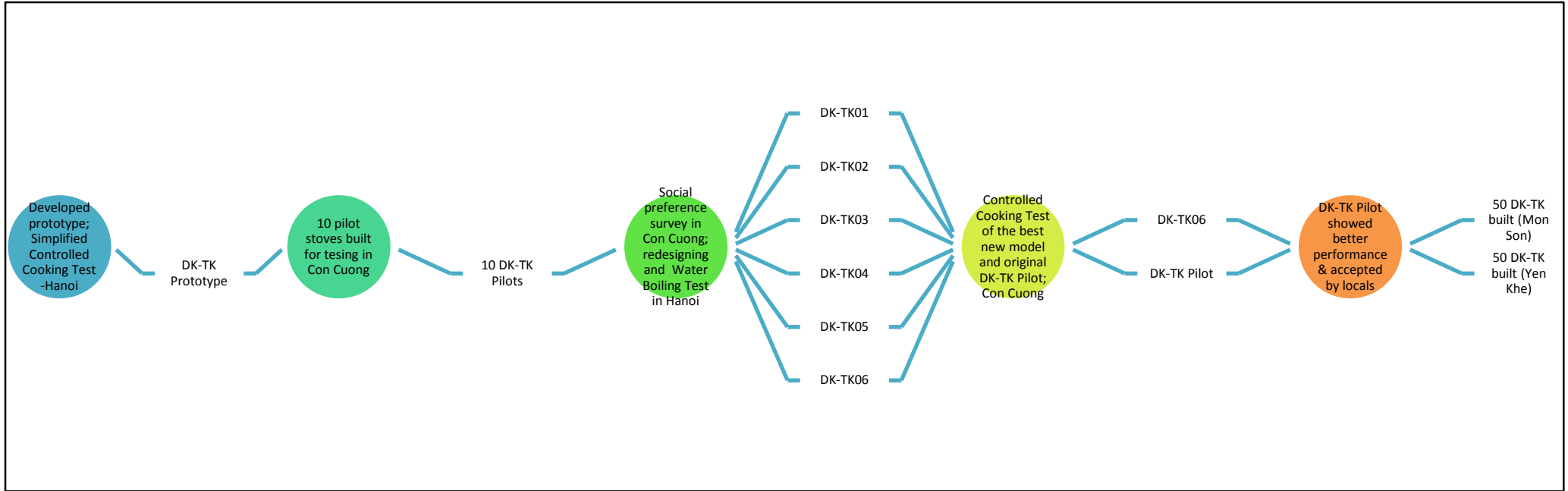


FIGURE 7: ICS DESIGN, TESTING AND DEVELOPMENT



PICTURE 8: FROM LEFT TO RIGHT: DK-TK PILOT STOVE BUILT IN THE FIELD: WATER BOILING TEST IN HANOI: DK-TK 06, PROVEN PERFORMANCE IN THE LAB BUT NOT IN THE FIELD; CONTROLLED COOKING TEST IN THE TARGET AREA

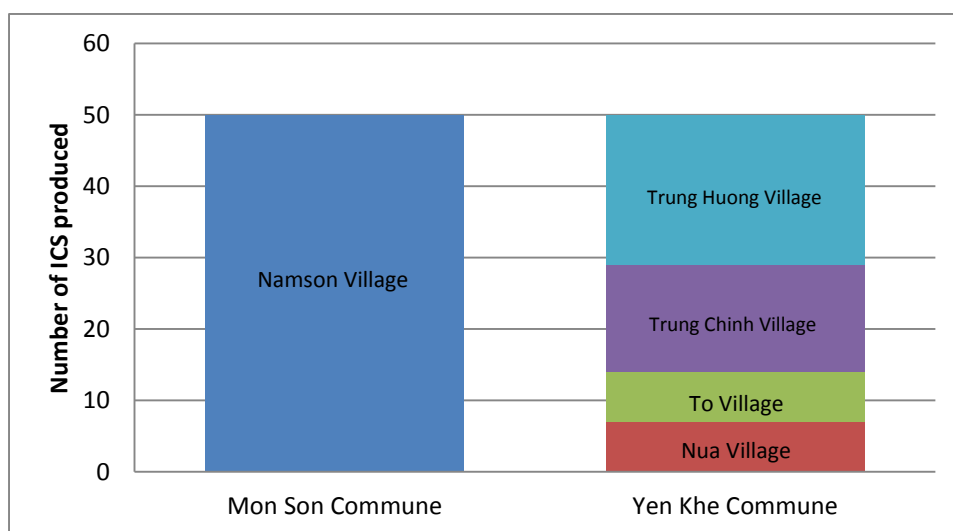
household’s preference. They underwent Water Boiling Test (WBT), a standardized internationally recognized protocol for lab testing of cookstoves, to check thermal efficiency in the lab and DK-TK06 showed the most promising results. DK-TK06 was then built in the field and tested using Controlled Cooking Test (CCT) performed by local cooks preparing local meals. Careful measurements were made and the protocols for all tests followed the Approvecho Research Center guidelines.

In the end, the CCT showed that DK-TK06 was not as efficient as the original pilot stove. This was a surprising result since the WBT in the lab showed contrary results. Nevertheless, a decision needed to be made quickly so the original pilot DK-TK model was chosen for full implementation⁴. Retrospectively, USAID LEAF staff reflected that the DK-TK06 built in the field for CCT did not meet the specification of the original design.

IMPLEMENTATION

After the ICS design was selected, proven in the field and awareness-raising conducted, 100 ICS were built in Mon Son and Yen Khe Communes. It was made clear from the start that the household would need to pay for the construction materials, which cost around 250,000 – 300,000 VND per stove. This was in addition to a subsidy provided by USAID LEAF for the masons’ labour at the rate of 250,000 VND per stove. While a small portion of the households had leftover materials that could be used for stove construction, most relied on the village Women’s Union representative to organize bulk purchasing of the materials, some of which were only available from Anh Son District which was located 45 kilometres away. The village Women’s Union staff also scheduled the construction, involving the local masons visiting the house whose owner had the materials ready for construction. The households were instructed to wait one week for the stove to properly dry before it was used. After the construction was completed a Quality Control (QC) process took place with the Women’s Union representative, the household and when available SNV RE Team checking the measurements and construction quality before they signed off on the QC form. After the forms were submitted to USAID LEAF, fund was transferred to the WU and paid to the masons.

FIGURE 9: ICS DISTRIBUTION BY COMMUNE AND VILLAGE



⁴ Information on ICS tests can be found in LEAF (2013) ICS Model; Report on Modification of DK-TK Stove; Design and Testing Results

B. OUTCOME

1) FIREWOOD CONSUMPTION

The Controlled Cooking Test (CCT) in Con Cuong involved three local cooks. Each of them prepared the same meal three times for each of the following stoves: DK-TK (original pilot design), DK-TK06 (improved designed) and the iron bar (traditional stove). The test results showed that on average, the DK-TK model, 100 of which would be built in the target communities, uses 33 percent less fuel than the traditional iron bar.

All 100 target households were surveyed after having used the ICS for the duration of two to three months. An analysis of their responses revealed that on average the respondents reported consuming 48 percent less firewood with the ICS compared to the traditional iron bar. The following table shows the amount of fuel saved according to the respondents.

	Traditional Stove	ICS	Difference
Average estimated firewood consumption per week per household (kilograms)	71	37	-34

FIGURE 10: TABLE OF FIREWOOD CONSUMPTION BY STOVE TYPE

A number of households have reported cracks developing on the ICS and this issue will be discussed in detailed in section 4. Nevertheless, for the purpose of estimating yearly fuel saving, an assumption is made that USAID LEAF will resolve this issue by improving the design and fixing the cracked stoves so that 100 households will continue using the ICS for at least up to one year. With this assumption it is estimated that the annual firewood saving is 176,800 kilograms per year for the 100 households.

The local masons from Mon Son provided a detailed description of how the ICS uses less fuel. One of them said the traditional iron bar wastes a lot of heat compared with the closed chamber of the ICS, which keeps the heat inside, resulting in faster cooking time and saving firewood. When asked to compare between ICS with traditional cooking method, another mason from Yen Khe said the big difference is the ICS saves a lot of firewood.

When the ICS is used and works properly, all the respondents agreed that it consumes less fuel. The following are statements of women in Mon Son and Yen Khe commune expressing in their own words the difference between the iron bar and the ICS in terms of fuel consumption.

Household 1, Mon Son:

On the traditional stove one bundle of firewood, which weighs around four to five kilograms, is needed to cook one pot of bran, but the new stove, only half of a bundle is needed, which is around two kilograms.

With the same amount of firewood for cooking one pot of animal feed on the traditional stove, I can cook another pot of rice wine afterwards to make the most use of the fuel on the ICS. Sometimes even after the rice wine I can still heat another pot of water for bathing, taking advantage of the hot ember. This is very convenient.

Household 2, Mon Son explained that with the iron bar, one bundle of firewood is used up in two days but with the ICS, one bundle can last a week. She also said with the traditional stove, the firewood shown in figure 11 would be used up in 10 days, but with the ICS, they can last up to 2 months.

Household 4, Yen Khe said “when I used the traditional stove, one bundle of firewood is consumed to make one pot of bran. With the ICS one third of a bundle is used.”



PICTURE 11: COLLECTED FIREWOOD IN THE TARGET AREA

Evaluation Question: 1.a) Has the objective on reducing firewood consumption for cooking within the target households been met?

While the estimates by respondents may vary and can sometimes be exaggerated, they consistently showed that the ICS uses less fuel than the iron bar. This is confirmed by three data sources, the CCT, the survey and the in-depth interviews. Overall, the ICS has reduced firewood consumption of the target households, therefore meeting the corresponding objective.

2) LIVELIHOOD OPPORTUNITIES

2.1 CHANGES IN DAILY LIFE FROM USING ICS

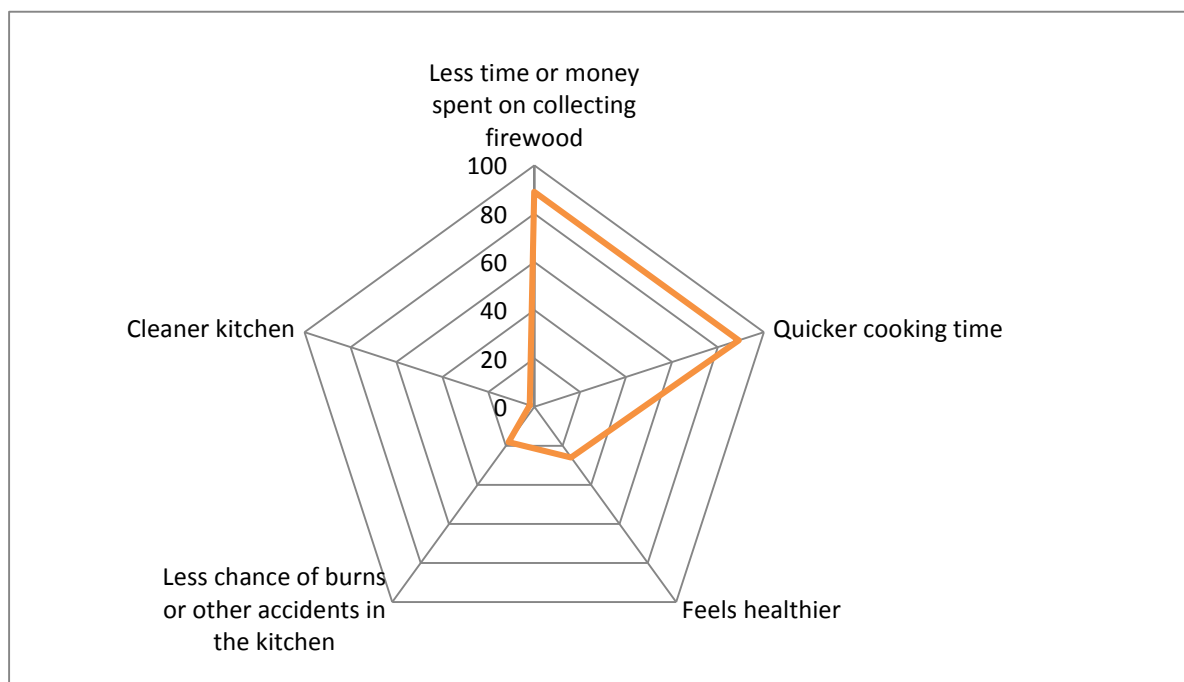


FIGURE 12: RESPONSE FREQUENCY (FROM THE TOTAL OF 100) ON PERCEIVED CHANGES IN DAILY LIVES SINCE USING ICS

89 of the 100 target households agreed their daily lives have changed by using the ICS. These 89 households equate to 100 percent of households whose stove remained intact. The changes that were reported by all 89 households were less time used for collecting or less money spent on firewood and quicker cooking time. Also, respondents from 26 households reported feeling healthier after using the ICS. 18 believes there is less chance of burns or other accidents in the kitchen than before and 2 said their kitchen is cleaner. Conversely, the 11 percent whose stoves

are no longer in use do not experience changes in their daily live. Figure 12 shows how often each response is provided in the survey. These changes will be explored in detail below.

2.1.1 TIME SPENT ON FIREWOOD COLLECTION

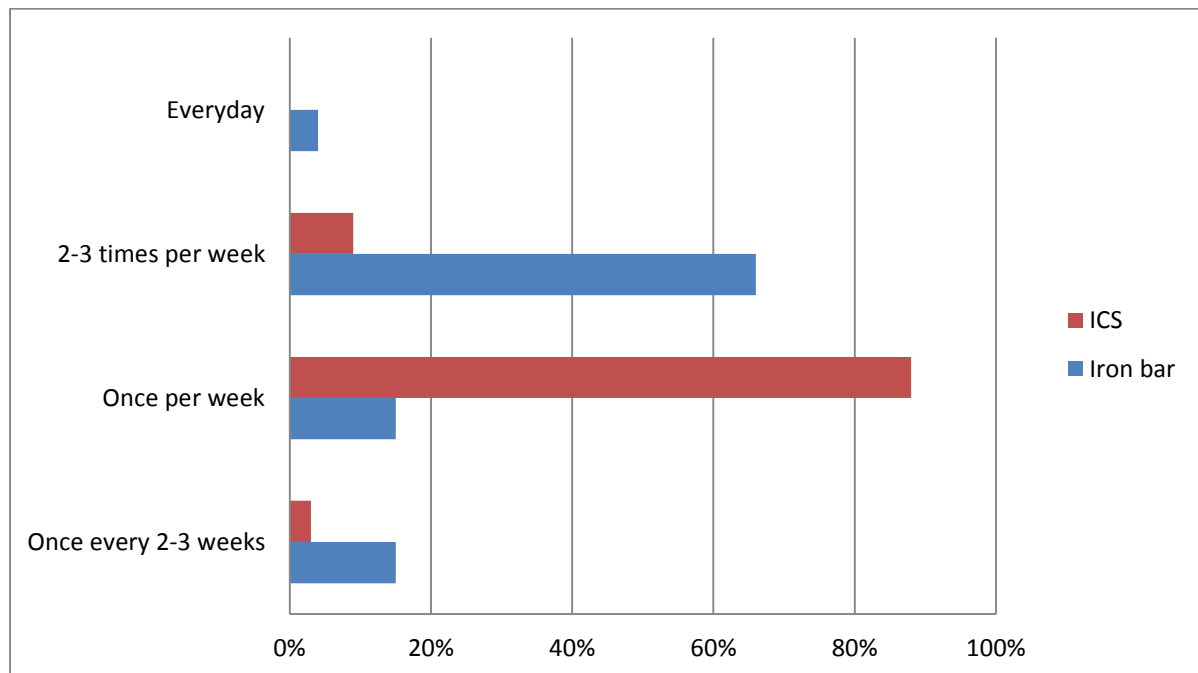


FIGURE 13: TIME SPENT COLLECTING FIREWOOD FOR COOKING WITH IRON BAR AND ICS

Using the iron bar, the majority (66 percent) of the households collected firewood two to three times per week. Since having the ICS, the majority (88 percent) of the households collect firewood once per week. Overall, the target households are collecting firewood less frequently after they have been using the ICS.

The interview informants convey that because the ICS requires less fuel than the iron bar, the households are consuming less wood and therefore spending less time collecting firewood. When a member of Household 4 from Yen Khe village was asked what she liked most about the ICS, she indicated the energy saving potential because she does not need to collect firewood from the forest as often as before. She added that with the old stove it was 2-3 times per week but with the ICS 2-3 times per month, collecting 2-3 bundles of 30 kilograms each time, which requires from 3-4 hours up to 8 hours of time. If her estimates are correct then around 40 hours or 5 days' worth of labour is saved per month. Household 2, Yen Khe said "before I used to go to the forest every 4-5 days [to collect firewood]. Since using the ICS, I visit the forest once every 10 days." Another household in Mon Son echo these answers by saying "I spend less time collecting firewood so I can do other things. Before I went to the forest to collect firewood everyday but now [I go] just once a week."

2.1.2 TIME SPENT ON COOKING

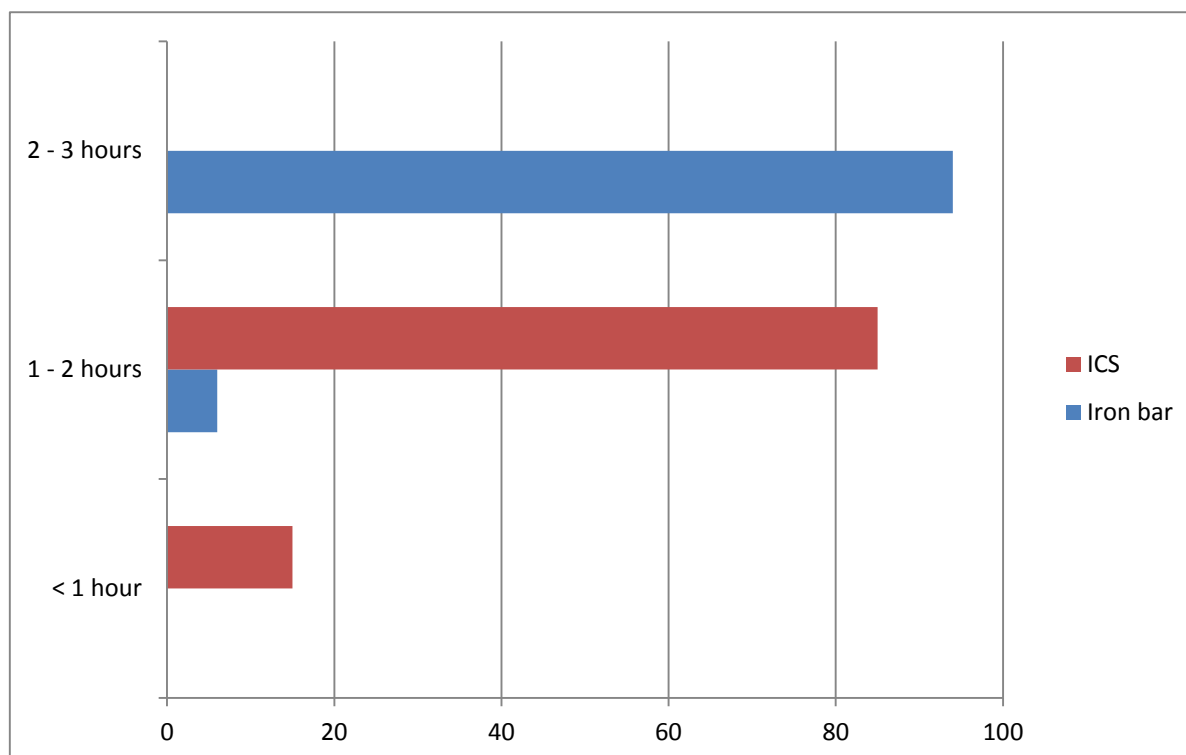


FIGURE 14: TIME SPENT ON COOKING ON IRON BAR AND ICS

From the survey, the majority of households said they spend 2-3 hours cooking rice wine on the iron bar. But with the ICS, the majority said they spent 1-2 hours or less. So on average rice wine cooking time is reduced from 2.44 hours to 1.35 hours, around one hour or 45 percent decrease. Similarly the time required for cooking animal feed has been significantly reduced with the ICS. The majority of the households reported that with the iron bar, cooking animal feed took around 2-3 hours. However, with the ICS, most said that the task takes between one half to one hour.

The Controlled Cooking Test result showed that there is a 36 percent time saving when comparing ICS to the iron bar. The average cooking time for rice wine is 1.8 hours on the iron bar and 1.3 hours on the ICS.

The in-depth interviews also showed that ICS cooks faster than the iron bar. Household 1, Mon Son said "the new stove is much quicker." This is the same with Household 2, Mon Son who pronounced that "the ICS is faster to heat up and boils water quicker." The estimation of the actual time saving varies among informants but they all pointed towards ICS reducing cooking time. Household 2, Mon Son recalls "using the traditional stove, it would take one hour to boil rice wine, [but] with the ICS it takes 30 minutes". Household 2, Yen Khe said that "for rice wine, the traditional stove took two hours but the ICS takes just a little over one hour." Lastly, household 4, Yen Khe described that "to cook a pot of bran, it takes 20 minutes on the ICS but on the old one takes 30 minutes".

2.1.3 TIME AND EFFORT TO KEEP THE FIRE BURNING

"Just light it and leave it" said Household 2, Yen Khe, of the ICS. In contrast to the traditional stove, she said "I have to sit there [to tend the fire]." This was a surprising benefit of the ICS that the Evaluation Team has found. It certainly was not mentioned in the project planning

documents. When asked about the cooking process and whether there are changes after switching from the iron bar to ICS, the informants explained that with the closed chamber, there was no need for them to tend the fire as it just keeps burning by itself. Vi Thi Ly, Mon Son WU Chairwoman, said that “For women in Nam Son village, after they start the fire, they can just leave it. They do not need to watch the fire”. So instead of focusing on keeping the fire burning, people could use their time more productively. Household 2, Mon Son explained that with the traditional stove she had to pay attention to keep the fire going, but with the ICS “I only need to start the fire then I could do other things and comeback when the cooking is finished.” Lastly, Luong Thi Hai, Yen Khe WU Chairwoman said that for those who raise a lot of livestock, the ICS has freed them a considerable amount of time from tending the fire involved in cooking animal feed.

2.1.4 USING THE TIME GAINED

The households mentioned three main sources of time saving: spending less time collecting firewood, faster cooking time and being freed from the task of tending the fire. 89 percent of the target households or 100 percent of those with fully functional ICS said that they now have more time, which is spent on:

1. Caring for their children: for example, the WU staff at Yen Khe said that after using the ICS, the Women’s Union members now have more time to care for their children and participate in social affairs such as joining meetings;
2. Farming and raising livestock: e.g. when asked how she spends the extra time from using the ICS, Household 2, Mon Son replied “working on my [Acacia and bamboo] plantation;”
3. Housework: e.g. Household 4, Yen Khe said that with the additional time, she spends it cleaning up, washing and taking care of her farm;
4. Recreation and relaxing: The Mon Son WU staff said that “since using the ICS, women have more time to relax and enjoy life ... They have more time to play volleyball or practice singing for campaigns.”

2.2 FIREWOOD COST SAVING

	Iron Bar	ICS	Difference
Average cost of purchased firewood (or cost equivalent of collected firewood) per month per household	244,594 VND =12 USD	127,436 VND =6 USD	117,158 VND =6 USD

FIGURE 15: COST FOR PURCHASING FIREWOOD (EXCHANGE RATE AT 20,800 VND)

The baseline report showed that 94 percent of the target households mainly collect firewood while only 6 percent usually buy it. However, the situation is not clear-cut because some households that normally collect firewood would buy if they are too busy with other tasks. Nevertheless, the average saving (or equivalent in firewood collected) is estimated as 117,158 VND or 6 USD per month. This is significant especially for families with less income.

Keeping in mind that only 6 percent of the target households rely solely on purchasing firewood, the following figure is a breakdown of how they and the rest of the household would spend their income that is saved from buying less firewood.

From the in-depth interview Household 1, Mon Son described the following:

With the traditional stove, I was buying 5 bundles of wood per month. Each bundle cost 50,000 VND [which equals to 250,000 VND or 12 USD per month]. Since using the ICS,

we don't need to buy anymore. My husband [now] uses an ox cart to collect 3-4 bundle of firewood per month. Or sometimes if we buy it, the money is reduced by half.

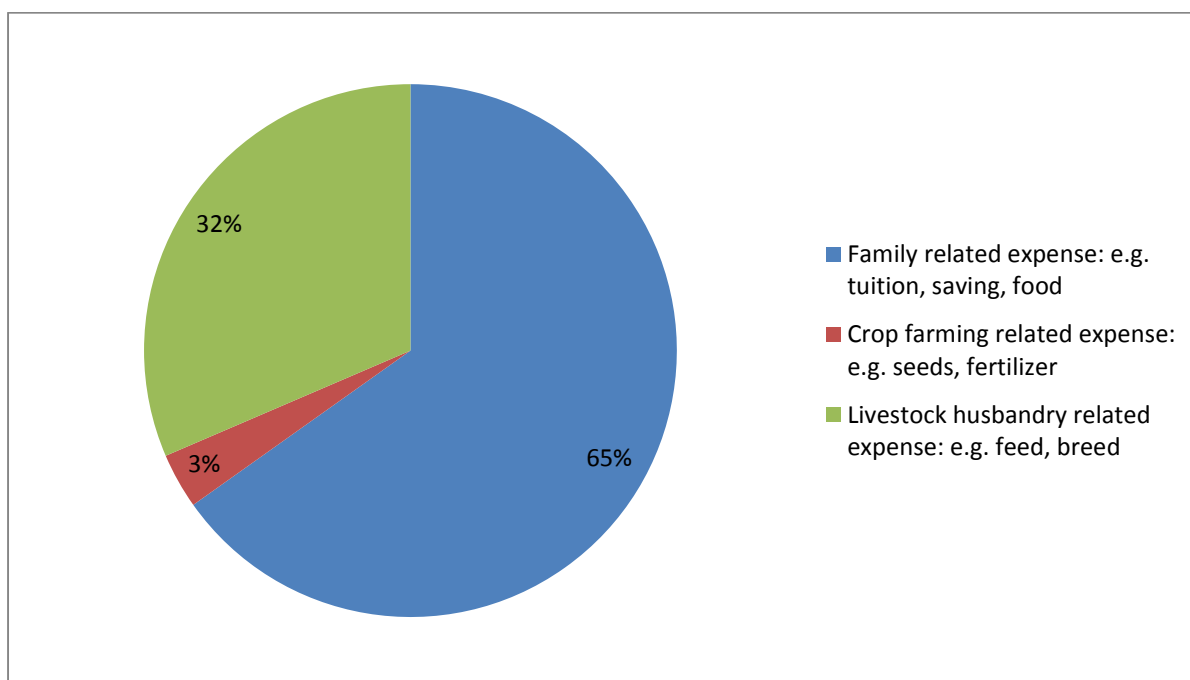


FIGURE 16: EXPENDITURE OR POTENTIAL USE OF SAVED INCOME

2.3 HEALTH AND CHANCE OF ACCIDENTS

28 percent of all target households believes using ICS provides health benefits and 18 percent said that the chance of having accidents, mainly burns, is reduced. A Yen Khe WU staff informed that “less particulates comes out [of the ICS] so I feel healthier.” She added that the ICS provides a very clean and safe environment to cook in and that it was easier to get burnt with the old stove. Another account is by Household 4, Yen Khe. When compared to the traditional stove, she said the ICS emits “less smoke when the fire is strong. I can work beside the stove. There is no problem.” She also said that the ICS is “very safe. I do not have to care much about getting burnt.”

2.4 LOCAL MASONS

The ICS activity resulted in eight local masons having been trained on how to build the ICS. The reason for utilizing local people rather than bringing in prebuilt stove or experts from other area is to build local capacity, which can lead to creating local businesses for ICS production.

Here is how the ICS activity has affected the local masons’ livelihoods. First, they have received extra income for building the ICS for the project. The payment is 250,000 VND per stove. The masons from Mon Son said that the income they received contributes to paying their children’s school fee, improving their house or spent on other family expenses. One of them said “I was happy to give this extra income to my wife and I am proud to be part of this project.” On the other hand the masons from Yen Khe complained that for each stove, the 250,000 VND payment was shared among two men who make up the team, plus the cost of fuel, phone calls and sometimes inconveniences of turning up at a house as scheduled but with the family not having prepared proper materials makes this 250,000 VND seems like small earning. However, they do welcome the additional income by “mainly spending it on family expenses such as tuition fee.” At this point, the masons have not yet mention any plan to turn ICS production

into a business. According to them, there have been instances where people outside the target area approach them or the WU asking if they could have ICS built at their homes and were willing to pay for it themselves. So far there has been at least one case where the local masons built a stove and received payment outside the project support. It appears that overall there is high demand for ICS and people are willing spend their own money.

After the training and having experienced building a number of ICS, the masons have developed a new ability. The masons from Mon Son said they had learnt new skills, techniques and the design specifications of the ICS. One in particular mentioned that he wished to improve his stove to make better use of straw and sawdust. Another outcome is the Mon Son masons have built stoves for their own family's use at home so they benefited from the ICS like the other target households. This is in contrast to the masons from Yen Khe who have not yet built ICS at their houses. When asked if their livelihoods have changed by becoming part of this activity, one said "yes, a lot. I used to go to the forest every day and now every 5-6 days". The others agree.

Evaluation Question 2.1) How has the target households' livelihoods (both the households using the ICS and the local masons) been affected by using the ICS model?

Evaluation Question 1.b) Has the objective on Enhancing livelihood opportunities of the target households been met?

The target households' livelihoods have been improved as a result of using the ICS. Changes include reduced time spent on collecting firewood, cooking and tending the fire. A smaller percentage saves money that would have been spent on firewood. Other positive changes include less exposure to smoke, particulates and chance of having accidents such as burns. For the masons, four of them have built ICS for their own use so they have also experienced these benefits. The payment for the ICS is positive for the short term but the learned skills on how to build ICS and the knowledge of how it works could turn into long term benefit if applied.

Therefore the objective on enhancing livelihood opportunities has been reached for 89 target households and 8 masons' households, totalling at 97 households.

3) REDUCING FOREST DEGRADATION

When considering the environmental outcome, many of the findings on firewood consumption and livelihoods in the previous sections are applicable. First the Controlled Cooking Test results show that 33 percent less fuel is required of the ICS compared to the iron bar. Then according to the survey results, it was estimated that the firewood saving of 100 household would be 176,800 kilograms per year. Although this is a rough estimate, it does show that potential decrease in firewood extraction could be significant if scaling up takes place. The reduction in firewood consumption is also supported by multiple accounts from the in-depth interviews with the masons and the target households. Moreover, 89 percent of all target households said that with the ICS, they are now spending less time collecting firewood from the forest or less money to buy it. From this change in behaviour together with high level of certainty that the ICS

requires less fuel it can be inferred that less firewood is being extracted from the forest and possibly in the scale of a hundred thousand kilograms per year. Furthermore by reducing firewood consumption, it can be assumed that the ICS is also contributing to lowering GHG emissions. The preliminary emission reduction potential is estimated to be between 1-2 tonnes of CO₂e per year per stove⁵. These claims are not made with complete certainty because no physical measurements of the natural resource or fuel consumption at the households have been taken.

Another development that may contribute to reducing firewood extraction is the use of other alternative fuel. The Mon Son WU Chairwoman observed that the ICS can be used with different fuel like straw or corncob. Phay Van Bay, leader of Trung Huong Village, Yen Khe confirmed that ICS enabled the use of straw, sawdust and corn cob. While corncob can be used as fuel with the iron bar, this is not possible with straw and sawdust and there is no other noteworthy use for these materials. With ICS, these materials were mixed with firewood and used as fuel in some cases. "We adapted by chopping wood into small pieces and mix with sawdust. This burns for hours," said the village head. Although this has been an unintended use of ICS, it may contribute to reducing firewood consumption and extraction from the forest even further. Nevertheless the use of alternative fuel that the stove was not designed for could result in pollution and negative health consequences. Appropriate tests would reveal whether or not this is the case.

Evaluation Question 2.2) How has the target households' behaviour change in regarding forest resource consumption?

Evaluation Question 1.c) Has the objective on contributing to reducing pressure on the forest resources in the targeted district been met

The target households are cooking with less firewood and adjusted their behaviour accordingly by decreasing their visit to the forest to collect firewood or buying less firewood. From this it is inferred that there has been a decrease in firewood extracted from the forest. Hence the ICS has contributed to reducing pressure on the forest in the target area as well as reducing greenhouse gas emissions. However, it should be noted that no physical measurements of the forest or firewood consumption at the have been taken for this evaluation.

4) USERS' SATISFACTION, SUGGESTED IMPROVEMENTS AND DURABILITY

While most households are either pleased or very pleased with the ICS, 7 percent gave a "fair" rating. For those who were happy with the ICS, the reasons they provided were very similar to the description of how ICS affected their daily life. These changes are time and firewood saving, safety, reduction in smoke, convenience and cleanliness. The 7 percent who are not completely satisfied and even those who were pleased provided some suggestions on how the ICS could be improved. Some of the areas that could be perfected or the ICS characteristics that were believed to cause problems were: cracks, having too small air-holes, fire being difficult to start, the need to use electric blower to facilitate fire burning, and only one big size pot can be used so it is not possible to cook daily meals which require smaller pots. The suggestions made by

⁵ See Annex D for calculation details

the households were to enable use of different pot size or using more than one pot at the same time, improve the appearance, increase the combustion chamber (which could have negative consequences on fuel efficiency), making the air holes bigger and finally to prevent the ICS from cracking.

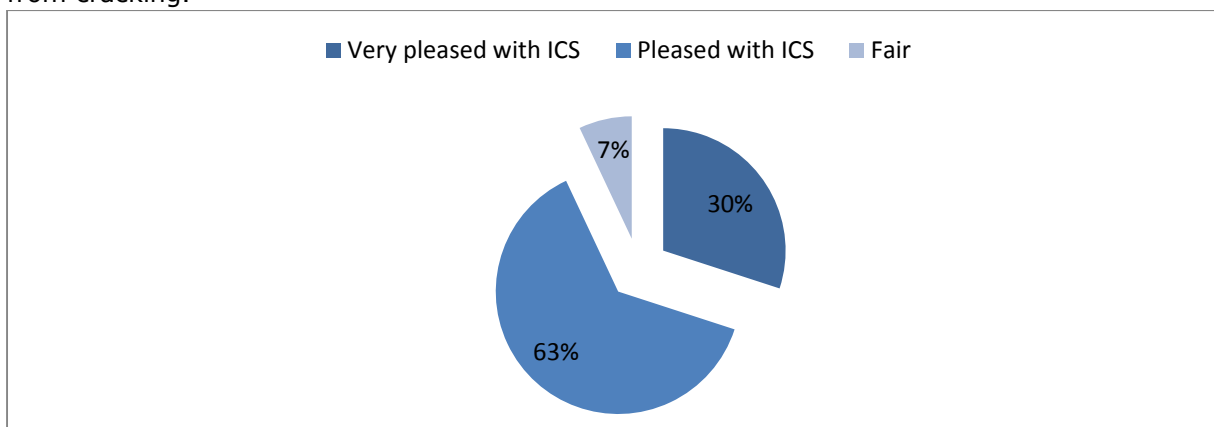


FIGURE 17: LEVEL OF SATISFACTION OF THE ICS

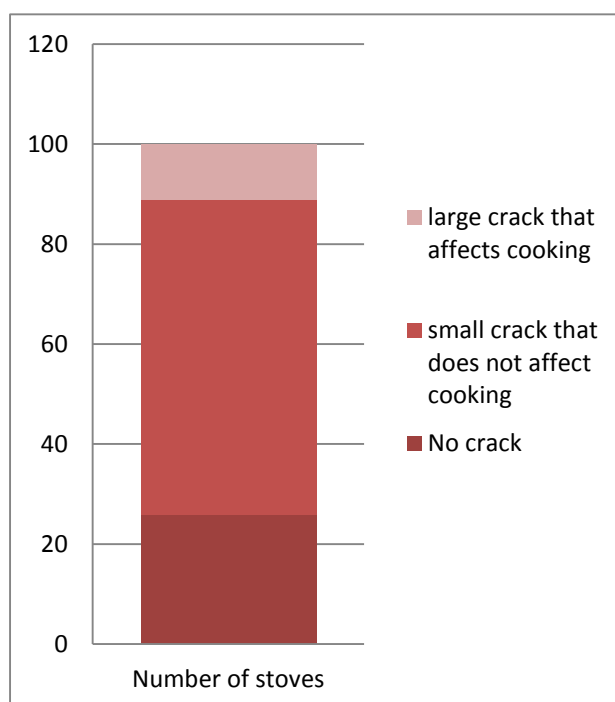


FIGURE 18: PROPORTION OF CRACKED ICS

Despite all the positive benefits from the ICS, the biggest concern is the development of cracks only after a short period of use. Only a small percentage of households reported that the ICS is without any crack. 63 of the households reported small cracks on their ICS that do not affect cooking and 11 households stated that the cracks are large enough to affect cooking performance, which certainly would have an effect on thermal efficiency. 15 respondents said that if their ICS finally breaks, they would not rebuild it. Most likely in their view, ICS is not durable enough to be worth the price or effort. One household in Mon Son said "the total money we paid was 250,000 VND. We used the stove 12 days after the construction was completed [to let it dry]. Then the more we cooked the more it cracks. More smoke comes out from the stove. Now we have gone back to using the old one." Another informant told this story about her cracked stove:

Before, my husband did not support me joining any local WU activities because we do not receive any benefits from that. For example we have not received loans from WU or saplings or rice except some fish from before. This is why my husband said "if you don't benefit from the meetings so why do you keep going to them?" This time it was a big honour for me to get the stove and this was a proof to my husband that this is the benefit I received from attending the local WU meeting. But it turned out into this bad result, so my husband is still unhappy about me joining the local WU meetings.



FIGURE 19: A CRACKED STOVE IN THE TARGET AREA

On the possible cause(s) of the cracks, there are many different views and suggested solutions. The table below summarize the possible causes and solutions according to the informants:

Number	Causes	Solutions
1	Low quality bricks or cement	Use better bricks or cement. Fireproof brick and cement could also be a solution but costs may increase depending on local availability.
2	Ratio of raw materials added to the cement mixture	Adding lime or other bonding agent (some local masons, WU and target community members said from their experience, adding lime to the mixture made it more adhesive and prevented cracks. However, the SNV RE team cautioned against this as it may cause the stove to explode)
3	Inevitable with concrete stoves	Change materials completely to, for example, ceramic or metal
4	Poor built quality	Provide further training to masons and perform stricter quality control
5	Not enough time for the stove to dry	Longer drying time, particularly more than the specified period during rainy weather
6	Not using an electric blower	Use an electric blower
7	Use firewood that is too large	Chop up firewood into smaller pieces before use
8	Using large pots that are too heavy when filled	Use smaller pot or redesign the stove so that the weight of the pot is supported by the ground rather than the stove
9	Expanding metal	Redesign the stove so the metal parts are located away from the centre where heat is greatest

FIGURE 20: TABLE OF POSSIBLE CAUSES AND SOLUTIONS TO THE CRACKING PROBLEM

VI. CONCLUSION

The ICS activity has resulted in all three of its objective being met, which are reduced firewood consumption, improved livelihoods and reduced pressure on the forest. The reason for this high performance can be attributed to multiple factors, including effective situation analysis and planning, appropriate activity selection, strong collaboration, adherence to participatory approach, and well executed implementation.

Forest degradation was traced back to high level of firewood extraction as one of the major drivers, which was connected the large rice wine/animal feed stoves that use more firewood than the stoves for cooking meals. Although switching to LPG is an option, it is not economically viable for the targeted area because the cost would be too high. So targeting the wine/feed stove was relevant to addressing the issue at hand.

Collaboration among various actors was very strong. USAID LEAF Vietnam did a tremendous job providing the overall coordination among USAID LEAF, SNV Renewable Energy Team, Women’s Union and the local authorities. Each organization also had the right resources, was committed and executed their function appropriately. For example the WU, with its vertical structure leading from the district to commune and village level were able to build awareness

and share experience among different villages as well as coordinate the construction process and raw materials acquisition on the ground. The SNV renewable energy team provided sound technical input on the stove design, scientific testing and quality control process, which benefited from previous experience. Utilizing a participatory approach ensured that the new technology was well received and fitted well with the local culture. The needs of community members were heard and acted upon. Lastly, all the pieces fitted together so that the outcomes are evident. Many people ranging from a government policy maker at the provincial level to the beneficiary households have been requesting USAID LEAF to expand the ICS activity to other households and neighbouring villages.

Despite all the benefits, one issue that could potentially unravel the positive outcomes is the cracks that are developing on the ICS. At the moment, there are different points of views on the cause and solution and these have not yet been narrowed down and fixed. Lastly, this ICS effort has taken the form of a project activity as a proof of concept. It was not designed as a full-scale ICS enterprise development. In the future a local business model could be developed to take advantage of the demand for ICS and support expansion into neighbouring villages, communes or even districts and provinces.

VII. RECOMMENDATIONS (FOR USAID LEAF)

Evaluation Question 3.2) How can the ICS activity be improved for up-scaling in other communes in Nghe An in the future?

Find the root cause, fix and prevent cracks; apply the solution to the current stoves as well as the model design for future application. Because the problem of cracking has led to reduced performance, broken stoves and disuse, it is important that the first priority is to fix the stoves already built. This should be done in order to ensure the good outcomes of the activity does not come to a halt or even reversed by creating another negative impression with the target households, who have already experienced a previous ICS project that did not work. Then the solution should be applied to the design before it is published for replication. Even if the cracking issue is resolved, maintenance service or insurance could also be included in the price of the stove to ensure after-sales support is available.

Develop and implement an exit strategy. Con Cuong, like many other areas where there have been multiple development projects implemented or under implementation, has developed a subsidy culture where some people have become used to receiving project benefits and investments. This together with the fact that USAID LEAF's did not clearly announce that it will discontinue its work in Con Cuong have resulted in expectations of the local people that USAID LEAF would up-scale the ICS project. Now that USAID LEAF's plan is finalized, a clear exit strategy should be outlined and communicated, with efforts to build a local business model and handing over the task of up-scaling and replication to another project or organization. It is clear that the ICS business would need a certain level of economy of scale and help with organization development support. The Women's Union have proven that it could take on a coordinating role for the 100 stoves and are willing to assist with scaling up.

Finalizing the ICS design and providing guidance to facilitate scaling up and replication by other organizations. The target households, local Women's Union and local authorities have requested USAID LEAF to help with scaling up the ICS activities. While USAID LEAF may no longer commit resources to lead this effort, it could still help by, as mentioned

earlier, fixing the crack issue and integrating the solution into the latest model design. Although the DK-TK model was chosen over the improved DK-TK06 due to the CCT result, this was most likely due to the problems with the testing and not the design itself. The DK-TK06 model is the most advance model produced by USAID LEAF. It should be retested and together with solving the crack issue recommended for replication. DK-TK06 should be the most efficient ICS with many modification requests from the users already taken into account. Also while USAID LEAF is still active in Con Cuong, it could maintain an advisory role to provide guidance to the Women's Union and other agencies that may undertake scaling up or even assist with resource mobilization.

USAID's Vietnam's Forests and Deltas (VFD) Program has expressed interest in replicating the ICS in other areas of Nghe An and Thanh Hoa Provinces. USAID LEAF should provide as much as possible information on the design, the lessons learned and experience with VFD to maximize impact from replication. Lastly, as suggested by Chris Dickinson, VFD Sustainable Landscape Team Leader, USAID LEAF could also help coordinate exchange visits between replicating communities and USAID LEAF's target households, masons and Women's Union representatives.

VIII. LESSONS LEARNED (FOR REPLICATING ORGANISATIONS)

Evaluation Question 3.1) What lessons can be drawn from the experience of implementing the ICS activity?

Problem analysis: the ICS activity was highly relevant to the target area due to careful decision making based on comprehensive information on the target area. Much effort was also spent on analysing the forest cover change, assessing drivers of deforestation and degradation and projecting threats into the future. When the right driver has been identified and realistic solution proposed and committed to, there is a higher chance of success if the intervention is executed properly.

Encourage participation: the level of participation in designing the stove was notable. The ICS activity involved piloting by local people, conducting social preference survey, informal interviews as well as having local cooks performing the cooking tasks for scientific testing. These efforts have ensured the technology is appropriate with the communities and well received. In order to replicate the ICS model, it may be worthwhile to do similar piloting with new communities, particularly if they are ethnically or culturally different.

Work through and enhance local capacity: as a local partner, the Women's Union members mentioned that they had learned a lot from implementing this activity. The masons are also trained not only on how to build stoves but how it works. Another step that should be taken by a replicating organization is to build local entrepreneurship in order to sustain the production to meet increasing demands as more people learn about the benefits of ICS.

Gender equality: ICS is directly linked to cooking, which is traditionally considered as woman's role. Livelihoods improvements from adopting ICS such as having less burden, more leisure time and safer and healthier cooking environment obviously benefitted women. Beyond that, women, as well as men, were able to influence the activity and design of the ICS. Also as the focal point for this activity, the Women's Union staff were able to exercise leadership by

successfully coordinating the preparation, building and quality control of the ICS. They proved that they were capable of handling technical development activities, which is a change from their usual “women-only” campaigns towards integration into technical forestry activities. The ICS activity shows that strategic gender needs such as women’s leadership and empowerment can be addressed by integrating them into the design and implementation of technical environmental interventions through a tailored gender-responsive design.

Create enabling environment: Although working through local authorities and Women’s Union has resulted in the introduction of ICS to their official agenda, in operational terms, there is no financial resource attached to the plan. A strategy to address this could be at the policy level where decision on resource management takes place. Resource mobilization from other sources should also be considered.

Promote flexibility: ICS activity looks simple, but successful implementation requires time, thoroughness and flexibility, said the USAID LEAF Country Manager. Challenges were evident in many forms: floods, people’s availability, technical problems or dealing with diverging opinions. There were delays and the activity was more complicated than what the project staff previously thought. A longer timeframe and a more flexible plan would benefit ICS activity implementation.

Shape environmental minds: One of the local authorities said that if people really understood the objective of this activity, they would all build ICS even without the project support. What she means was that people’s main motivation for acquiring the stove was livelihoods, rather than environmental benefits. This is not uncommon in development work where the most pressing issue of poverty takes precedents in people’s decision making. So through livelihoods as an entry point, there is a potential for building environmental awareness and this should be taken full advantage of.

Accept adaptation: when a new technology such as the ICS is introduced, no person or organisation really owns the design. Already, some community members are experimenting with alternative fuel such as farm residue, sawdust and straw. Moreover, only after three months, an imitation stove has already been built and being used. It was not a simple imitation but was rather adapted so that what people saw as the weak points of the original ICS design were improved. The redesign stove is proof of people’s ingenuity. Nonetheless small changes in design can make large difference in efficiency and emission performance. Also agricultural residues or other fuel may emit pollution when burnt on a stove that is not design for them. To be certain, the new design and the use of alternative fuel should be tested and results shared with the communities.



FIGURE 21: ADAPTED ICS BUILT BY LOCAL PEOPLE

IX. THE ANNEX

A) TERMS OF REFERENCE

TERMS OF REFERENCE

Country:	Vietnam
Organisation:	SNV – Netherlands Development Organisation and Winrock International
Program:	Reduced Emission from Deforestation and Forest Degradation (REDD)
Project:	Lowering Emissions in Asia’s Forests (USAID LEAF)
Abstract:	In-house evaluation of the outcome of an Improved Cook Stove (ICS) model being tested by 100 households in Con Cuong, Nghe An
Number:	One Monitoring and Evaluation Advisor from LEAF Bangkok Office working in conjunction with LEAF Vietnam and SNV Renewable Energy team, with support from LEAF Bangkok and Winrock International Home Office staff
Duration:	Approximately 32 days for the M&E Advisor over the period between the beginning of November 2013 and the end of February 2014

I. Background

The Lowering Emissions in Asia’s Forests (USAID LEAF) program is a 5 year program (2011-2015) of the United States Agency for International Development/Regional Development Mission for Asia (USAID/RDMA) that complements the efforts of numerous other donor organizations, private sector investors, and non-government organizations (NGOs) who are working to develop REDD+ capacity and operational frameworks in parallel with on-going United Nations Framework Convention for Climate Change (UNFCCC) negotiations that seek to define an effective and equitable REDD+ mechanism.

The program is being implemented in six countries: Vietnam, Laos, Cambodia, Thailand, Malaysia and Papua New Guinea. The purpose of the program is to strengthen the capacity of countries aiming to reduce greenhouse gas emissions from the forestry sector in Southeast Asia, and support countries to benefit from the emerging international REDD+ framework.

In Vietnam the program "Lowering Emission in Asia's Forests" was approved by the Ministry of Agriculture and Rural Development in Decision No. 1006/QD-BNN-HTQT dated on May 4th 2012, but then adjusted at the Decision No 562/QD-BNN-HTQT dated 19/3/2013 in which VNFOREST is assigned as the project owner; the Netherlands Development Organisation – SNV assigned as the project implementer; the Forest Inventory and Planning Institute, the Department of Agriculture and Rural Development of Nghe An and Lam Dong provinces, Winrock International and Climate Focus are collaborating to implement this project.

The program has four components:

1. Pilot emission reduction innovations through sustainable land management;
2. Establish policy and market incentives for Greenhouse Gas reductions;

3. Build and institutionalize technical capacity for economic valuation of forest ecosystem services and monitoring changes in forest carbon stocks at the project and national levels; and
4. Replicate and scale-up innovation through regional platforms and partnerships.

The Improved Cook Stoves (ICS) model, which has been implemented through a partnership between the Renewable Energy (RE) team/SNV and USAID LEAF Vietnam, is under the framework of Component 1- piloting initiatives for emissions reduction through sustainable land management. The Improved Cook Stove (ICS) model introduced in Mon Son and Yen Khe commune was aimed at reducing firewood consumption for cooking, which would produce the following expected outcomes: 1) enhance livelihood opportunities of households and 2) contribute to the reduction of pressure on the forest resources in the targeted district. The first outcome is aligned with USAID LEAF's Performance Management Plan (PMP) indicator 4.2.1, Number of households with improved well-being through sustainable natural resource management as a result of USG assistance while the second outcome may, to a limited extent, contribute to indicator P.1.1 Quantity of greenhouse gas (GHG) emissions, measured in metric tons of CO₂e, reduced or sequestered as a result of USG assistance.

The ICS model is the first in Nghe An done with a full set of scientific testing, including Water Boiling Test and Controlled Cooking Test to prove the ICS's efficiency and effectiveness based on procedure of Appovecho, a famous non-profit research center of America on Improved Cook Stove. The results from the testing showed that the ICS stove could save up to nearly 40% of energy and time. In addition, to maximize the efficiency and effectiveness of the cookstoves and as well as given the importance of participatory approach and gender perspectives, the local people was involved in all phases of this model from the designing, testing and implementation. Up to now, the improved cookstoves for cooking bran and rice wine were built for 100 households located in 7 villages of the two targeted communes: Mon Son and Yen Khe. According to feedback from the local women union, the local villagers significantly valued the new ICS stoves as they drastically reduce burden in cooking related tasks such as exposure to smoke, demanding effort in fuelwood collection and others.

The ICS model has a potential for scaling up to include other communes in Con Cuong where the "hotspot" of high pressure on extracting forest resources has been identified. It is necessary to have an evaluation expert assess this model as well as capturing lessons learnt and making recommendations for a possible up-scaling in the year 2014-2015 where 200 ICS could be supported in Luc Gia, Chau Khe and Chi Khe communes in Nghe An where illegal logging has been identified.

II. Objectives and Evaluation Questions

Objectives of the Evaluation

1. Determine whether the objectives of the Improved Cook Stove (ICS) activity as have been met
2. Assess the nature and extend of the ICS activity's outcomes on the beneficiaries' livelihoods and forest resource consumption
3. Identify lessons learned and provide recommendations for future up-scaling

Evaluation questions

1. Has the following objectives of the ICS activity been met?
 - a. Reduce firewood consumption for cooking within the target households
 - b. Enhance livelihood opportunities of the target households
 - c. Contribute to reducing pressure on the forest resources in the targeted district
- 2.1 How has the target households' livelihoods (both the households using the ICS and the local masons) been affected by using the ICS model?
- 2.2 How has the target households' behaviour change in regarding forest resource consumption?
- 3.1 What lessons can be drawn from the experience of implementing the ICS activity?
- 3.2 How can the ICS activity be improved for up-scaling in other communes in Nghe An in the future?

Uses of the evaluation findings

1. For beneficiaries: learn from other households and communities on how their livelihoods and forest resource consumption has been affected by using the ICS.
2. For project implementers, partners and potential replicating organizations: understand the intended and unintended outcomes of the ICS activities and how to improve the activity for up-scaling
3. For USAID: discover how its investments have produced outcomes on the ground

III. Scope

- The evaluation will focus on the target household members who participated directly in the ICS activity. However, the evaluation will require collecting data from implementers and key partners.
- Although the evaluation will explore how the pressure on forest resources has been affected by the ICS activity, it would be too resource-intensive and too early to scientifically measure the physical changes in the forest. The data sources for this line of inquiry will be the target households and other stakeholders.

IV. Methodology

The evaluation will combine summative and formative elements. The investigation of outcomes under evaluation questions one and two can be classified as summative. On the other hand, much of the lessons learned to be captured by evaluation question three is concerned with formative assessment focusing on processes for improvements in the future.

The overarching framework for data collection and analysis is a mixed-method approach that takes advantage of both quantitative and qualitative study. The quantitative part involves conducting an endline survey, the results from which will be compared to the baseline. Because the scale of the project is fairly small with 100 households involved, it is possible to survey all of the target households rather than using statistical sampling. The quantitative component will provide a broad picture of change. On the qualitative side, in-depth interviews will be

conducted with a selection of households, possibly one from each village chosen through purposive sampling. The interviews will reveal a deeper understanding and insights of the outcome. Focus group discussion (FGD) in combination with participatory evaluation method such as ranking will also be conducted to take advantage of group dynamics in agreeing or disagreeing with certain outcomes or processes. One FGD will be conducted in each commune. Lastly, in-depth interviews focusing on the processes and potential for improvement will be conducted with key implementers and partners. The informants will include USAID LEAF and RE staff, Department of Agriculture and Rural Development (DARD) of Nghe An, Con Cuong Local Women Unions, local authorities at communal level of Mon Son and Yen Khe, the local ICS masons and a representative from Vietnam Forests and Deltas Programme.

V. Specific tasks and Tentative Schedule

Specific tasks	Output/deliverables	Responsible persons	Level of effort and deadline
I. Preparation and desk study			
Review and finalize detailed TOR	Final TOR	-Tom to redraft the TOR -Evaluation Team to review and come to agreement	-2 days; 8-Nov-13 -1 day; 15-Nov-13
Review documents relevant to ICS activity implementation including concept notes, work plan, scientific testing reports, baseline report, field trip reports, as well as secondary data such as evaluation of other ICS projects in the region, etc.	Annotated bibliography on relevant documents	-Van to send all documents to Tom -Tom to study the documents and write the annotated bibliography	-1 day; 15-Nov-13 -3 days; 22-Nov-13
Refine methodology, develop indicators and prepare data collection tools	Detailed methodology document including a list of indicators, questionnaires, and interview questions for beneficiaries, implementers and partners	-Tom to draft the methodology document and in-depth interview guide -Van to draft the household questionnaires Quang to review the household questionnaires -Evaluation Team to review	3 days; 29-Nov-13 2 days; 29-Nov-13 1 day; 6 -Dec-13 1 day; 6 -Dec-13
II. Data Collection			
Van and Women Union's members interview the 100 target households to complete the questionnaires	100 filled in questionnaires entered into a spreadsheet	-Van and Women Union's members	10 days; 30-Dec-13
In parallel, Tom travels to Nghe Ann with a translator and interview (in-depth) selected target households (7), DARD (1), Women Unions (2), local	Interview recordings and transcriptions	-Tom and translator to conduct interviews and transcribe -Van to arrange meetings	10 days; 30-Dec-13

authorities (2), local Masons (2) and LEAF staff (1)			
III. Data analysis, write up and verification			
Van analyse quantitative data with support from Quang	Preliminary findings notes	Van and Quang	3 days; 7-Jan
Tom analyse qualitative data and assist Van in quantitative analysis	Preliminary findings notes	Tom	3 days; 7-Jan
Write up	Evaluation Report draft 1	-Tom to draft report -Winrock experts to provide advice and technical support on analysis	5 days; 24-Jan 2 days; 17-Jan
	Evaluation Report draft 2	-Quang to provide technical support on write up -Evaluation team to review report -Tom to incorporate comments	1 day; 17-Jan 1 day; 31-Jan 1 day; 5-Feb
Translate draft 2 of the report	Evaluation Report draft 2 in Vietnamese	Translator	5 days; 14-Feb
Verification with stakeholders: circulate the draft report and present to implementers and partners; present to beneficiaries	Comments document	Van	3 days; 21-Feb
Incorporate comments, formatting and finalize evaluation report	Finished evaluation report in English	Tom	2 days; 26-Feb
Translate revised section into Vietnamese	Finished evaluation report in Vietnamese	Translator	1 day; 28-Feb

VI. Management and Resources

The Evaluation Team

Name	Title	Responsibilities	Level of effort (days)
Chanin Chiumkanokchai (Tom)	LEAF M&E Advisor	Lead the evaluation	32
Nguyen Thi Khanh, Van	LEAF Field Coordinator - Nghe An	Coordinate overall effort and lead quantitative component	22
Nguyen Thanh, Quang	Renewable Energy Advisor	Advise on technical aspects of ICS and conduct quantitative data collection and analysis	7
Ly Thi Minh, Hai	LEAF Vietnam Country Manager	Advise and oversee SNV resource management	5
Peter Stephen	LEAF Forest Management and Climate Change Advisor	Advise on technical aspects	3
Brian Bean	LEAF Deputy Chief of Party	Advise and oversee Winrock resource management	3
Katie Gross	Senior Program Associate	Advise on technical aspects of ICS	3
Katie Goslee	Senior Program Associate	Advise on ecosystem aspects of ICS	3

Translation

An interpreter/translator will be hired to interpret for the M&E Advisor during the 10 days of interviews and focus group discussions. Ideally, she or he will also transcribe half of the interview recordings while the M&E Advisor does the other half. Also, she or he will translate from English to Vietnamese the second draft of the evaluation report, which will be circulated for comments, and translate additional revisions to the final report.

Resource management

Winrock International is responsible for its staff's time on this evaluation, including both USAID LEAF Bangkok and Headquarter staff. Also, the M&E Advisor's travel, per diem and accommodation to conduct data collection will be paid from Winrock's USAID LEAF budget.

SNV is responsible for its staff time on this evaluation, including USAID LEAF Vietnam and Renewable Energy staff. SNV will expend resource to facilitate data collection and verification with local stakeholders in Nghe An, which includes costs for local transportation, meetings, per diem and interpretation service.

B) DATA COLLECTION INSTRUMENTS

ICS EVALUATION QUESTIONNAIRE

This questionnaire is part of an evaluation of the improved cookstove (ICS) model supported by USAID LEAF project. The questions are aimed at assessing the effectiveness of the ICS model on the living standards among local communities and the use of forest resources in two communes: Mon Son and Yen Khe in Con Cuong district. The findings help us learn about the result of the ICS and how to improve it for the future. Your true and full answers to the questions would be very significant for us in evaluating the ICS in the most effective and accurate manner. Thank you very much.

A. General					
Interview Date:		Interviewed by:			HH No:
Q1. Full name of interviewee					
Q2. Sex		1 <input type="checkbox"/> Male 2 <input type="checkbox"/> female	Q3. Head of household	1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No	
Q4. Address		Village			
		Commune			
		District			
Q5. Mobile phone:					
Q6. Number of HH member		Adult	Male: Female:	Children (under 16 yrs)	Boy: Girl:
Q8. Household's ranking		1 <input type="checkbox"/> Poor 2 <input type="checkbox"/> Nearly poor 3 <input type="checkbox"/> Medium 4 <input type="checkbox"/> Out of poverty			
Q7. Ethnic group: _____					
DK –TK					
Q9. Stove's name		Q10. Are you still using the ICS?	Q11. How long have you been using ICS?	Q12. Time spent cooking with ICS	Q.13 How much did you pay for the ICS?
DK –TK		1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No(month(s))(days/week)(hours/day)	(VND)
Q14. Who takes care of the cooking in your family?		1 <input type="checkbox"/> Women 2 <input type="checkbox"/> Men 3 <input type="checkbox"/> Both			
Q15. Usage of ICS		1 <input type="checkbox"/> Cooking household meals 2 <input type="checkbox"/> water boiling 3 <input type="checkbox"/> Rice wine 4 <input type="checkbox"/> Bran 5 <input type="checkbox"/> Other (specify):.....			
C.1 Stove performance: energy use					
Q16. Since purchasing the ICS, on average how much firewood do you use for cooking bran and rice wine per week?		(kg)		

Q17. Before purchasing the ICS, on average how much firewood did you use for cooking bran and rice wine per week?	(kg)
Q18. Since purchasing the ICS would you say you:		1 <input type="checkbox"/> use the same amount of firewood as before you purchased the ICS 2 <input type="checkbox"/> use more firewood than before 3 <input type="checkbox"/> use less firewood than before
Q19. How does your family obtain firewood?		1 <input type="checkbox"/> buy 2 <input type="checkbox"/> collect 3 <input type="checkbox"/> combination of buying (____%) and collecting (____%)
In the case of buying firewood	Q20. How much does your household spend on buying firewood per month since using the ICS ?(VND)
	Q21. How much did your household spend on buying firewood per month before purchasing the ICS (using the old stove)?(VND)
	Q22. Compared to your old stove, for the ICS you:	1 <input type="checkbox"/> spend the same amount of money purchasing firewood 2 <input type="checkbox"/> spend more money purchasing firewood 3 <input type="checkbox"/> spend less money purchasing firewood
	Q23. If there is a difference, what is the reason for it?	1 <input type="checkbox"/> the amount of firewood required is different 2 <input type="checkbox"/> the price of firewood has changed 3 <input type="checkbox"/> other, specify:
In the case of collecting firewood	Q24. Since using the ICS , how often does your household collect firewood?	1 <input type="checkbox"/> Everyday 2 <input type="checkbox"/> Once per 2-3 days 3 <input type="checkbox"/> 1 per week 4 <input type="checkbox"/> Once per 2-3 weeks 5 <input type="checkbox"/> other, specify:
	Q25. When you were using your old stove , how often did your household collect firewood?	1 <input type="checkbox"/> Everyday 2 <input type="checkbox"/> Once per 2-3 days 3 <input type="checkbox"/> 1 per week 4 <input type="checkbox"/> Once per 2-3 weeks 5 <input type="checkbox"/> other, specify:

	
	Q26. Compare to your old stove, since using the ICS, you	1 <input type="checkbox"/> spend the same amount of time collecting firewood 2 <input type="checkbox"/> spend more time collecting firewood 3 <input type="checkbox"/> spend less time collecting firewood
C.2 Stove performance: cooking time		
If you are using the ICS to cook Rice wine	Q.27 Using the ICS , on average, how long does it take to cook a rice wine batch?	1 <input type="checkbox"/> Less than 2 hours 2 <input type="checkbox"/> Between 2-3 hours 3 <input type="checkbox"/> Above 4 hours
	Q.28 Using your old stove , on average, how long does it take to cook a rice wine batch?	1 <input type="checkbox"/> Less than 2 hours 2 <input type="checkbox"/> Between 2-3 hours 3 <input type="checkbox"/> Above 4 hours
If you are using the ICS to cook bran	Q.29 Using the ICS , on average, how long does it take to cook a bran pot?	1 <input type="checkbox"/> Below 30minutes 2 <input type="checkbox"/> Between 30minutes-1 hour 2 <input type="checkbox"/> Between 2-3 hours 3 <input type="checkbox"/> Above 3 hours
	Q.30 Using your old stove , on average, how long does it take to cook a bran pot?	1 <input type="checkbox"/> Below 30minutes 2 <input type="checkbox"/> Between 30minutes-1 hour 2 <input type="checkbox"/> Between 2-3 hours 3 <input type="checkbox"/> Above 3 hours
If you are using the ICS to complete other cooking task Q.32 please specify: _____ _____	Q.31 With the ICS , on average, how long does it take to cook?	1 <input type="checkbox"/> Below 30minutes 2 <input type="checkbox"/> Between 30minutes-1 hour 2 <input type="checkbox"/> Between 2-3 hours 3 <input type="checkbox"/> Above 3 hours
	Q.32 With your old stove , on average, how long does it take to cook?	1 <input type="checkbox"/> Below 30 minutes 2 <input type="checkbox"/> Between 30 minutes-1 hour 3 <input type="checkbox"/> Between 2-3 hours 4 <input type="checkbox"/> Above 3 hours
	Q33. With the ICS, how much firewood do you consume to cook this task per week?(kg)
	Q34. With old stove, how much firewood do you consume to cook this task per week?(kg)
	Q35. In general, is the time per cooking task:	1 <input type="checkbox"/> The same amount of time as before 2 <input type="checkbox"/> More time than before 3 <input type="checkbox"/> Less time than before
Q36. Have you noticed a difference in the amount of smoke in your home or kitchen where you place the ICS?		1 <input type="checkbox"/> The same amount of time as before 2 <input type="checkbox"/> More time than before 3 <input type="checkbox"/> Less time than before 4 <input type="checkbox"/> other, specify:

Q37. Have you noticed a difference in the amount of heat from the ICS?	1 <input type="checkbox"/> No change - the heat is the same as before 2 <input type="checkbox"/> This stove creates more heat 3 <input type="checkbox"/> This stove creates less heat 4 <input type="checkbox"/> other, specify:
Q38. Compared with the old stove, to get the fire started for the ICS is	1 <input type="checkbox"/> same level of difficulty 2 <input type="checkbox"/> more difficult 3 <input type="checkbox"/> easier 4 <input type="checkbox"/> other, specify:
Q39. How satisfied are you with the new stove?	1 <input type="checkbox"/> Extremely satisfied 2 <input type="checkbox"/> Satisfied 3 <input type="checkbox"/> Somewhat satisfied 4 <input type="checkbox"/> Not at all satisfied
Q40. Please give us the reasons why you are satisfied ?	1 _____ _____
	2 _____ _____
	3 _____ _____
Q41. Do you have any problems cooking on the improved stove? If yes, please describe.?	1 _____ _____
	2 _____ _____
	3 _____ _____
Q42. Does your stove get cracked?	1 <input type="checkbox"/> No, not at all 2 <input type="checkbox"/> Yes, but it does not affect the cooking 3 <input type="checkbox"/> Yes, that stop us from using it now.
Q43. If there is a bigger crack, do you still keep using it?	1 <input type="checkbox"/> Yes, sometimes 2 <input type="checkbox"/> No, not any more
Q44. If you cannot use the ICS stoves any more because of the big crack, are you willing to install a new one? Why?

Q45. What would you change about the new stove to make it better?

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.....
.....
.....

D. Change of livelihood framework

Q46. If by using the ICS, you spend less time collecting firewood, what do you intend to use the extra time for?

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.....
.....

Q47. If by using the ICS, you spend less money on buying firewood, what do you intend to use the extra money for?

.....
.....
.....

Q48. Has using the ICS changed your or other family member's everyday life? (Choose as many as apply. Do not prompt answer)

- 1 No change
- 2 Less time collecting firewood
- 3 Less money spent on firewood
- 4 Shorter cooking time
- 5 Better health
- 6 Less burn or accidents in the kitchen
- 7 Cleaner kitchen
- 8 Cleaner clothes
- 9 Other (Please specify.....

.....
.....

Q49. Since you have got ICS stove, do men in the family help women cook?

- 1 Yes
- 2 No

Q50. Do you talk to others about your ICS? If so, what do you tell these people about the ICS?

.....
.....
.....
.....

USAID LEAF ICS Evaluation Interview Guide

Informant Categories and Evaluation Questions

Category	Informants	Process/ Outcome	Related Evaluation Questions
Implementers – LEAF staff	Van; Hai	Process	3.1 What lessons can be drawn from the experience of implementing the ICS activity? 3.2 How can the ICS activity be improved for up-scaling in other communes in Nghe An in the future?
Potential replicator – VFD	Chris	Process	3.2 How can the ICS activity be improved for up-scaling in other communes in Nghe An in the future?
Government and local authority	-Mr. Lam, Vice Director (DARD); -Vice Chairwoman of Con Cuong District; -Commune leaders;	Process	3.1 What lessons can be drawn from the experience of implementing the ICS activity? 3.2 How can the ICS activity be improved for up-scaling in Con Cuong District other communes in Nghe An in the future?
	-Village heads	Process and outcome	1. Has the following objectives of the ICS activity been met? a. Reduce firewood consumption for cooking within the target households b. Enhance livelihood opportunities of the target households c. Contribute to reducing pressure on the forest resources in the targeted district 2.1 How has the target households' livelihoods (both the households using the ICS and the local masons) been affected by using the ICS model? 2.2 How has the target households' behaviour change in regarding forest resource consumption? 3.1 What lessons can be drawn from the experience of implementing the ICS activity?
Implementers – Women's Union	WU Rep -Con Cuong; -Monson Commune; -Yen Khe Commune	Process	3.1 What lessons can be drawn from the experience of implementing the ICS activity? 3.2 How can the ICS activity be improved for up-scaling in Con Cuong District other communes in Nghe An in the future?
Beneficiary	local masons	Process and Outcome	2.1 How has the target households' livelihoods (both the households using the ICS and the local masons) been affected by using the ICS model? 3.1 What lessons can be drawn from the experience of implementing the ICS activity?
	Target households	Outcome	1. Has the following objectives of the ICS activity been met? a. Reduce firewood consumption for cooking within the target households b. Enhance livelihood opportunities of the target households c. Contribute to reducing pressure on the forest resources in the targeted district 2.1 How has the target households' livelihoods (both the households using the ICS and the local masons) been affected by using the ICS model? 2.2 How has the target households' behaviour change in regarding forest resource consumption? 3.1 What lessons can be drawn from the experience of implementing the ICS activity?

Interview Questions

Hai and Van (USAID LEAF)

- What has been your role in the ICS work?
- What factors influenced LEAF in choosing Nghe An? And the target area (commune, district, village)?
- Why did LEAF decide to implement ICS?
- Which agencies or organizations do you coordinate with to facilitate the ICS work?
- What is the level of cooperation from these agencies or organizations?
- Were there any coordination mechanisms for ICS (e.g. coordination meeting, project management committee)? Do they work well? Why or why not?
- Would you please describe briefly the process of ICS implementation from beginning until the end?
- Which part of the ICS implementation process worked best?
- Did you consider gender issues for the ICS activity? If yes, what were the actions taken to address them?
- Did you face any challenges in managing the ICS activity?
 - If yes, what were they?
 - If no, why do you think it worked so well?
- If you had to oversee another ICS project in the future,
 - What would you improve to make the implementation better?
 - What would you keep doing the same as you did this time?

Chris (VFD)

- How much have you been exposed to the ICS activity being implemented?
 - Where did you get the information from?
- From what you have heard so far, what do you think about the ICS activity?
- If the results prove to be positive, would VFD be interested in (and in a position to) replicate ICS in Nghe An or elsewhere?
 - Why or why not?
 - If yes, what would you change/adapt? And what would you do similarly?

Mr. Lam. Vice Director (DARD), Vice Chairwoman, Con Cuong District, Commune leaders and Village heads

- What has been your involvement with the ICS activity?
 - Are you part of any coordinating committee?
- Do you think ICS is an appropriate activity for Nghe An Province (district, commune or village as appropriate to the informant's level)?
 - Why or why not?
- From what you have seen or heard about ICS, what do you like best about its implementation process?
- Were there any challenges on the implementation of ICS?
 - If yes, what were they?
 - If no, why do you think it worked so well?
 - What about in terms of coordination?
- If a similar ICS activity is implemented again in the future
 - What should be improved to make the implementation better?
 - What should remain the same as before?
- What should be the next steps for ICS in Nghe An Province (district, commune or village as appropriate to the informant's level)?

- Do you think there is a potential for replication of ICS in other villages/communes/ districts in Nghe An or elsewhere in Vietnam?
- For the past three years, has there been any change (same, more or less) in
 - Availability of fuelwood,
 - price of fuelwood,
 - Policies which controls the collection of fuelwood
 - Probe on the reasons for change
- (For village heads only) From what you have seen, how has ICS affected the target households?
 - Their daily lives and activities
 - Level of fuelwood consumption
 - Time and labor for collecting fuelwood or money for buying
 - Do you think the amount of logging has changed due to the change in fuelwood consumption?
 - Smoke/heat
 - Cooking time
 - Relationships between family members
 - Other unexpected results?

Women’s Union Representatives, (Con Cuong District) (Monson and Yen Khe Commune)

- What has been your role in the ICS work?
- Would you please describe briefly the process of ICS implementation
- Which part of the ICS implementation process worked best?
- Did you take into account any issues related to gender in the implementation process?
- Who do you collaborate with for the ICS activity?
 - How is your relationship with them?
- Did you face any challenges in implementing the ICS activity?
 - If yes, what were they?
 - If no, why do you think it worked so well?
- If you had to implement another ICS project in the future,
 - What would you improve to make the implementation better?
 - What would you keep doing the same as you did this time?
- Have you learnt anything new or develop new skills from working on the ICS?

Local masons (together in group)

- How did you become involved in building the ICS?
- Please briefly describe how you build an ICS.
- What is the difference between the ICS and traditional stove?
- How many ICS have you built?
- How much does it cost to build one ICS
 - Raw materials
 - Labor/time
- How much income do you get from one ICS?
 - From whom? (Probe on subsidy)
 - Calculate profit
- How significant (compare to what you normally earn) is the extra income you have received from building and selling ICS?
- What do you use the extra income for?
- Have you sold any ICS outside the project (i.e. without subsidy)

- Do you have any intention to produce ICS for the market?
- Have you learnt anything new or develop new skills from working on the ICS?
- Do you also use ICS at home?
 - Why or why not?
 - If yes, has there been any change in your household?
- Would you recommend other masons to build ICS?
 - Why or why not?

Target Households (interviewed separately)

- How long have you been using the ICS?
- Who made the decision to buy the ICS?
- How much did you pay for it?
 - Do you think it is worth the price?
 - Why or why not?
 - Probe on whether or not they would still buy it at unsubsidized price
- Please tell (or show) me, step by step, how you use the cookstove.
- Are there any problems with using the ICS?
 - Any modification to the stove?
 - Any change to your cooking style?
- Compare to your old stove, how is the new stove different?
 - Is the amount of (fuelwood required, smoke, heat, cooking time: ask one at a time) the same, more, or less than the old stove?
 - On fuelwood, probe on the source and whether the changes in amount of fuelwood required translate to changes in collecting/buying fuelwood?
 - Probe other unexpected difference
- Have there been any changes in your daily life since using the new stove?
 - Time and effort in collecting or amount of money paid to buy firewood
 - If more time, what is the extra time used for?
 - If less money, what is the extra money used for?
 - Probe on significance of having extra time or money
 - Probe on how these additional resources (time and money) may be used for acquiring new assets, increase production or other IGA
 - Has using the ICS changed women's daily work (work load and condition)? How?
 - Probe on smoke (indoor air quality), heat (accidents), cooking time (part of time saving) and other unexpected changes
- What do you like best about the ICS?
- What do you not like about the ICS?
 - How do you think the ICS can be improved?
- Would you recommend ICS to your neighbours or relatives?
 - Why or why not?
- For the past three years, has there been any change in:
 - Availability of fuelwood,
 - price of fuelwood,
 - Policies which restricts collection of fuelwood?

C) LIST OF INFORMANTS AND TARGET COMMUNITIES

List of Informants

Name	Position	Organization	Place
Chris Dickinson	Team Leader – Sustainable Landscapes	Vietnam Forests and Deltas Program (VFD)	Hanoi
Ly Thi Minh, Hai	Country Manager	USAID LEAF	Hanoi
Mr. Nguyen Tien Lam	Vice Director	Department of Agriculture and Rural Development (DARD) – Nghe An	Vinh
Nguyen Thi Khanh Van	Field Coordinator	USAID LEAF	Vinh
Ms. Kha Thi Tim	Vice Chairwoman	District Administration Office	Con Cuong
Ms. Ha	Chairwoman	District Women’s Union	Con Cuong
Ms. Dong	Vice Chairwoman	District Women’s Union	Con Cuong
Ms. Ngan Thi Ha	Chairwoman	Commune	Mon Son
Ms. Quang Thi Van	Village Head	Village	Nam Son village, Mon Son
Ms. Vi Thi Ly	Chairwoman	Commune Women’s Union	Mon Son
Household 1	Beneficiary	-	Nam Son, Mon Son
Household 2	Beneficiary	-	Nam Son , Mon Son
Household 3	Beneficiary	-	Nam Son, Mon Son
Mason 1	Beneficiary	-	Tan Son village, Mon Son
Mason 2	Beneficiary	-	Thai Son village, Mon Son
Mason 3	Beneficiary	-	Thai Son village, Mon Son
Mason 4	Beneficiary	-	Nam Son village, Mon Son
Mr.Phay Van Bay	Chairman	Village	Trung Huong village, Yen Khe
Mr.Lo Van Chanh	Vice-chairman	Village	Trung Huong village, Yen Khe
Ms.Vi Thi Chien	Chairwoman	Village Women’s Union	To village, Yen Khe
Ms. Luong Thi Hai	Chairwoman	Commune Women’s Union	Yen Khe
Ms.Lo Thi Cang	Vice-chairwoman	Commune Women’s Union	Yen Khe
Household 1	Beneficiary	-	Trung Huong village, Yen Khe
Household 2	Beneficiary	-	Trung Huong village, Yen Khe
Household 3	Beneficiary	-	Trung Chinh village, Yen Khe
Household 4	Beneficiary	-	Nua village, Yen Khe
Mason 1	Beneficiary	-	To village, Yen Khe
Mason 2	Beneficiary	-	Nua village, Yen Khe
Mason 3	Beneficiary	-	Pha village, Yen Khe
Mason 4	Beneficiary	-	To village, Yen Khe
Nguyen Thanh, Quang	Renewable Energy Advisor	SNV	Hanoi

Name and numbers where ICS was built

Commune	Village name	Number of HH where ICS was built
Mon Son	Nam Son	50
Yen Khe	Trung Huong	20
	Trung Chinh	16
	To	7
	Nua	7

Distances

From	To	Distance (Km)	Travel time by car (hours, minutes)
Con Cuong Town	Mon Son Commune	25	35 minutes
Con Cuong Town	Yen Khe Commune	10	15 minutes
Con Cuong Town	Anh Son Town for supplies	45	50 minutes
Con Cuong Town	Vinh City	140	180 minutes

D) GREENHOUSE GAS EMISSION REDUCTION CALCULATION

$$ER_y = B_{y,savings} * f_{NRB,y} * NCV_{biomass} * EF_{projected_fossil\ fuel}$$

Where:

ER_y = Emission reductions during the year y in tCO₂e

$B_{y,savings}$ = Quantity of biomass that is saved in tonnes

$f_{NRB,y}$ = Fraction of biomass saved by the project activity in year y that can be established as non-renewable biomass using survey methods

$NCV_{biomass}$ = Net calorific value of the non-renewable biomass that is substituted (IPCC default for wood fuel, 0.015 TJ/tonne)

$EF_{projected_fossilfuel}$ = Emission factor for the substitution of non-renewable biomass by similar consumers. The substitution fuel likely to be used by similar consumers is taken: 71.5 tCO₂/TJ for Kerosene, 63.0 tCO₂/TJ for Liquefied Petroleum Gas (LPG) or the IPCC default value of other relevant fuel

In the case of ICS:

$$B_{y,savings} = 34 * 52 \text{ kg} = 1768 \text{ kg}$$

$$f_{NRB,y} = 0.7 \text{ (assumption).}$$

$$NCV_{biomass} = 0.015 \text{ TJ/tonne}$$

$$EF_{projected_fossil\ fuel} = 71.5 \text{ tCO}_2/\text{TJ}$$

$$\text{So } ER_y = 1768 \text{ kg} \times 0.7 \times 0.015 \text{ TJ/tonne} \times 1 \text{ tonne}/1000 \text{ kg} \times 71.5 \text{ tCO}_2/\text{TJ} = 1.33 \text{ tCO}_2\text{e}/\text{year}/\text{stove}$$

If the last factor in the equation, $EF_{projected_fossil\ fuel}$, is replaced with Emission Factor of firewood, which is quite a bit higher than fossil fuels at around 109.6 tCO₂/TJ, the Emission Reduction is 2 tCO₂e/year/ stove

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