Asian Development Bank

Greater Mekong Subregion

Capacity Building for Efficient Utilization of Biomass for Bioenergy & Food Security in the GMS [TA7833-REG]

FINAL REPORT:

Feasibility Study for a Pilot Investment Project to Scale-Up Improved Cookstove Use, Viet Nam

September 2013

EPRO Consulting

Landell Mills DEVELOPMENT CONSULTANTS

nexus Carbon For Development

KEY DATA

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1. INTRODUCTION

This assignment on ***Feasibility Study for a Pilot Investment Project to Scale-up Improved Cook Stove Use*** is one of the activities under framework of the ADB/Landell Mills Ltd project on ***Capacity Building for Efficient Utilization of Biomass for Bioenergy and Food Security in the Greater Mekong Sub region (TA-7833-REG)*** and is carried out by EPRO Consulting JSC. The Feasibility Study will provide inputs for designing a pilot investment with demand creation of Improved Cook Stove (ICS) in two districts of Hanoi and Phu Tho provinces.

The pilot investment aims to start a demand-creation of ICS in the two above-mentioned districts. Experiences from this pilot will be used for the formulation of the investment loan. The pilot investment is expected to have the participation of Agriculture and/or Forestry Institute (for awareness strategy and materials development), Hanoi University of Technology (for stove testing), Woman/farmer unions (for ICS awareness and dissemination), households (for demanding creation) of the pilot location and ICS supply chains (for ICS supply).

The pilot is expected to be implemented with (1) testing stove supply, (2) stove producer support and (3) community awareness and demand aggregation with the indicative budget of 65.000 USD. The two selected pilot districts of Hanoi and Phu Tho are Ung Hoa and Ha Hoa (control districts are Thanh Oai and Tan Son) respectively. Please see the inception report for more background on these districts.

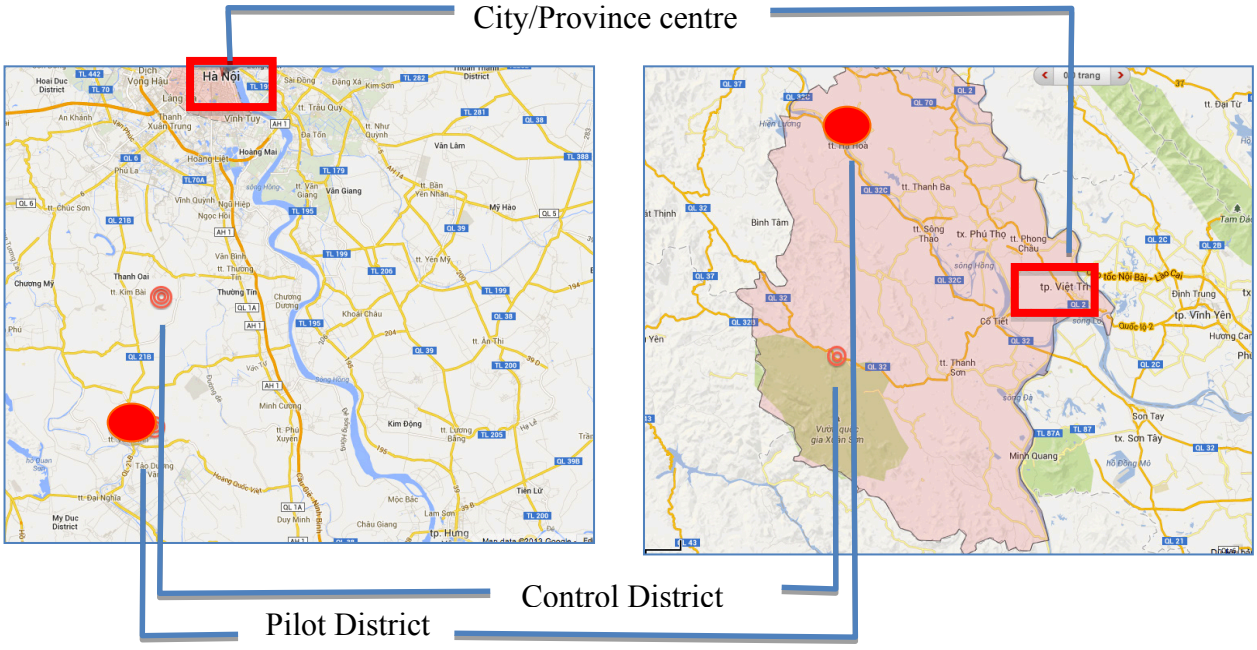

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Figure 1-1. Location of selected districts in Hanoi (left) and Phu Tho (right)

This report describes the findings from surveys in selected pilot districts, ICS supply chain and proposal on pilot investment project to scale up ICS under pre-defined framework of TA-7833-REG.

2. BACKGROUND

This feasibility study is based on results of the interviews in Hanoi and Phu Tho. The distribution of the responses is presented in the following table.

Table 2-1 . Overview of interviewees

Stakeholder interview	Hanoi		Phu Tho		Note
District	Ung Hoa (Pilot)	Thanh Oai (Control)	Ha Hoa (Pilot)	Tan Son (Control)	Both Pilot and control districts
Commune	Town: Van Dinh Communes: Vien Noi, Vien An, Dong Tien, Son Cong	Commune: Do Dong, Son Duong	Town: Ha Hoa Commune: Am Ha, Xuan Ang, Dai Pham, Phu Khanh	Town: Thu Cuc Commune: Tan Son	5 communes in pilot districts and 2 communes in control district. Communes are selected by woman union
Key Informant	6	1	1	5	Both district and commune levels
Woman Union, Farmer Union	12	1	12	3	Both district and commune levels
Household	78	27	77	29	Randomly selected by woman union/farmer union
ICS supply chain	21 11 ICS manufacturers and distributors, 1 ICS testing lab, 5 agriculture/forest extension organization, and 4 financial supporters				

The survey was carried out with financial data in VND. In order to present these data in USD, the exchange rate of 21.000 VND/USD is used.

2.1. Hanoi

The selected districts: Ung Hoa, pilot district, is located 40 km Southern of Hanoi centre with total area of 183.72km^2 and 198,000 residents in 56,788 households (see Table 4-1). It has 28 communes and 1 town. Thanh Oai, the control district, is 30 km away from Hanoi. According to the annual socio-economic achievement report of Ung Hoa People Committee, in 2012, the district grew by 2.6%. The district product values are contributed by 41% in agriculture (rice, vegetable, animal), 37% in industry (paper, metal casting, garment) and 22% in trading and services (retailer, garment exporting). In the control district (Thanh Oai), 50% of product values are from industrial activities.

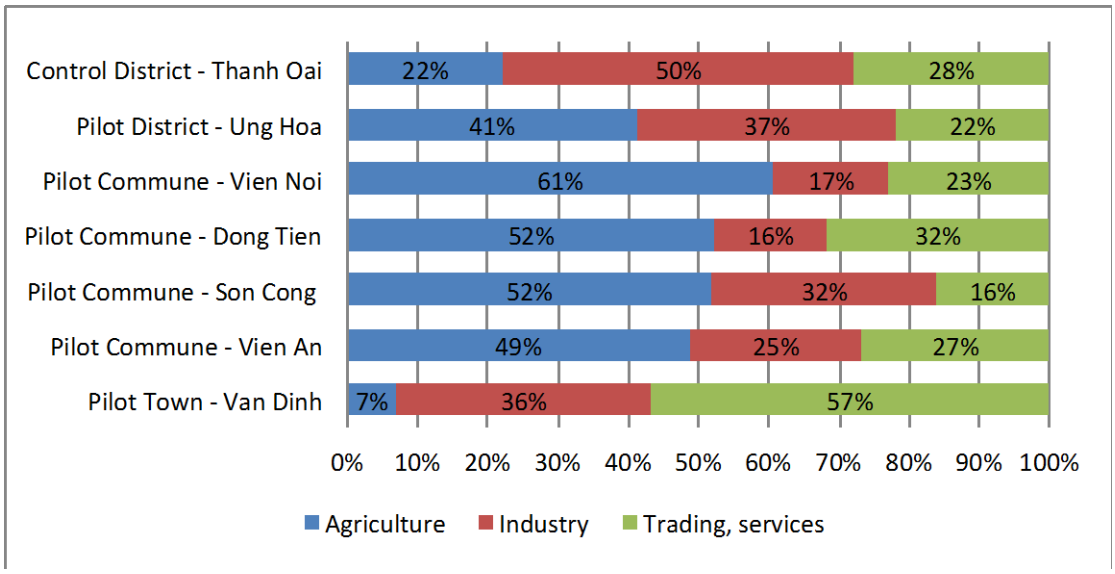


Figure 2-1. Economic structure in two selected districts of Hanoi

Ung Hoa is one of the eight priority districts of Hanoi to develop rice farming. Besides rice farming, residues of maize and Thanh Hao (Artemisia annua, medical) plants are the second important biomass sources. Firewood from gardens is also used for cooking. An overview of biomass sources in Ung Hoa is presented below

Table 2-2. Biomass sources in Ung Hoa District

No	Production			Biomass (see converting factor in annex 4.2)		
	Product	Unit	Quantity	Type	Unit	Quantity
1	Rice*	ton	134,036	Rice straw	ton	134,036
				Rice husk	ton	26,807
2	Corn*	ton	3,050	Corn stalk & leave	ton	9,150
				Corn cob	ton	3,050
3	Thanh Hao Leaves**	ton	469	Thanh Hao stalk	ton	704
** Socio-economic achievement report 2012 and orientation to 2013, Ung Hoa Peole Commitee, 2012*						
*** Uncompleted data, but covering 5 main plantation communes, including the biggest production of Son Cong commune*						

See biomass flow of pilot district in 2.3.

Cooking habit: In Ung Hoa district, 61% of surveyed households use biomass for cooking without gas (LGP). Gas is used as main cooking fuel in town (Van Dinh) and as supplement fuel in four remaining survey communes. The respondents showed that amongst residue cooking households, 84% use free residues, 14% buy residue (rice husk) and 2% buy residue when needed. Firewood, including Thanh Hao stalk are used as free biomass source in 74% of survey households.

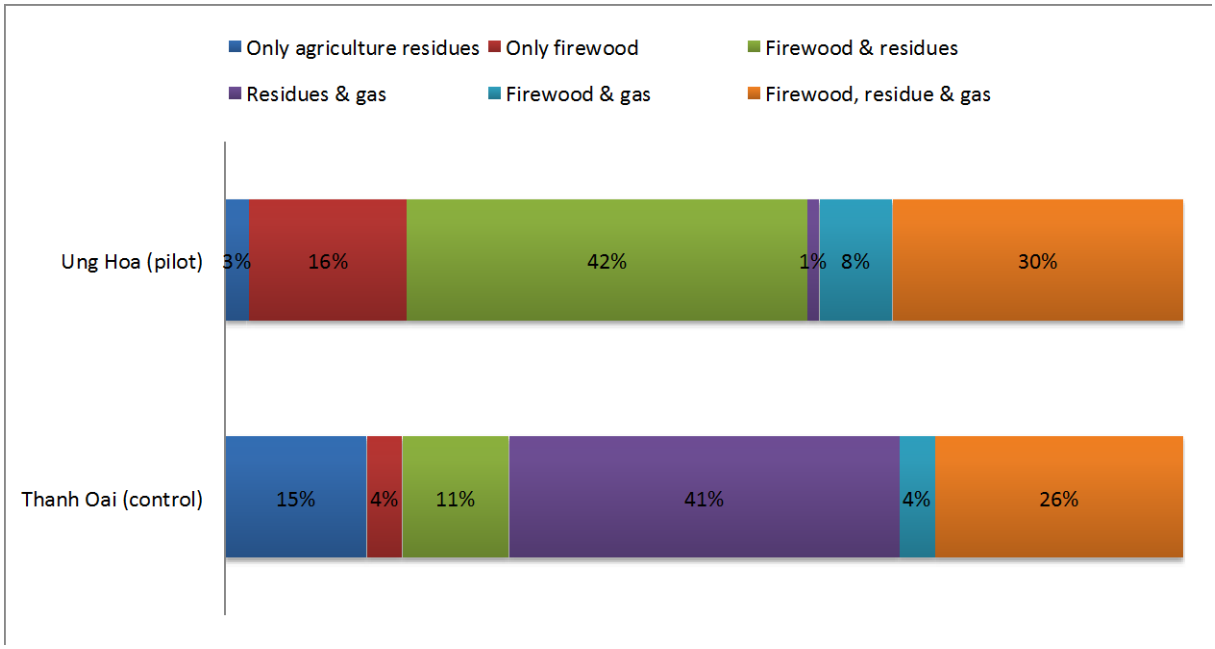


Figure 2-2. Fuels for cooking in two selected districts of Hanoi

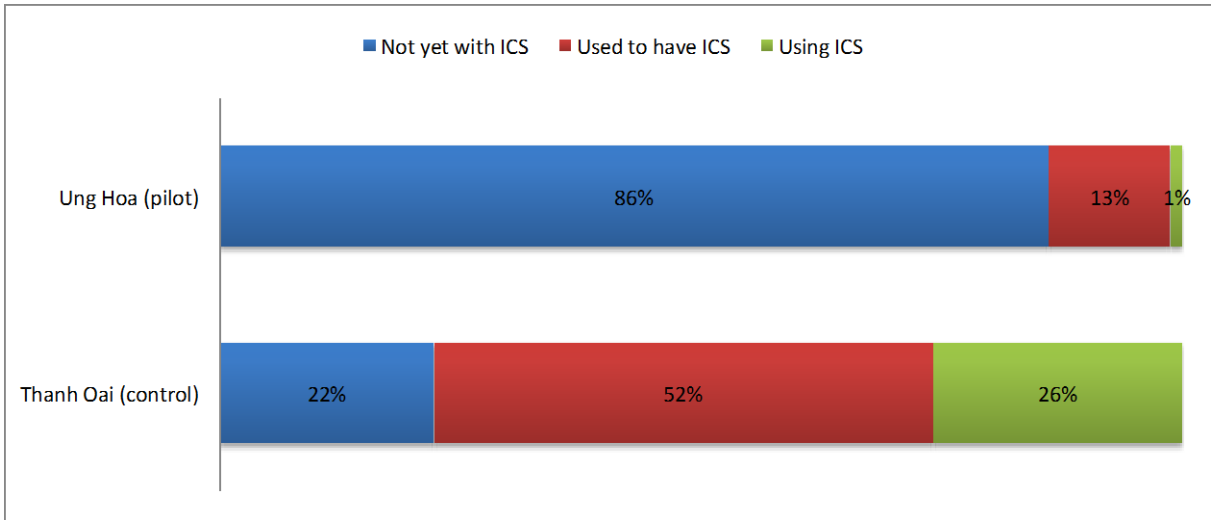


Figure 2-3. Usage of ICSs in two selected districts of Hanoi

There is a mix of traditional and improved cook stoves, where most of cook stoves at the surveyed households are still traditional (99% in Ung Hoa district). Rice husk used to be available for free and became costly in some communes after the introduction of ICS (introduction of Thanh Thuy model, see Figure 4-1, in 2011 by ICS producers through scrap dealers). The first ICSs were well accepted by the community at the price of 14.3 USD and remained good for one year. After that, cheaper ICSs were introduced with prices going gradually down to 5.7 USD and less life time (1-6 months). A number of households went back to the traditional cook stoves (13% in Ung Hoa and 52% in Thanh Oai).

Ung Hoa is one of the poorest districts in Hanoi. The Ung Hoa district has 3730 poor and magical poor households[1], counting for 6.5% of total households in the district. The ratio of poor households in five survey communes ranges from 4% to 20%. The economic condition of households also reflects their cooking cost (80% spent less than 14.3 USD a month). On average, a household in Ung Hoa district spents 5.3 USD per month for cooking.

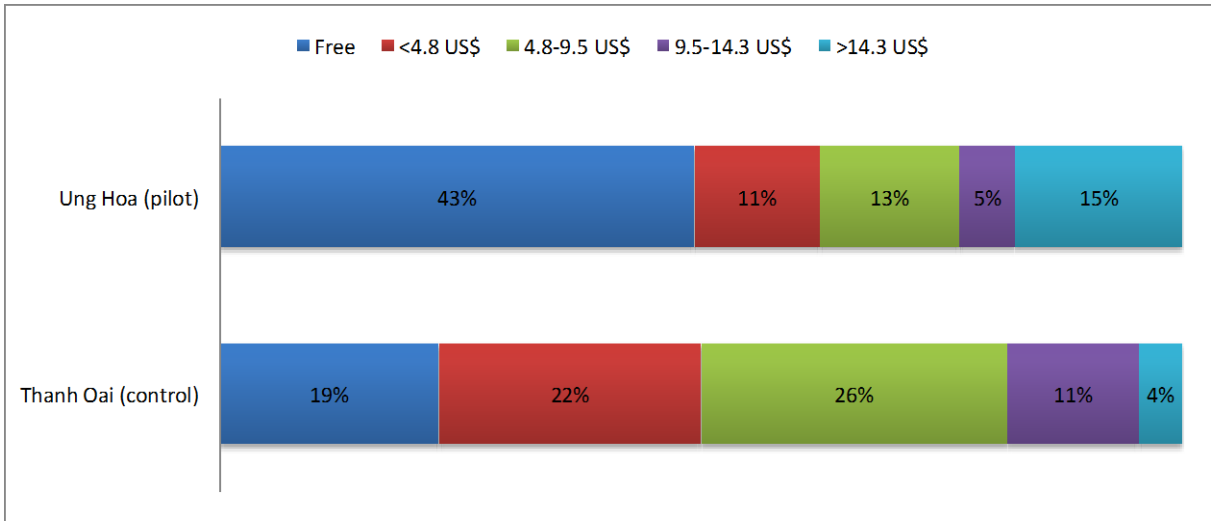
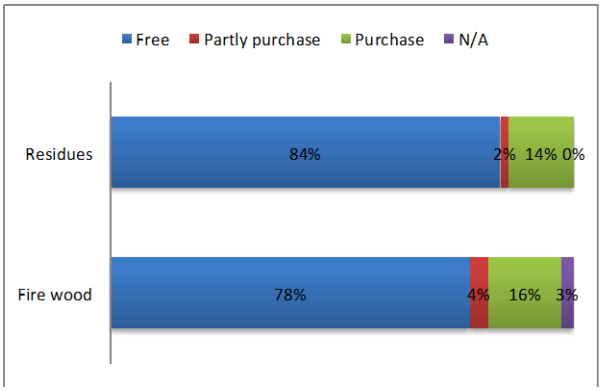
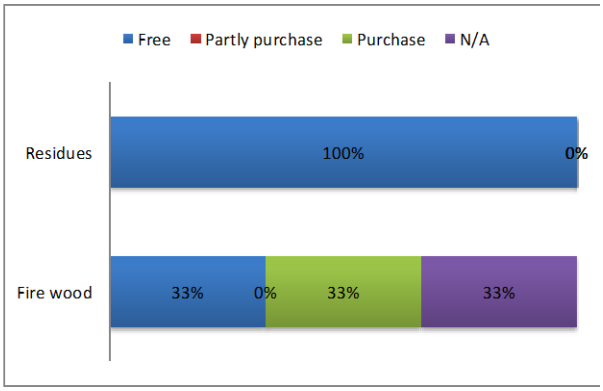


Figure 2-4. Monthly cooking cost in two selected districts of Hanoi





[1] Poor households' norm (2011-2015) for rural area those with monthly incomes of less than 19.0 USD. Marginally poor households in rural area are those with monthly incomes from 19.1-24.7 USD (decision 09/2011/QD-TTg, 30 November 2011).

Figure 2-5. Cooking cost by biomass in Ung Hoa (left) and Thanh Oai (right)

Desired ICS (ICS demand): The surveyed households responded very positive to the introduction of ICSs. 92% of surveyed households in Ung Hoa district expressed their interest in participation in pilot phase, 6% were not sure about their participation. There is only 1 household fears to change and said no to the pilot.

The surveyed households in Ung Hoa district indicated their preference on the cost of ICS that they are willing to pay. 14% of the households expect subsidies and 22% have no idea on the price they can pay for ICS, the key informants and representatives of farmer/woman unions believed that the ICS can be sold at the price of less than 14.3 USD as it was when introduced in 2011.

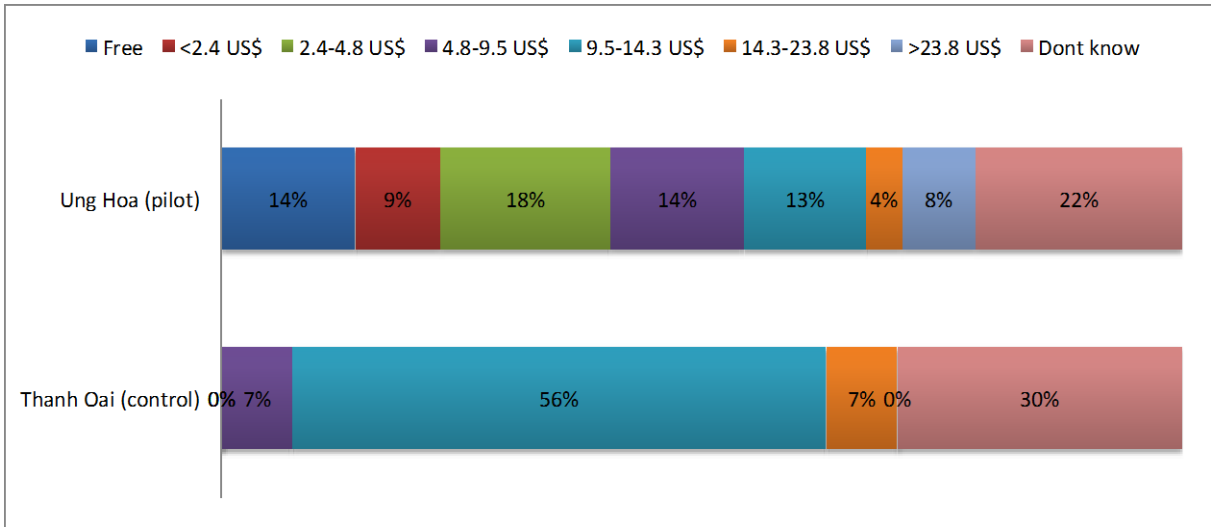


Figure 2-6. Affordable cost for ICSs in two selected districts of Hanoi

The six top expectations of desired ICSs are presented above, in which long lasting (more than 6 months), smokeless and affordable (less than 14.3 USD) are three top demands for ICSs in Ung Hoa district.

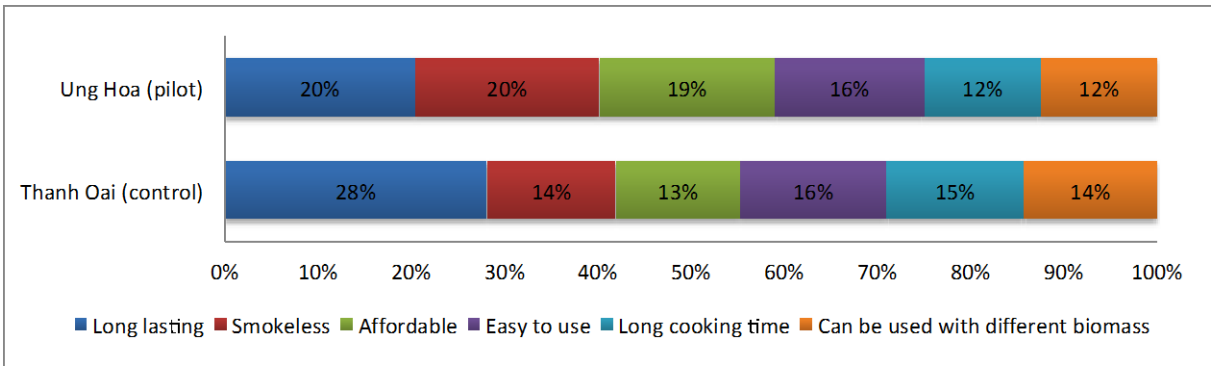


Figure 2-7. Desired ICSs in two selected districts of Hanoi

Preferred distribution channel: The surveyed households in Ung Hoa district expressed their interest in receiving information mainly from unions, while that of Thanh Oai district from local authority, union and other channel, mainly from mouth-to-mouth.

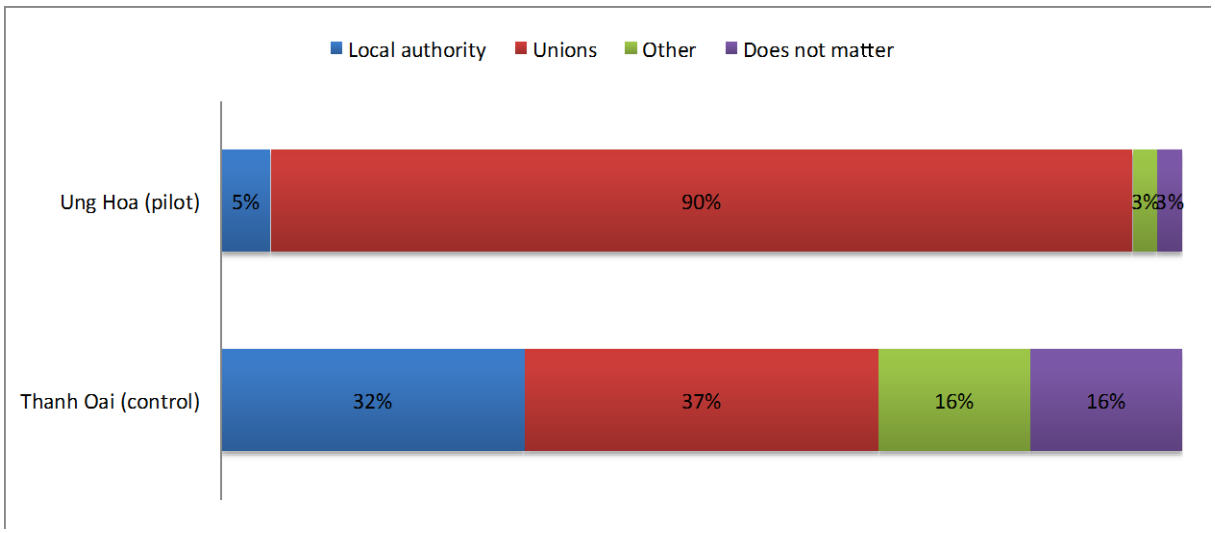


Figure 2-8. Prefered ICS promoters in two selected districts of Hanoi

It is noted that the surveyed households are not interested in receiving information from leaflets, but introduction of ICS through house visits, introduction events and to some extent the mass media.

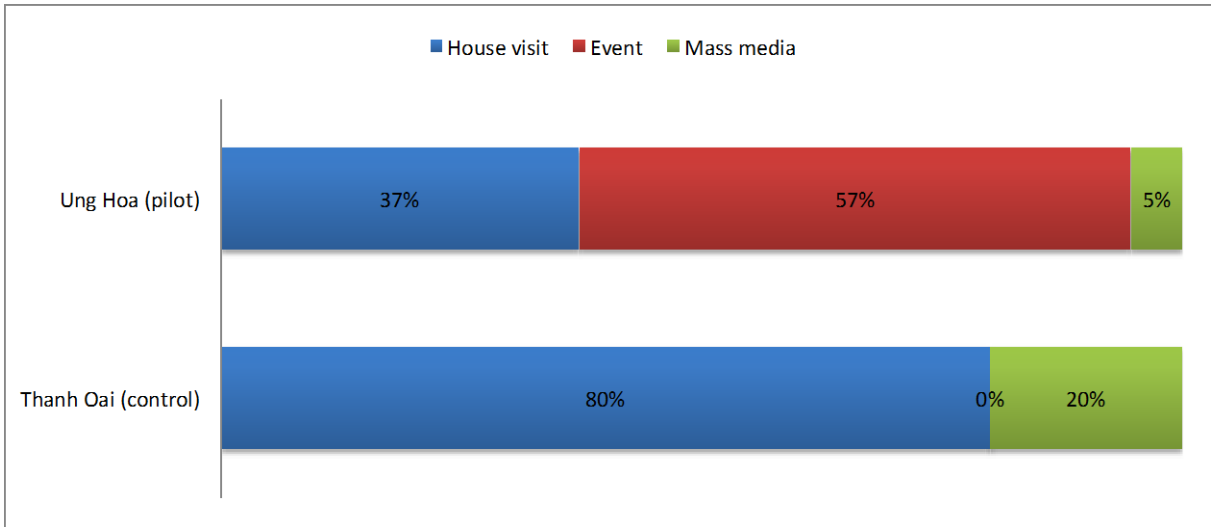


Figure 2-9. Prefered dissemination chanels in two selected districts of Hanoi

Representatives of both Unions (woman and farmer) were contacted to evaluate their interest in ICS pilot. We found that the Farmer Unions are more interested than Woman Unions in the surveyed districts, presented through interaction and time spent for the survey. It was difficult to make initial appointments with the Woman Union as well as re-contacting them after the survey to verify their needs.

100% of the representatives of the Farmer Unions in Ung Hoa district expressed their interest in promoting and distributing the ICS. Amongst them, 30% has experience in promoting commercial products. The farmer union is confident in introducing ICS with less than 14.3 USD, but good quality. Their expectations in participating in the pilot are:

- ICS must be of good quality: Being able to see and use the ICS before introducing it to the communities
- Training: Training in the features of ICS is more important than marketing/ communication and sale.
- Fee: there is fee for participating in the pilot phase and a commission on sales. There is no specific expectation on the fee for participation. The expected commission fee ranged from 3% to 15% in the five surveyed communes and based on the sales volume.

2.2. Phu Tho

<u>The selected districts:</u> Ha Hoa, pilot district, is 70 km North West of Phu Tho centre with total area of 339.34 km^2. In 2011, Ha Hoa district had 106,177 residents in 30,530 households; of them 82.55% are farmers, the highest farmer ratio in Phu Tho and 14% are poor and margical poor households (see

Table 4-2). There were 13% of poor households in Ha Hoa district. Ha Hoa has 33 communes and 1 town. Tan Son, the control district, is 80 km away from Phu Tho Centre.

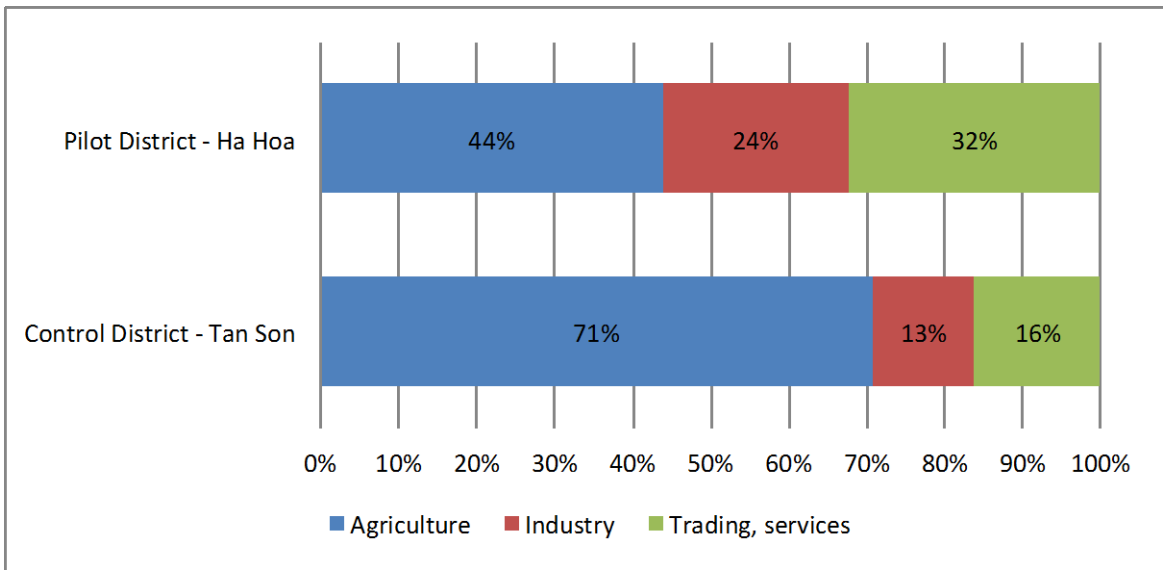


Figure 2-10. Economic structure in two selected districts of Phu Tho

Ha Hoa is a fast growing district. According to Statistic Office of Ha Hoa District and Department of Natural Resources and Environment of Phu Tho province, in 2011, the district grew by 11.7%. The product contribution of agriculture-forestry activities are gradually reducing and being replaced by industrial, trading and services. Compared to the activities in 2011, the area for rice farming in 2012 reduced by 14%, and consequently led to reduction in rice production by 6% and in maize production by 34%. However, the wood production increased by 40% and firewood increased by 1% without increasing the total area of natural forest.

With 16,689 ha for forestry, Ha Hoa is the second district of fire wood production in Phu Tho province, after Doan Hung district. Ha Hoa district was selected for this study due to the very high interest and responsiveness of the local authorities, including the Woman Union. Beside fire wood as main biomass source for cooking, Ha Hoa has 10,818 ha for agriculture, in which 65.9% and 8.5% areas are used for rice and maize farming. Overview of biomass sources in Ha Hoa district is presented below

Table 2-3. Biomass sources in Ha Hoa District

No	Production			Biomass (see converting factor in annex 4.2)		
	Product	Unit	Quantity	Type	Unit	Quantity
1	Rice*	ton	37,359	Rice straw	ton	37,359
				Rice husk	ton	7,472
2	Corn*	ton	3,639	Corn stalk & leaves	ton	10,917
				Corn cob	ton	3,639
3	Firewood**	Ste	171,340	Fire wood	ton	102,804
** Agriculture production of Phu Tho in 2012, DARD of Phu Tho*						
*** Forestry update 2012, DARD of Phu Tho*						

See biomass flow of pilot district in 2.3.

Cooking habit: In Ha Hoa district, firewood is the main fuel for cooking. There is mix of cooking fuels and the usage of these fuels very much depends from one household to another. Gas (LPG) is used for preparing breakfast and as a back up for cooking, counting for less than 30% of cooking time. Firewood is used for cooking the main meal, water, pig food and alcohol making. There are some biogas digesters introduced in Xuan Ang, one of the surveyed communes in Ha Hoa district. The production of biogas is not enough for cooking purposes.

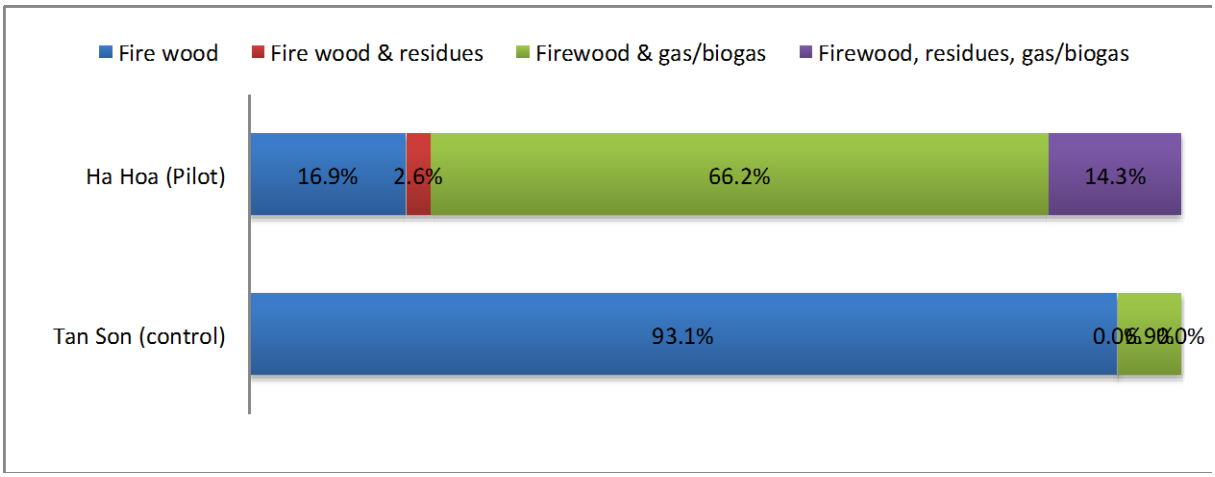


Figure 2-11. Fuels for cooking in two selected districts of Phu Tho

Only a small portion of the surveyed households use ICSs (7%) and most of cook stoves are traditional. In 1990, there was an introduction of ICS in Ha Hoa district (fix TK90 model, see Figure 4-1. The usage of this model was positively perceived by households due to its fire wood saving. However, this model was found smoky and difficult to use (fix place, short life time) and therefore some went back to traditional cook stoves.

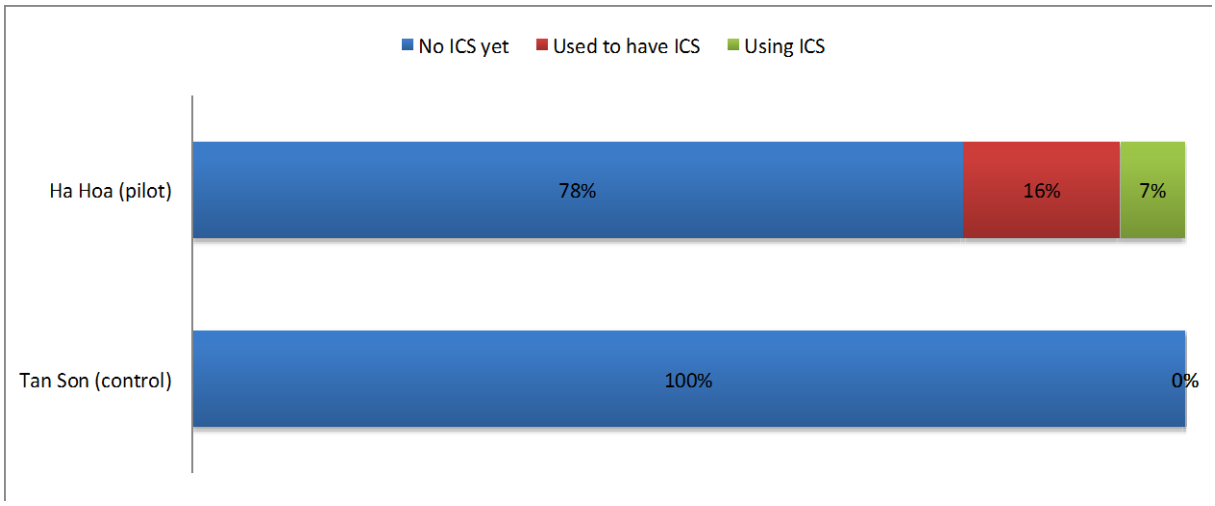


Figure 2-12. Usage of ICSs in two selected districts of Phu Tho

Usage of gas, although in small quantity (3-12 month per LPG bottle of 20 kg), contributes to the most cooking cost of the surveyed households. On average, the households in Ha Hoa district spent 8 USD/month for cooking.

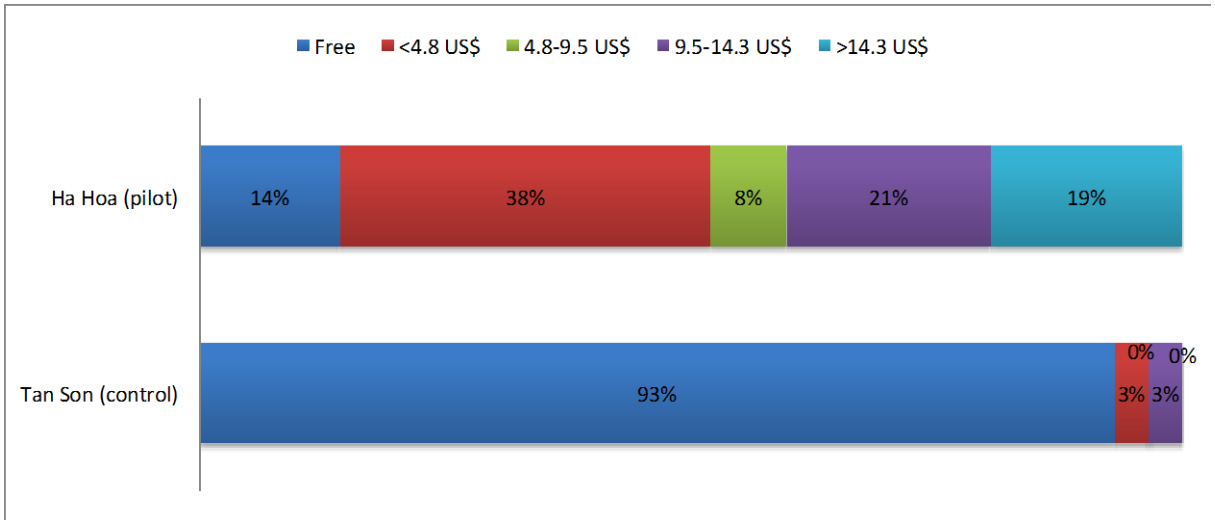


Figure 2-13. Monthly cooking cost in two selected districts of Phu Tho

Cost for cooking by biomass, particularly firewood is still low in two selected districts, where 52% of households cook with firewood for free in Ha Hoa district. The usage of residues is not popular in two selected districts, thus unclear answer on whether they have to pay.

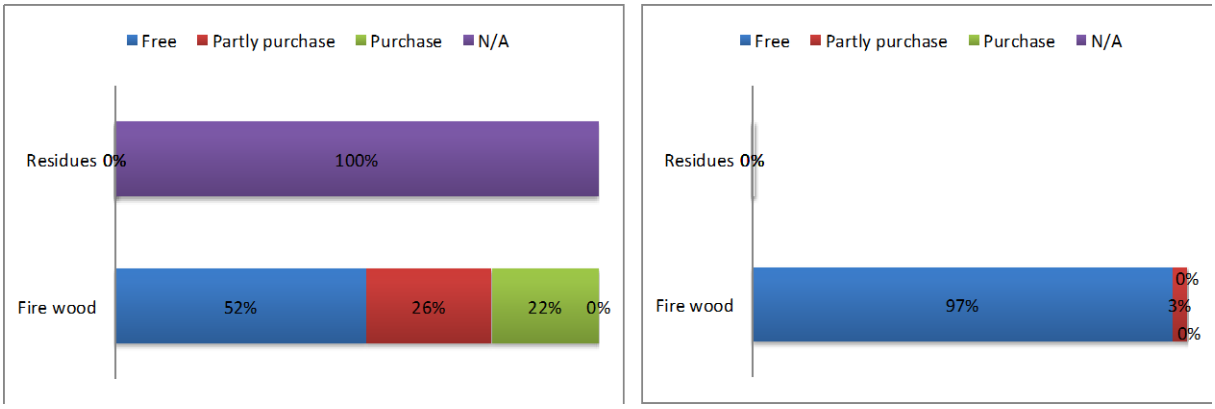


Figure 2-14. Cost of cooking by biomass in Ha Hoa (left) and Tan Son (right)

Desired ICS (ICS demand): The surveyed households responded very positive to the introduction of ICSs. 94% of the surveyed households in Ha Hoa district expressed their interest in participating thepilot phase, 4% is not sure about their participation. Only 1 household fears to change and said no to the pilot. This ratio in Tan Son is much lower (37%, 24% and 38% respectively).

Unlike the case of Hanoi, there are no households in Ha Hoa district who expect to receive ICSs for free. Depending on the purpose of cooking, ICS costs of less than 14.3 USD, and to some extent up to 23.8 USD would be purchased in Ha Hoa district. None of the households are willing to pay more than 47.6 USD for ICS at this moment. Consultancy to key informants and woman union of Ha Hoa districts confirms that the cookstoves of 9.5-14.3 USD can be sold for home cooking and of 14.3-23.8 USD can be sold for other cooking purposes such as preparing animal food, tofu, alcohol...

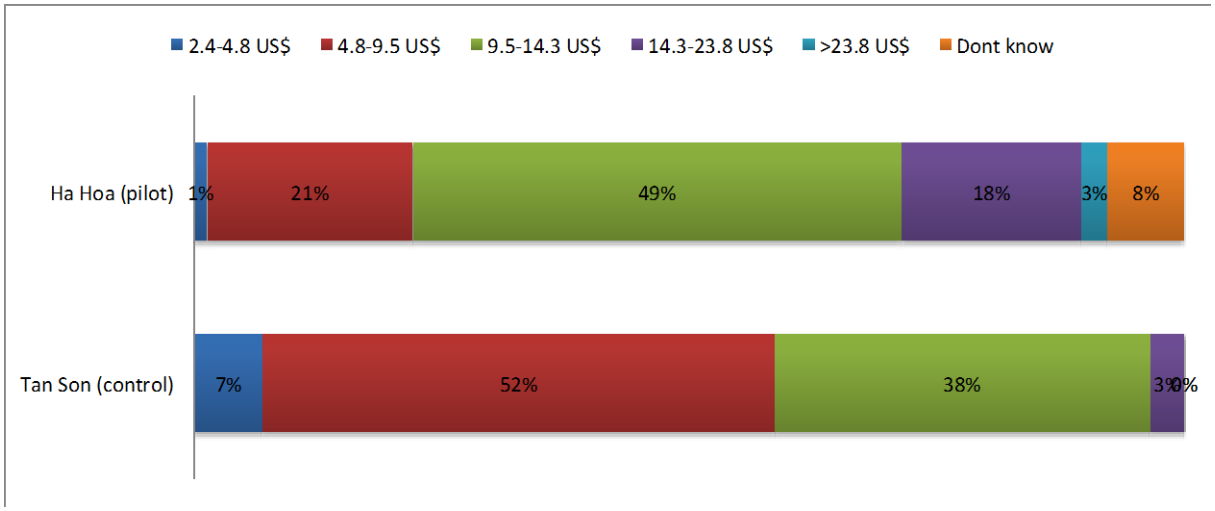


Figure 2-15. Aforrdable cost for ICSs in two selected districts of Phu Tho

The preferred characteristics of ICSs are also defined with smokeless, easy to use, long lasting (up to 2 years), long cooking time, usable with different biomass and affordable (up to 23.8USD) are the top six preferred criteria of ICS in Ha Hoa district.

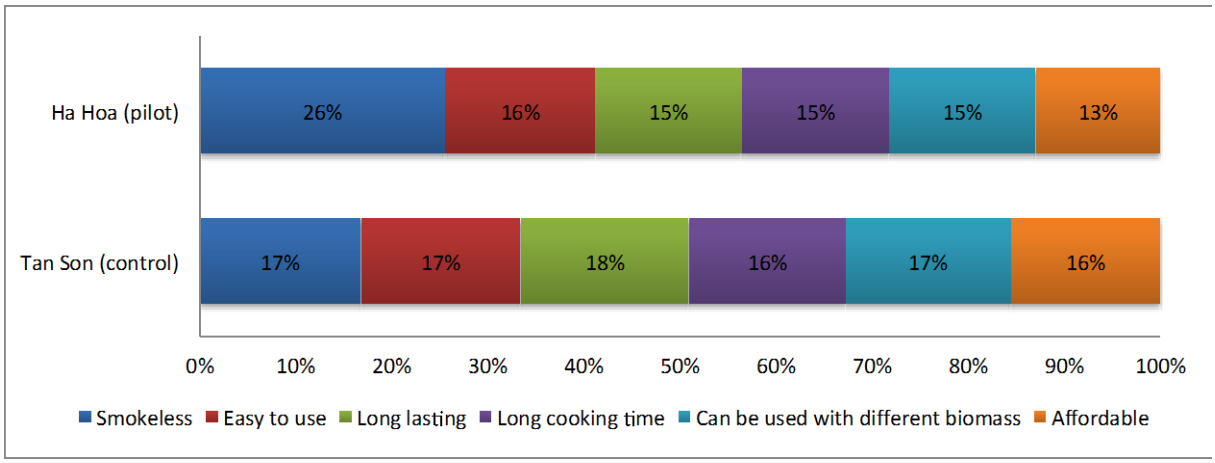


Figure 2-16. Expected ICSs in two selected districts of Phu Tho

It was also noted that the households are expecting to be able to use firewood with diameter of up to 5 cm and are not interested in pre-processing. They also expressed no interest in purchasing the current TK90 model. Some households expect, where biomass is not only used for food cooking, the ICS can bear a big pot (up to 60cm in diameter).

Preferred distribution channel: There is strong and consistent feedback of survey households on ICS promoters. Local authorities and unions are the preferred promoters. This can be explained as the households have experienced many fake electronic products introduced by suppliers and distributers recently. Mouth-to-mouth talk is not expected here, but quality guarantee of the local authority/unions.

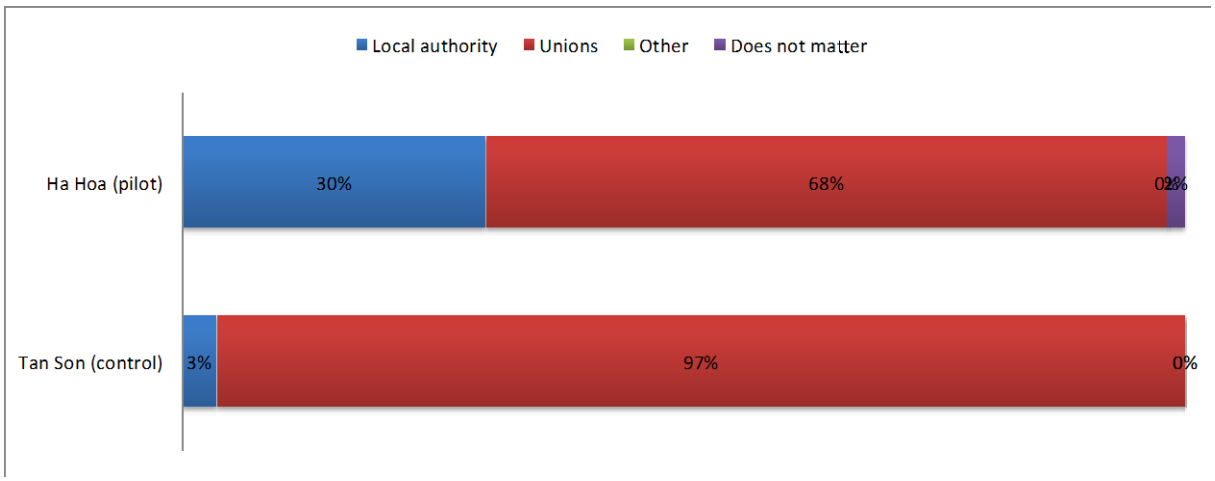


Figure 2-17. Prefered ICS promoter in two selected districts of Phu Tho

Unlike the responses in Hanoi, house visit, information event and leaflets are expected by the survey households in Ha Hoa district.

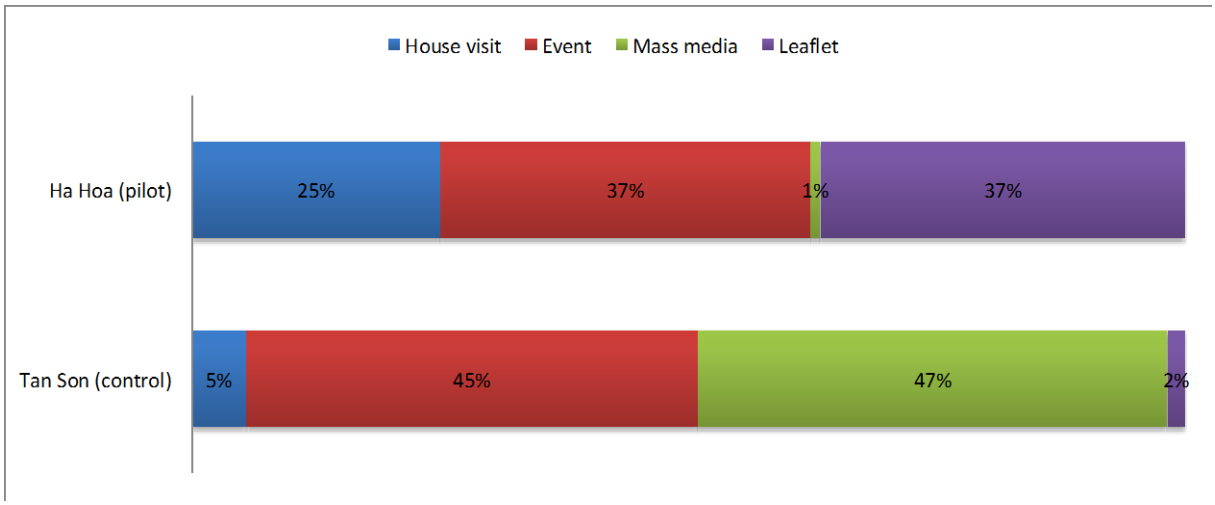


Figure 2-18. Prefered ICS information channels in two districts of Phu Tho

Representatives of both unions (woman and farmer) were contacted to evaluate their interest in the ICS pilot. We found that the the Woman Unions are recommended by Farmer Unions for this ICS promotion due to their natural activities of cooking, experiences in supporting households to access soft loans and promoting good chicken meat.

100% of representatives from woman unions in Ha Hoa district expressed their interest in promoting and distributing the ICS. Most of them are confident to carry out the ICS promotion without additional training, but some introduction to ICSs. Their expectations in participating in the pilot are:

- ICS must be of good quality: Not repeating the degradation in quality of TK90 fixed model. Some of them express their concern in test using before introduction to community
- Training: Training in ICS feature. Training in marketing/communication is more important than sales
- Fee: The woman unions see the fee for their participation will be paid under the promotion activities and are familiar with commission on sales. They are expecting to develop the promotion materials and activities on their own. The expected commission fee is similar to the rate from bank, ie 10-15% and based on sale volume.
- Legal binding: Contract singed with project on expected sale volume is expected

2.3. Biomass flow

Availability of biomass in two pilot districts is presented in Table 2-4 and Table 2-5, in which a large amount of rice farming residues are wasted in Hanoi (70% rice straw is burnt) and firewood is wasted in Phu Tho (20% tree bark is burnt). The usage of biomass in Hanoi and Phu Tho are estimated by key informants of the two pilot districts and presented as follows:

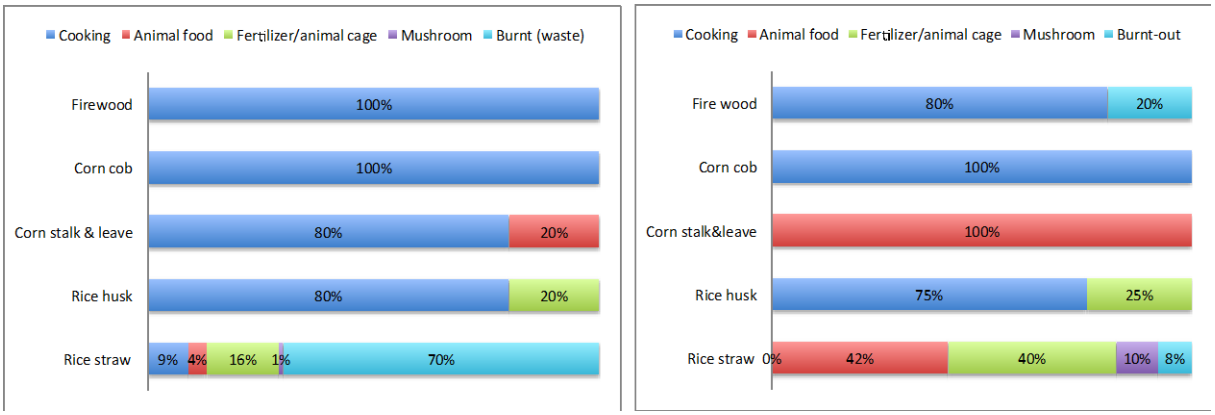


Figure 2-19. Usage of biomass in Ung Hoa (left) and Ha Hoa (right)

Taking these ratios on usage of biomass, the following tables present biomass usage by different purposes in two pilot districts

Table 2-4. Biomass availability and usage in Ung Hoa district, Hanoi

Biomass	Availability		Usage				
Type	Unit	Quantity	Cooking	Animal food	Fertilizer/ nesting	Mushroom	Burnt-out
Rice straw	ton	134,036	9,382.52	13,403.60	17,022.57	402.11	93,825.20
Rice husk	ton	26,807	21,445.76	-	5,361.44	-	-
Corn stalk & leave	ton	9,150	7,320.00	1,830.00	-	-	-
Corn cob	ton	3,050	3,050		-	-	-
Thanh Hao Stalk	ton	704	703.50	-	-	-	-
Total	**ton**	**173,747**	**43,972.50**	**7,801.44**	**26,807.20**	**1,340.36**	**93,825.20**

Table 2-5. Biomass availability and usage in Ha Hoa district, Phu Tho

Biomass	Availability		Usage				
Type	Unit	Quantity	Cooking	Animal food	Fertilizer/ nesting	Mushroom	Burnt-out
Rice straw	ton	37,359	-	15,690.78	14,943.60	3,735.90	2,988.72
Rice husk	ton	7,472	5,603.85	-	1,867.95	-	-
Corn stalk & leave	ton	10,917	-	10,917.00	-	-	-
Corn cob	ton	3,639	3,639.00	-	-	-	-
Thanh Hao Stalk	ton	102,804	82,243.15	-	-	-	20,560.79
Total	**ton**	**162,191**	**91,486.00**	**26,607.78**	**16,811.55**	**3,735.90**	**23,549.51**

Firewood:

Ung Hoa is the rice farming district. The major source of firewood in Ung Hoa is Thanh Hao stalk and leftover rattan from joss products (handicraft applications to burn and send to dead people). The incomplete data from major sources of firewood presents availability of 704 tons firewood for cooking in Ung Hoa district.

Firewood is available in the form of small branches and barks of the furniture workshop in Ha Hoa district. It is estimated that the district has 102,804 tons firewood in 2012, excluding sawdust, short chips of the workshop. Due to high availability of firewood, 20% is burned for cleaning up purposes, wasting an estimated amount of 20,000 tons, three times firewood resource in Ung Hoa at the moment.

Firewood is used directly for cooking without pre-chopping or processing.

Maize residues (corn leave, stalks and cob):

Maize is grown in both pilot districts with a small production of around 3,000-4,000 tons per year. Maize residues can be used for both cooking and animal food. All corncobs are used for cooking. In Ung Hoa, 20% of corn leaves and stalk are used for animal feed, 80% for cooking, while 100% of the corn leave and stalk is used for animal food in Ha Hoa district. Therefore 10,370 tons of maize residues in Ung Hoa district and 3639 ton of corn cob in Ha Hoa district for cooking would be available.

Both districts, Ung Hoa and Ha Hoa, are growing secondary crops such as peanut, vegetables... The biomass values of these sources are unknown, but not expected to be significant for cooking as they were not mentioned/seen during the survey.

Maize residues are used directly for cooking without pre-chopping or processing.

Rice residues (rice straw, rice husk):

Rice residues are available in both Ung Hoa and Ha Hoa district, of them most of rice husk is used for cooking (80% in Ung Hoa and 75% in Ha Hoa district). Rice husk is also used for fertilizing back the rice fields or nesting the cattles.

Unlike rice husk, rice straw is less popular for cooking due to its low density and therefore large storage requirement. In Ung Hoa, a rice farming based district, 70% of the rice straw is burned to the air after crop. This does not only cause waste of biomass sources, but creates smoking issues during burning. Ha Hoa district, a forest dependent district, has sufficient biomass resources and does not use rice straw for cooking. Here, rice straw is mainly used as animal food, cattle nesting, fertilizer sources or mushroom cultivation. There is an estimate of 8% rice straw burned in the field in Ha Hoa.

The following figures present current biomass flows in both pilot districts, in which the daily cooking needs of a person is estimated as 1.5 kg/person/day for Hanoi and 1.3 kg/person/day for Phu Tho and of a household is 7.7 kg/household/day for other purposes than daily food cooking[2] (preparation of animal food, products), specific heat values of rice husk, rice straw, corn leave & stalk, corn cob, and firewood are 14.6, 14.4, 14.7, 15.4, and 15.5 GJ/ton[3] accordingly. These figures also present the biomass coverage for cooking of 198.000 residents or 56.788 households in Ung Hoa districts, Hanoi and 105,459 residents and 30,530 households in Ha Hoa district, Phu Tho (see detail in 4.3 and 0).

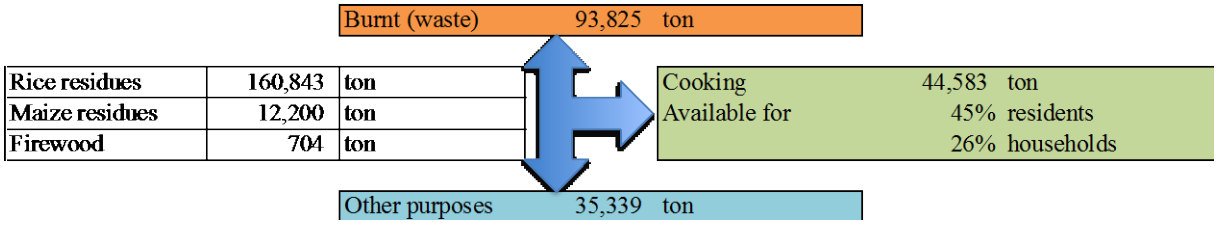


Figure 2-20. Current biomass flow in Ung Hoa district, Hanoi

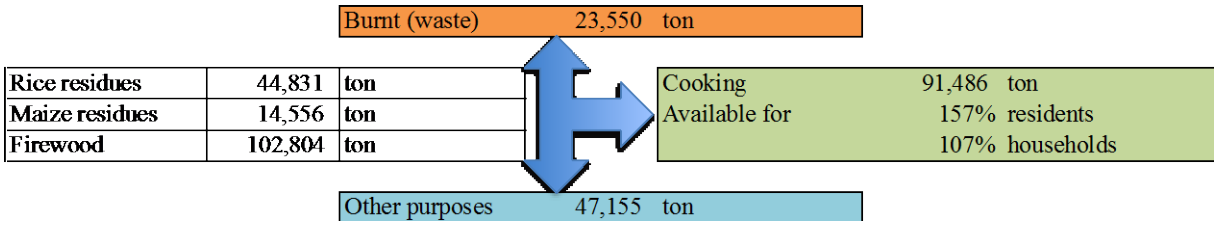


Figure 2-21. Current biomass flow in Ha Hoa district, Phu Tho

It is clear that the current biomass resources and usage is sufficient to cover cooking needs of all residents in Ha Hoa district, while it is not enough for Ung Hoa district. Without

[2] Ministry of Industry and Trade – Study on widely use of ICSs in rural households in selected provinces, 2007
[3] Tran Thi Quynh, Stuty and evaluate technology for biomass usage in Hai Dung, Hanoi National University, 2009

consideration of utilizing the burned rice straw, the upscale in Ung Hoa district will be very limited.

The following figure presents the biomass flow after using burnt-out rice straw, which show sufficient biomass resources for household cooking.

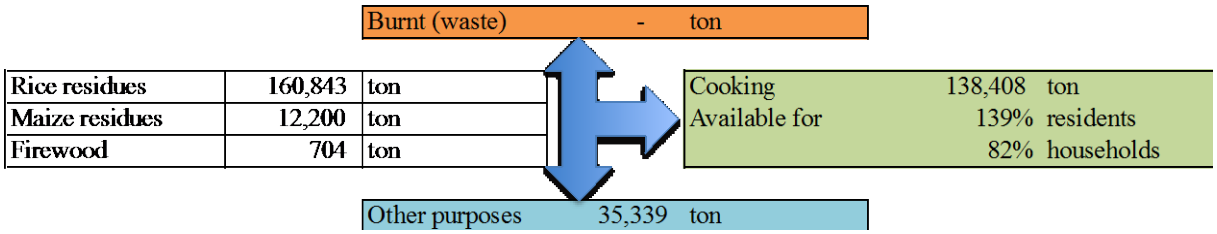


Figure 2-22. Scenario on utilization of burnt-out rice straw in Ung Hoa district, Hanoi

Although the usage of rice straw for cooking provides opportunity to utilise waste biomass, it is difficult to predict the attitudes of the households in changing cooking fuels, thus the maximum usage of waste rice straw is un-realistic. It is therefore recommended not to target all households in Ung Hoa district to use biomass. The introduction of ICSs at pilot phase, and later scale-up, will be therefore selected to the affordable households with possibility to use rice straw as cooking fuels.

The introduction of ICS in Ha Hoa districts will have no limitation, except the availability of ICSs and the expectations of the households.

2.4. ICS

There are 26 ICS models of 12 producers (see list in annex 0) with three levels of technologies:

- Simple ICS: Simple improves of traditional cook stove without electric fan. There are 15 models and provided by 5 producers
- Semi-gasification: Fire and generated CO/biomass are in the same chamber. Electric fan and pre-processed biomass or small size (rice husk, wood chip, pressed biomass...) are required. There are 7 models and provided by 5 producers
- Gasification: Fire and generated CO/biomass are in different chambers. Electric fan and pre-processed biomass or small size (rice husk, wood chip, pressed biomass...) are required. There are 4 models and provided by 4 producers

10 ICS suppliers were contacted and interviewed to have a better understanding of their comparability to pilot. Amongst 26 ICS, 12 have been evaluated for pilot due to their readiness/availability for pilot investment and with lifetime of more than 6 months, smokeless, safe, selling cost of less than 47.6 USD, and availability of commercial products. Willingness of ICS owners also reflects readiness in participation of the pilot. The following criteria haves been used to evaluate suitable ICS for the pilot phase:

Table 2-6. ICS evaluation criteria for pilot

Evaluation	Evaluation point (1-5)					Weight of importance[4]	
Criteria	**1**	**2**	**3**	**4**	**5**	**Ung Hoa**	**Ha Hoa**
Long lasting, year life time	1 to ≤ 2	2 to ≤ 3	3 to ≤ 4	4 to ≤ 5	>5	20.4%	25.5%
Smokeless	Less than traditional stove	Little smoke during cooking and start	Little smoke during cooking	Smoke at start only	No smoke	19.7%	15.6%
Affordable cost[5], USD	≥ 47.6	23.8 to ≤ 47.6	14.3 to ≤ 23.8	9.5 to ≤ 14.3	≤ 9.5	18.9%	15.3%
Easy to use	Fix type, training or additional energy required	Fixed type, no training or additional energy required	Portable type, training, additional energy required	Portable type, no training or additional energy needed	Portable type, no training, no additional energy	16.0%	15.3%
Long cooking time, minutes	< 30	30 to ≤ 40	40 to ≤ 50	50 to ≤ 60	> 60	12.5%	15.3%
Can be used with variation type of biomass	Processed biomass – particular type	Processed biomass – all type	Available biomass – particular type	Available biomass – all type with particular type required	Available biomass – all type	12.5%	13.0%

Transportation cost was added into original cost with assumption of using delivery trucks, 50 stoves per order (see Table 4-5 and Table 4-6). The selling price for evaluation is based on average expected 12% commission (see estimation in 4.8).

Four models of ICSs from three producers with highest evaluation points are recommended below. Please see annex 4.12 for more evaluation results of all ICS candidates. These ICSs will be introduced in both Ung Hoa and Ha Hoa districts.

[4] Refer to responses, that are presented in Figure 2-7 and Figure 2-16

[5] Selling price, including transportation and commission fee for marketing/sale

Table 2-7. List of recommended ICSs for pilot

Producer	Model	Description	Selling price in Ung Hoa, USD	Selling Price in Ha Hoa, USD	Evaluation point
Thân Xuân Trường	Truong Giang-2	Portable ICS for cooking, boiling water and preparing animal food with big pot, 5kg, cone shape, 1-3 years life time, smoke at start and became less during cooking, original price of 7.1 USD, every one can use, continuous cooking, can be used with all type of biomass but better with firewood, 10 years in the market, durability material test, clean stove certificate. This model is slowly replacing smaller model of Truong Giang 1	9.9	11.2	3.56
Lê Hồng	Portable TK90	Portable ICS, 15 kg, cylinder shape, made of clay with metal cover, improved model of previous TK90 in lifetime, 1-3 year life time, smoke at start and less during cooking, original price of 7.1 USD, continuous cooking, firewood only, less than 5 years in market	10.6	9.1	3.51
Đỗ Đức Khôi	DK-T4-2	Portable ICS, 4 kg, cylinder shape with diameter of 25 cm, rustless, 1.5-2 year life time, little smoke at start only, original price of 19.5 USD, 50 min cooking if collecting activated carbon, all type of biomass but fire wood is compulsory, around 3 years in market. Improvement of DK-T3 in double bottom and core chamber, leading to better fire with less biomass. Exported to Cambodia	23.5	24.6	3.15
Đỗ Đức Khôi	DK-T5-2	Portable ICS, 3 kg, cylinder shape with diameter of 22 cm, rustless, 1.5-2 year life time, little smoke at start only, original price of 19.1 USD, continuous cooking, designed for short fire wood (20cm) only, less than 3 years in market. Improvement of DK-T4 for the area of no rice husk available	23.5	24.6	3.18

2.5. ICS supply chain & training needs

Besides the key stakeholders in ICS supply chain (ICS producers, local unions, households and TA7833 office), the catalytic stakeholders, that support the implementation of pilot investment were interviewed. The overview of ICS supply chain and its stakeholders are presented in below diagram.

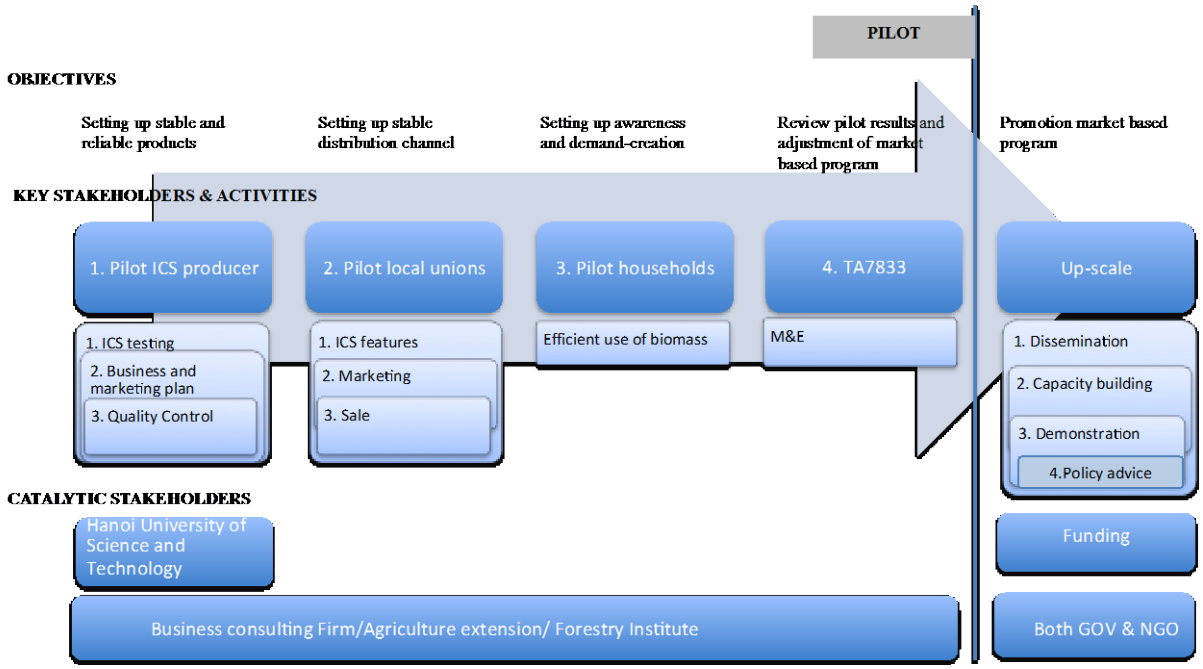


Figure 2-23. ICS supply chain and stakeholders

ICS producers:

The three recommended ICS producers for pilot investment are Than Xuan Truong, Le Hong and Do Duc Khoi. These ICS producers shall provide selected ICS and technical support to local unions as sale agencies in two pilot districts. The production capacity of these producers are 400 stoves/day, 10 stoves/day and 10 stoves/day. Mr. Than Xuan Truong has experience in building his own market in the North, Mr. Mr Le Hong has developed smaller market but with 23 years experience. Mr Do Duc Khoi mainly provide ICS under project needs, including to Cambodia market.

All three recommended ICS producers expressed the needs of training in business and marketing plan. The training and support in quality control should not go too deep into their knowhow as they do not want to share with others. This means there will be peer-to-peer and tailor capacity building support per producer.

ICS producers provide ICS with fix cost to distributors, if any. Distributors decide the selling price by themselves.There have been no conflicts between producers and distributors so far. The case of Thuan Phu Company, sale agency of Thao Nguyen (gasification ICS in Phu Tho), is an example when Thuan Phu became ICS producer after serving Thao Nguyen. However, since the ICS market is not yet saturated, there have been no concern on this by producers yet.

Local unions:

Farmer unions in Ung Hoa district (Hanoi) and woman unions in Ha Hoa district (Phu Tho) was found suitable for the role of ICS promotion, distribution and sale under this pilot investment. The local unions shall act as sale agency of selected producers to outreach the households in their area. Besides, the local unions shall promote efficient use of biomass to households.

While the union in Ung Hoa has limited experience in sale, the union in Ha Hoa has been working on sale of different products for years. It was defined that both unions needs training on ICS features (strength, weakness, installation, safe and efficiency, maintenance, testing and labelling). Marketing and communication skills are needed to trainboth unions. The union in Ha Hoa (Phu Tho) does not find the need for sale skills while it is required by the union in Ung Hoa (Ha noi). While some contents can be covered by the ICS producers (installation, maintenance, testing and labelling), the business consulting firm/agriculture extension/forestry institutes should arrange different trainings for the remaining contents. It is important that the unions are able to test the ICS as they will not be only in charge of sale, but also after sale services. Capacity on efficient use of biomass should also be delivered to unions, so that they can further disseminate to households.

The both unions expect some fee in participation in the pilot (not specify) under the form of promotion activities and set up the distribution and sale channel. It was expected that the capacity of the union, and market, would be increased through support of pilot in investment and connection to producers. In scale up phase, the unions can use their own funds to purchase ICS and sell with commission fees of 10-15%.

The introduction of ICS should be started at district level to communes. Communication and information channels Ung Hoa and Ha Hoa districts are different. Leaflets should not be used in Ung Hoa (Hanoi), but house visits, information events and mass media, while in Ha Hoa, Phu Tho, all communication channels of house visits, information events, and leaflets are welcome. The mass media is not recommended in Phu Tho.

Households

Households in five communes and the town of Ung Hoa district (Hanoi), including Van Dinh, Vien Noi, Vien An, Dong Tien, Son Cong and of Ha Hoa district (Phu Tho), including Ha Hoa, Am Ha, Xuan Ang, Dai Khang and Phu Khanh will participate in this pilot investment.

Although the training needs are not studied amongst the households, it is assumed that the households will receive basic training on how to use the ICS and awareness on efficient use of biomass. These trainings will be delivered either by ICS producers, unions or even business consulting firms, depending on the time of training.

In Ung Hoa district, since the biomass resources is insufficient for all households cooking in if not utilizing burnt rice straw and there is number of households expected to receive ICS for free under this pilot, which is not strongly support market mechanism, it is recommended to take selective households to participate in this pilot, ie. the ones in need of biomass cooking and can afford payment.

Hanoi University of Science and Technology:

The Laboratory at Department of Thermal Energy Systems, Institute of Heat Engineering and Refrigeration of Hanoi University of Science and Technology has been selected as the stove testing organization during pilot phase.
The quotation of the laboratory for stove testing includes 21 parameters with total cost of 785.7 USD per sample. An estimation of 610 USD per sample is made for 11 most relevant parameters of this pilot promotion and dissemination activities (see annex 4.5).
It is noted that the test results of the Laboratory is not an official certificate for ICS, but the only available facility at the moment.

Business Consulting Firm/Agriculture Extension/Forestry Institute
The TOR required contacting and exploring the possibility for Agriculture Extension/forestry institute participating in this pilot investment as capacity building service providers on awareness strategy and development of awareness materials as well as the bridge to link woman union engagement to awareness program.

Four organizations were contacted and interviewed; each has advantages and disadvantages in participating in the pilot. Their qualification in capacity building, awareness raising and ICS is summarised below:

Table 2-8. Overview of some interviewed agriculture extension/forestry institute

Organization	Findings	Risks in pilot participation
Faculty of Forestry, Vietnam Forestry University	Providing capacity building in biomass	Lack of experience in business and ICS
Faculty of Engineering, Hanoi University of Agriculture	Developing and manufacturing rice husk cook stoves in laboratory scale with reference from Thailand, the Philippines Experience in technical capacity building in Cao Bang, Ha Giang, Hoa Binh, Thanh Hoa provinces in using rice husk cook stoves	Lack of experience in business
Vietnam Institute of Agricultural Engineering and Post Harvesting	Developing ICS model with pressed biomass Provided ICS training and technology transfer in Cao Bang, Thai Binh, Nam Dinh under small orders last two years	Conflicts of interest during pilot

Organization	Findings	Risks in pilot participation
Technology		
Centre for Silviculture Technique Research and Transfer, Vietnam Academy of Forest Science (VAFS)	23 years experience in ICS research and development Providing fix and portable ICS to 27 provinces under donor program Experience in ICS supply chain and technical capacity building on ICS usage	Conflicts of interest during pilot

Due to certain risks found as described above, it is not possible to recommend the appropriate capacity building service providers at this stage. The TA7833 should consider providing capacity building opportunity not only to the agricultural extension or forestry institute, but any Business Consulting Firm, who ideally can deliver capacity building per above described training needs, no conflicts of interest and good understanding of ICSs and its supply.

Funding:

Two Vietnam Banks for Social Policies in Ung Hoa and Ha Hoa were contacted to explore possibility of financial support under pilot and scale up phase. The banks are providing soft loans of 6% for vocational learning or woman doing business. Investment in ICSs is not in the supporting list of Ha Hoa (Phu Tho). In Ung Hoa (Hanoi), the loan for ICS will be charged with interest rate of 10.8% under environmental supporting program. However, this interest rate is no longer attractive. The union may consider usage of the soft loan under scale-up phase.

3. PILOT DESIGN

The feasibility study showed interest and positive responses of households in both Ung Hoa and Ha Hoa districts towards introduction of ICS. It also showed that the best available ICSs met 63-71% expectation of the households in affordable cost, smokeless, duration as well as duration of cooking time, easy to use and possibility of using different biomass sources.

The feasibility study also confirmed the confidence of local unions in playing promotion and sale role in ICS supply. If selecting a focal point in pilot district, Farmer Union in Ung Hoa district and Woman Union in Ha Hoa districts were found suitable. The connection to the unions should come from district to commune level. These unions need to be trained in participating in ICS supply chain, including efficient use of biomass, ICS features, its maintenance and guarantee. Marketing and sale skill should also be built, in which the woman union in Ung Hoa districts and its communes are confident in their sale skill.

The feasibility study found selected ICS producers in need of support in marketing and business plan as well as setting up reliable distribution channel. The market for their available ICSs are not confirmed in pilot district due to limitation in not meeting all expectation of

households and the ICS introduction in pilot districts may even come up with additional models. Under this pilot, the reliable supply chain can be developed and tested with their willingness in participation.

There are sufficient biomass resources for cooking in upscale phase in Ha Hoa district, Phu Tho. However, the introduction of ICS in upscale phase in Ung Hoa district, Hanoi should be selective unless the current burned out rice straw is also used for cooking.

Guarantee scheme, including duration and safety is not yet set up and is under responsible of the producers. This responsibility can be shared with unions, once the unions participate in the supply chain and be defined in the commercial contract.

3.1. Pilot location

The pilot will be carried out in both Ung Hoa District (Hanoi) and Ha Hoa District (Phu Tho), of them there will be five communes and town each.

The characteristics of these two pilot locations is summarised below. For more information, please refer to the background in chapter 2.1 and 2.2.

Table 3-1. Overview of pilot location

Category	Ung Hoa, Hanoi	Ha Hoa, Phu Tho
Location	40 km Southern of Hanoi centre	70 km North West of Phu Tho centre
Area	183.72 km^2	339.34 km^2
No of residents	198,000	106,177
No of households	56,788	30,530
No of communes & town	28	34
% of poor family	6.5%	14%
Pilot communes and town	5 (Van Dinh, Vien Noi, Vien An, Dong Tien and Son Cong)	5 (Ha Hoa, Am Ha, Xuan Ang, Dai Pham and Phu Khanh)
Cooking purpose	Daily meal, water	Daily meal, water and other purposes as animal food, preparation of tofu, alcohol
Current biomass sources for cooking in weight	Rice husk: 48%, free, partly purchase Rice straw: 27%, free Corn stalk and leaves: 16%, free Corn cob: 7%, free Firewood: 2%, free, partly purchase	Fire wood: 90%, free, partly purchase Rice husk: 6%, free, partly purchase Corn cob: 4%, free
Other fuel for cooking	Gas (combined with biomass)	Coal, gas, biogas (combined with biomass)
Average cost for cooking	5.3 USD/month/households	8 USD/month/households

3.2. Pilot stakeholder

Three ICS producers, representatives of district's and 5 commune's farmer unions in Ung Hoa district, district's and 5 commune's woman unions in Ha Hoa district, laboratory of Hanoi University of Science and Technology and one business consulting firm will be key stakeholders of this pilot. Their background and expectation are summarised in chapter 2.5, their contact is attached in chapter 4.11. The participating stakeholders in this pilot shall contribute to the demand creation with their responsibility as follows:

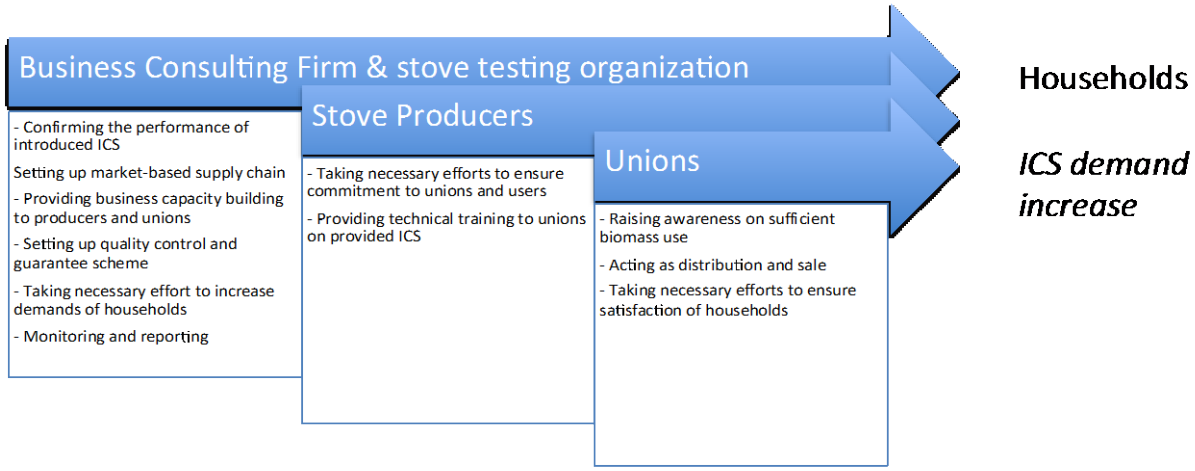


Figure 3-1. Pilot stakeholders and responsibilities

The following table summarised their role/activities in pilot.

Table 3-2. Overview of stakeholders and activities

Category		Ung Hoa, Hanoi	Ha Hoa, Phu Tho
Stove producer	Contact	Mr. Than Xuan Truong (Bac Giang), Mr. Le Hong (Phu Tho) and Mr. Do Duc Khoi (Hanoi) - see contact in 4.11	
	Mr. Than Xuan Truong	• Model: Truong Giang 2, orriginal price of 7.1 USD/stove • Portable ICS for cooking, boiling water and preparing animal food with big pot, 5kg, cone shape, 1-3 years life time, smoke at start and became less during cooking, continuous cooking, can be used with all type of biomass but better with firewood • This model is 10 years in the market, obtained durability material test, clean stove certificate. The production capacity of this model is 400 stoves/day.	
	Mr. Le Hong	• Model: Portable TK90, original price of 7.1 USD/stove • Portable ICS, 15 kg, cylinder shape, made of clay with metal cover, can be used outdoor, 1-3 year life time, smoke at start and less during cooking, continuous cooking, firewood only • This model is the innovation of the fix stove, which has 23 years in market, obtained innovation award in 1990, efficiency test in 1990, but lost some credit in Ha Hoa district. The production capacity of this	

Category		Ung Hoa, Hanoi	Ha Hoa, Phu Tho
		model is 10 stove/day	
	Mr. Do Duc Khoi	• Model: DK-T4-2, original price of 19.5 USD/stove • Portable ICS, 4 kg, cylinder shape with diameter of 25 cm, 1.5-2 year life time, little smoke at start only, 50 min cooking if collecting activated carbon, can be used with all type of biomass but fire wood is compulsory • This model is the improvement of model DK-T3 with double bottom and core chamber, leading to better fire with less biomass. The model has been exported to Cambodia. The production capacity of this model is 10 stove/day	
	Mr. Do Duc Khoi	• Model: DK-T5-2, original price of 19.1 USD/stove • Portable ICS, 3 kg, cylinder shape with diameter of 22 cm, 1.5-2 year life time, little smoke at start only, continuous cooking, designed for short fire wood (20cm) only • This model is the latest version of the producer, focusing on the areas with high availability of firewood. The production capacity of this model is 10 stove/day	
	Number of ICS under pilot	75, selection per type by households	75, selection per type by households
	Average cost, USD	13.2 (from 7.1 to 19.1 USD)	13.2 (from 7.1 to 19.1 USD)
	Role	• Providing ICS on order of unions • Providing technical training on ICS features, operation, maintenance... as to distributor • Providing necessary technical information and supports as manual, participation in information events • Developing and implementing a marketing and business plan • Ensure quality control as committed to union	
	Training & support need	• Marketing and business plan • Quality control (limited, not to touch know how of ICS)	
Woman/ farmer unions	Contact	Farmer unions of 5 communes and town (see contact in 4.11)	Woman unions of 5 communes and town with pre-contact to woman union of Ha Hoa district (see contact in 4.11)
	Role	• Directly working with ICS producers on promotion, distribution, sale and after sale • Providing ICS to households as sale agency (voucher system), including guarantee • Development of ICS awareness materials and implementation of awareness strategy • Raising awareness to households on sufficient biomass usage	
	Training &	• ICS features and usage	• ICS features and usage

Category		Ung Hoa, Hanoi	Ha Hoa, Phu Tho
	support need	• Marketing and sale skill	• Marketing skill, to some extent sale skill
	Expected commission fee	3-15% (12% will be used for pilot design)	10-15% (12% will be used for pilot design)
Hanoi University of Science and Technology	Contact	Hanoi University of Science and Technology (see contact in 4.11)	
	Role	Testing stoves with provided biomass	
	Cost	610 USD per sample (see full testing category and cost in 4.5)	
Business consulting Firm	Contact	To be defined, can be one of the agriculture extension, forestry institute, but not necessarily recommended (see Table 2-8)	
	Role	• Setting up commercial contract between unions and ICS producers • Supporting stove producers in developing, implementation of marketing and business plan, quality control, ICS user manual during pilot phase • Supporting unions in developing and implementation of voucher & guarantee system, awareness strategy, training in marketing and sale skill, training in efficient use of biomass • Supporting TA 7833 in monitoring and evaluation	

3.3. Biomass availability and flow

Rice farming residues (rice husk, rice straw), maize residues (corn stalk, leaves, cob) and firewood are available in both Ung Hoa and Ha Hoa district. They are used for cooking, other purposes as food for animal, preparing their nest, making fertiliser, and as a base for mushroom plantation. There is an significant amount of rice straw (70%) not in used, but wasted by being burnt after crop right in the fields.

It is estimated that the current biomass resources in Ha Hoa district is sufficient for cooking by all residents and households, even for additional purposes as preparing animal food, tofu or alcohol. However, the current biomass resources for cooking in Ung hoa district is only sufficient for 45% of residents. Without considering the utilisation of burned out rice straw or being selective with households to introduce ICS, the district may face shortage of biomass for cooking.

Detail findings and analysis on biomass availability and flow is presented in chapter 2.3.

3.4. Pilot outputs

The pilot investment will achieve the following outputs:

1. The stove supply chain from producers to union is set up and tested on market based mechanism
2. The stove producers are supported in sustainable business and
3. The demand on sufficient biomass use increased

3.5. Pilot activities

The pilot will include four groups of activities. They are (1) Establishment of stove supply chain framework, (2) Stove producer supports, (3) Communication awareness and demand aggregation and (4) Pilot management with the activities as follows. It is noted that the stove producers and unions are beneficiaries of this pilot, however, it is strongly recommended to assign responsibility of some activities to unions in order to encourage community participation.

Table 3-3. Overview of pilot activities

Activities			Organization in charge
1		**ESTABLISHMENT OF STOVE SUPPLY CHAIN FRAMEWORK**	
	1	Kick-off introductory meetings in Ung Hoa, Hanoi	Consulting firm
	2	Kick-of Introductory meetings in Ha Hoa, Phu Tho	Consulting firm
	3	Development of three way commercial contracts between producers, union and TA 8377	Consulting firm
3		**STOVE PRODUCER SUPPORTS**	
	1	Laboratory test	HUST/Consulting firm
	2	Development of simple ICS manual	Consulting firm
	4	Peer-to-peer support in business and marketing plan	Consulting firm
	5	Per-to-peer support in quality control	Consulting firm
	5	Show-room rental in Ung hoa, Hanoi	Farmer Union
	6	Show-room rental in Ha Hoa, Phu Tho	Woman Union
4		**COMMUNICATION AWARENESS & DEMAND AGREGATION**	
	1	Development of voucher and guarantee scheme for unions	Consulting firm
	2	Providing support in voucher and guarantee scheme of unions	Consulting firm
	3	Developing awareness strategy for 10 communes	Consulting firm
	4	Awareness/demonstration event in Ha Hoa, Phu Tho	Woman Union
	5	Awareness/demonstration event in Ung Hoa, Hanoi	Farmer Union
	6	Training in marketing, communication skill and efficient biomass use	Consulting firm

Activities			Organization in charge
	7	Developing and printing awareness materials in Ha Hoa, Phu Tho	Woman Union
	8	Usage of local media in Ung Hoa, Hanoi	Farmer Union
	9	Buy one get one free campaign in Ung Hoa, Hanoi	Farmer Union
	10	Buy four get one free campaign in Ung Hoa, Hanoi	Farmer Union
	11	Buy one get one free campaign in Ha Hoa, Phu Tho	Woman Union
	12	Buy four get one free campaign in Ha Hoa, Phu Tho	Woman Union
5		**PILOT MANAGEMENT**	
	1	Quarterly monitoring and reporting	Consulting firm
	4	Efficiency comparison between traditional and ICS	Consulting firm
	3	Logistics (contact, administrative support, change in campaign, translation...)	Consulting firm

Establishment of supply chain framework

These activities are carried out to link producers with future local sale agencies (unions) under commercial/market mechanism contract. This framework should be continued without support of TA7833 after pilot period.

Within the first quarter of pilot, the supply chain should be set up. The business-consulting firm shall contact both ICS producers and district's and commune's unions and connect them through a number of introductory meetings and discussion in order to obtain common agreement for pilot period that the producers agree to let unions act as their sale agency with specific conditions on the following, but not limited to:

- Committed quality of ICS to guarantee
- Price list to pilot location with different volumes
- Committed selling price to households with consideration of volume, transportation cost, commission rate that both union and producers can sell and maintain during pilot period (currently the selling price is estimated with order of 50 stoves and 12% commission)
- Term of payment
- Responsibility of each party in guarantee scheme, particularly in committed durability and safety of ICS to households as well as no direct selling of producers in pilot districts.

At this stage, the TA7833 should be the witness of agreement and provided commitment on supporting the development of supply chain, including marketing, sale, capacity building and

two promotion campaigns on “buy one get one” (up to 5 stove per communes) and “buy four get one” (1 stove per commune).

The common agreement will be in the form of three parties contract between producers, district’s union and TA7833.

It is expected that the introductory meetings will not include only introduction of ICSs, discussion, but trial usage before common agreement is made. The business-consulting firm is responsible for this arrangement and receive cost to cover these meetings.

Stove producer support

The activities under this group are carried out in order to strengthen the capacity of producers in knowing and committing the quality of ICS as well as the local supply chain. It is expected that the pilot producers will understand the links between business and commitment to its supply chain members.

The business-consulting firm shall work in peer with each producer to identify performance of selected ICS, development of user manual, development of marketing and business plan, quality control, and setting up local show room in pilot communes.

The performance of selected ICSs will be tested with representative biomass source, which will be recommended by producers and unions, two samples per ICS.

The ICS user manual will be developed in ready-to-print form and user friendly. The manual should be short, self explain and can be attached to ICS. The Business Consulting Firm shall provide this manual to district’s and commune’s union. The producers shall decide on its usage, including printing. The user manual shall include information on its advantages to traditional cook stoves, how to use and maintain ICS and contact.

Each producer shall be trained by Consulting Firm in understanding the market, setting sale target per quarter and developing marketing and business plan to meet the desired. The marketing and business plan for pilot district will be developed as results of capacity building, where quarter sale volume is defined and monitored. This marketing and business plan shall be prepared in first quarter and maintained during the pilot period.

Capacity building for individual producer in quality control will be built as a part of business plan and with voucher and guarantee scheme, which will be developed for union. The capacity building in quality control will focus on QC principle, setting up quality control system on defect rates during production and after sale rather than going into design of ICS as no producer would like to share this.

Last but not least support to the stove producers, the Consulting firm will work with communities to set up local showroom and contact in each pilot communes, so that the commune union can response directly to producers on their needs of technical support and urgent orders.

Communication awareness / demand aggregation

The activities under this group are carried out to increase awareness on sufficient biomass use and in the same time strengthen the marketing and sale capacity of the union in supply chain.

Within the first quarter, the Business Consulting Firm shall build pilot union's capacity on communicating sufficient biomass use, marketing and sale skill in through the introduction of selected ICSs toward households.

Voucher and guarantee system will also be introduced in first quarter to unions as bookkeeping skill for reporting and quality control purposes. The business consulting firm shall not only introduce, instruct, but also monitor and provide support in following this system to the union. Stakeholders (producers, district union, commune union, business consulting firm and TA7833) will review the data of this system.

During this capacity building, awareness strategy per each commune shall be developed with active participation of unions. The Business Consulting Firm shall collect local knowledge of unions and findings of this feasibility study to work out the awareness strategy and its communication materials. Each province shall receive an amount of 12,700 USD for carry out the strategy with objective of installation up to 75 stoves per province (see budgeting in 3.9). The following activities are suggestion, based on survey results are listed below, and need to be revised, if needed, under awareness strategy:

- Quarter 1: Marketing materials in the form of print-out for Ha Hoa district and news for local media in Ung Hoa district.
- Quarter 2: Buy one get one free campaign at the commune's show rooms. This is opportunity to introduce sale agency (unions) and interest in ICS and is limited to first 25 free stove per district. This campaign is expected to achieve installation of 100 stoves with project support and other installation without project support.
- Quarter 3 & 4: Awareness/information events (2 times per commune). This will be organized in the form that three providers can demonstrate their ICSs, the unions can increase awareness and demand on sufficient biomass use and sale. This can be organized in one central place, house visit or combining. In the first event, buy four get one free will be introduced to the first purchase to understand the market preferred ICS. Unions and producers will decide the promotion strategy in second information event with their own costs or agreed cost sharing between them.

Pilot management

The business consulting firm shall not only in charge of setting up ICS supply chain in pilot districts, supporting its stakeholders, but providing management support to TA7833 in

success implementation of the pilot, including impact assessment, regular monitoring and evaluation.

The impact assessment will be based on comparison between traditional cook stove and purchased ICS in pilot in efficiency (boiling 2,5 litter in the same condition), CO (in low fire), CO (in high fire) and particles with the same biomass sources. This baseline should be completed in first quarter.

The business consulting firm shall work with district's and commune's unions to understand their sale volume and demand as well as provide logistic and professional support in demand aggregation and maintaining voucher and quality guarantee system. The business-consulting firm will, in parallel, work with producers to understand working cooperation with unions and provide professional support in implementation of marketing and business plan.

The achievement in pilot districts will be reported quarterly to TA7833. In the last quarter, the monitoring and evaluation will include impact comparison between pilot (Ung Hoa, Ha Hoa) and control districts (Thanh Oai, Tan Son). Regular monitoring and reporting shall be carried out by business consulting firm as described in 3.8.

3.6. Performance indicator

The pilot shall be monitored by the expected outputs, not its activities, as follows:

Output 1: The stove supply chain from producers to unions is set up and tested on market based mechanism

Two indicators are proposed for this output to measure the performance in:

- Setting up supply chain: It is expected that each producer will have their own marketing and business plan and therefore conditions for their supply chain. The indicator for this performance is *"6 commercial contracts for pilot period are signed between producers, district unions and TA7833 within first quarter of pilot"*.
- Testing supply chain: The contract should not only be maintained by all three parties, but should also be proved to be feasible. The indicator for this performance is *"There is continuation of at least one commercial contract between producer and union at the end of pilot phase"*.

Output 2: The stove producers are supported in sustainable business

Three indicators are proposed for this output to measure performance in:

- Being able to commit quality: Lesson learnt from previous introduced ICSs in two selected pilot districts showed the disappointment in degradation of ICS quality, particularly in its lifetime. There will be no firm demand if this quality is not

committed and guaranteed. The indicator for this performance is *"All stove producers are able to identify and provide guarantee scheme to users within first quarter of pilot"*.

- Being able to demonstrate the product: ICS is developed with two main purposes of more efficient use of biomass and less smoke than traditional cook stoves. How to use it properly is critical to achieve these purposes. Development of ICS user manual helps producers in increase their capacity in demonstration, in present these advantages and secure the lifetime of products. The indicator for this performance is *"All stove producers have developed ICS user manual within first quarter of pilot"*.

- Being able to develop and implement marketing and business plan: There is no specific marketing and business plan found in selected producers. The supply is based on call-in order. For long-term sustainable business, if the producers wish so, they should be able to understand their market, set target and proactively access the market to meet the target. The indicator for this performance is *"At lease one producer is successful with marketing and business plan"*

Output 3: Increasing demand on efficient biomass use:

Two indicators are proposed for this output to measure the performance in:

- Increase demand on ICS: Purchasing and usage of ICS are the best prove of demand in efficient use of biomass. This can happen in the form of changing from traditional cook stove into ICS (more efficient use) or replacing current cooking fuel (biomass use). Within the scope of pilot, the number of purchased ICS can be measured. The indicator for this performance is *"Number of purchased ICS in pilot districts increased"*

- Shifting from traditional cook stoves to ICS: ICS is proved to be better efficient in biomass usage. The shifting from traditional cook stoves to ICS should not only be measured by number of ICS, but also number of households that still use traditional cook stoves or the households that purchases ICS to replace traditional cookstoves. Ung Hoa has 86% households using traditional cook stoves and this number is 78% in Ha Hoa district. The indicator for this performance is "*Number of households with traditional cook stoves reduced by the end of pilot"*.

3.7. Work plan

Work schedule

The implementation of the pilot will be one year long, includes four quarters, in which the activities in quarter 1 include preparation/setting up, in quarter 2 and 3 are promoting and in last quarter is self-running. The pilot schedule is presented in the following table

Table 3-4. Pilot work schedule

Activities		Month											
		1	2	3	4	5	6	7	8	9	10	11	12
ESTABLISHMENT OF STOVE SUPPLY CHAIN FRAMEWORK													
1.1	Kick-off introductory meetings in Ung Hoa, Hanoi												
1.2	Kick-of Introductory meetings in Ha Hoa, Phu Tho												
1.3	Development of three way commercial contracts between producers, union and TA 8377												
STOVE PRODUCER SUPPORTS													
2.1	Laboratory test												
2.2	Development of simple ICS manual												
2.3	Peer-to-peer support in business and marketing plan												
2.4	Per-to-peer support in quality control												
2.5	Show-room rental in Ung hoa, Hanoi												
2.6	Show-room rental in Ha Hoa, Phu Tho												
COMMUNICATION AWARENESS & DEMAND AGREGATION													
3.1	Development of voucher and guarantee scheme												
3.2	Providing support in voucher and guarantee scheme												
3.3	Developing awareness strategy for 10 communes												
3.4	Awareness/demonstration event in Ha Hoa, Phu Tho												
3.5	Awareness/demonstration event in Ung Hoa, Hanoi												
3.6	Training in marketing, communication skill and efficient biomass use												
3.7	Developing awareness printing materials in Ha Hoa, Phu Tho												
3.8	Usage of local media in Ung Hoa, Hanoi												
3.9	Buy one get one free campaign in Ung Hoa, Hanoi												
3.10	Buy four get one free campaign in Ung Hoa, Hanoi												

Activities		Month											
		1	2	3	4	5	6	7	8	9	10	11	12
3.11	Buy one get one free campaign in Ha Hoa, Phu Tho												
3.12	Buy four get one free campaign in Ha Hoa, Phu Tho												
PILOT MANAGEMENT													
4.1	Quarterly monitoring and reporting												
4.2	Efficiency comparison between traditional and ICS												
4.3	Logistics												

Implementation arrangement

The responsible of each stakeholder is presented in Figure 3-1 and Table 3-3. Accordingly, the overall management of the pilot, including logistic and technical supports to all stakeholders will be provided by Business Consulting Firm, while agreed marketing activities under commune's awareness strategies will be provided by district's and commune's unions. The budget allocation (see 3.9) reflects this arrangement. The following presents target of each stakeholder along with implementation schedule

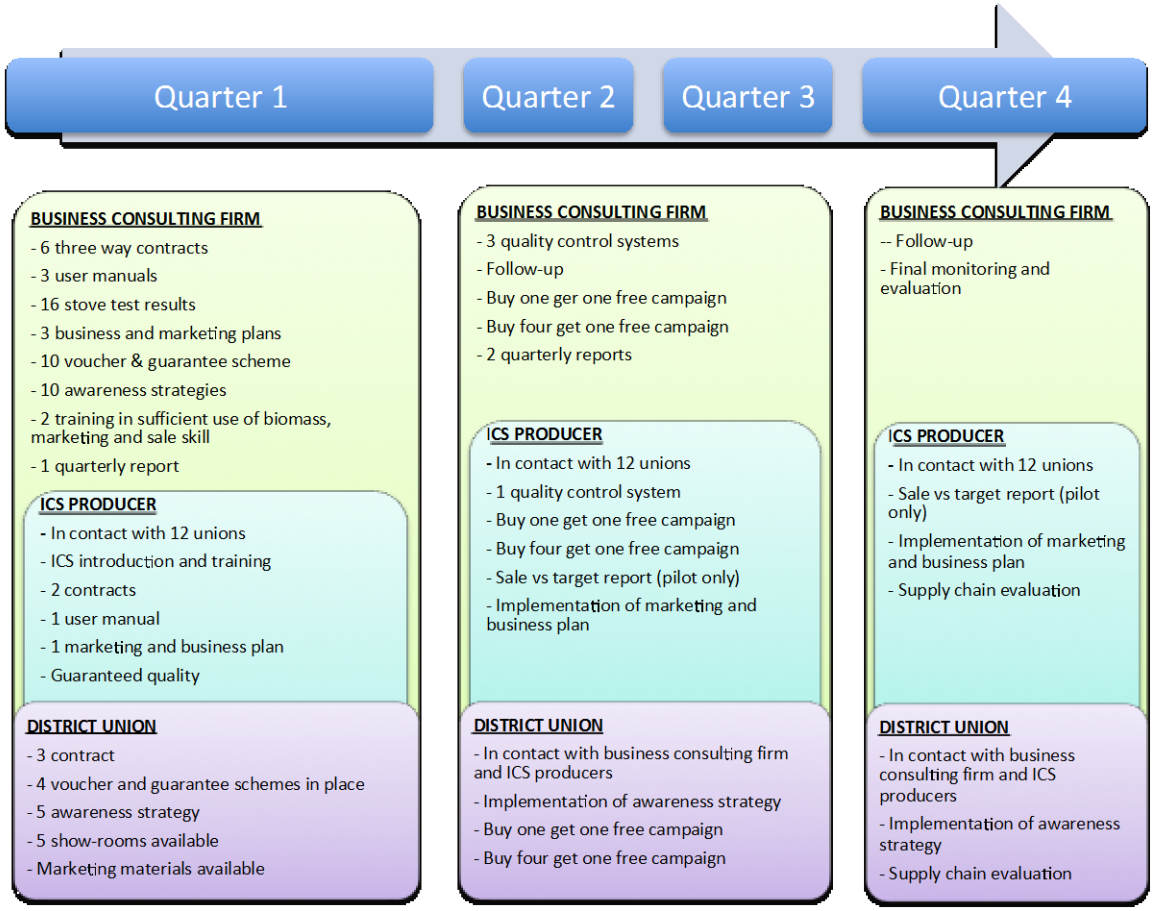


Figure 3-2. Pilot schedule with target per stakeholder

3.8. Monitoring and reporting

Monitoring and reporting will be carried out by Business Consulting Firm, based on regular visit to pilot districts/communes, collected data under voucher/guarantee scheme and further study.

Monitoring

Pilot monitoring will be carried out quarterly. The monitoring requirement is presented below:

Table 3-5. Monitoring

	Indicator	Frequency	Means of verification
1	**The stove supply chain from producers to unions is set up and tested on market based mechanism**		
1.1	6 commercial contracts for pilot period are signed between producers, district unions and TA7833 within first quarter of pilot	Quarterly	- Number of signed contracts (three per province)
1.2	There is continuation of at least one commercial contract between producer and union at the end of pilot phase	Yearly	- Number of signed contracts with extension/amendment - Number if new contracts between producers and its new sale agency/unions
2	**The stove producers are supported in sustainable business**		
2.1	All stove producers are able to identify and provide guarantee scheme to users within first quarter of pilot	Quarterly	- Number of producers with committed guarantee scheme - Number of producers with quality control system in place
2.2.	All stove producers have developed ICS user manual within first quarter of pilot	Quarterly	- Number of producers developed user manual for selected ICS - Number of other ICS with user manuals
2.3.	At lease one producer is successful with marketing and business plan	Quarterly	- Number of ICS selling in pilot districts per producer - % of sale compared to plan by producer in pilot districts
3	**Increasing demand on efficient biomass use**		
3.1	Number of purchased ICS in pilot districts increased	Quarterly	- Number of purchased ICSs per type, producers and commune - Number of purchased ICS per its purpose (new, replacement of traditional cook stove, replacement of current ICS, replacement of other cook stove) and estimation of cooking time with new ICS
3.2	Number of households with	Yearly	- % of households with traditional cook stoves

	Indicator	Frequency	Means of verification
	traditional cook stoves reduced by the end of pilot		in pilot and control districts (preferred with same surveyed households as listed in 4.10) - Number of households that purchased ICS to replace traditional cook stoves in pilot districts

Reporting

The Business Consulting Firm will prepare the quarterly report, which include:

- Completed activities and key achievement
- Status of performance indicator (as described in means of verification in Table 3-5)
- Next quarter activities
- Conclusion

In the last quarter report, the achievement will include pilot impact by comparing achievement in pilot districts (Ung Hoa, Ha Hoa) and control districts (Thanh Oai, Tan Son) in increase usage of ICS. The impact includes estimation of biomass savings (estimated by number of purchased ICS to replace traditional cook stoves, the difference in cooking efficiency and average cooking time from voucher system).

3.9. Pilot cost

The cost of pilot is 65,000 USD with the overview and breakdown as follows:

Table 3-6. Overview of pilot cost

Cost distribution per activity group	Consulting firm, USD	Ung Hoa, USD	Ha Hoa, USD	sum, USD
ESTABLISHMENT OF STOVE SUPPLY CHAIN FRAMEWORK	5,396	0	0	**5,396**
STOVE PRODUCER SUPPORTS	12,013	2,500	2,500	**17,013**
COMMUNICATION AWARENESS & DEMAND AGREGATION	15,428	10,200	10,200	**35,828**
PILOT MANAGEMENT	6,767	-	-	**6,767**
SUM	**39,619**	**12,700**	**12,700**	**65,004**

Table 3-7. Overview of pilot cost by activities

No		Activities	Organized /implemented by	Cost, USD	Recommend to allocated to
1		**ESTABLISHMENT OF STOVE SUPPLY CHAIN FRAMEWORK**		**5,396**	
	1	Kick-off introductory meetings in Ung Hoa, Hanoi	Farmer Union	1,295	Consulting firm
	2	Kick-of Introductory meetings in Ha Hoa, Phu Tho	Woman Union	1,531	Consulting firm
	3	Development of three way commercial contracts between producers, union and TA 8377	Consulting firm	2,570	Consulting firm
2		**STOVE PRODUCER SUPPORTS**		**17,013**	
	1	Laboratory test	HUST	5,128	Consulting firm
	2	Development of simple ICS manual	Consulting firm	1,200	Consulting firm
	3	Peer-to-peer support in bussiness and marketing plan	Consulting firm	4,580	Consulting firm
	4	Per-to-peer support in quality control	Consulting firm	1,105	Consulting firm
	5	Show-room rental in Ung hoa, Hanoi	Farmer Union	2,500	Ung Hoa
	6	Show-room rental in Ha Hoa, Phu Tho	Woman Union	2,500	Ha Hoa
3		**COMMUNICATION AWARENESS & DEMAND AGREGATION**		**35,828**	
	1	Development of voucher and guarantee scheme for unions	Consulting firm	2,068	Consulting firm
	2	Providing support in voucher and guarantee scheme of unions	Consulting firm	4,971	Consulting firm
	3	Developing awareness strategy for 10 communes	Consulting firm	2,088	Consulting firm
	4	Awareness/demonstration event in Ha Hoa, Phu Tho	Woman Union	10,000	Ha Hoa
	5	Awareness/demonstration event in Ung Hoa, Hanoi	Farmner Union	10,000	Ung Hoa
	6	Trainning in marketing, communication skill and efficient biomass use	Consulting firm	3,238	Consulting firm
	7	Developing awawreness printing materials in Ha Hoa, Phu Tho	Woman Union	200	Ha Hoa
	8	Usage of local media in Ung Hoa, Hanoi	Farmer Union	200	Ung Hoa
	9	Buy one get one free campaign in Ung Hoa, Hanoi	Farmer Union	927	Consulting firm

No		Activities	Organized /implemented by	Cost, USD	Recommend to allocated to
	10	Buy four get one free campaign in Ung Hoa, Hanoi	Farmer Union	589	Consulting firm
	11	Buy one get one free campaign in Ha Hoa, Phu Tho	Woman Union	948	Consulting firm
	12	Buy four get one free campaign in Ha Hoa, Phu Tho	Woman Union	600	Consulting firm
4		**PILOT MANAGEMENT**		**6,767**	
	1	Quarterly monitoring and reporting	Consulting firm	4,591	Consulting firm
	2	Efficiency comparision between traditional and ICS	Consulting firm	1,376	Consulting firm
	3	Logisitc (administrative support, translation)	Consulting firm	800	Consulting firm

Table 3-8. Overview of pilot cost by unit price and quantity

No	Item	Unit	Unit price, USD	Quantity	Total, USD
1	**STAFF**				**21,900**
1.1	Team leader – Bussiness consultant	day	150.0	54	8,100
1.2	Marketing consultant	day	150.0	29	4,350
1.3	Communication consultant	day	150.0	27	4,050
1.4	ICS quality control consultant	day	150.0	36	5,400
2	**LOCAL TRANSPORTATION**				**3,530**
2.1	HN-Ung Hoa	return trip	54.9	11	603
2.2	HN-Ha Hoa	return trip	172.8	11	1,901
2.3	Hanoi	trip	20.0	5	100
2.4	Hanoi-Tan Yen, BacGiang	return trip	62.9	5	314
2.5	Hanoi-Thanh Ba, Phu Tho	return trip	122.3	5	611
3	**STAFF ALLOWANCE**				**520**
3.1	Day on fields	day	20.0	26	520
4	**MEETING WORKSHOP**				**1,650**
4.1	Facility rental	workshop	250.0	5	1,250
4.2	Local participant support	participant	5.0	80	400
5	**AWARENESS & PROMOTION (via UNIONS)**				**25,400**
5.1	Materials	lumpsum	200.0	2	400
5.2	Showroom	Place	500.0	10	5,000

No	Item	Unit	Unit price, USD	Quantity	Total, USD
5.3	Event	event	1,000.0	20	20,000
6	**OTHERS**				**8,013**
6.1	ICS Stove testing	test	601.0	8	4,808
6.2	Traditional stove testing	test	172.0	8	1,376
6.3	ICS promotion campaign in Ung Hoa	ICS	16.9	30	507
6.4	ICS promotion campaign in Ha Hoa	ICS	17.4	30	522
6.5	Miscelaneous	lumpsum	1.0	800	800
7	**MONITORING AND EVALUATION**				**3,991**
7.1	M&E consultant	day	150.0	20	3,000
7.2	Transportation HN-Ung Hoa	return trip	54.9	4	219
7.3	Transportation HN-Ha Hoa	return trip	172.8	4	691
7.4	Allowance on site	day	20.0	4	80
	TOTAL				**65,004**

Cost break-out is attached in 4.9.

3.10. Sumary Poverty Reduction and Social Strategy (SPRSS)

Country:	Vietnam	Project Title:	Pilot investment project to scale up ICS

I. POVERTY AND SOCIAL ANALYSIS AND STRATEGY
A. Links to the National Poverty Reduction and Inclusive Growth Strategy and Country Partnership Strategy The Green Growth Strategy for the period of 2011-2020 with vision to 2050 was approved in 25 September 2012 by decision number 1393/QD-TTg with overall objective is "*Green growth, as a mean to achieve the low carbon economy and to enrich natural capital, will become the dominant trend in sustainable economic development which requires that mitigation of green house gas emissions and increased capability to capture green house gas are gradually becoming essential indicators in social-economic development"*. By viewpoint, the Green growth strategy in Vietnam is *"by the people and for the people, contributing to employment, poverty reduction and improving the material and spiritual life of all people"*. According to the 2012 Vietnam Poverty Assessment of the World Bank (Well Begun, not yet done: Vienam Remarkable Progress on Poverty Reduction and the Emerging Challenges), the poverty headcount in Vietnam fell from nearly 60 percent to 20.7 percent in the past 20 years. However, it also emphased that this success created new challenges in reaching the remaining poor people due to their isolation, limited assets, low level of education and poor health status. The pilot will be implemented in the districts with 7% of poor households in Ung Hoa district and 14% of poor households in Ha Hoa district. It will bring the knowledge on efficient use of biomass to the pilot residents,

including poor households.

ADB and the Government of Vietnam have signed country partnership strategy (CPS) for the period of 2012-2015. Under sector assessment, it has pointed out *"Agriculture is the only production base available to the poor, and rural women are usually poorer than men, with the majority of rural women working as farmers"*

The pilot will set up supply chain of ICS through unions, farmer unions in Ung Hoa, Ha Noi and woman unions in Ha Hoa, Phu Tho. The supply chain is expeted to bring the union members, including woman additional income from selling ICS, which is more efficient in using biomass than traditional cookstoves. Biomass is available for cooking from both rice-farming (in Ung Hoa) and forest (in Ha Hoa)

B. Results from the Poverty and Social Analysis during PPTA or Due Diligence

Key poverty and social issues: The poverty assessment of the ADB 2006 has identified the key poverty and social issues are different from one place to others. In upland sites the problems included poorly developed factor markets and product markets. In low land, being unemployed is one of the key issues. Increasing of environmental concerns, including deforestation and poor health condition are also key issues.

Beneficiaries: The pilot will introduce improved cook stoves to households in Ung Hoa and Ha Hoa district, where 86% and 78% of households are still using traditional cookstoves. The pilot will also provide job opportunities for unions in 10 pilot communities.

3. Impact channels. To households: the usage of ICS requires less biomass for cooking and creating less smoke, thus better cooking environment for the health. To unions: the pilot provides commercial opportunity to get addtional income.

4. Other social and poverty issues. Due to no supply chain, the payment for ICSs are not secured in delivered quality, causing possibility of using more biomass than expected or wasting money for shorter life time of ICS.

5. Design features. The pilot is designed to create awareness on sufficient use of biomass as well as providing job opportunities to local unions by setting up supply chain. The capacity on sustainable business will be built to alll members of the supply chain.

II. PARTICIPATION AND EMPOWERING THE POOR

Summarize the participatory approaches and the proposed project activities that strengthen inclusiveness and empowerment of the poor and vulnerable in project implementation. The pilot will be implemented with three key partners, the business consulting firm, the ICS producers and the unions in the pilot district. The business consulting firm plays catalytic roles in setting up and testing ICS supply chain. There will be commercial contracts signed between supply chain members, ie ICS producers and sale (unions), where the unions is protected with the condition that the producers would not provide direct sale to the pilot districts. The marketing and sale skills of unions, including woman unions will be strengtherned by training and market base mechanism.

If civil society has a specific role in the project, summarize the actions taken to ensure their participation. The farmer unions and woman unions will be participating in the pilot as sale agency. They will participate in development of awareness strategies and being in charge of the awareness materials.

Explain how the project ensures adequate participation of civil society organizations in project implementation. The unions are provided with equal opportunities to work with producers and access the market in their own communes.

4. What forms of civil society organization participation is envisaged during project implementation?

H☐ Information gathering and sharing M☐ Consultation M ☐Collaboration M ☐Partnership

5. Will a project level participation plan be prepared to strengthen participation of civil society as interest holders for affected persons particularly the poor and vulnerable?

☐☑Yes. Spesific budget has been defined ☐ No

III. GENDER AND DEVELOPMENT

Gender mainstreaming category: some gender elements

A. Key issues. The initial idea of feasibility study aims to support woman unions in both pilot district to particicipate in this pilot. However, after survey, it came out that the farmer unions in Ung Hoa district (Hanoi) can implement the pilot with higher success, while the woman union was selected in Ha Hoa (Phu Tho). There are only female in woman unions, but mix of male and female in farmer union. The chance for empowering woman in Ung Hoa district is less than that of Ha Hoa district.

B. Key actions. During the pilot, the available and interested female of farmer union will naturally participate as the ICS is relating to cooking or works of woman

☐ Gender action plan ☐ Other actions or measures ☑ No action or measure

IV. ADDRESSING SOCIAL SAFEGUARD ISSUES

A. Involuntary Resettlement Safeguard Category: ☐ A ☐ B ☑ C ☐ FI

1. Key impacts.

2. Strategy to address the impacts

3. Plan or other Actions.

☐ Resettlement plan
☐ Resettlement framework
☐ Environmental and social management system arrangement
☑ No action
☐ Combined resettlement and indigenous peoples plan[1]
☐ Combined resettlement framework and indigenous peoples planning framework
☐ Social impact matrix

B. Indigenous Peoples Safeguard Category: ☐ A ☐ B ☑ C ☐ FI

Key impacts.

Is broad community support triggered? ☐ Yes ☑ No

2. Strategy to address the impacts.

3. Plan or other actions.

☐ Indigenous peoples plan
☐ Indigenous peoples planning framework
☐ Environmental and social management system arrangement
☐ Social impact matrix
☑ No action
☐ Combined resettlement plan and indigenous peoples plan
☐ Combined resettlement framework and indigenous peoples planning framework
☐ Indigenous peoples plan elements integrated in project with a summary

V. ADDRESSING OTHER SOCIAL RISKS

A. Risks in the Labor Market

1. Relevance of the project for the country's or region's or sector's labor market.
L ☐ unemployment L ☐ underemployment L☐ retrenchment L ☐ core labor standards

2. Labor market impact.

B. Affordability

The pilot is expected to start immediately after completion of this study, therefore no big change from cost estimation is expected. The ICS cost is estimated as average cost and can be changed depending on the prefered ICS. This will not change the total budget as it is between producers and unions.
C. Communicable Diseases and Other Social Risks 1. Indicate the respective risks, if any, and rate the impact as high (H), medium (M), low (L), or not applicable (NA): N/A☐ Communicable diseases N/A☐ Human trafficking N/A ☐ Others (please specify) _____ 2. Describe the related risks of the project on people in project area.
VI. MONITORING AND EVALUATION
1. Targets and indicators: see 3.6 2. Required human resources: N/A 3. Information in PAM: see 3.8 4. Monitoring tools: N/A

3.11. Initial Enironmental Examimation (IEE) screening matrix

The following matrixes are prepared for two pilot location in Ung Hoa (Ha Noi) and Ha Hoa (Phu Tho).

Table 3-9. IEE screening matrix of Ung Hoa, Ha Noi

Screening Questions	Yes	No	Remarks (Hanoi)
A. Project Siting Is the Project area adjacent to or within any of the following environmentally sensitive areas?		x	The project will be carried out in Ung Hoa district of Ha Noi capital. This is one of the districts having the largest rice farming area in Hanoi. Ung Hoa district has a total area of 183.72 km^2, including 1 town and 28 communes. The pilot communes & town including: Van Dinh town, Vien An commune, Vien Noi commune, Son Cong commune, Dong Tien commune.
1. Cultural heritage site		x	There is no cultural heritage site in the project site
2. Legally protected Area (core zone or buffer zone)		x	There is no legally protected area in the project site
3. Wetland		x	Wetlands in Ung Hoa district are the natural lakes and rivers (Nhue, Day) flowing through the district. These wetlands are not completely located within the project site.
4. Mangrove		x	There is no mangrove in the project site
5. Estuarine		x	Ung Hoa has two rivers flowing though. That is Day river and Nhue river. However, there is no estuarine of the two rivers on the territory of Ung Hoa district.
B. Special area for protecting biodiversity		x	There is no special area for protecting biodiversity

Screening Questions	Yes	No	Remarks (Hanoi)
			in the project site
C. Potential Environmental Impacts Will the Project cause…			
1. Impairment of historical/cultural areas; disfiguration of landscape or potential loss/damage to physical cultural resources?		x	There will be no such impairment
2. Disturbance to precious ecology (e.g. sensitive or protected areas)?		x	The pilot is not situated in such sensitive or protected areas
3. Alteration of surface water hydrology of waterways resulting in increased sediment in streams affected by increased soil erosion at construction site?		x	There is no construction activity in the project site. Therefore, there will be no such alteration
4. Deterioration of surface water quality due to silt runoff and sanitary wastes from worker-based camps and chemicals used in construction?		x	No worker-based camps and much chemicals is expected to be used under the pilot. Therefore, there will be no such deterioration
5. Increased air pollution due to project construction (using brick, cement …)?		x	No project construction
6. Increased air pollution due to project operation?		x	Air quality in project site is expected to be improved because one of the goals of the project is to improve the cooking conditions and reduce the amount of waste straw being burnt out
7. Noise and vibration due to project construction or operation?		x	There will be no noise and vibration due to project operation
8. Involuntary resettlement of people? (physical displacement and/or economic displacement)		x	There is no resettlement foreseen
9. Disproportionate impacts on the poor, women and children, Indigenous Peoples or other vulnerable groups?		x	Many poor households participate in the pilot. Thus the project has a positive impact on poverty alleviation work in the pilot communes.
10. Poor sanitation and solid waste disposal in construction camps and work sites, and possible transmission of communicable diseases (such as STI's and HIV/AIDS) from workers to local populations?		x	No camps
11. Creation of temporary breeding habitats for diseases such as those transmitted by mosquitoes and rodents (inadequate substrate preparation)?		x	There will be no creation of temporary breeding habitats for diseases in project site. On the other hand, the product from cooking process is biochar, which is very useful for environmental sanitation in the project site
12. Social conflicts if workers from other regions or countries are hired?		x	Mainly local worker required from Farmer Union
13. Large population influx during project		x	The number of workers is very small, no camps.

Screening Questions	Yes	No	Remarks (Hanoi)
construction and operation that causes increased burden on social infrastructure and services (such as water supply and sanitation systems)?			Therefore, there will be no burden on social infrastructure and services
14. Risks and vulnerabilities related to occupational health and safety due to physical, chemical, biological, and radiological hazards during project construction and operation		x	There will be no such risks and vulnerabilities
15. Risks to community health and safety due to the transport, storage, and use and/or disposal of materials such as explosives, fuel and other chemicals during construction and operation?		x	There is no chemical and explosives that is expected to be used in project operation
16. Community safety risks due to both accidental and natural causes, especially where the structural elements or components of the project are accessible to members of the affected community or where their failure could result in injury to the community throughout project construction, operation and decommissioning?		x	The project is expected to contribute to safer cooking because the improved cook stoves will be checked for smoke emissions and safety before being given to residents.
17. Generation of solid waste and/or hazardous waste?		x	Solid waste being generated is ash and biochar. This is the product of combustion process of improved cook stove. However, not only these solid wastes are completely harmless but these substances are also very useful for agriculture farming and environmental sanitation in the project site
18. Use of chemicals?		x	There is no chemicals involved in project operation. In addition, the project implementation will create biochar which is very useful for agriculture farming as well as rural sanitation.

Climate Change and Disaster Risk Questions The following questions are not for environmental categorization. They are included in this checklist to help identify potential climate and disaster risks.	Yes	No	Remarks
1. Is the Project area subject to hazards such as earthquakes, floods, landslides, tropical cyclone winds, storm surges, tsunami or volcanic eruptions and climate changes?			Floods and storms may occur. But these are the natural weather phenomena. The project will not cause such hazards
2. Could changes in precipitation, temperature, salinity, or extreme events over the Project lifespan affect its sustainability or cost?		x	Nothing foreseen
3. Are there any demographic or socio-economic aspects of the Project area that are already vulnerable (e.g. high incidence of marginalized populations, rural-urban migrants, illegal settlements, ethnic minorities, women or children)?		x	Definitely not. The project is expected to reduce cooking cost of households and limit the number of poor quality stoves
4. Could the Project potentially increase the climate or disaster vulnerability of the surrounding area (e.g., increasing traffic or housing in areas that will be more prone to flooding, by encouraging settlement in earthquake zones)?		x	Definitely not. No such impact can be imagined

Table 3-10. IEE screening matrix of Ha Hoa, Phu tho

Screening Questions	Yes	No	Remarks (Phu Tho)
A. Project Siting Is the Project area adjacent to or within any of the following environmentally sensitive areas?		x	The project will be carried out in Ha Hoa district of Phu Tho province. This is one of the largest forestry districts of Phu Tho province. Ha Hoa district has a total area of 339.34 km2, including 1 town and 33 communes. The pilot communes and town, including: Ha Hoa town, Am Ha, Dai Pham, Phu Khanh and Xuan Ang commune.
1. Cultural heritage site		x	There is no cultural heritage site in the project site
2. Legally protected Area (core zone or buffer zone)		x	There is no legally protected area in the project site
3. Wetland		x	Wetlands in Ha Hoa district are the natural lakes (Chinh Cong pond, Tri pond ...) and river (Thao River) flowing through Ha Hoa district. These

Screening Questions	Yes	No	Remarks (Phu Tho)
			wetlands are not completely located within the project site.
4. Mangrove		x	There is no mangrove in the project site
5. Estuarine		x	Thao river flows through Ha Hoa district. However, there is no estuarine on the territory of Ha Hoa district.
B. Special area for protecting biodiversity		x	Ha Hoa district has 702, 7 ha of natural protection forest and 129 ha of planted protection forest. However, the project site is not located near these areas.
C. Potential Environmental Impacts Will the Project cause…			
1. Impairment of historical/cultural areas; disfiguration of landscape or potential loss/damage to physical cultural resources?		x	There will be no such impairment
2. Disturbance to precious ecology (e.g. sensitive or protected areas)?		x	The pilot is not situated in such sensitive or protected areas
3. Alteration of surface water hydrology of waterways resulting in increased sediment in streams affected by increased soil erosion at construction site?		x	There is no construction activity in the project site, so there will be no such alteration
4. Deterioration of surface water quality due to silt runoff and sanitary wastes from worker-based camps and chemicals used in construction?		x	No worker-based camps and much chemicals is expected to be used under the pilot. Therefore, there will be no such deterioration
5. Increased air pollution due to project construction (using brick, cement …)?		x	No project construction
6. Increased air pollution due to project operation?		x	Air quality in project site is expected to be improved because one of the goals of the project is to improve the cooking conditions and reduce the amount of waste straw being burnt out
7. Noise and vibration due to project construction or operation?		x	There will be no noise and vibration due to project operation
8. Involuntary resettlement of people? (physical displacement and/or economic displacement)		x	There is no resettlement foreseen
9. Disproportionate impacts on the poor, women and children, Indigenous Peoples or other vulnerable groups?		x	Many poor households participate in the pilot. Thus the project has a positive impact on poverty alleviation work in the pilot communes.
10. Poor sanitation and solid waste disposal in construction camps and work sites, and possible transmission of communicable diseases (such as STI's and HIV/AIDS)		x	No camps

Screening Questions	Yes	No	Remarks (Phu Tho)
from workers to local populations?			
11. Creation of temporary breeding habitats for diseases such as those transmitted by mosquitoes and rodents (inadequate substrate preparation)?		x	There will be no creation of temporary breeding habitats for diseases in project site. On the other hand, the product from cooking process is biochar, which is very useful for environmental sanitation in the project site
12. Social conflicts if workers from other regions or countries are hired?		x	Mainly local worker required from Woman Union
13. Large population influx during project construction and operation that causes increased burden on social infrastructure and services (such as water supply and sanitation systems)?		x	The number of workers is very small, no camps. Therefore, there will be no burden on social infrastructure and services
14. Risks and vulnerabilities related to occupational health and safety due to physical, chemical, biological, and radiological hazards during project construction and operation		x	There will be no such risks and vulnerabilities
15. Risks to community health and safety due to the transport, storage, and use and/or disposal of materials such as explosives, fuel and other chemicals during construction and operation?		x	There is no chemical and explosives that is expected to be use in project operation
16. Community safety risks due to both accidental and natural causes, especially where the structural elements or components of the project are accessible to members of the affected community or where their failure could result in injury to the community throughout project construction, operation and decommissioning?		x	The project is expected to contribute to safer cooking because the improved cook stoves will be checked for smoke emissions and safety before being given to residents.
17. Generation of solid waste and/or hazardous waste?		x	Solid waste being generated is ash and biochar. This is the product of combustion process of improved cook stove. However, not only these solid wastes are completely harmless but these substances are also very useful for agriculture farming and environmental sanitation in the project site
18. Use of chemicals?		x	There is no chemicals involved in project operation. In addition, the project implementation will create biochar which is very useful for agriculture farming as well as rural sanitation.

Climate Change and Disaster Risk Questions The following questions are not for environmental categorization. They are included in this checklist to help identify potential climate and disaster risks.	Yes	No	Remarks
1. Is the Project area subject to hazards such as earthquakes, floods, landslides, tropical cyclone winds, storm surges, tsunami or volcanic eruptions and climate changes?		x	Floods and storms may occur. But these are the natural weather phenomena. The project will not cause such hazards
2. Could changes in precipitation, temperature, salinity, or extreme events over the Project lifespan affect its sustainability or cost?		x	Nothing foreseen
3. Are there any demographic or socio-economic aspects of the Project area that are already vulnerable (e.g. high incidence of marginalized populations, rural-urban migrants, illegal settlements, ethnic minorities, women or children)?		x	Definitely not. The project is expected to reduce cooking cost of households and limit the number of poor quality stoves
4. Could the Project potentially increase the climate or disaster vulnerability of the surrounding area (e.g., increasing traffic or housing in areas that will be more prone to flooding, by encouraging settlement in earthquake zones)?		x	Definitely not. No such impact can be imagined

3.12. Risk, assumption and uncertainties

The pilot investment is designed based on survey results and interview. The implementation of the pilot may face the following low-level risk, assumption and uncertainties:

1. Selection of ICS:
    a. The four recommended ICS are top matching expectation of households in two pilot districts. The evaluation was prepared on desk without practical verification with local people in two pilot districts and the recommended ICS met 71% of expectation only. There may also be additional ICS that meets expectation of households during pilot period and enter pilot districts. This is evaluated as low risk level as the market mechanism will define the preferred stoves. However, during monitoring, the Business Consulting Firm shall support the enter of the new ICS through supply chain to avoid unforeseen competition.

b. The introduction of four ICSs per district/thus may be per commune may lead to disappointment of ICS producers due to smaller order. This is opportunity for ICS producers to expand their market, prove their marketing and business plan and is consider of low risk on drop-out of the producer.

2. Commitment of producers:

   a. The three selected ICS producers expressed their interest and willingness in working with unions under this pilot. The ICSs currently has no supply chain and no local contact in two pilot districts but also no business experience in working with unions. They also express interest in increasing sale volume through better management. However, this requires change in attitude and efforts for participating. During pilot, the producer may drop out due to neither not finding the seleted local unions as appropriate partner in supply chain nor not interested in spending efforts in management change. This is considered as low level risk. The pilot was designed with participation of more than one producers.

   b. The three selected ICS producers shall commit not to sell ICS directly in pilot districts in order to set up and test the supply chain. Depending on the sale volume, the may not follow the commitment and compete directly to the unions. This is considered as low risk as the producers only care on their selling price, not who is buying at the moment.

3. Participation of communes:

   a. The pilot were designed to set up supply chain through farmer union in Ung Hoa district and through woman union in Ha Hoa district. If there is high market demand, there may be more agency interested in being sale agency. This should be encouraged, but may create competitiveness to selected unions. This is a low risk due to the connection between agencies in the communes/districts and is an opportunity for unions to justify the awareness strategy and prove marketing and sale skill.

   b. The pilot were designed to implement in five proposed communes by the district union. The district union may want to change this number of participating communes. This is evaluated as low risk as the pilot can not handle more than 5 communes per district and if less, each commune will receive more intensive supports.

4. ANNEX

4.1. Population structure in selected pilot area

Table 4-1. Population structure in Ung Hoa District

Area	Population, people	Households	Poor & marginal poor, households
UNG HOA DISTRICT	198,000	56,788	3,707
5 COMMUNES	38,936	9,321	912
Van Dinh town	14,000	3,202	128
Vien An	7,166	1,846	279
Vien Noi	4,286	1,180	90
Dong Tien	6,784	1,693	135
Son Cong	6,700	1,400	280

Table 4-2. Population structure in Ha Hoa District

Area	Population, people	Households	Poor & marginal poor, households
HA HOA DISTRICT	106,177	30,530	4,244
5 COMMUNES	23,066	6,996	901
Dai Pham	4733	1324	232
Phu Khanh	2997	875	136
Am Ha	3555	1074	177
Ha Hoa town	7674	2568	148
Xuan Ang	4107	1155	208

4.2. Biomass converting factor

Plant	Agriculture residues	Biomass/product	Source
Rice	Rice Straw	100%	*Tran Van Quy – Biomass study – estimation of potential and technology with agricultural residues in Red River Delta, Vietnam National University, Hanoi, 2010*
	Rice Husk	20%	
Maize	Maize leaves and stalk	300%	
	Corn cob	100%	
Thanh Hao	Stalk	150%	Estimation of residents

4.3. Estimation of biomass availability vs cooking needs in Ung Hoa District, Hanoi

Scenario 1: Using available biomass for cooking

Biomass source	Heat value (GJ/ton)	Available biomass for cooking	Unit	No of residents can cook, 1.3 kg fire wood/person	No of households can cook with additional purposes, 7.7 kg firewood/house
Rice straw	14.6	12,063	ton	23,947	4,043
Rice husk	14.4	21,446	ton	41,989	7,089
Corn stalk & leave	14.7	7,320	ton	14,631	2,470
Corn cob	15.4	3,050	ton	6,386	1,078
Firewood	15.5	704	ton	1,483	250
	Total	**44,583**	ton	**88,435**	**14,931**
		No of residents and households		198,000	56,788
			Coverage	45%	26%

Scenario 2: Using available biomass and burnt rice straw for cooking

Biomass source	Heat value (GJ/ton)	Available biomass for cooking & burnt out	Unit	No of residents can cook, 1.3 kg fire wood/person	No of households can cook with additional purposes, 7.7 kg firewood/house
Rice straw	14.6	105,888	ton	210,200	35,488
Rice husk	14.4	21,446	ton	41,989	7,089
Corn stalk & leave	14.7	7,320	ton	14,631	2,470
Corn cob	15.4	3,050	ton	6,386	1,078
Firewood	15.5	704	ton	1,483	250
	Total	**138,408**	ton	**274,689**	**46,376**
		No of residents and households		198,000	56,788
			Coverage	139%	82%

4.4. Estimation of biomass availability vs cooking needs in Ha Hoa District, Phu Tho

Biomass source	Heat value (GJ/ton)	Available biomass for cooking	Unit	No of residents can cook, 1.5 kg firewood/person	No of households can cook with additional purposes, 7.7 kg firewood/house
Rice straw	14.6	-	ton	-	-
Rice husk	14.4	5,604	ton	9,509	1,994
Corn stalk&leave	14.7	-	ton	-	-
Corn cob	15.4	3,639	ton	6,604	1,295
Fire wood	15.5	82,243	ton	150,216	29,263
	Total	**91,486**	**ton**	**166,328**	**32,552**
		No of residents and households		106,177	30,530
			Coverage	157%	107%

4.5. Quatation of stove testing

This quotation was sent on 28 August by Laboratory at Department of Thermal Energy Systems, Institute of Heat Engineering and Refrigeration of Hanoi University of Science and Technology and is valid for 30 days.

No	Items	Unit	1000VND /sample	USD /sample	ICS testing	Traditional cookstove testing
	Fuel properties					
1	Fuel per batch	g	70	3.3	x	
2	Moisture content of fuel	%	330	15.7	x	
3	Calorific value of fuel (Dry base)	kJ/kg	540	25.7	x	
4	HHV			-		
5	LHV (dry base)	kJ/kg	540	25.7		
6	LHV (Working base)	kJ/kg	540	25.7		
	Thermal efficiency and Fuel consumption					
7	Cold start (full power)	%	3,470	165.2	x	
8	Cool start +simmer (low power)	%	3,470	165.2	x	

No	Items	Unit	1000VND /sample	USD /sample	ICS testing	Traditional cookstove testing
9	Fuel consumption at full power	g/min	450	21.4		
10	Fuel consumption at low power	g/min	450	21.4		
11	Time for starting up	min	150	7.1		
12	Time for boiling 2,5 l water at full power	min	290	13.8	x	x
13	Burning time (at full speed of fan)	min	250	11.9		
14	Burning time (at low speed of fan)	min	250	11.9		
	Emission			-		
15	CO(high power)	mg/m^3	750	35.7	x	x
16	CO (low power)	mg/m^3	750	35.7	x	x
17	PM2,5	mg/m^3	1,500	71.4	x	x
	Temperature and safety			-		
19	Max stove body temperature	Degree C	150	7.1	x	
20	Max flame temperature	Degree C	150	7.1	x	
	Bio-char	**kg**		-		
21	Biochar weight/rice husk - ratio		350	16.7		
22	Char HHV	kJ/kg	550	26.2		
	TOTAL COST		**15,000**	**714.3**	**546.2**	**156.7**
			With VAT	**785.7**	**600.8**	**172.3**

4.6. List of ICSs

Table 4-3. List of available/ready ICSs for pilot

Producer	Model	Category	Description
Thân Xuân Trường	Truong Giang-2	Simple ICS	Portable ICS for cooking, boiling water and preparing animal food with big pot, 5kg, cone shape, 1-3 years life time, smoke at start and became less during cooking, original price of 7.1 USD, portable, every one can use, continuous cooking, can be used with all type of biomass, 10 years in the market, durability material test, clean stove certificate. This model is slowly is replacing smaller model of Truong Giang 1
Lê Hồng	Fix TK90-1	Simple ICS	Fix ICS at the weight of 20 kg, made of unburnt clay, easy to be broken outdoor, 1-3 years life time, smoke at start and less during cooking, original price of 7.1 USD, continuous cooking, all type of biomass, 23 years in market, innovation award 1990, efficiency test in 1990. Introduced in Ha Hoa and lost some credit
	Fix TK90-2	Simple ICS	Fix ICS at the weight of 30 kg, made of unburnt clay and three supporting metal pieces, easy to be broken outdoor, 1-3 years life time, smoke at start and less during cooking, original price of 14.3 USD, continuous cooking, all type of biomass, less than 5 years in market. Introduced in Ha Hoa and lost some credit
	Mobile TK90	Simple ICS	Portable ICS, 15 kg, cylinder shape, made of clay with metal cover, can be used outdoor, 1-3 year life time, smoke at start and less during cooking, original price of 7.1 USD, continuous cooking, all type of biomass, less than 5 years in market
Đỗ Đức Khôi	DK-T3-1	Simple ICS	Portable ICS, 4 kg, cylinder shape with diameter of 25 cm, steeless, 1 year life time, little smoke at start only, original price of 18.1 USD, 50 min cooking if collecting activated carbon, all type of biomass but fire wood is compulsory, around 3 years in market
	DK-T3-2	Simple ICS	Portable ICS, 4 kg, cylinder shape with diameter of 25 cm, steeless, 1.5-2 year life time, little smoke at start only, original price of 19.5 USD, 50 min cooking if collecting activated carbon, all type of biomass but fire wood is compulsory, around 3 years in market
	DK-T4-1	Simple ICS	Portable ICS, 4 kg, cylinder shape with diameter of 25 cm, steeless, 1 year life time, little smoke at start only, original price of 18.1 USD, 50 min cooking if collecting activated carbon, all type of biomass but fire wood is compulsory, around 3 years in market. Improvement of DK-T3 in double bottom and core chamber, leading to better fire with less biomass
	DK-T4-2	Simple ICS	Portable ICS, 4 kg, cylinder shape with diameter of 25 cm, steeless, 1.5-2 year life time, little smoke at start only, original price of 19.5 USD, 50 min cooking if collecting activated carbon, all type of biomass but fire wood is compulsory, around 3 years in market. Improvement of DK-T3 in double bottom and core chamber, leading to better fire with less biomass. Exported to Cambodia
	DK-T5-1	Simple ICS	Portable ICS, 3 kg, cylinder shape with diameter of 22 cm, steeless, 1 year life time, little smoke at start only, original price of 18.1 USD,

Producer	Model	Category	Description
			continuous cooking, designed for short fire wood (20cm) is compulsory, less than 3 years in market. Improvement of DK-T4 for the area of no rice husk available
	DK-T5-2	Simple ICS	Portable ICS, 3 kg, cylinder shape with diameter of 22 cm, steeless, 1.5-2 year life time, little smoke at start only, original price of 19.1 USD, continuous cooking, designed for short fire wood (20cm) is compulsory, less than 3 years in market. Improvement of DK-T4 for the area of no rice husk available
Hoàng Tiến Khải	Type 2	Semi-gasification	Portable ICS with the size of 300x400, cylinder shape, 1 year life time, no smoke, original price of 16.7 USD, 40-60 minute cooking, rice husk only, 2 years in market
	Type 3	Semi-gasification	Portable ICS with the size of 300x400, cylinder shape, 2 year life time, no smoke, original price of 47.6 USD, 40-60 minute cooking, rice husk only, 2 years in market

Table 4-4. List of not-yet suitable ICSs for pilot

Producer	Model	Category	Description
Thân Xuân Trường	Truong Giang-1	Simple ICS	Small portable ICS for cooking, boiling water, 3kg, cone shape, 1-3 years life time, smoke at start and became less during cooking, 4.1 USD, portable, every one can use, continuous cooking, can be used with all type of biomass but better with firewood, 10 years in the market, durability material test, clean stove certificate. This model is slowly be replaced by larger model of Truong Giang 2 and the production is phasing out
Đỗ Đức Khôi	Brick	Simple ICS	Fix stove with heat recovery, introduced as pilot in Nghe An province in January 2013 under requirement of SNV. Not ready for pilot - only heat recycling is advantage, fix cook stoves with high cost (33 USD), low efficiency according to designer
Đỗ Đức Khôi / Mai Thi Lan Anh	DK-T2	Simple ICS	Earlier model of DK T3, DK T4 and DK T5, suitable for all kind of biomass. This model is no longer available in the market as being replaced by later model, short life time of less than 6 month
Trần Ngọc Tuệ	One model	Simple ICS	5 year life time, smoke at start and during cooking, using firewood, continuous cooking, two innovation awards. Not ready for pilot - no willing to go for testing, no mass production
Nguyễn Năng Nhượng	One model	Simple ICS	Cylinder shape with diameter of 20cm, pressed firewood is required, 1.5-2 year life time, no smoke, continuous cooking. Not ready for pilot - not yet commercialised
Hoàng Tiến Khải	Type 1	Semi-gasification	300x400 cm, 6 month, 4.5 US, 40-60 min cooking, rice husk only. Not suitable for pilot - short lifetime of 6 months
Mr Khai - Thanh Thuy craft village	One model	Semi-gasification	Cylinder, no smoke, short lifetime and fan, designed for rice husk, 40-60 minute cooking. Not suitable for pilot - short life time of 6 months
Dai Vinh	One	Semi-	Cylinder, designed for rice husk with 40-60 minute cooking. Not

Producer	Model	Category	Description
workshop - Thanh Thuy craft village	model	gasification	available for pilot - the workshop went to bankrupted and no more production
Đào Ngọc Viết	One model	Semi-gasification	Cylinder, designed for rice husk, found not safe. Not suitable for pilot - not safe
Nguyễn Hồng Long	One model	Semi-gasification	Designed by Dr. Paul Olivier, efficiency test results available, 10 year life time, no smoke, 1.5-4 hours cooking, not yet commercialised. Not ready for pilot - not yet commercialised and the cost is not affordable (190 USD)
Nguyễn Văn Trọng/ Nguyen Khac Chien	One model	Gasification	Two chambers of gasification and cooking, 10 years long, smoke was found only at start, 4-6 hour cooking, requirement of biomass chip, electricity, training on operation, 4 years in the market. Not ready for pilot - the cost is not affordable (109 USD)
Bùi Trung Tuấn	One model	Gasification	Two chambers of gasification and cooking, 10 years long, no smoke at all, 4-6 hour cooking, requirement of biomass chip, electricity, training on operation, 6 years in the market, awarded of MONRE, innovators, intellectual property protected. Not ready for pilot - the cost is not affordable (119 USD)
Lê Tất Khương	One model	Gasification	Two chambers of gasification and cooking, 10 years long, no smoke at all, continuous cooking, requirement of biomass chip, electricity, training on operation, 6 years in the market. Not ready for pilot - the cost is not affordable (143 USD), not yet commercialised
Nguyễn Thanh Hải	One model	Gasification	Two chambers of gasification and cooking, 10 years long, no smoke at all, 4-6 hour cooking, requirement of biomass chip, electricity, training on operation, not commercialised yet. Not yet ready for pilot - the cost is not affordable (143 USD), not yet commercialised
Nguyễn Đức Cường	N/A	N/A	No information provided - meeting appointment was refused

4.7. Cost estimation for transportation

Table 4-5. Cost norm per trip

From	To	Distance, km	Price, USD/km	Cost, USD/trip
Tân Yên, Bắc Giang	Ứng Hòa, Hà Nội	108	0.7	77.1
Tân Yên, Bắc Giang	Hạ Hòa, Phú Thọ	192	0.7	137.1
Thanh Ba, Phú Thọ	Ứng Hòa, Hà Nội	156	0.7	111.4
Thanh Ba, Phú Thọ	Hạ Hòa, Phú Thọ	36	1.2	42.9

Hà Nội	Ứng Hòa, Hà Nội	48	1.2	57.1
Hà Nội	Hạ Hòa, Phú Thọ	151.2	0.7	108.0
Thanh Oai, Hà Nội	Ứng Hòa, Hà Nội	24	1.2	28.6
Thanh Oai, Hà Nội	Hạ Hòa, Phú Thọ	168	0.7	120.0
Văn Lâm, Hưng yên	Ứng Hòa, Hà Nội	72	1.0	68.6
Việt trì, Phú Thọ	Hạ Hòa, Phú Thọ	72	1.0	68.6
Việt trì, Phú Thọ	Ứng Hòa, Hà Nội	132	0.7	94.3

Table 4-6. Estimation of transportation cost, USD/stove

No	Producer	Model	To Ung Hoa (50 stoves/trip)	To Ha Hoa (50 stove/trip)
1	Thân Xuân Trường	Truong Giang-2	1.54	2.74
2	Lê Hồng	Fix TK90-1	2.23	0.86
3		Fix TK90-2	2.23	0.86
4		Portable TK90	2.23	0.86
5	Đỗ Đức Khôi	DK-T3-1	1.14	2.16
6		DK-T3-2	1.14	2.16
7		DK-T4-1	1.14	2.16
8		DK-T4-2	1.14	2.16
9		DK-T5-1	1.14	2.16
10		DK-T5-2	1.14	2.16
11	Hoàng Tiến Khải	Type 2	0.57	2.40
12		Type 3	0.57	2.40

4.8. Selling cost estimation

Table 4-7. Selling cost estimation with 12% commission for marketing/sale

No	Producer	Model	Category	Original price, USD	Unit price to Ung Hoa, USD	Selling price in Ung Hoa, USD	Unit price to Ha Hoa, USD	Selling price in Ha Hoa, USD
1	Thân Xuân Trường	Truong Giang-2	Simple ICS	7.1	8.7	9.9	9.9	11.2
2	Lê Hồng	Fix TK90-1	Simple ICS	7.1	9.4	10.6	8.0	9.1
3		Fix	Simple ICS	14.3	16.5	18.8	15.1	17.2

		TK90-2						
4		Portable TK90	Simple ICS	7.1	9.4	10.6	8.0	9.1
5	Đỗ Đức Khôi	DK-T3-1	Simple ICS	18.1	19.2	21.9	20.3	23.0
6		DK-T3-2	Simple ICS	19.5	20.7	23.5	21.7	24.6
7		DK-T4-1	Simple ICS	18.1	19.2	21.9	20.3	23.0
8		DK-T4-2	Simple ICS	19.5	20.7	23.5	21.7	24.6
9		DK-T5-1	Simple ICS	18.1	19.2	21.9	20.3	23.0
10		DK-T5-2	Simple ICS	19.5	20.7	23.5	21.7	24.6
11	Hoàng Tiến Khải	Type 2	Semi-gasification	16.7	17.2	19.6	19.1	21.7
12		Type 3	Semi-gasification	47.6	48.2	54.8	50.0	56.8

Table 4-8. Selling cost estimation of recommended ICS with different commission rate

	Original price, USD	Transportation price to Ung Hoa, USD	Selling price, 10% commission, USD	Selling price, 12% commission, USD	Selling price, 15% commission, USD
UNG HOA					
Truong Giang-2	7.1	8.7	9.7	9.9	10.2
Portable TK90	7.1	9.4	10.4	10.6	11.0
DK-T4-2	19.5	20.7	23.0	23.5	24.3
DK-T5-2	19.5	20.7	23.0	23.5	24.3
Average	**13.3**	**14.8**	**16.5**	**16.9**	**17.5**
HA HOA					
Truong Giang-2	7.1	9.9	11.0	11.2	11.6
Portable TK90	7.1	8.0	8.9	9.1	9.4
DK-T4-2	19.5	21.7	24.1	24.6	25.5
DK-T5-2	19.5	21.7	24.1	24.6	25.5
Average	**13.3**	**15.3**	**17.0**	**17.4**	**18.0**

4.9. Break-out of pilot cost

Table 4-9. Break-out of pilot cost on staff

	Item	Team leader - Bussiness	Marketing consultant	Communication consultant	ICS quality control consultant
	Unit	day			
	Unit price, USD/unit	150	150	150	150
	Quantity	54	29	27	36
	Total, USD	8,100	4,350	4,050	5,400
No	**Activities**	**Quantity**			
1	**ESTABLISHMENT OF STOVE SUPPLY CHAIN FRAMEWORK**				
1	Kick-off introductory meetings in Ung Hoa, Hanoi	2	1	1	1
2	Kick-of Introductory meetings in Ha Hoa, Phu Tho	2	1	1	1
3	Development of three way commercial contracts between producers, union and TA 8377	12	1	1	3
2	**STOVE PRODUCER SUPPORTS**				
1	Laboratory test	1			1
2	Development of simple ICS manual	4	2	2	
3	Peer-to-peer support in bussiness and marketing plan	9	9	9	
4	Per-to-peer support in quality control	3			3
5	Show-room rental in Ung hoa, Hanoi				
6	Show-room rental in Ha Hoa, Phu Tho				
3	**COMMUNICATION AWARENESS & DEMAND AGREGATION**				
1	Development of voucher and guarantee scheme for unions	6			6
2	Providing support in voucher and guarantee scheme of unions	2	2	2	20
3	Developing awareness strategy for 10 communes	3	3	3	
4	Awareness/demonstration event in Ha Hoa, Phu Tho				

	Item	Team leader - Bussiness	Marketing consultant	Communication consultant	ICS quality control consultant
5	Awareness/demonstration event in Ung Hoa, Hanoi				
6	Trainning in marketing, communication skill and efficient biomass use	5	5	5	
7	Developing awawreness printing materials in Ha Hoa, Phu Tho				
8	Usage of local media in Ung Hoa, Hanoi				
9	Buy one get one free campaign in Ung Hoa, Hanoi	1	1	1	
10	Buy four get one free campaign in Ung Hoa, Hanoi	1	1	1	
11	Buy one get one free campaign in Ha Hoa, Phu Tho	1	1		
12	Buy four get one free campaign in Ha Hoa, Phu Tho	1	1		
4	**PILOT MANAGEMENT**				
1	Quarterly monitoring and reporting	1	1	1	1
2	Efficiency comparision between traditional and ICS				
3	Logisitc (administrative support, translation)				

Table 4-10. Break-out of pilot cost on transporation and accomodation

	Item	Local transport					Staff allowance on field
		HN-Ung Hoa	HN-Ha Hoa	Hanoi	Hanoi-Tan Yen, BacGiang	Hanoi-Thanh Ba, Phu Tho	
	Unit	return trip					day
	Unit price, USD/unit	55	173	20	63	122	20
	Quantity	11	11	5	5	5	26
	Total, USD	603	1,901	100	314	611	520
No	**Activities**						
1	**ESTABLISHMENT OF STOVE SUPPLY CHAIN FRAMEWORK**						
1	Kick-off introductory	2			1	1	

	Item	Local transport					Staff allowance on field
		HN-Ung Hoa	HN-Ha Hoa	Hanoi	Hanoi-Tan Yen, BacGiang	Hanoi-Thanh Ba, Phu Tho	
	meetings in Ung Hoa, Hanoi						
2	Kick-of Introductory meetings in Ha Hoa, Phu Tho		2		1	1	
3	Development of three way commercial contracts between producers, union and TA 8377			1			
2	**STOVE PRODUCER SUPPORTS**						
1	Laboratory test			1			
2	Development of simple ICS manual						
3	Peer-to-peer support in bussiness and marketing plan			2	2	2	6
4	Per-to-peer support in quality control			1	1	1	
5	Show-room rental in Ung hoa, Hanoi						
6	Show-room rental in Ha Hoa, Phu Tho						
3	**COMMUNICATION AWARENESS & DEMAND AGREGATION**						
1	Development of voucher and guarantee scheme for unions	1	1				2
2	Providing support in voucher and guarantee scheme of unions	4	4				8
3	Developing awareness strategy for 10 communes	1	1				3
4	Awareness/demonstration event in Ha Hoa, Phu Tho						
5	Awareness/demonstration event in Ung Hoa, Hanoi						
6	Trainning in marketing, communication skill and efficient biomass use	1	1				3

	Item	Local transport					Staff allowance on field
		HN-Ung Hoa	HN-Ha Hoa	Hanoi	Hanoi-Tan Yen, BacGiang	Hanoi-Thanh Ba, Phu Tho	
7	Developing awawreness printing materials in Ha Hoa, Phu Tho						
8	Usage of local media in Ung Hoa, Hanoi						
9	Buy one get one free campaign in Ung Hoa, Hanoi	1					
10	Buy four get one free campaign in Ung Hoa, Hanoi	1					
11	Buy one get one free campaign in Ha Hoa, Phu Tho		1				2
12	Buy four get one free campaign in Ha Hoa, Phu Tho		1				2
4	**PILOT MANAGEMENT**						
1	Quarterly monitoring and reporting						
2	Efficiency comparision between traditional and ICS						
3	Logisitc (administrative support, translation)						

Table 4-11. Break-out of pilot cost on meeting, workshop and promotion program

Item	Meeting worshop		Awareness and promotion program (via union)		
	Facility rental	Local participant support	Materials	Showroom	Event
Unit	workshop	participant	lumpsum	Place	event
Unit price, USD/unit	250	5	200	500	1000
Quantity	5	80	2	10	20
Total, USD	1250	400	400	5,000	20,000

	Item	Meeting worshop		Awareness and promotion program (via union)		
		Facility rental	Local participant support	Materials	Showroom	Event
	Activities					
	ESTABLISHMENT OF STOVE SUPPLY CHAIN FRAMEWORK					
1	Kick-off introductory meetings in Ung Hoa, Hanoi	1				
2	Kick-of Introductory meetings in Ha Hoa, Phu Tho	1				
3	Development of three way commercial contracts between producers, union and TA 8377					
	STOVE PRODUCER SUPPORTS					
1	Laboratory test					
2	Development of simple ICS manual					
3	Peer-to-peer support in bussiness and marketing plan					
4	Per-to-peer support in quality control					
5	Show-room rental in Ung hoa, Hanoi				5	
6	Show-room rental in Ha Hoa, Phu Tho				5	
	COMMUNICATION AWARENESS & DEMAND AGREGATION					
1	Development of voucher and guarantee scheme for unions					
2	Providing support in voucher and guarantee scheme of unions					
3	Developing awareness strategy for 10 communes	1	40			
4	Awareness/demonstration event in Ha Hoa, Phu Tho					10
5	Awareness/demonstration event in Ung Hoa, Hanoi					10
6	Trainning in marketing, communication skill and efficient biomass use	2	40			
7	Developing awawreness printing			1		

	Item	Meeting worshop		Awareness and promotion program (via union)		
		Facility rental	Local participant support	Materials	Showroom	Event
	materials in Ha Hoa, Phu Tho					
8	Usage of local media in Ung Hoa, Hanoi			1		
9	Buy one get one free campaign in Ung Hoa, Hanoi					
10	Buy four get one free campaign in Ung Hoa, Hanoi					
11	Buy one get one free campaign in Ha Hoa, Phu Tho					
12	Buy four get one free campaign in Ha Hoa, Phu Tho					
	PILOT MANAGEMENT					
1	Quarterly monitoring and reporting					
2	Efficiency comparision between traditional and ICS					
3	Logisitc (administrative support, translation)					

Table 4-12. Break-out of pilot cost on other cost

	Item	ICS Stove testing	Traditional stove testing	ICS promotion campaign in Ung Hoa	ICS promotion campaign in Ha Hoa	Mis-celaneous
	Unit	test	test	ICS	ICS	lumpsum
	Unit price, USD/unit	601	172	16.9	17.4	1
	Quantity	8	8	30	30	800
	Total, USD	4808	1376	507	522	800
	Activities					
	ESTABLISHMENT OF STOVE SUPPLY CHAIN FRAMEWORK					
1	Kick-off introductory meetings in Ung Hoa, Hanoi					
2	Kick-of Introductory meetings in Ha Hoa, Phu Tho					

	Item	ICS Stove testing	Traditional stove testing	ICS promotion campaign in Ung Hoa	ICS promotion campaign in Ha Hoa	Mis-celaneous
3	Development of three way commercial contracts between producers, union and TA 8377					
	STOVE PRODUCER SUPPORTS					
1	Laboratory test	8				
2	Development of simple ICS manual					
3	Peer-to-peer support in bussiness and marketing plan					
4	Per-to-peer support in quality control					
5	Show-room rental in Ung hoa, Hanoi					
6	Show-room rental in Ha Hoa, Phu Tho					
	COMMUNICATION AWARENESS & DEMAND AGREGATION					
1	Development of voucher and guarantee scheme for unions					
2	Providing support in voucher and guarantee scheme of unions					
3	Developing awareness strategy for 10 communes					
4	Awareness/demonstration event in Ha Hoa, Phu Tho					
5	Awareness/demonstration event in Ung Hoa, Hanoi					
6	Trainning in marketing, communication skill and efficient biomass use					
7	Developing awawreness printing materials in Ha Hoa, Phu Tho					
8	Usage of local media in Ung Hoa, Hanoi					
9	Buy one get one free campaign in Ung Hoa, Hanoi			25		
10	Buy four get one free campaign in Ung Hoa, Hanoi			5		

	Item	ICS Stove testing	Traditional stove testing	ICS promotion campaign in Ung Hoa	ICS promotion campaign in Ha Hoa	Mis-celaneous
11	Buy one get one free campaign in Ha Hoa, Phu Tho				25	
12	Buy four get one free campaign in Ha Hoa, Phu Tho				5	
	PILOT MANAGEMENT					
1	Quarterly monitoring and reporting					
2	Efficiency comparision between traditional and ICS		8			
3	Logisitc (administrative support, translation)					800

Table 4-13. Break-out of pilot cost on monitoring and evaluation

	Item	M&E consultant	Transportation HN-Ung Hoa	Transportation HN-Ha Hoa	Allowance on site
	Unit	man-day	return trip	return trip	day
	Unit price, USD/unit	150	55	173	20
	Quantity	20	4	4	4
	Total, USD	3,000	219	691	80
	Activities				
	ESTABLISHMENT OF STOVE SUPPLY CHAIN FRAMEWORK				
1	Kick-off introductory meetings in Ung Hoa, Hanoi				
2	Kick-of Introductory meetings in Ha Hoa, Phu Tho				
3	Development of three way commercial contracts between producers, union and TA 8377				
	STOVE PRODUCER SUPPORTS				
1	Laboratory test				
2	Development of simple ICS manual				
3	Peer-to-peer support in bussiness and marketing plan				
4	Per-to-peer support in quality				

	Item	M&E consultant	Transportation on HN-Ung Hoa	Transportation HN-Ha Hoa	Allowance on site
	control				
5	Show-room rental in Ung hoa, Hanoi				
6	Show-room rental in Ha Hoa, Phu Tho				
	COMMUNICATION AWARENESS & DEMAND AGREGATION				
1	Development of voucher and guarantee scheme for unions				
2	Providing support in voucher and guarantee scheme of unions				
3	Developing awareness strategy for 10 communes				
4	Awareness/demonstration event in Ha Hoa, Phu Tho				
5	Awareness/demonstration event in Ung Hoa, Hanoi				
6	Trainning in marketing, communication skill and efficient biomass use				
7	Developing awawreness printing materials in Ha Hoa, Phu Tho				
8	Usage of local media in Ung Hoa, Hanoi				
9	Buy one get one free campaign in Ung Hoa, Hanoi				
10	Buy four get one free campaign in Ung Hoa, Hanoi				
11	Buy one get one free campaign in Ha Hoa, Phu Tho				
12	Buy four get one free campaign in Ha Hoa, Phu Tho				
	PILOT MANAGEMENT				
1	Quarterly monitoring and reporting	20	4	4	4
2	Efficiency comparision between traditional and ICS				
3	Logisitc (administrative support, translation)				

4.10. List of surveyed households

Table 4-14. List of surveyed households in Hanoi

No	Name	Address	Commune	District	Telephone
1	Đặng Viết Hòa	Số nhà 27, Thôn Hoàng Xá	TT Vân Đình	Ứng Hòa	097 5100 850
2	Đặng Viết Trung	Xóm Hồng Thanh, Thôn Hoàng Xá	TT Vân Đình	Ứng Hòa	043 388 3 716
3	Nguyễn Tất Hanh	Thôn Hoàng Xá	TT Vân Đình	Ứng Hòa	097 2101 266
4	Trần Quang Cần	Xóm 12, Vân Đình	TT Vân Đình	Ứng Hòa	097 8510 576
5	Nguyễn Đình Văn	Thôn Ngọ Xá	TT Vân Đình	Ứng Hòa	
6	Nguyễn Thị Gấm	Xóm Mạnh Tiến, Thôn Ngọ Xá	TT Vân Đình	Ứng Hòa	-
7	Phạm Thị May	Thôn Ngụ Xá	TT Vân Đình	Ứng Hòa	-
8	Bùi Thị Hiền	Thôn Ngụ Xá	TT Vân Đình	Ứng Hòa	-
9	Nguyễn Duy Thìn	Xóm 10, Thôn Vân Đình	TT Vân Đình	Ứng Hòa	-
10	Đỗ Đặng Thành	Số 7, Thôn Hoàng Xá	TT Vân Đình	Ứng Hòa	0168 4104 290
11	Đỗ Đặng Lộc	262 Phố Lê Lợi	TT Vân Đình	Ứng Hòa	043 3882 282
12	Phạm Văn Tiến	Số nhà 29, Ngõ 9, Xóm Bách Hóa	TT Vân Đình	Ứng Hòa	-
13	Nguyễn Thị Minh Chín	Số nhà 89, Nguyễn Thượng Hiền	TT Vân Đình	Ứng Hòa	01697 516 182
14	Trần Văn Nhạn	Số nhà 18, xóm 7	TT Vân Đình	Ứng Hòa	0913 370 231
15	Nguyễn Hữu Tít	Xóm 6, Ngõ 2	TT Vân Đình	Ứng Hòa	0164 2635 901
16	Đặng Hồng Căn	Số nhà 10, Ngõ 49, Thôn Hoàng Xá	TT Vân Đình	Ứng Hòa	0433 982 854
17	Đặng Văn Nhữ	Viên Ngoại	Viên An	Ứng Hòa	-
18	Đặng Minh Tâm		Viên An	Ứng Hòa	-
19	Nguyễn Thị Huệ	Phù Yên	Viên An	Ứng Hòa	01687 737 521
20	Nguyễn Tiến	Xóm 1- Viên Ngoại	Viên An	Ứng Hòa	0466597118
21	Lê Văn Nên	Xóm 3, Viên Ngoại	Viên An	Ứng Hòa	01679 696 723
22	Nguyễn Văn Tưởng	Xóm 3, Viên Ngoại	Viên An	Ứng Hòa	0985 985 974
23	Đặng Đình	Xóm 3, Viên Ngoại	Viên An	Ứng Hòa	0433771573

No	Name	Address	Commune	District	Telephone
	Hùng				
24	Trọng Đại	Viên Ngoại	Viên An	Ứng Hòa	0973968938
25	Nguyễn Văn Thanh	Xóm 3, Viên Ngoại	Viên An	Ứng Hòa	0983735512
26	Mai Văn Nghị	Xóm 2, Viên Ngoại	Viên An	Ứng Hòa	-
27	Nguyễn Văn Biến	Xóm 3, Phù Yên	Viên An	Ứng Hòa	0974802688
28	Nguyễn Duy Đằng	Xóm 1, Viên Ngoại	Viên An	Ứng Hòa	0973956513
29	Mai Văn Luyện	Xóm 2, Viên Ngoại	Viên An	Ứng Hòa	0976752008
30	Nguyễn Xuân Trường	Xóm 3, Viên Ngoại	Viên An	Ứng Hòa	01692734621
31	Nguyễn Đình Nội	Xóm 3, Viên Ngoại	Viên An	Ứng Hòa	01665816873
32	Ngô Thị Xuân	Xóm 3, Vân Ngoại	Viên An	Ứng Hòa	0973242052
33	Lê Thị Linh	Thôn Trung	Viên Nội	Ứng Hòa	0984530799
34	Trần Thị Nguyệt	Thôn Trung	Viên Nội	Ứng Hòa	01662780505
35	Nguyễn Thị Liên	Thôn Trung	Viên Nội	Ứng Hòa	01662780505
36	Bùi Thị Sử	Thôn Giang, Đội 9	Viên Nội	Ứng Hòa	01663054471
37	Nguyễn Văn Huỳnh	Thôn Thượng, Ngõ Cả	Viên Nội	Ứng Hòa	01656713214
38	Đỗ Thị Hội	Thôn Giang	Viên Nội	Ứng Hòa	01663054471
39	Trần Văn Đồng	Thôn Trung	Viên Nội	Ứng Hòa	-
40	Nguyễn Minh Chúc	Xóm Đồng, Thôn Thượng	Viên Nội	Ứng Hòa	0963121365
41	Lương Thị Hà	Thôn Tiền	Viên Nội	Ứng Hòa	016755383868
42	Nguyễn Hữu Hà	Thôn Giang	Viên Nội	Ứng Hòa	0985597198
43	Hồ Văn Hải	Thôn Giang	Viên Nội	Ứng Hòa	-
44	Nguyễn Duy Chính	Thôn Thượng	Viên Nội	Ứng Hòa	0987931976
45	Nguyễn Thị Lương	Thôn Giang	Viên Nội	Ứng Hòa	-
46	Bùi Văn Chiến	Thôn Giang	Viên Nội	Ứng Hòa	0974347021
47	Trần Mạnh Phong	Thôn Trung	Viên Nội	Ứng Hòa	01662780505

No	Name	Address	Commune	District	Telephone
48	Bùi Văn Chỉnh	Thôn Tiền	Viên Nội	Ứng Hòa	0978078307
49	Nguyễn Hữu Huệ	Thôn Giang	Viên Nội	Ứng Hòa	0973069525
50	Nguyễn Văn Khoa	Giang Đường	Đòng Tiến	Ứng Hòa	0979664037
51	Nguyễn Thị Thơm	Giang Đường	Đòng Tiến	Ứng Hòa	-
52	Nguyễn Văn Hiếu	Giang Làng	Đòng Tiến	Ứng Hòa	-
53	Lưu Văn Kha	Giang Láng	Đòng Tiến	Ứng Hòa	01648823791
54	Bùi Đức Tiến	Giang Láng	Đòng Tiến	Ứng Hòa	-
55	Quản Thị Nhung	Giang Sá	Đòng Tiến	Ứng Hòa	01632534364
56	Phạm Văn Toản	Giang Sá	Đòng Tiến	Ứng Hòa	-
57	Quản Thị Tiến	Thôn Thành Vật	Đòng Tiến	Ứng Hòa	-
58	Nguyễn Thị Đĩnh	Xóm Giữa, Thôn Đoàn Xá	Đòng Tiến	Ứng Hòa	-
59	Nguyễn Văn Ban	Thôn Đoàn Xá	Đòng Tiến	Ứng Hòa	-
60	Phạm Thị Lược	Thôn Đoàn Xá	Đòng Tiến	Ứng Hòa	-
61	Nguyễn Thị Thiếu	Thôn Đoàn Xá	Đòng Tiến	Ứng Hòa	-
62	Nguyễn Thị Chủ	Thành Vật	Đòng Tiến	Ứng Hòa	-
63	Quản Văn Dọng	Thành Vật	Đòng Tiến	Ứng Hòa	0946371532
64	Quản Việt Cường	Thành Vật	Đòng Tiến	Ứng Hòa	01634207166
65	Quản Thị Hà	Thôn Nghi Lộc	Sơn Công	Ứng Hòa	01688555575
66	Cao Thị Lý	Thôn Hoàng Dương	Sơn Công	Ứng Hòa	-
67	Vũ Thị Thắng	Thôn Vĩnh Thượng	Sơn Công	Ứng Hòa	0977264609
68	Nguyễn Thị Han	Thôn Vĩnh Thượng	Sơn Công	Ứng Hòa	-
69	Đặng Thị Mai	Thôn Nghi Lộc	Sơn Công	Ứng Hòa	01253659078
70	Nguyễn Văn Con	Đội 4, Thôn Nghi Lộc	Sơn Công	Ứng Hòa	0985282703
71	Vũ Thị Lợi	Vĩnh Thượng	Sơn Công	Ứng Hòa	-
72	Vũ Thị Trống	Vĩnh Thượng	Sơn Công	Ứng Hòa	-

No	Name	Address	Commune	District	Telephone
73	Vũ Thị Sang	Vĩnh Thượng	Sơn Công	Ứng Hòa	01664815463
74	Nguyễn Thị Vân	Hoàng Dương	Sơn Công	Ứng Hòa	01685952877
75	Nguyễn Thị Luyến	Hoàng Dương	Sơn Công	Ứng Hòa	0973095280
76	Lê Xuân Linh	Hoàng Dương	Sơn Công	Ứng Hòa	0975957613
77	Nguyễn Thị Trụ	Hoàng Dương	Sơn Công	Ứng Hòa	-
78	Ngô Hữu Mạo	Hoàng Dương	Sơn Công	Ứng Hòa	-
79	Ngô Hữu Nhuệ	Hoàng Dương	Sơn Công	Ứng Hòa	01676991247
80	Nguyễn Gian	Thôn Động Giã	Đỗ Động	Thanh Oai	-
81	Phạm Thị Dương	xóm trong, Thôn Động Giã	Đỗ Động	Thanh Oai	-
82	Trần Văn Hùng	Thôn Động Giã	Đỗ Động	Thanh Oai	0979947595
83	Nguyễn Thị Thanh	Thôn Động Giã	Đỗ Động	Thanh Oai	01692800728
84	Nguyễn Xuân Nguyện	Thôn Động Giã	Đỗ Động	Thanh Oai	01654419092 (số chị Thơm)
85	Phạm Thị Tuyết	Thôn Động Giã	Đỗ Động	Thanh Oai	-
86	Nguyễn Thị Loan	Thôn Động Giã	Đỗ Động	Thanh Oai	01679971345
87	Phạm Thế Cải	Thôn Động Giã	Đỗ Động	Thanh Oai	01635544061
88	Thủy (béo)	Thôn Động Giã	Đỗ Động	Thanh Oai	0982096739
89	Nguyễn Xuân Bích	Xóm 4, Trường Chinh, Động Giã	Đỗ Động	Thanh Oai	01669539049
90	Nguyễn Xuân Lanh	Xóm trong Động Giã	Đỗ Động	Thanh Oai	0977040463
91	Nguyễn Thị Lê	Xóm 4, Trường Chinh, Động Giã	Đỗ Động	Thanh Oai	-
92	Lê Khắc Công	Động Giã	Đỗ Động	Thanh Oai	01666633491/01666655491
93	Nguyễn Xuân Bảo	Động Giã	Đỗ Động	Thanh Oai	-
94	Nguyễn Xuân Mùi	Động Giã	Đỗ Động	Thanh Oai	-
95	Nguyễn Xuân Vinh	Động Giã	Đỗ Động	Thanh Oai	01652531965
96	Nguyễn Thị Mích	Thôn Trường Xuân	Sơn Dương	Thanh Oai	0167273128
97	Vũ Ngọc Biên	Thôn Trường Xuân	Sơn Dương	Thanh Oai	01254265324

No	Name	Address	Commune	District	Telephone
98	Nguyễn Văn Ký	Xóm 1, Thôn Trường Xuân	Sơn Dương	Thanh Oai	0912544621
99	Hoàng Văn Oanh	Xóm 1, Thôn Trường Xuân	Sơn Dương	Thanh Oai	01682635734
100	Lê Văn Mừng	Xóm 1, Thôn Trường Xuân	Sơn Dương	Thanh Oai	01665636836
101	Lê Quang Nhàn	Xóm 1, Thôn Trường Xuân	Sơn Dương	Thanh Oai	-
102	Vũ Văn Bình	Xóm 1, Thôn Trường Xuân	Sơn Dương	Thanh Oai	01663017831
103	Nguyễn Tiến Dũng	Xóm 2, Thôn Trường Xuân	Sơn Dương	Thanh Oai	0983465340
104	Lê Mai Quân	Xóm 2, Thôn Trường Xuân	Sơn Dương	Thanh Oai	01695458715
105	Lê Thị Vân	Xóm 1, Thôn Trường Xuân	Sơn Dương	Thanh Oai	-
106	Nguyễn Thị Thắm	Xóm 1, Thôn Trường Xuân	Sơn Dương	Thanh Oai	0987693750

Table 4-15. List of surveyed households in Phu Tho

No	Name	Address	Commune	District	Telephone
1	Nguyễn Thị The	Khu 01	Ấm Hạ	Hạ Hòa	
2	Trương Thị Thuần	Khu 09	Ấm Hạ	Hạ Hòa	0914 302 057
3	Nguyễn Thị Thanh	Khu 08	Ấm Hạ	Hạ Hòa	01664 366 703
4	Trần Văn Hoàng	Khu 05	Ấm Hạ	Hạ Hòa	0963 226 009
5	Nguyễn Ngọc Tiến	Khu 07	Ấm Hạ	Hạ Hòa	09777 742 901
6	Nguyễn Thị Thúy Hồng	Khu 07	Ấm Hạ	Hạ Hòa	0982 646 694
7	Lê Thị Mai	Khu 05	Ấm Hạ	Hạ Hòa	01683 954 808
8	Nguyễn Thị Tuyến	Khu 05	Ấm Hạ	Hạ Hòa	0986 189 250
9	Trần Thị Việt Hà	Khu 05	Ấm Hạ	Hạ Hòa	0966 139 383
10	Lê Thị Hà	Khu 09	Ấm Hạ	Hạ Hòa	0978 913 744
11	Trương Thị Hạnh	Khu 08	Ấm Hạ	Hạ Hòa	0983 251 518
12	Vũ Thị Thúy	Khu 05	Ấm Hạ	Hạ Hòa	0972 679 744
13	Phạm Thị Ngọc Hoa	Khu 06	Ấm Hạ	Hạ Hòa	01666 290 292
14	Tương Thị Nga	Khu 02	Ấm Hạ	Hạ Hòa	01642 084 967
15	Đỗ Thị Sang	Khu 06	Ấm Hạ	Hạ Hòa	01672 227 9399

No	Name	Address	Commune	District	Telephone
16	Tô Thị Luyến	Khu 03	Đại Phạm	Hạ Hòa	01653 973 352
17	Nguyễn Thị Vạn	Khu 02	Đại Phạm	Hạ Hòa	01692 935 885
18	Phạm Thị Hà	Khu 12	Đại Phạm	Hạ Hòa	01688 008 097
19	Nguyễn Thị Huyền	Khu 10	Đại Phạm	Hạ Hòa	0984 969 259
20	Nguyễn Thị Đủ	Khu 11	Đại Phạm	Hạ Hòa	01668 260 949
21	Phạm Thị Bích Luận	Khu 07	Đại Phạm	Hạ Hòa	01694 103 576
22	Đỗ Thị Huyền	Khu 03	Đại Phạm	Hạ Hòa	01694 085 525
23	Lương Thị Thơ	Khu 12	Đại Phạm	Hạ Hòa	01666 244 822
24	Đăng Thị Lệ Hằng	Khu 11	Đại Phạm	Hạ Hòa	01696 644 865
25	Phạm Thị Như	Khu 16	Đại Phạm	Hạ Hòa	01684 469 456
26	Dương Kim Tuấn	Khu 11	Đại Phạm	Hạ Hòa	01673 646 608
27	Ngô Thị Tuyến	Khu 08	Đại Phạm	Hạ Hòa	01635 520 735
28	Nguyễn Thị Hồng	Khu 06	Đại Phạm	Hạ Hòa	01652 190 448
29	Đỗ Thị Quyên	Khu 04	Đại Phạm	Hạ Hòa	0975 687 802
30	Trần Thị Thảo	Khu 15	Đại Phạm	Hạ Hòa	
31	Nguyễn Việt Quỳnh	Khu 04	Phụ Khánh	Hạ Hòa	01688 154 330
32	Trần Thị Hân	Khu 07	Phụ Khánh	Hạ Hòa	01666 675 037
33	Nguyễn Thị Ngoan	Khu 02	Phụ Khánh	Hạ Hòa	0986 987 431
34	Nguyễn Thị Kim Thuấn	Khu 16	Phụ Khánh	Hạ Hòa	0984 411 399
35	Ngô Thị Luyến	Khu 07	Phụ Khánh	Hạ Hòa	01676 694 019
36	Mai Văn Nam	Khu 08	Phụ Khánh	Hạ Hòa	0983 948 586
37	Đỗ Thị Phượng	Khu 10	Phụ Khánh	Hạ Hòa	
38	Đào Thị Chính	Khu 09	Phụ Khánh	Hạ Hòa	01698 168 376
39	Đặng Thị Thêm	Khu 09	Phụ Khánh	Hạ Hòa	0974 027 413
40	Nguyễn Thị Tuy	Khu 09	Phụ Khánh	Hạ Hòa	01629 720 946
41	Nguyễn Thị Hồng Nụ	Khu 01	Phụ Khánh	Hạ Hòa	0972 128 535
42	Nguyễn Thị Luyện	Khu 02	Phụ Khánh	Hạ Hòa	01682 871 688
43	Nguyễn Thị Thư	Khu 03	Phụ Khánh	Hạ Hòa	01682 775 367
44	Đinh Thị Thêm	Khu 04	Phụ Khánh	Hạ Hòa	01696 248 772
45	Chu Thị Hải	Khu 05	Phụ Khánh	Hạ Hòa	0985 977 650
46	Ngô Hồng Minh	Khu 9	Phụ Khánh	Hạ Hòa	0973348861
47	Nguyễn Thị Tâm	Khu 04	TT Hạ Hoà	Hạ Hòa	0985 147 299
48	Hứa Thị Thu Hà	Khu 05	TT Hạ Hoà	Hạ Hòa	0123 536 525

No	Name	Address	Commune	District	Telephone
49	Trần Thị An	Khu 01	TT Hạ Hoà	Hạ Hòa	0210 3837 812
50	Phạm Thị Thanh Huệ	Khu 03	TT Hạ Hoà	Hạ Hòa	0966 258 418
51	Nguyễn Thị Nước	Khu 10	TT Hạ Hoà	Hạ Hòa	0975 425 117
52	Nguyễn Thị Thanh	Khu 03	TT Hạ Hoà	Hạ Hòa	
53	Trần Thị Thuận	Khu 09	TT Hạ Hoà	Hạ Hòa	01635 234 869
54	Nguyễn Ngọc Anh	Khu 01	TT Hạ Hoà	Hạ Hòa	0977 605 766
55	Nguyễn Thị Thọ	Khu 02	TT Hạ Hoà	Hạ Hòa	0165 345 8205
56	Nguyễn Thị Hồng Việt	Khu 09	TT Hạ Hoà	Hạ Hòa	0988 582 374
57	Trần Thị Dung	Khu 11	TT Hạ Hoà	Hạ Hòa	01659 496 085
58	Hồ Thị Minh	Khu 11	TT Hạ Hoà	Hạ Hòa	0985 752 139
59	Phạm Thị Mai	Khu 09	TT Hạ Hoà	Hạ Hòa	01672 237 416
60	Bùi Thị Bích	Khu 08	TT Hạ Hoà	Hạ Hòa	01676 694 019
61	Nguyễn Thị Minh Tâm	Khu 07	TT Hạ Hoà	Hạ Hòa	01653 188 422
62	Hoàng Thị Lịch	Khu 04	Xuân Áng	Hạ Hòa	01654 086 524
63	Hà Thị Thoa	Khu 05	Xuân Áng	Hạ Hòa	0976 137 674
64	Nguyễn Thị Thiện	Khu 08	Xuân Áng	Hạ Hòa	0967 911 007
65	Nguyễn Thị Hải	Khu 04	Xuân Áng	Hạ Hòa	0976 018 660
66	Hà Thị Kim Thoa	Khu 02	Xuân Áng	Hạ Hòa	01687 868 590
67	Tô Thị Thanh	Khu 01	Xuân Áng	Hạ Hòa	01689 273 196
68	Nguyễn Thị Thúy	Khu 07	Xuân Áng	Hạ Hòa	01678 652 048
69	Nguyễn Thị Tuyên	Khu 06	Xuân Áng	Hạ Hòa	01689 699 421
70	Nguyễn Thị Vinh	Khu 11	Xuân Áng	Hạ Hòa	01655 314 046
71	Phạm Thị Ngân	Khu 10	Xuân Áng	Hạ Hòa	01699 541 163
72	Nguyễn Thị Ngân	Khu 03	Xuân Áng	Hạ Hòa	01666 422 924
73	Tô Kim Quân	Khu 01	Xuân Áng	Hạ Hòa	01657 422 575
74	Đoàn Thị Oanh	Khu 09	Xuân Áng	Hạ Hòa	0978 059 881
75	Nguyễn Thị Ân	Khu 08	Xuân Áng	Hạ Hòa	01683 486 081
76	Bùi Thị Nguyên	Khu 05	Xuân Áng	Hạ Hòa	01669 575 040
77	Nguyễn Thị Hải	Khu 09	Xuân Áng	Hạ Hòa	01647 622 375
78	Hà Thị Phóng	Thừ 2	Tân Sơn	Tân Sơn	
79	Hà Thị Nguyệt	Thừ 2	Tân Sơn	Tân Sơn	
80	Hà Thị Lan	Thừ 2	Tân Sơn	Tân Sơn	
81	Hà Thi Hoà	Thừ 2	Tân Sơn	Tân Sơn	

No	Name	Address	Commune	District	Telephone
82	Hà Thị Mầu	Thừ 2	Tân Sơn	Tân Sơn	
83	Hà Thị Hoa	Thừ 2	Tân Sơn	Tân Sơn	
84	Hà Thị Huyển	Thừ 2	Tân Sơn	Tân Sơn	
85	Hà Thị Mừng	Thừ 2	Tân Sơn	Tân Sơn	
86	Hà Thị Gương	Thừ 2	Tân Sơn	Tân Sơn	
87	Hà Thị Như	Thừ 2	Tân Sơn	Tân Sơn	
88	Hà Thị Vân	Thừ 2	Tân Sơn	Tân Sơn	
89	Đinh thị Nhức	Thừ 2	Tân Sơn	Tân Sơn	
90	Hà Thị Trinh	Xóm 3	Thu Cúc	Tân Sơn	
91	Hà Thị Khái	Xóm 3	Thu Cúc	Tân Sơn	
92	Hà Thị Phóng	Xóm 3	Thu Cúc	Tân Sơn	
93	Hà Thị Viện	Xóm 3	Thu Cúc	Tân Sơn	
94	Hà Thị Hướng	Xóm 3	Thu Cúc	Tân Sơn	
95	Hà Thị Giác	Xóm 3	Thu Cúc	Tân Sơn	
96	Hà Thị Thanh	Xóm 3	Thu Cúc	Tân Sơn	
97	Hà Thị Đài	Xóm 3	Thu Cúc	Tân Sơn	
98	Hà Thị Liền	Xóm 3	Thu Cúc	Tân Sơn	
99	Hà Thị Hinh	Xóm 4	Thu Cúc	Tân Sơn	
100	Hà Thị Huệ	Tổ 3	Thu Cúc	Tân Sơn	
101	Hà Thị Đoàn	Tổ 3	Thu Cúc	Tân Sơn	
102	Hà Thị Hiền	Tổ 3	Thu Cúc	Tân Sơn	
103	Hà Thị Xanh	Tổ 3	Thu Cúc	Tân Sơn	
104	Hà Thị Thu	Xóm 3	Thu Cúc	Tân Sơn	
105	Hà Thị Miên	Xóm 3	Thu Cúc	Tân Sơn	
106	Hà Thị Nguyên	Xóm 3	Thu Cúc	Tân Sơn	

4.11. List of stakeholders for pilot

Table 4-16. Contact of ICS producers

	Name	Address	Telephone
1	Mr. Thân Xuân Trường	Thôn Um Ngò, xã Việt Lập, huyện Tân Yên, Bắc Giang)	0982.537.729
2	Mr. Lê Hồng	Khu 11, TT Thanh Ba - Thanh Ba, Phú Thọ	0973.419.138
3	Mr. Đỗ Đức Khôi	58/162/43 Nguyễn Văn Cừ, Long Biên, Hà Nội	0913.540.129

Table 4-17. Contact of Farmer Unions in Ung Hoa Districts

	Name	Position	Telephone
1	Nguyễn Hữu Bảy	Chairman, Van Dinh Farmer Union	01674783558
2	Đặng Văn Dân	Chairmain, Vien An Farmer Union	0973242052
3	Nguyễn Minh Thoa	Chairmain, Son Cong Farmer Union	0979699802
4	Quản Ngọc Thắm	Chair man, Dong Tien Farmer Union	01686599271
5	Nguyễn Đình Thắng	Chair man, Vien Noi Farmer Union	01662961968
6	Phạm Văn Hoạch	Chair man, Ung Hoa District farmer union	0988527546

Table 4-18. Contacts of Woman Unions in Ha Hoa district

No	Name	Postion	Telephone
7	Bùi Thị Tuyết	Chairwoman, Xuan Ang Woman Union	01657 422 575
8	Phạm Thị Bình	Chair woman, Ha Hoa district woman union	
9	Văn Thị Thu Hiền	Chair woman, Dai Pham Woman Union	0989 460 146
10	Đỗ Thị Thanh Huyền	Chair woman, Ha Hoa commune woman union	0978 650 184
11	Tường Thị Bính Hạnh	Chair woman, Am Ha woman union	
12	Trần Thị Châm	Chairwoman, Phu Khanh woman union	0987 526 651

Table 4-19. Contact of stove testing

No	Name	Address		Telephone
1	Lê Đức Dũng	Laboratory at Department of Thermal Energy Systems, Institute of Heat Engineering and Refrigeration	Hanoi University of Science and Technology, 1 Dai Co Viet, Hanoi	0912307717

4.12. ICS evaluation

Table 4-20. ICS evaluation point and ranking

ICS			Evaluation point (1-5)							Total point			Ranking		
No	Producer	Model	Life time	Smokeless	Cost, Ung Hoa	Cost, Ha Hoa	Easy to use	Cooking time	Biomass type	Ung Hoa	Ha Hoa	Average	Ung Hoa	Ha Hoa	Pilot
1	Thân Xuân Trường	Truong Giang-2	3	2	4	4	4	5	4	3.53	3.59	3.56	1	2	1
2	Lê Hồng	Fix TK90-1	1	2	4	5	2	5	4	2.80	2.92	2.86	11	7	9
3		Fix TK90-2	1	2	3	3	2	5	4	2.61	2.62	2.61	12	12	12
4		Portable TK90	3	2	4	5	4	5	3	3.40	3.61	3.51	2	1	2
5	Đỗ Đức Khôi	DK-T3-1	1	3	3	3	4	3	4	2.88	2.77	2.83	9	11	10
6		DK-T3-2	2	3	3	2	4	3	4	3.08	2.88	2.98	5	8	7
7		DK-T4-1	1	4	3	3	4	3	4	3.07	2.93	3.00	6	6	6
8		DK-T4-2	2	4	3	2	4	3	4	3.28	3.03	3.15	3	4	4
9		DK-T5-1	1	4	3	3	4	5	2	3.07	2.98	3.02	6	5	5
10		DK-T5-2	2	4	3	2	4	5	2	3.28	3.08	3.18	3	3	3
11	Hoàng Tiến Khải	Type 2	1	5	3	3	4	3	2	3.02	2.83	2.92	8	9	8
12		Type 3	2	5	1	1	4	3	2	2.85	2.77	2.81	10	10	11

		
Model: Truong Giang-1 and Truong Giang 2 **Owner:** Mr. Than Xuan Truong	**Model**: Brick ICS **Owner:** Do Duc Khoi	**Model**: DK-2,3,4,5 **Owner:** Do Duc Khoi
		
Model: Fix TK90 - 1 **Owner:** Mr. Le Hong	**Model**: Fix TK90 – 2 **Owner:** Mr. Le Hong	**Model**: Portable TK90 **Owner:** Mr. Le Hong

		
Model: (No name) **Owner:** Thanh Thuy craft village, Mr. Khai and Dai Vinh workshop	**Model:** (No name) **Owner:** Mr. Dao Ngoc Viet	**Model**: Top-lift **Owner:** Dr. Paul Oliver
		
Model: (No name) **Owner: Mr. Nguyen Van Trong** same as of Mr. Nguyen Khac Chien	**Model**: (No name) **Owner:** Mr. Bui Trung Tuan	**Model**: (No name) **Owner:** Mr. Le Tat Khuong

Figure 4-1. Available ICSs in Vietnam