Federal Democratic Republic of Nepal

Preparatory Survey on BOP business on insulating firebrick cook stove with carbon funding
Final Report（Summary）

September 2013

JAPAN INTERNATIONAL COOPERATION AGENCY(JICA)

Tepia Corporation Japan
Isolite Jyuki Co., Ltd.
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ALCEDO Corporation

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Annex: Currency Exchange Rate (as of 10 September 2013)

Nepalese Rupee to US Dollar	0.009667 USD
Nepalese Rupee to Japanese Yen	0.96376 JPY

Chapter 1. Project objectives

Traditional Cook Stoves (TCS) are widely used in Nepal for cooking but they have very low combustion efficiency and consumes lots of biomass energy mainly fuel wood causing many direct and indirect problems, such as indoor air pollution, public health problems and deforestation. To counteract with such kind of problems, lots of efforts have been made to distribute Improved Cook Stoves (ICS) through funding from different government and non-government bodies. But the situation has not shown considerable progress yet. This feasibility study was conducted for a BOP business model applying the technology of Japanese companies, Isolite Insulating Products Ltd. and Isolite Jyuki. These companies have outstanding technology in manufacturing cook stoves using diatomite bricks that have excellent insulating property. The main objective of this study is to check the feasibility of manufacturing, sales and distribution of cook stoves developed by Isolite Insulating Products Ltd and Isolite Jyuki locally to mitigate emission of GHG (Green House Gases) that are more abundantly generated due to use of TCS (Traditional Cook Stoves).

This feasibility study was conducted with the innovative business plan to fabricate ICS in a local site using locally manufactured insulating fire bricks with designs, specifications and production guidance from Isolite Insulating Product Ltd. and Isolite Jyuki. There are plenty of ceramic factories with high temperature furnaces in Bhaktapur district and, since they can produce airtight bricks, it was considered that the insulating bricks would be manufactured locally. The diatomite insulating cook stoves produced in Japan are durable and have high heat retaining properties. 80% of the volume of the insulating bricks developed by the company consists of air pores that not only make the bricks light in weight but also give superior thermal insulating property. The characteristics of the diatomite bricks for maintaining tightness, along with the property of thermal insulation is the main feature of diatomite cook stoves. One diatomite cook stove manufactured in Japan was actually transported to Nepal at the laboratory of Faculty of Engineering in the Kathmandu University to test and compare its efficiency. The test results showed the thermal efficiency of this stove was about 20 to 30 percent compared to mere 10 % efficiency of traditional cook stoves. (Firewood can be reduced by 50 to 70 percent). During the study, prototype cook stoves were fabricated by modifying the specification of Japanese cook stove to match with Nepali lifestyle and retaining low production cost. In addition, during the survey, the procurement of bricks from India seemed to be better option due to difficulty in finding them within Nepal. Therefore, northern India was also included in the study, in case; the operation of the business has to be conducted from India.

At the same time, to counteract with the price matter, which is often a major issue in BOP business, a study on possibility of distribution of the cook stoves at lower price using carbon funding through CDM scheme was also studied in parallel.

Chapter 2. Implementation Schedule

This study was conducted according to the schedule as shown in the table below.

Table 1：Survey Schedule

	Members and period of field Survey		Main research agenda
	Study period of the main survey member	Members of study team from Japan	
1st Field Survey	2nd to 8th September, 2012	・Wen (Team Leader), ・Shiono, ・Moriyama	・Obtaining and testing local diatomite sample. ・Making sample brick in local ceramic factory.
(Local Task)	September to November, 2012	-	・Diatomite ingredient analysis. ・Sample brick component analysis. ・Survey on accessibility of bricks from India. ・1st Workshop to investigate food culture and purchasing power.（①）
2nd Field Survey	14th to 25th November, 2012	・Ishige（Sub-leader） ・Gamo ・Moriyama	・Discussion on the designs of the cook stoves. ・Obtaining details and inspection of the proposed assembly site. ・Adjustment of obtaining bricks from India. ・Research on government policies through interviews.
(Local Task)	December 2012 to March 2013	-	・Design conception of cook stove. ・Fabrication of pilot cook stove Prototype Ver.1, Ver.2 and Ver.3.
3rd Field Survey	25th March to 3rd April, 2013	・Ishige（Sub-leader） ・Gamo ・Moriyama	・Estimating quantity and production cost of sample accessories obtained from local factories. ・Fabrication of pilot cook stove, Prototype Ver.4. ・Profit & loss calculation.
(Local Task)	April to May, 2013	-	・Fabrication of pilot cook stove, Prototype Ver.5. ・Experiment on finding optimum mixing ratio for the cement.
4th Field Survey	19th to 25th May, 2013	・Wen (Team Leader), ・Moriyama	・2nd Workshop to review the design and to determine the selling price.（②） ・Survey on potential subsidies ・Negotiating terms and condition with the distributors. ・Survey on microfinance schemes in financial institutions.

① Summary of the 1st Workshop (To investigate food culture and purchasing power).

Date： 1st October to 7th November, 2012

Location： 10 districts in 8 Zones from Central Development Region and Eastern Development Region（See Table 2）. After consultation with The Federation of Community Forestry Users Nepal（FECOFUN）, these study locations were selected judging their distances from Kathmandu and other features considering realistic business implementation.

Participant： A total of 150 CFUG members, 15 from each district

Summary： Collected important information such as types of cook stoves being used, total expenditure on fuel wood, household annual income, food culture etc.

Table 2：Schedules of the 1st Workshop

Period	Location
1st to 3rd October	Kavre District, Bagmati Zone
4th to 5th October	Dhading District, Bagmati Zone
6th to 8th October	Makwanpur District, Narayani Zone
9th to 10th October	Dhanusa District, Janakpur Zone
11th to 13th October	Udaypur District, Sagarmatha Zone
19th to 20th October	Dhankuta District, Koshi Zone
3rd November	Syangia District, Gandaki Zone
4th November	Palpa District, Lumbini Zone
5th November	Pyuthan District, Rapti Zone
7th November	Rolpa District, Rapti Zone

② Summary of 2nd Workshop (Review of the design and determination of selling price).

Date： May 23rd, 2013（Thursday）

Venue： Dhulikhel, Kavre District

Participants： Total 30（Male 13、Female 17）. 15 members each from 2 CUFGs.

Average age： 37.8

Ethnic group： Tamang (11), Dalit (10), Brahmin (5), Chhetri (1), Others (3)

Summary： The prototype Ver.5 was presented in the workshop. Opinions on the design of the prototype were collected from the participants and they were asked how much they would like to pay for the cook stove when it becomes available in the market.

Chapter 3. Investment Environment for Business Implementation （Related policies and systems, Infrastructures and facilities）

(A) Political and economic situation in Nepal and neighboring countries

●Political and economic situation of Nepal

【Political Overview】

After the fall of Maoist Communist Party in May 2009, strikes and riots occurred more frequently and unstable political situation in Nepal prolonged. Rise of corruption and inflation became the main cause for the downturn of the Nepalese economy followed by degradation of living condition of people. New constitution as expected by the people could not be formed within 2012 due to the dissolution of the parliament and this inflated people`s dissatisfaction toward politics and the interim government. Swelling dissatisfaction of people can lead to higher possibility of demonstrations and riots if a new parliament is not established in near future. However, statistics show the declining trend of overall incidence of strikes and riots, large scale demonstrations and riots can be predicted if Maoist Communist Party is left alone without political power. If this happens, investment can be very risky in Nepal.

【Economic Overview】

Nepal is a Landlocked Least Developed Country surrounded by China in the north and India in the south, east and west. According to the International Monetary Fund (IMF), the real GDP in 2011 was 642.55 billion NPR with the growth rate of 3.88% compared to 618.52 billion NPR in 2010. With the GDP per capita of 21,077 NPR, Nepal is still one of the poorest countries in the Southeast Asia. According to Nepal Living Standard Survey "NLSS (2010/2011)" conducted by the Central Bureau of Statistics, average per capita income (nominal) in the rural and urban region is 34,607 NPR and 71,720 NPR respectively. Moreover, per capita income in Kathmandu is the highest, i.e. 98,084 NPR. The major industry in Nepal is service industry consisting of tourism. Agriculture is the second largest industry involving about 60% of the total population. However, manufacturing industry is the least developed in Nepal and still showing very slow growth. During the fiscal year 2010/11, the service, agriculture and manufacturing sectors contributed about 51.71%, 37.01% and 15.54% of the GDP respectively.

【Wage standard】

According to the revised minimum wage by Ministry of Labor and Transport Management on March 2011, the monthly minimum wage was raised to 6,200 NPR from 4,600 NPR. This figure consist of basic wage and allowance respectively 3,550 NPR and 2,650 NPR. Similarly, the

minimum daily wage was raised to 231 NPR from 190 NPR.[1]

Since there is no statistical data on the actual wage level in Nepal, brief interviews were conducted in January, 2013 with two engineers working in communication related companies in Nepal. According to the interviews, low class engineers for simple tasks can be employed in relatively inexpensive wage. However, additional deals are required to be made to hire engineers with specialized skills. Moreover, according to the wage index of fiscal year 2011/12, with the fiscal year 2007/08 as base, i.e. setting the wage of FY 2007/08 to be 100, the wage of an engineer class worker has increased 1.5 times; the wage of a labor has increased almost 2 times, and these are expected to rise further in the future.

Table 3：Wage level by occupation

Occupation	Wage（NPR）
Labor（Daily wage）	500～1,500
※Monthly wage calculated with 25 working days per month.	12,500～37,500
Engineer in manager level position　(Monthly wage)	30,000～300,000

Source：Information collected through interviews with two engineers working in Telecommunication sectors in Kathmandu and Bhaktapur by JICA Study Team in January 2013

Table 4：Wage Index by occupation（Indexed FY 2007/2008 as100）

Occupation	FY 2008/2009	FY 2009/2010	FY 2010/2011	FY 2011/2012
Engineer	114.83	132.02	138.25	153.85
Supervisor	125.62	147.20	165.51	198.02
Labor/Worker	120.79	150.35	178.82	203.27

Source：Central Bureau of Statistics

【Inflation rate】

The inflation rate in Nepal is relatively high among the member countries of SAARC (South Asian Association for Regional Cooperation) (see Table 5). According to the forecast of IMF, the inflation rate remains at more than 5%, although inflation is on a downward trend in the future. Therefore, this needs to be considered while setting up the prices.

[1] Nepal Chamber of Commerce（ http://employers.fncci.org/news/detail.php?id=22）

Table 5：Inflation rate in Asian Countries

Country	2009	2010	2011	Forecast			
				2012	2013	2015	2017
Afghanistan	-12.24	7.68	11.81	6.61	6.67	5.00	5.00
Bangladesh	5.43	8.13	10.70	8.52	6.69	5.87	5.50
Bhutan	4.36	7.04	8.86	9.37	7.81	6.45	6.45
India	10.88	11.99	8.86	10.25	9.65	6.45	5.01
Maldives	4.00	4.74	14.15	12.30	8.30	7.00	3.04
Nepal	12.62	9.52	9.61	8.31	8.03	6.93	6.48
Pakistan	17.63	10.10	13.66	11.01	10.36	12.00	13.00
Sri Lanka	3.47	6.22	6.72	7.91	7.99	6.00	6.00

Source：Prepared by JICA Study Team based on IMF, World Economic Outlook Database October 2012

【Ease of doing business】

According to the Doing Business Rank[2] by the World Bank, Nepal ranks 108th out of 185 countries in the world (see Table 6). Out of 8 countries in South Asia, Nepal`s rank is 4th. These are comprehensive ranking based on about 10 or more items such as ease for starting business, acquisition of construction permit, days and procedures required for electrification, land acquisition etc. Out of 33 low-income countries, Nepal ranks 3rd following Rwanda and the Kyrgyz Republic.

In addition, Table 7 shows the comparison of the number and duration of each procedure with that of the average of OECD member countries the average of 8 countries in South Asia. This enlightens the situation of Nepal is slightly better than the average of the other two.

Table 6：Comparison on ease of doing business（Comparison of top and bottom 3 countries with few Asian countries.

Rank	Country	Rank	Country
1	Singapore	107	Pakistan
2	Hong Kong	108	Nepal
3	New Zealand	129	Bangladesh
18	Thailand	132	India
24	Japan	148	Bhutan
81	Sri Lanka	168	Afghanistan
91	China	183	Congo
95	Maldives	184	Chad

[2] World Bank, Doing Business 2013 – Smarter Regulations for Small and Medium-Size Enterprises http://www.doingbusiness.org/~/media/GIAWB/Doing%20Business/Documents/Annual-Reports/English/DB13-full-report.pdf

99	Vietnam	185	Central African Republic

Source：World Bank, Doing Business 2013

Table 7: Duration and procedures for opening a business (Comparing the average value of the OECD and South Asian countries)

	Nepal	Average of South Asia	Average of OECD countries
Number of procedures for Factory / warehouse establishment.	13	16	14
Number of procedures for electric connection.	5	6	5
Number of procedures to start business.	7	7	5
Number of days required for Factory / warehouse establishment.	115	201	143
Number of days required for electric connection.	70	148	98
The number of days required to start business.	29	19	12

Source: World Bank, Doing Business 2013

【Treaties and conventions with Japan】

So far, there has not been any tax treaty and investment protection agreement between Japan and Nepal, and hence the investment from Japan is not subjected to protection, nor there are any means to avoid double taxation. In case of project implementation, not only the risk of business halt due to political condition should be taken into consideration but also remittances of dividends and royalties to Japan need to be considered assuming the risk of double taxation, especially for the salary payment to the personnel dispatched from Japan.

(B) Various legal and tax system related to foreign investment in Nepal

● Business regulation for foreign companies involving in manufacturing and sales

Industries except cottage, retail and other small industries set forth in the Annex of the Foreign Investment and Technology Transfer Act 1992, will be granted permission to perform business in Nepal. In case of business related to manufacturing and sales of ICS, 100% foreign investment can be made with a condition that the minimum capital should be at least 5 million NPR regardless the percentage of equity.[3]

● Import and Export regulation

There are import/export regulations for certain items in Nepal. Among the materials necessary for production of ICS, the insulating bricks needed to be imported and the insulating bricks do

[3] Information collected through interview with Mr. Bipin Rajbhandari, Director at the Department of Industry on 29th November 2012.

not fall under the import forbidden items.

● Import tariff

According to the interviews conducted, the custom duty for insulating bricks to be imported from India is not exactly determined, but it was confirmed that custom duty for the insulating bricks ranges from 5% to 10%. The maximum side, i.e. 10% is entered in the profit and loss account to prevent potential troubles in the future.

● VISA and WP to foreign workers

Non-tourist visa, i.e. business visa shall be issued without any problem to foreign investors and their families or the certified representatives until the foreign investment retains in Nepal.

● Corporate income taxes (With or without special tax)

Corporate income tax in Nepal is defined for each industry based on the Income Tax Act, 2002. In addition, tax incentives are also defined for particular sector of industry. As the result of negotiation with related authorities, it was confirmed that there is no special exemption or reduction of income tax for the business related to manufacturing and sales of ICS. Therefore, the tax rate of 20 % is applied as similar to other general businesses.

● Depreciation

Depreciation is determined by the ratio followed by the declining-balance method mentioned below.

Table 8：List of depreciation list

Class	Assets	Rate
A	Building or fixed assets	5%
B	Office supplies, equipment and furniture	25%
C	Vehicle, Mini bus/bus	20%
D	Construction and civil engineering equipment, other assets that are not classified elsewhere	15%
E	Other intellectual property rights except for the assets that are set forth in D	Divide by the product lifetime

● Loss Transfer

Losses in investment and business can be carried over for seven years. Losses in infrastructure development projects and oil related business can be carried over for 12 years.

● VAT、Excise duty

Generally, VAT is defined in the uniform rate of 13%. It is confirmed that the VAT for ICS and the supplementary parts or accessories will be counted for normal tax rate of 13%. As for excise duty, certain products like Tobacco, alcoholic beverages, plastic, cement, automotive, marble etc., either produced in Nepal or imported are intended for taxation, however, it is confirmed that ICS is excluded from excise duty.

● Central Sales Tax (CST)

Central sales tax (CST) is levied by Central Government of India on inter-state sales or purchase of goods. CST is imposed by the state government of shipping side. Therefore, it is assumed that CST is not applicable for the goods exported across the national border and not taken into consideration in this project.

● Dividend tax, Capital Gains Tax (CGT)

Dividend tax: 5%, Capital Gains Tax (In the case of natural person): 10%
Income by non-residents through marine or air shipping, telecom etc.: 2%
Income repatriation from foreign PE by non-residents: 10%

● Other investment benefits

From the negotiations with the authorities, no particular benefits or advantages could be distinguished for the manufacturing and sales of ICS.

● Condition of Investment agreement with Japan, Taxation Treaty

Profit remittance of dividend will be double taxed because tax treaties have not been concluded with Japan. Therefore, in the future, when there is dividend income to be repatriated, incorporation of enterprise in the third country or other measures might become necessary. In addition royalties are not subject to tax withholding under the tax law of Nepal.

(C) Various laws and policies relevant to the distribution of ICS

● Condition and content of the current regulations on emissions of greenhouse gases such as carbon dioxide, soot and dust from households, and future trends

The environmental protection rules 1997, prohibit acts that directly or indirectly causes negative impact on the environment, however, no specific numeric limitation and regulation have been set for emission of carbon dioxide and other greenhouse gases from both household and industry level. Therefore, strengthening the regulations is not likely to be the potential

driving force to increase the sales of ICS. It becomes necessary to prepare an attractive design and set an affordable price to increase the potential buyers and users of the ICS.

(D) Market research (Market competitiveness, rival products, market place, market size etc.)

- Summary on type of ICS (Clay/Mud and Metallic), their sales price, and rate of distribution

According to NLSS 2010/2011 by Central Bureau of Statistics, half of the households (52%) in Nepal use cook stoves made up of mud. Open-fire place and Kerosene/gas stoves are used by respectively about 21% of the total households. Only about 3% of the households use smokeless stoves (see Table 9.)

Usage of gas stoves in households are high (61%) in urban areas and in Kathmandu it accounts for about 92% showing a very high distribution rate for gas stoves. On the other hand, cook stoves made up of clay are common in rural areas and covers about 58%. In addition, most of the poor households use clay stove (62%), whereas, most of the well-to-do households use gas cook stoves (61%).

Table 9：Regional distribution of cook stoves

Regions	Population	Avg size of household	Rate of distribution of stoves					
			Open Fire place	Mud Stove	Smokeless Stove	Kerosene Stove	Gas Stove	Other
1. Development Regions								
Eastern	5,811,555	4.8	14.6	68.9	1.1	0.1	13.7	1.5
Central	9,656,985	4.9	14.7	49.0	2.6	1.0	31.1	1.5
Western	4,926,985	4.7	29.5	39.6	5.7	0.3	23.7	1.3
Mid-Western	3,546,682	5.2	46.4	34.9	8.6	0.2	9.0	0.9
Far Western	2,552,517	5.1	15.9	74.8	0.7	0.6	7.1	1.0
2. Topographic distribution								
Mountain	1,781,792	5.0	45.2	35.9	10.6	0.9	5.6	1.7
Hills	11,394,007	4.6	33.2	33.1	5.2	0.7	26.3	1.5
Terai	13,318,705	5.2	6.1	74.7	0.5	0.3	17.4	1.1
3. Economic status								
Urban	4,523,820	4.5	4.3	29.0	1.1	1.7	62.1	1.8
Rural	21,970,684	5.0	26.2	58.4	4.1	0.2	9.9	1.2
4. Economic status of Topographic classifications								
Urban Kathmandu	1,744,240	4.2	0.0	3.0	0.0	3.5	92.8	0.7

Urban Hill	-	4.3	9.4	30.8	3.1	1.0	53.8	1.9
Urban Terai	-	4.8	4.3	47.2	0.5	0.8	44.5	2.6
Rural Hill - Eastern	1,601,347	4.8	37.5	55.7	3.1	0.0	1.0	2.6
Rural Hill - Central	4,431,813	4.7	31.7	36.3	7.5	0.4	21.6	2.5
Rural Hill - Western	2,811,135	4.3	48.5	30.6	9.6	0.0	10.5	0.8
Rural Hill - Mid & Far Western	2,549,712	5.1	52.3	40.6	4.0	0.0	2.4	0.8
Rural Terai - Eastern	3,818,119	4.9	2.3	84.2	0.4	0.0	12.7	0.4
Rural Terai - Central	4,707,517	5.6	4.4	89.1	0.0	0.2	5.6	0.6
Rural Terai - Western	2,095,640	5.7	7.1	72.1	0.0	0.3	18.8	1.7
Rural Terai – Mid & Far Western	2,697,429	5.0	17.4	67.9	2.0	0.0	12.0	0.7
Nepal	**26,620,809**	**4.7**	**21.6**	**52.3**	**3.4**	**0.5**	**20.8**	**1.3**

Source : Prepared by JICA Study Team based on NLSS 2010/2011, Central Bureau of Statistics (* Data of "Population" & Average size of household" obtained from National Population and Housing Census 2011, Central Bureau of Statistics)

● Review of market size and target sales volume of the Improved Cook Stoves

According to the results of the field survey, the distribution rate of ICS is very low in compare to its potential demand (survey by Kathmandu University showed about 5%). This shows that "the growth potential" is very high. In the larger cities like Kathmandu and Pokhara, LPG gas stoves are common; however, in suburban regions even close to Kathmandu, cook stoves are used together with LPG gas stoves. In the households located farther from the center of urban areas, LPG gas stoves are less common. Considering the potential demand of ICS, about ten thousand units can be set as annual sales target.

On the other hand, from the detailed production capacity mentioned below and from the risk averse perceptive, the maximum production capacity of a general factory can be considered to be about 1,000 units. The profit and loss account is prepared with the estimated production volume and sales target to be 1,000 units per year.

(E) Overview of demographics of target buyers

● Food culture of the proposed target area

Food culture is different depending on ethnicity of people in various regions in Nepal, however,

Rice, Roti and Dhido[4] can be considered as most common staple food. Out of all 10 locations chosen for workshop, rice is main staple food in Dhankuta, Syangja, Palpa, Kavre, Udaypur and Dhading. Dhido is staple food in Makwanpur and Rolpa. Likewise, Roti is the staple food in Dhanusa and Pyuthan. Different types of utensils are used for cooking each of these foods and the size of the pot holes of cook stoves also varies accordingly. For example, round bottomed pots/pans of different sizes are mostly used to cook rice and dhido. Whereas, iron plates are mostly used to cook roti. Therefore, the pot holes of the cook stoves need to be designed in such a way that they fit diverse kind of utensils.

- Selling price of firewood in different regions

As the result of examination of selling price of fuel wood in each region through FECOFUN workshops, it was found that there is a wide range of selling prices and difference between the maximum and minimum is about 3 times. The firewood is most expensive in Palpa and it is consistent with the high penetration rate of ICS in the region. However, Dhading also having high ICS penetration rate, the price of the fuel wood are comparatively cheaper. Therefore, no correlation could be proved between the price of the fuel wood and ICS penetration rate.

Thus, if Kathmandu suburbs are defined as Phase 1 distribution area, it is necessary to select other areas for Phase 2 distribution after intensive study of availability and selling price of fuel wood in the respective areas.

Table 10：Selling price of firewood in different regions

Area	Price per bundle (NPR)	Average weight of each bundle (kg)	Price per Kg (NPR)
Kavre	87.5	40	2.1875
Dhading	85	45	1.88
Makwanpur	100	50	2
Dhanusa	120	50	2.4
Udaypur	135	50	2.7
Rolpa	175	50	3.5
Palpa	350	50	7
Syangja	187.5	50	3.75
Pyuthan	200	50	4

[4] Staple food in the northern region. Semi-solid state, prepared by mixing either buckwheat flour or corn flour and hot water or milk.

Dhankuta	100	50	2

Source : Prepared by JICA Study Team, based on the responses obtained from the 1st workshop

(F) Situation of Infrastructures (Electricity, roads, water, etc.) and related equipment and maintenance facilities

● Power/electricity situation in proposed site of assembly factory installation

The assembly plant installation site for the initial stage is proposed in Thimi, located about 5km from Kathmandu as described below in Chapter 4（A）. Power/electricity situation in Thimi is relatively better off, although it is not totally satisfactory. An emergency generator is being installed in the proposed site to cope with scheduled blackout which is about 10 hours per week (as of May 2013). The operation of the factory can also be adjusted by devising the scheduled blackout and hence the impacts in direct operation can be suppressed to minimum.

● Situation of road and distribution of ICS (required packing condition)

The proposed assembly site in Thimi is facing the main road which is paved and connecting Kathmandu and highway to Banepa on the opposite direction to Kathmandu. However, other roads are in extremely deteriorated condition and for the transportation of cook stoves, well packing seems necessary.

No distinct damage was found in the prototype cook stove when it was round-tripped from Kathmandu University to workshop site in Dhulikhel (80km distance and two and half hours) with the packing condition stated below.

Picture 1 : Packing for transportation (Second layer in the left, third layer in the right)

Condition of packaging: Layer 1 Bubble wrap + Packing tape
Layer 2 Bubble wrap + Packing tape
Layer 3 Cardboard + wire

(G) Social and cultural aspects (Cultural acceptability, social influence, etc.)

- Social and cultural acceptability of improved cook stoves in different regions

However, no special interview or survey was conducted specially for confirming social and cultural issues; there were no particular questions or comments against ICS during the workshop among the members of Community Forest Users Group (CFUG). Moreover, many NGOs have been trying to distribute ICS in the rural area and since the product itself does not have adverse effect to the community, it can be an acceptable business model.

Chapter 4. Project

(A) Survey of the proposed target areas

● Review of the proposed sales regions, functions required in ICS and demand price range

In the first workshop, which was carried out in 10 regions during October and November 2012, average time spent in kitchen per day, types of cook stoves and numbers of pots holes in their cook stoves being used were investigated. The awareness of ICS and willingness of the villager to pay for ICS were also studied.

As a result, greater majority of households in all other regions except in Palpa use Traditional Cook Stoves (TCS). It was also identified that potential for ICS exist in all regions. Some of the reasons for continuing the use of TCS in those regions despite of inconvenience and ineffectiveness of TCS in terms of physical health and average time to cook were also identified. According to the collected opinions, firstly, there is lack of knowledge about ICS and its benefits, secondly, either ICS is not available in the region or is not affordable.

<Summary of overall overview>

・TCS were generally used in most of the households in the proposed areas. The rate of ICS usage is below 20% in those areas except for Palpa where ICS usage is accounted to be more than 80%. Therefore, careful consideration needs to be conducted during the planning process for distribution of ICS in the future.

・Cost of fuel wood varies with the difference of more than 3 times depending on the region. The price of the fuel wood is most expensive in Palpa, where the ICS distribution rate is the highest. However, Dhading having the lowest price for fuel wood does not necessarily indicate the least distribution rate of ICS. Therefore, no correlation was found between the ICS distribution rate and the price of fuel wood.

・More than 50% of the households use cook stoves with single pot hole. About 40% of them use cook stoves with 2 pot holes and cook stoves with 3 pot holes are used by only about 10% of the households.

・After introducing benefits and functions of ICS such as combustion efficiency, reduction of cooking time, less smoke etc. the desired amount to pay for ICS, i.e. willingness to pay for ICS was queried. As a result, answers from more than 70% of the household fall in the range

of 500 NPR to 1,000 NPR. Therefore, this indicates that appropriate amount for the customers to pay for general ICS is very low and this needed to be taken into consideration for determining the selling price of ICS during the feasibility study.

Based on the above mentioned result, the schedule of sales and distribution of ICS is arranged as in the chart below. During the first and second year from business launch, the target area for sales and distribution of ICS shall be within Bagmati Zone, close to Kathmandu where the awareness of ICS is relatively high and barriers in setting up manufacturing and sales channel are relatively low. At this moment, it is difficult to identify particular areas as target areas for third year and after that. New target areas will be identified through studying the awareness level of ICS, purchasing power, and conducting marketing activities in parallel with the expansion of business during the first two years.

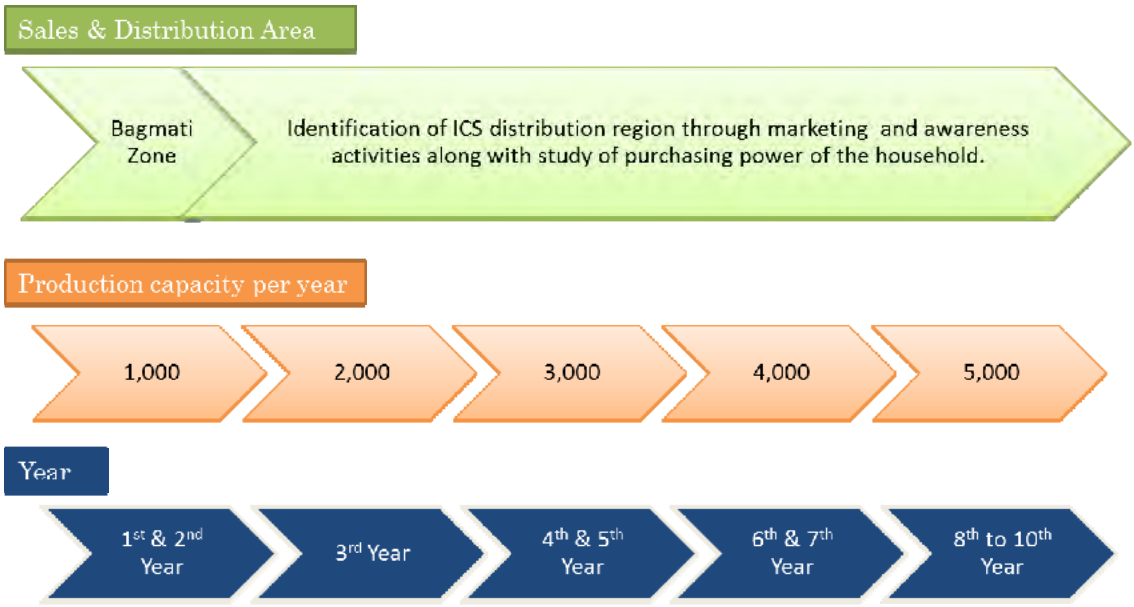


Chart 1：Development schedule

● Examination of the candidate region for setting up first assembly plant

During the second field study, large scale rental factory were searched in the suburb of Kathmandu but no such site could be found. Considering accessibility in Bagmati zone which is the proposed region for first business launch and sale expansion, one factory site of size about 500 square meters in Thimi city, located about 5km away from Kathmandu is determined to be optimal for setting up the first assembly plant. Accessibility to the site and terms an condition for rent seem to be considerable.

【Overview of the proposed factory site】

◯ Owner : Bagmati Paper Industries Pvt., Ltd.

◯ Condition : Rental（Period of time and term is not fixed. Cancellation is permitted at any time）

◯ Available area for use：Factory space 250 square meters
Office space 30 square meters
Outdoor space within the site 500 square meters

※ Area of the factory building is about 700 square meters. Remaining space is used by Bagmati Paper Industries, Inc. as a warehouse.

◯ Rent : 50,000 NPR monthly

【Evaluation and production capacity】

By installing three lines in the space of 250 square meters inside the building, production capacity of 100 units per month can be achieved. From structural (strength of the building) and location (located near the main road) point of view, availability of sufficient facilities to implement the production activities can be determined.

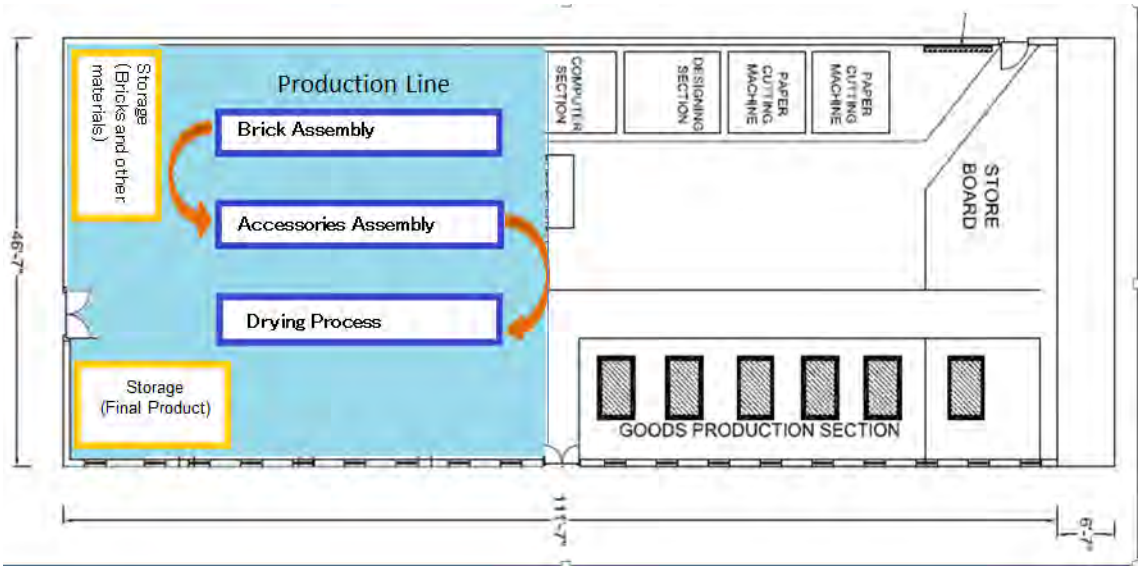


Chart 2：Factory Layout Diagram

(B) Availability of necessary materials

● Availability of diatomite mud or alternative material for bricks and price

【Performance evaluation test, Diatomite mud】

The physical property tests were performed on three kinds of diatomite mud obtained in Nepal and the results were sent to Ishikawa Prefecture to compare with the Japanese diatomite mud (hereinafter referred as “JT diatomite mud”) used to manufacture Japanese cook stoves. The result showed that the diatomite mud obtained in Nepal is of highly inferior quality than that of the JT diatomite mud.

Table 11：Test result of evaluation of diatomite mud

				Note: Diatomite mud is raw material for production of insulating bricks		
				Measurement	Specification	
	K-1	K-2	THIMI	JT diatomite mud	JT diatomite mud	JM diatomite mud
Appearance (color)	Gray	Dark Gray	Gray	Greenish Gray	Greenish Gray	Greenish Gray
SEM inspection (Presence/Absence of diatomite)	Normal amount (Small form)	Very little (Small form)	Very little (Small form)	Large amount (Large form)	—	—
Moisture content (%)	6.2	1.2	7.0	43.8	—	—
Ig.Loss (%)	7.3	4.6	6.3	14.9	—	—
Chemical composition						
SiO2	77	68	70	77	70～77	66～72
Al2O3	15	16	18	12	7～13	10～15
TiO2	0.7	1.0	0.9	0.6		
Fe2O3	3.2	5.8	5.0	4.0	2～5	2～5
CaO	0.5	0.8	0.8	1.3		
MgO	1.1	2.1	1.9	1.2		
K2O	2.2	3.5	2.9	1.2		
Na2O	0.5	1.9	0.7	1.0		
ZrO2	0.0	0.1	0.0	0.0		
MnO	0.0	0.1	0.0	0.0		
P2O5	0.0	0.1	0.0	0.1		
SO3	0.0	0.1	0.0	0.3		
BaO	0.1	0.1	0.1	0.1		

Created by：JICA Study Team

【Availability of diatomite mud】

In addition to the above test results, it was also known that diatomite mud had been dug from Thimi in Kathmandu Valley, but due to urban development, mining process has been almost impossible at the present.[5] Production of insulating bricks from the mixture of sawdust and diatomaceous earth was also considered, however, from the fact that this requires very fine control of the calcination temperature and due to absence of such equipment and technology for stable calcination of bricks; this idea seems not feasible at the moment. As an alternative, import of light insulating bricks from northern India seems to be best available option and it was decided to fabricate the products based on the imported bricks.

- Heat retaining property and weight of the bricks

According to the result of physical property tests, the bricks imported from India have cleared the B2 quality standards target (bulk density, thermal conductivity, variation in residual strength). Specially, the thermal conductivity is lower than that of the B2 standard and gives excellent insulation performance. However, the compressive strength is less than one third comparing to that of the B2 standard and therefore, fabrication of strong cook stove might be a new challenge.

Table 12：Physical properties test results of insulating bricks imported from India

	Measurements of insulating bricks	B2 quality standard	Measurements of B2 quality standard brick
Bulk density（g/㎤）	0.59	≦0.70	0.65
Hot wire method thermal conductivity [W/(m/K)] at 600±10℃	ρ＝0.61 0.21	≦0.28	0.26
Compressive strength Bulk density (g / cm3) Compressive strength (Mpa)	 0.59 0.96		 3.2
Variation in residual strength（&） 1000℃×12hr	-0.03	Below ±2%	-0.8

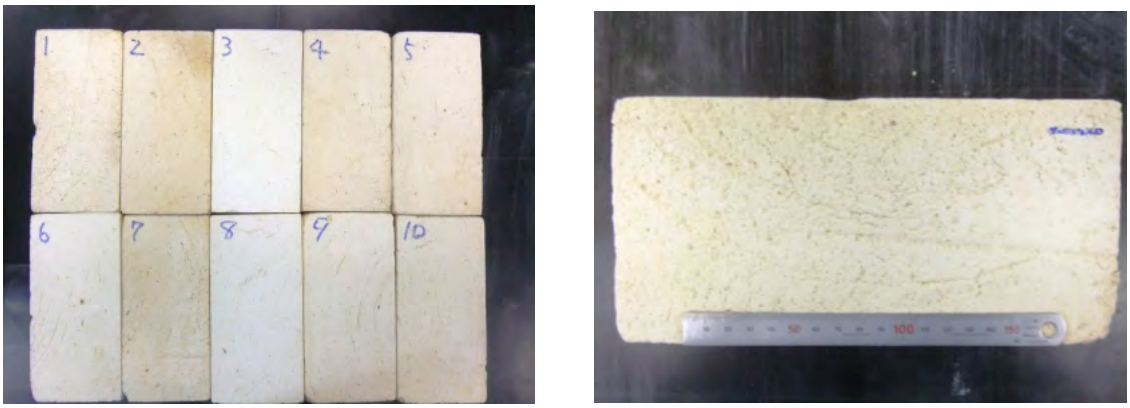
[5] Interview with Dr. Shree Ram Maharjan, Deputy Director, Department of Mines and Geology (21st November, 2012)

Chemical composition（wt%）			
SiO2	49.9		82.3
AI2O3	37.9		9.7
TiO2	4.9		0.5
Fe23	2.3		3.8
CaO	2		0.6
Others	3.05		3.14

Created by：JICA Study Team（Measurements are average values）

＜Size, quantity and exterior pictures of the insulating bricks tested for physical properties＞

Size：230 x 115 x 78 、Quantity：10 pieces



Picture 2：Exterior appearance of the insulating bricks imported from India

(C) Product Development Plan

- Local design and specification/ Development results

【Product Design】

Product specifications were considered based on the following three points.

【Points to consider】

① Because it is necessary to ensure certain level of combustion efficiency for CDM, double combustion chamber for secondary combustion is desirable.

② From the point of view of cost and transportation, compactness in size is desirable.

③ Designs that reflect the originality of cook stoves of Isolite Insulating products are desirable.

Based on the above mentioned points, a draft design was prepared in Kathmandu University (corresponding to prototype ver.1). Then a counter proposal was design by Isolite Jyuki (corresponding to prototype ver.2). This design as the base, Kathmandu University prepared another design with slight modifications (corresponding to prototype ver.3). Thus, the final design was prepared with the specification mentioned below (see Table 13 for features of each prototype cook stove).

Unlike other ICS, this design consist of respectively two fire holes (Takiguchi) and Pot holes (Kamaguchi) and enable cooking in strong heat with high combustion efficiency (more than 20%). By creating a connecting channel between two combustion chambers, two pots can be heated simultaneously by using fire wood in only one fire hole.

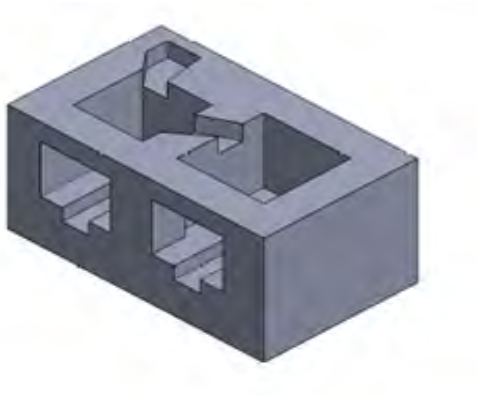


Chart 3：Specification of final design

● Fabrication of prototype cook stove

【Demonstration of prototype cook stove】

Based on the three types of designs made stepwise, five different types of prototypes were actually fabricated with sequential improvements. The prototype Ver.4 and Ver.5 are based on the same design but changes were made in the composition of bonding materials for the bricks to ensure strength and better durability.

Table 13：Details of the prototypes

Version	Picture	Combustion Efficiency	Features	Drawbacks
Ver.1		Cold start : 14% Hot start : 16%	・Size is big enough for sufficient combustion chamber. ・The chimney installed in the middle. ・Outer lay of bricks painted with mud/clay.	・The size is too big and 30 bricks were used. ・The cover of the pot hole is fragile. ・The chimney being too wide, the thermal efficiency is reduced.
Ver.2		Cold start : 18% Hot start : 19%	・The design is compact (only 20 bricks used). ・The chimney is install in the side and a channel is constructed between the chambers. ・The diameter of pot holes are 18cm and 24cm.	・ The combustion chamber being too small, the efficiency is not high enough. ・The size of right side pot hole is big such that there is contact with the inner bricks. ・The fire holes being small, big fuel woods cannot be used. ・ The position of the chimney is very close to the pot hole such that some pots are blocked by the chimney.
Ver.3		Cold start : 19% Hot start : 26%	・The height is increased to secure bigger combustion chamber. ・The diameter of the pot holes maintained at 18cm and 20cm. ・The size of the fire holes increased.	・Bonding between the bricks being too weak, it may not stand vibration during transportation. ・Making the cut of “U” shaped part of the brick is challenging.
Ver.4, Ver.5		Cold start : 23% Hot start : 26%	・ An altered cement, mixture of sodium silicate and cement for insulating bricks(imported from India) is used. Different ratios of mixtures were tested to produce better result for Ver 5. ・ The samples of accessories made in Nepal are used. ・The dimensions were well adjusted.	・Durability is not verified yet. · The bricks having soft property, there might be variance of qualify during mass production.

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【Evaluation & Improvement of the pilot cook stove】

The design of prototype Ver.5 was also reviewed during the 2nd workshop held with 30 local people in Kavre District which was planned as one of the target areas for initial sale. There were positive reactions for the design of the product mainly having two fire holes, thermal insulating properties. (The overall reaction would be even better if domestically produced bricks were used.) However, during the design review, one of the metallic protective frames of the fire hole fell of and this episode made the durability of the cook stove questionable.

Picture 3：Showing the fire hole without frame (right)

(D)　Production、Distribution、Sales Plan

- Production plan considering brick factory, assembly capacity etc.

However, there is no constrains in maximum volume for procurements of insulating bricks and other materials from India; the assembling capacity has to be maintained lower than previously expected due to various constrains in assembling.

As a result of inspecting industrial areas of Nepal, rental factory site of sufficiently big area could not be found, but the land owned by Bagmati Paper Industries Pvt., Co. Ltd in Thimi was the best option at the stage. Moreover, as with the expansion of proposed sales area from the 3rd year, set up of new factories of similar scale close to the sales area also have been under consideration.

Moreover, during the rainy season, between June and September, transportation of the products becomes difficult and hence there is a possibility of decline in sales activities. During this time, it can be assumed that the stock of the products will be temporarily increased. Manufacturing lead time of the ICS is about two weeks and this situation will be controlled by adjusting the production volume during the lot production. The production capacity will be adjusted to 100

units per month, and set to 1,000 units per year with adjustment included.

Table 14：Planned production quantity

Year	Production Volume	Total number
1st Year	1,000	1,000
2nd Year	1,000	2,000
3rd Year	2,000	4,000
4th Year	3,000	7,000
5th Year	3,000	10,000
6th Year	4,000	14,000
7th Year	4,000	18,000
8th Year	5,000	23,000
9th Year	5,000	28,000
10th Year	5,000	33,000

Created by：JICA Study Team

● Selection of distributors

For the sales and distribution of the assembled cook stoves, selecting the local distributors familiar with the local communities seem to be more effective and efficient far beyond than getting directly involved.

As for selecting distributor candidates, two methods were examined. One way is to involve private business groups along with Bagmati Group and the other way is to take advantage of the NGOs dedicated to enhance the local livelihood of the people. Negotiations with private business groups indicated that about 40% of selling price per unit as incentive and other transaction condition are required. If the private business groups are selected as distributors, the reduction of business profitability cannot be avoided.

On the other hand, regarding the cooperation with NGOs, representatives from two local NGOs (IDE Nepal, REMREC) were interviewed. Based on the terms of sales and other conditions the possibility of appointing the NGOs as distributors became very high and the details are described in ● sales margin under (F).

NGOs working very closely with the local communities have high potential to approach the potential consumers of ICS. They not only work in urban area but also can cover wider area including the rural regions. As the method of sales, ICS will be setup in few households for demonstration purpose to promote their performance and hence potential consumers can be effectively amplified. The NGOs will collect ICS from the factory and deliver them to the users and provide the installation services.

Two NGOs, IDE Nepal and REMREC were selected as the candidates and as the result of face to face discussion, it became clear that these local NGOs have high potential to be the distributors if the design of the cook stoves is certified by AEPC.

● Applicability of Microfinance

Applicability of microfinance was investigated to check the potential of benefiting the customers of ICS such that they do not need to pay the full amount at the time of purchase and might enable them to buy ICS through installment payments. Specifically, representatives of two financial institutions were interviewed; one from class A, commercial bank (Civil Bank) and other from class D, Micro Credit Development Bank, (ILFCO, International Leasing & Finance Company Limited) according to the classification by Central Bank in Nepal.

As a result, following two points became clear. (a) Microfinance scheme cannot be applied for the purchase of ICS as this is not the activity that generates income for the users. (b) The target selling price of ICS being too small (assuming 3,500 NPR), the application of microfinance scheme is found difficult.

From these interviews, JICA study team also got the hint that if the amount is below 5,000 NPR, it could be paid out as a lump sum amount even by the BOP layer population and hence showed very low applicability of microfinance.

Table 15：Classification of financial institutions by Central Bank of Nepal.

Classification		Major financial Institutions
A	Commercial Banks	About 32 banks including, Bank of Kathmandu Ltd., Nepal Investment Bank Ltd., Himalayan Bank Ltd., Civil Bank Ltd. etc.
B	Development Banks	About 88 banks including, United Development Bank Ltd., Annapurna Development bank Ltd., Nepal Community Development Bank Ltd. etc.
C	Finance Companies	About 76 finance companies that lend money to individuals or enterprises.
D	Micro Credit Development Banks	About 21 institutions including ILFCO, conducting micro credit activities.

Created by：JICA Study Team

● Countermeasures against imitation or counterfeit products

Risks of counterfeit products are inevitable in Nepal where the intellectual property rights are not entirely protected by the legal system. There are possibilities of mimic products in terms of

shape and function of the ICS in the market without endorsement. However, in this business model of ICS, the gap between the selling price and the production cost is compensated by carbon credit. Since monitoring process is necessary for emissions reduction credit, the imitation of the business model itself would be very difficult.

However, not the entire business model, but the shape of the ICS can be imitated and due to such replicated products, the reputation of the ICS might have negative impact. In this business model, regular monitoring becomes necessary for generation of credits and this also becomes the chance to discourage the replicated products by promoting the ICS during the sale and regular inspection.

(E) Manpower planning

In the initial stage, launching a company with 5 members for manufacturing and distribution of the cook stoves had been under consideration. This scheme was incorporated in the profit and loss account. With the expansion of the production line after the third year, more manufacturing staffs will be hired. It should also be noted that, after a certain quantity of cook stoves are sold, monitoring and management of credit issuance through CDM scheme (CER) becomes necessary. Bagmati Paper Industries Pvt. Co. Ltd as CME, the revenue from the credit will cover the management cost and remaining amount will be used for production and distribution. So this is not yet included in the manpower planning.

(F) Total project cost (Initial investment capital, operation and maintenance cost etc.)

- Initial Investment (Production line installation, land and buildings, capital, incorporation etc.)

As a basic idea, the project will be implemented with minimum budget as much as possible without owning fixed assets such as land, offices, manufacturing plants. The initial investment of 2 million NPR is estimated for the cost of setting up production line, workbenches, cement mixer, brick cutting machine, office equipment and for other expenses necessary for setting up a company.

- Material Cost

Among the raw materials, the insulating bricks become the most important. As for the procurement process, cost estimations were obtained from more than one suppliers and the one with lowest price quotation was taken into consideration. As the result, the cost per brick is settled at 52 NPR. Regarding the manufacturing and distribution of cook stoves locally, the total

cost for procuring all the required components and parts is estimated to be 4,083 NPR (see Table 16). This estimation is higher than originally expected because, the density of insulating bricks imported from India is approximately one third of that used in Japan and more cement seemed necessary for reinforcing the strength.

Table 16：Estimation of cost for raw materials for each cook stove

Parts	Unit Price (NPR)	Quantity	Total (NPR)
Insulating brick	53	21	1,113
Cement	200	1	200
Chimney	500	1	500
Grate	285	2	570
Iron plate (top)	500	1	500
Base frame	500	1	500
Packing material	100	1	100
Pot hole protective frame	300	2	600
Total			4,083

Created by：JICA Study Team

● Labor Cost for manufacturing

Assuming 2 workers hired for 1 production line (for 1,000 unit annual production capacity), the monthly salary according to general salary level in Nepal, would be 25,000 NPR(600,000 NPR annually).

● Management and administrative expenses for Local Firm

Based on the results of interviews with the companies operating in Kathmandu suburbs, the indirect cost such as indirect employee salary, communication expenses, utilities, SG & A expenses is estimated to be 125,000 NPR per month or 1.5 million NPR annually.

● Credit management cost

Initially, 1 million NPR is estimated for management of Carbon credits that are generated by distributing cook stoves. During the period when credit revenue is generated, management cost of 254,000 NPR for 1000 units of cook stoves is estimated.

● Sales margin

As mentioned above in (D) "Production、Distribution、Sales Plan", NGOs have shown a positive attitude for playing the role of distributors and taking the advantage of the network of NGOs is considered to be the most effective way. During the study period, negotiations and agreement on facilitation fee could not be conducted but based on the normal margin rate, 20% of the selling price would be satisfactory with the condition of delivery to the users from the factory (EX-W). Hence, this margin rate is incorporate in the profit and loss account.

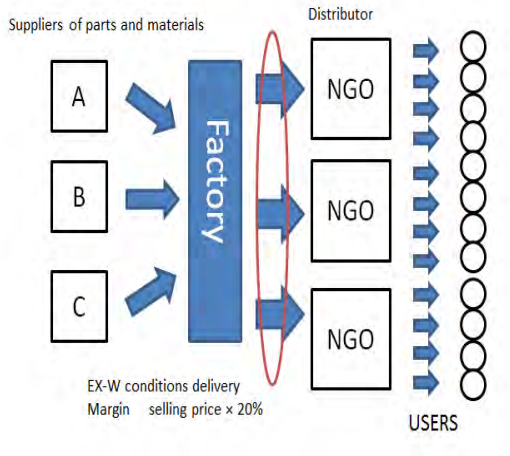

Chart 4：Image Chart of logistics

(G) Financial Planning

● Method of transferring fund（Case of Self-financing）

Since restrictions on transfer of funds do not otherwise exist, no obvious problem for monetary transfers from Japan could be identified.

● Possibility of carbon fund utilization

During March 2012, when the original business plan was prepared, market spot price of CER was 4.45 euros / ton, however, in June 2013 the price has fallen to 0.45 euros / ton, about one-tenth of previously mentioned rate. In this situation, the possibility of obtaining high price through relative CER trading has almost vanished. As an alternative scheme, the idea of carbon offsetting with VER activities under CDM was proposed to AEPC and it was likely to be approved. More specifically, the VER scheme will target approximately 280 thousands tourists from ANNEX I countries (Kyoto protocol) out of about 740 thousands tourists (2011) arriving in Nepal. Carbon offset products will be launched for offsetting the carbon generated by tourism. In this mechanism, the revenue will be merged with the original AEPC fund and subsidy will be provided with the sales of each cook stove. As a temporary scheme, VER revenue of 5 to 10 euros/ton can be incorporated in the profit and loss account, however, this is merely in idea based level at the moment and confirmation of details is required toward the actual implementation of this scheme.

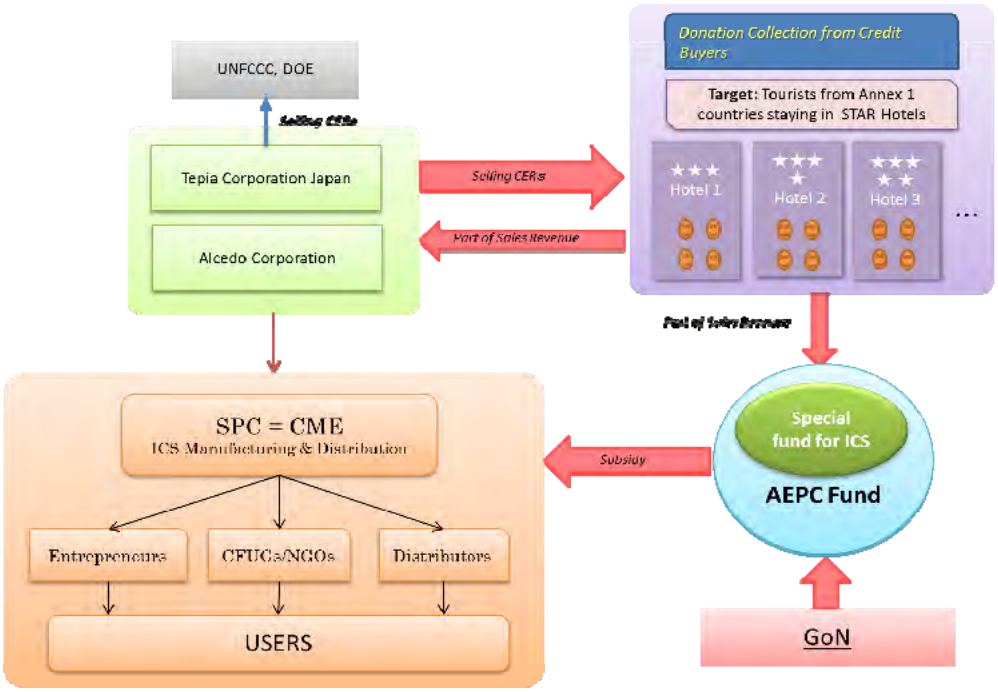

Chart 5: Proposed scheme of sales of carbon offsets through VER

(H) Subsidy eligibility and selling price determination

During the review of prototype ver.5 at the 2nd workshop conducted on 22nd May 2013, a survey on willingness to pay (WTP) for the ICS (if the prototype ver.5 is launched for sales) was also inquired. The overall average amount that the participants can afford for the ICS was 1,542 NPR with the median of 1,500 NPR. In order to ensure considerable amount of volume for the volume zone, the selling price should be set within the acceptable range of the customers. According to the survey the selling price needs to be suppressed at 1500 NPR. Therefore, to fill the gap between the actual selling price and the price that customers are willing to pay, possibilities of subsidies were also studied although it was not originally planned.

Table 17 : Result of questionnaire of WTP for ICS

Unit : NPR

Average	1,542
Highest value	2,400
Minimum	1,000
Median	1,500

Brief interviews were conducted at the Ministry of Science, Technology and Environment (MoSTE) and AEPC regarding potential subsidies. Although MoSTE was neutral, APEC was willing to grant subsidy with the condition that the design of the ICS should be approved in advance.

By June 2012, AEPC had disseminated 620,000 ICS of which mostly were mud types and 6940 units were metallic. No subsidy plan is available for ICS made up of bricks at the moment, but for metallic ICS, 2pot hole and 3 pot holes types are eligible for 3,000 NPR and 4,000 NPR per unit respectively.

Actual amount of the subsidy will be determined after the review and approval of the design. However, for this survey, it was assumed that subsidy amount of 2,000 NPR would be obtained per unit of ICS and entered in the profit and loss account accordingly. As a result, the sum of the subsidy amount, 2,000 NPR and actual payment from users 1,500 NPR per unit. i.e. 3,500 NPR will be assumed as the actual sales revenue by selling a unit of ICS.

(I) Licensing and Approval

- Necessary approvals for implementation of manufacturing and sales of ICS and others

For the implementation of manufacturing, sales and distribution of ICS, it was confirmed that no other license and special approval is necessary.[6]

[6] Interview with Mr. Bipin Rajbhandari, Director, Department of Industry on 29th November 2012

Chapter 5. Collaboration with JICA projects

(A) Overview of the Business scheme ((Financial cooperation, Japan Overseas Cooperation Volunteers)

While studying the possibility of collaboration with JICA projects after the business launch, it was determined that, (a) Collaboration with Japan Overseas Cooperation Volunteers and/or with senior volunteers, (b) Networking with NGOs are likely to be conducted. Following ways of cooperation are specifically studied to find the potential way of collaboration during the project implementation.

●Provision of Development loans (Two step loans)

About 10 loan aids have been granted to Nepal so far and in March 2013, yen-loan agreement was made for maximum of 15.137 billion yen to support the “Tanahu Hydroelectricity Project”. This becomes the first yen loan to Nepal after 12 year, however, from the current financial condition and political situation, new loan aids projects seem to be very difficult in reality. Therefore, two-step loans can be considered as a future challenge and hence, it will be excluded for the time being as for pursuing the business.

● Collaboration with Japan Overseas Cooperation Volunteers and/or with senior volunteers

In Nepal, as of March 2013, about 60 JOCV and SV members have been active. The currently active members are working on particular missions and it is unlikely to ask them to spend lots of time in new activity concerning dissemination of ICS. However, the existing members can be expected to corporate within a limited range of promotion activities such as doing PR of ICS in different gatherings or participate in ICS dissemination activities.

On the other hand, upon the request from local institutions like community forest user groups (CFUG), dispatch of new team members in the field of forest conservation can also be considered. In this case, following are the conditions. (1) Request should come from the local authorities, (2) Balance among the sectorial dispatch of personnel in the entire country must be maintained, (3) the content of the activities should contribute the forest conservation and the members should motivated by the assignments (activities that are directly involved in sales are excluded).

From the above, at the time of business implementation, publicity will be conducted by the existing members first and regarding the dispatch of new members, related bodies such as CFUG and JICA Nepal office will be consulted at that time.

● Networking with NGO

According to "Nepal · NGO Handbook (2011 version)", issued by JICA Nepal Office, there are a total of 62 NGOs active in Nepal, 31 of them are Japan based NGOs and 31 are local Nepal based NGOs. In order to promote grass-roots level cooperation between NGOs and JICA, NGO-JICA Desk (Nepal) was established in JICA Nepal office from 2003. NGO-JICA Desk (Nepal) is facilitating NGO-JICA cooperation business consultation, consultation on development projects and coordination of study tours. Activities such as reading of books related to ODA and Development of Nepal are also conducted as a part of facility.

The NGO- JICA Japan Desk in JICA Nepal office will act as a hub for networking with NGOs. The ICS project will be introduced to NGOs with objectives of forest and environmental conservation such that market development of ICS through NGOs can be expected. At the same time, demand of ICS in rural areas might also be expected. This kind of collaboration is thought to be started at the same time with the business launch.

Chapter 6. Development impacts

(A) Resolution and Indicator setting of development issues through BOP business (Environmental management, (Air pollution and climate change etc.)

In accordance with thematic guidelines of Environmental management (air, water), by JICA Global Environment Department on 21st July 2009, Sulfur dioxide (SO2), Nitrogen dioxide (NO2), Suspended particulate matter (SPM), Carbon monoxide (CO) are considered for measuring indoor pollution level of the cook stove. Following this guideline to determine the most appropriate method, it seems difficult to show the direct relationship on which factor should be considered to measure the improvement of indoor air pollution due the ICS. Moreover, due to limited availability of measuring equipment in Nepal, an alternative way is to evaluated this through questionnaire survey in household level to check the rate of improvements such as reduction in amount of smoke, decrease in cooking time and increase in indoor comfort due to cleanliness"

More specifically, a sample survey will be conducted every year in the households after they start using ICS to determine "the degree of improvement of discomfort caused by smoke during cooking". If this survey reveals the improvement of indoor air through introduction of ICS, the overall goal of "mitigation of indoor air pollution of BOP layer population in Nepal" shall be deemed to be achieved.

For calculating the sample size, "simple random sampling method" specified by UNFCCC will be used. Following is the calculation of required sample size with population rate up to 0.5 with the applicable methodology of AMS-II.G methodology "Energy efficiency measures in thermal applications of non-renewable biomass" with 90% confidence level and 10% standard error.

Table 18：Determination of sample size

	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year	8th year	9th year	10th year
Cumulative sales	1,000	2,000	4,000	7,000	10,000	14,000	18,000	23,000	28,000	33,000
Production volume forecast	1,000	1,950	3,853	6,660	9,327	12,861	16,218	20,407	24,386	28,167
Expected utilization rate	100%	98%	96%	95%	93%	92%	90%	89%	87%	85%
Required sample size	267	298	317	326	329	332	333	334	335	336

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Therefore, after one year from the beginning of ICS sales, a questionnaire survey in 267 households will be conducted to evaluate the effectiveness of the ICS by measuring the improvement due to use of the ICS. In the households selected for questionnaire survey, 4 levels of indoor air quality will be indicated and if the rate of response is more than 50% for the first 2 levels, it can be regarded that the indoor air pollution can be reduced by the introduction of ICS.

Chapter 7. Conclusion, Future business development plans

(A) Financial analysis (Profit and loss, Project cash flow, Profit analysis)

Since the value of carbon credit is uncertain, three patterns of project cash flows were calculated assuming different values of carbon credit. Best case (10 euros / ton), Moderate case (5 euros / ton), Worst case (no emissions revenue). (see Table 19 Table to Table 21)

As the consequence, with the best case (10 euros / ton), the IRR in the 10th year will be 37% which shows that the return is promising. However, with the moderate case (5 euros / ton) and worst case (no emissions revenue), the IRR values are negative suggesting that it is not eligible for investment in these two cases.

Table 19：Calculation of cash flow （Best case）

When VER selling price is 10 euros / ton										Unit：1000NPR	
	Initial Investment	1st Year	2nd Year	3rd Year	4th Year	5th Year	6th Year	7th Year	8th Year	9th Year	10th Year
Sales		3,500	3,500	7,000	10,500	10,500	14,000	14,000	17,500	17,500	17,500
Credit revenue		0	2,312	4,510	8,910	15,403	21,572	29,745	37,510	47,199	56,404
Capital	-2,000	0	-2,000	-2,000	0	-2,000	0	-2,000	0	0	
Material Cost		-4,083	-4,042	-8,003	-11,885	-11,766	-15,531	-15,376	-19,028	-18,837	-18,649
Labour Cost		-600	-600	-1,200	-1,800	-1,800	-2,400	-2,400	-3,000	-3,000	-3,000
SG & A expenses		-1,500	-1,500	-1,500	-1,500	-1,500	-1,500	-1,500	-1,500	-1,500	-1,500
Sales margin (20%)		-700	-700	-1,400	-2,100	-2,100	-2,800	-2,800	-3,500	-3,500	-3,500
Royalty		-175	-175	-350	-525	-525	-700	-700	-875	-875	-875
Credit Management	-1,000	0	-495	-978	-1,691	-2,369	-3,266	-4,119	-5,183	-6,194	-7,154
Pre-tax single-year CF	-3,000	-3,558	-3,700	-3,921	-91	3,843	9,375	14,850	21,924	30,793	39,226
NCF	-3,000	-6,558	-10,258	-14,179	-14,270	-10,427	-1,052	13,798	35,722	66,515	105,741
IRR								15.1%	25.5%	32.5%	37.0%

Table 20：Calculation of cash flow（Moderate case）

When VER selling price is 5 euros / ton											Unit：1000NPR
	Initial Investment	1st Year	2nd Year	3rd Year	4th Year	5th Year	6th Year	7th Year	8th Year	9th Year	10th Year
Sales		3,500	3,500	7,000	10,500	10,500	14,000	14,000	17,500	17,500	17,500
Credit revenue		0	1,156	2,255	4,455	7,701	10,786	14,872	18,755	23,599	28,202
Capital	-2,000	0	-2,000	-2,000	0	-2,000	0	-2,000	0	0	
Material Cost		-4,083	-4,042	-8,003	-11,885	-11,766	-15,531	-15,376	-19,028	-18,837	-18,649
Labour Cost		-600	-600	-1,200	-1,800	-1,800	-2,400	-2,400	-3,000	-3,000	-3,000
SG & A expenses		-1,500	-1,500	-1,500	-1,500	-1,500	-1,500	-1,500	-1,500	-1,500	-1,500
Sales margin (20%)		-700	-700	-1,400	-2,100	-2,100	-2,800	-2,800	-3,500	-3,500	-3,500
Royalty		-175	-175	-350	-525	-525	-700	-700	-875	-875	-875
Credit Management	-1,000	0	-495	-978	-1,691	-2,369	-3,266	-4,119	-5,183	-6,194	-7,154
Pre-tax single-year CF	-3,000	-3,558	-4,856	-6,176	-4,546	-3,859	-1,411	-23	3,169	7,193	11,024
NCF	-3,000	-6,558	-11,414	-17,590	-22,136	-25,995	-27,406	-27,429	-24,260	-17,067	-6,043
IRR								#NUM!	#NUM!	-15.9%	-3.8%

Table 21：Calculation of cash flow（Worst case）

Without credit revenue											Unit：1000NPR
	Initial Investment	1st Year	2nd Year	3rd Year	4th Year	5th Year	6th Year	7th Year	8th Year	9th Year	10th Year
Sales		3,500	3,500	7,000	10,500	10,500	14,000	14,000	17,500	17,500	17,500
Credit revenue		0	0	0	0	0	0	0	0	0	0
Capital	-2,000	0	-2,000	-2,000	0	-2,000	0	-2,000	0	0	
Material Cost		-4,083	-4,042	-8,003	-11,885	-11,766	-15,531	-15,376	-19,028	-18,837	-18,649
Labour Cost		-600	-600	-1,200	-1,800	-1,800	-2,400	-2,400	-3,000	-3,000	-3,000
SG & A expenses		-1,500	-1,500	-1,500	-1,500	-1,500	-1,500	-1,500	-1,500	-1,500	-1,500
Sales margin (20%)		-700	-700	-1,400	-2,100	-2,100	-2,800	-2,800	-3,500	-3,500	-3,500
Royalty		-175	-175	-350	-525	-525	-700	-700	-875	-875	-875
Credit Management	-1,000	0	-495	-978	-1,691	-2,369	-3,266	-4,119	-5,183	-6,194	-7,154
Pre-tax single-year CF	-3,000	-3,558	-6,012	-8,431	-9,001	-11,560	-12,197	-14,895	-15,586	-16,406	-17,178
NCF	-3,000	-6,558	-12,570	-21,001	-30,002	-41,562	-53,759	-68,654	-84,240	-100,646	-117,824
IRR										#NUM!	#NUM!

The balance of payment became stricter than the initial assumption because of unexpectedly higher cost of the raw materials and the price that the users are willing to pay discovered to be lower than expected.

At present, not only the production cost but the cost of raw materials alone is higher than the selling price of the product and the more ICS are sold, the more loss will incur. In the best case, the revenue of the carbon credit can cover the losses, but with the moderate case and worst case,

the business will not be successful.

(B) Agenda and schedule for decision making towards business launch

Through this survey, the design of ICS was almost finalized and certain direction of sales and distribution was also confirmed. However, towards the commercial launch of the ICS, it is necessary to overcome lots of challenges. First of all, verification of durability is important from the production point of view. One of the protective metallic frames of the fire hole fell off during the design review in the 2nd workshop. To avoid such glitches, the prototype cook stove needs to undergo test through everyday use by one of the households for about six months to one year for the verification of durability. After that, the final product should be fabricated based on the monitoring results.

The final version of ICS will be unveiled to AEPC for certification and consideration for subsidy. At the same time, agreements for product handling condition will be made with NGOs for distribution the ICS. In addition, the alternative schemes of VER that was introduced due to downfall of Credit values, needs to be carried out concurrently with the verification of durability. At the time of making final decision for business launch, the VER sales price also need to be verified.

Final decision for the business launch will be made around July, 2014 after considering the profitability and all the factors mentioned above together with verification study that will be continued as mentioned in the schedule in the Table 22. Regarding the results of the study, Alcedo Corporation, one of the members of the study team will follow up and the final judgment on project implementation would be made by Tepia Corporation as the implementing body.

Table 22：Schedule for making decision toward business

	2013					2014						
	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	April	May	June	July
1. Manufacturing												
Durability test												
Confirmation of final specification												
2. Sale												
Negotiation with distributors												
3. Carbon credits and subsidies												
Application to AEPC												
Consideration of VER Scheme												
Negotiation												
4. Decision for business launch												
Decision for business launch