Task 5

Cost-Benefit Analysis

Laos

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Abstract

Lao People's Democratic Republic (Lao PDR) is a member of Association of Southeast Asia Nations (ASEAN), and is among the most rapidly growing countries in the region. Development of the country has resulted in increasing energy demand and consumption, especially electrical energy. Residential sector remained the highest electricity consumer in the country Lao PDR with annual growth ranked third after Industrial and commercial. It was interesting to know the reasons contributing to that growing, in particular energy efficiency related issues. The report covers study on cost benefit analysis and rebound effect assessment of energy efficiency of new emerging Modern Energy Consumers (who has income between 2-5 USD per person per day, MECON) in Mekong Subregion at national level.

The results of Cost–benefit analysis (CBA) in case of Lao PDR show the benefits of the households from use of only some appliances, which have clearly or truly distinguished difference in energy efficiency meaning. Market distortion such as fake labelling, improper information is the typical cause of consumer confusion and will be a crucial factor to consider while promoting energy efficiency and conservation in Laos.

LEAP simulation results in three scenarios have shown increasing trend of energy demand of MECON group for all technologies compared, because proportion of households of this category will be remained growing by 2030.

In case of Laos, the rebound effect surveys have shown that energy expenditures are not the critical issues for Lao MECON households, rather than food, housing and education. These findings are similar to existing results of Lao expenditure and Consumption surveys.

1 Introduction

Energy efficiency (EE) means the ratio of output of performance, service, goods or energy, to input of energy. EE improvement means an increase in energy efficiency of an appliance due to a technological change. EE improvements offer multiple benefits, such as reduced household energy expenditure and improved productivity, thus contributing to economic growth, enhancing energy security and facilitating cheaper and faster energy access to populations. The 2012 World Energy Outlook highlights the importance of EE in reducing greenhouse gas emissions (GHG) in the coming decades: EE is responsible for 75% of emissions reductions by 2020 in a 2°C temperature increase scenario (IEA, 2012). For developing countries, EE will be important since it curbs demand growth, thereby reducing additional power capacity needs and facilitating cheaper and faster energy access to populations. Improved EE will also reduce energy consumption, leading to lower fossil fuel imports for the countries. Moreover, EE can make it easier for lower income households to pay energy bills, freeing up funds for other needs (Sarkar and Singh, 2010). Although the adoption of EE measures has few technical challenges, and numerous energy efficient technologies with accountable payback times do exist, there remain important non-technical barriers, particularly at the household level. As a result, many of the potential EE gains remain untapped.

Implementing EE measures within households will reduce the energy needed to produce the same quantity of energy services such lighting, heating, air conditioning, cooling, etc. As a consequence of reduced energy use, householders may benefit from lower energy bills. However, the overall cost and benefits to the householders depends on the cost of the appliance, the level of efficiency improvement and the price of fuel (for example electricity tariff) as well as any tax/subsidies applicable. Conversely, reduced bills may also lead to an increased level of energy consumption and real energy savings may be well below the expected level. One explanation is that improvements in EE encourage greater use of these devices (for example heat or mobility) which energy helps to provide. Behavioural responses such as these have come to be known as the EE "rebound effect". While rebound effects vary widely in size, in some cases they may be sufficiently large to lead to an overall increase in energy consumption - an outcome that has been termed 'backfire' (UKERC, 2007). In the MECON project, due to the nature of the target group – those who have access to electricity and are affordable to pay only for certain energy services at present – it is likely that they will use part of their extra income to consume more energy in two key ways. The first by buying more appliances and using them more for the same energy services to which they already have access (for example, buying more bulbs or using the them more). The second is buying a new appliance to meet an energy service which they did not have before (for example, buying a fan which they did not previously have).

In the Greater Mekong Subregion (GMS - Cambodia, Laos, Myanmar, Thailand and Vietnam), it will be the 'new Modern Energy CONsumers' (the MECON) i.e. people who have access to grid electricity but who live on low incomes (USD 2-5 per day), who will be responsible for a large share of expected increase in energy demand and thus GHG emissions. This report is one of five country-specific reports, which present the results of cost-benefit analysis carried on MECON project.

1.1 Objectives of the cost-benefit analysis

The aim of this study is to assess the cost-benefits at the household (new modern energy consumers) and at the national level. The study will also analyse the rebound effect of EE improvements.

2 Methodology

There are divided into 3 main categories which are following;

- Carrying out a cost-benefit analysis of selected energy efficient technologies at the individual household level
- Analysing energy-economic impact of energy efficiency policy packages at a national level. Two energy efficiency scenarios are defined under this task.
- Analysing the behavioural response of the households and the impacts on a household's energy services demands. A questionnaire survey will be carried out under this task.

2.1 Cost-benefit analysis at household level

The cost-benefit analysis (CBA) has been in use since the 1940s. Traditionally, the CBA has been applied to those costs and benefits to which an accepted basis of monetary valuation is available. In addition there are environmental factors and factors such as economic development, employment and energy use. The evaluation compares the benefits with and without the project. CBA involves defining the project, listing the costs and benefits, putting money values for them, and comparing the time streams of the benefits and costs.

The Life-Cycle Cost (LCC) of an appliance accounts for all expenditures associated with purchase and use. From the consumer perspective, the two main components of LCC are the equipment cost (capital cost) and the operating costs which is the fuel cost and maintenance cost. Equipment cost is the retail price paid by the consumer purchasing the appliance. Operating cost is the cost of energy, in the form of utility bills, for using the equipment. Life-Cycle Cost is given by:

$$LCC = CC + \sum_{t=1}^{n} \frac{FC_t + MC_t}{(1+DR)^t}$$ Equation (1)

Where:

LCC – life cycle cost

CC – capital cost of the appliance

FC_t – fuel cost in year t (Annual electricity consumption in year t X price in year t)

MC_t – maintenance cost in year t

DR – Discount rate

N – life of the appliance

The CBA can be carried out for selected technologies by comparing the LCC of efficient and inefficient technologies. Equation (1) shows the traditional way of calculating CBA. The MECON project focuses on a particular consumer group whose income is relatively low. This particular consumer group sometimes needs financial support, as they don't have sufficient capital to buy an efficient appliance. Rather, these households may have to borrow money from different institutions, or from friends and family members in order to buy an energy efficient appliance. In some countries, the shop owners also allow consumers to make payments in instalments. Irrespective of where the consumers get the financial support, they have to pay a higher price for the appliances due to the interest rate. This could be added to the cost of capital to the consumers. Therefore, here the capital cost of the appliance is annualised using a different discount rate, which is defined as the hurdle rate, which represents the interest rate and is normally higher than that of the discount rate. Equation (1) is then modified to take into account the hurdle rate:

$$LCC = \sum_{t=1}^{n} \frac{AC_t + FC_t + MC_t}{(1+DR)^t}$$ Equation (2)

$$AC = \frac{CC \times HR}{1-(1+HR)^{-l}}$$ Equation (3)

Where:

AC – annualised cost

HR – Hurdle rate (interest rate)

l – Number of years by which the loan is repaid.

If there is a government subsidy programme for energy efficient appliances, then consumers will pay net of subsidy for the capital cost.

$$LCC = CC - SS + \sum_{t=1}^{n} \frac{FC_t + MC_t}{(1 + DR)^t} \qquad \text{Equation (4)}$$

SS – is the amount of subsidy the consumer receives under the programme.

Analysis will compare the benefits of energy efficient over inefficient technologies. At least five appliances (such as TV, rice cooker, fan or refrigerator) are analysed here. The selection of appliances for the CBA are based on three criteria: energy consumption, ownership and future potential for each country.

2.2 Energy-economic impact of energy efficiency policy packages (national impacts)

The calculations shown above provide an estimate of the financial impacts of an efficient appliance for each household. Though the individual household level analysis is crucial, a second critical aspect to evaluate in an EE policy package is the national-level impacts. The three main national impacts calculations can be: Net Present Value; national energy savings potential; and reduced environmental impacts, including GHG emissions reductions.

National Electrification has been a trademark of Lao government’s development programs, where electrification rate rapidly increased from 16% in 1995 to 87% in 2013, with target 90% household basiselectrification by 2020. Based on such achievements, it is reasonable to assume that 100% electrification rate would be achieved by 2030 or earlier, and therefore, the households group with income between 2-5 USD per day per capita would have access to grid electricity by 2030.

The LEAP model has been used for the CBA at the national level under different scenarios, which have been defined through consideration of each country’s EE policy packages. Appliance stock and national end use consumption are driven by population growth and trends in appliance ownership rates. Unlike in developed countries, where the market for most major appliances is saturated, in developing countries the ownership rates of even basic appliances are dynamic, and depend critically on household income level, degree of urbanisation and electrification; this is particularly true for the emerging middle classes and the target group of this research, the MECON. The EE policy packages will define the diffusion of efficient technologies among the consumer groups and its saturation levels, which can be modelled in LEAP. The existing LEAP model, which has been developed under Task 1 of the MECON project, will be further improved by adding costs to appliances for both efficient and less efficient technologies under this Task.

2.2.1 Scenario Definitions

Three scenarios have been defined in the LEAP model for each country: the Base Case (BC) modelled under the Task 1, a High Energy Efficiency (HEE) scenario, and a Moderate Energy Efficiency (MEE) scenario.

- **High Energy Efficiency (HEE) scenario**: this scenario assumes 100% penetration of efficient appliances by end of the modelling period (2030) for each energy service. This Lao-HEE scenario assumes that the share of efficient appliances will reach highest percentage as possible. According to conservative of living style of Lao people and mostly imported HH appliances; therefore, the effort to own the newest technology with affordable price as production country, such Thailand, is still low. Lao-HEE is assumed slower than Thailand 20-30%. The share of efficient appliances will increase gradually from the current level to reach 80% for lighting, cooling, and entertainment, 70% for electric cooking and heating devices by 2030. This scenario aims to explore what the potential impacts on energy, emission and costs will be when all households use efficient appliances.
- **Moderate Energy Efficiency (MEE) scenario**: this scenario assumes a moderate penetration of efficient appliances in 2030. The appropriate share of efficient appliances for each energy service demand is defined by linking them to the energy efficiency policies discussed in Task 4. The share of energy efficient appliances in 2030 will be different for different energy services, which will vary according to each country. For example, the share of efficient refrigerators in 2030 will be different to the share of efficient televisions in 2030. Since each country team was best placed to make assumptions on the penetration levels of energy efficient appliances, the assumptions vary.
- For Laos, the key assumptions were:
  - Government target to shift country from status of the Least Developed countries (LDC) by the year 2020, which will result in increasing GDP per capita, national electrification rate, etc.
  - Government's target to reduce total final energy demand by 10% by year 2030, compared to Business As Usual
  - Best Examples from Thailand: 20 Year Energy Conservation Plan of Thailand, Thai label No. 5 and related standards;
  - Introduction of National Policy on Energy efficiency and energy conservation (to be approved by the Prime Minister by end of 2015)
  - National strategy on Energy efficiency and Conservation up to year 2030 (to be launched in 2016)

Under Task 5, two activities were undertaken using the LEAP model: firstly, to model the cost for each end-use appliances and the price for each fuel (i.e. electricity, gas, kerosene, biomass,); and secondly to develop the two new scenarios - HEE and MEE. In order to model the costs in LEAP, each country partner had to develop a technology database which shows the cost for each appliance. This was done by adding cost data, generated in Task 2, to the existing technology Excel-based database developed under Task 1. Once the modelling was completed, the results generated were used to analyse the impact of EE scenarios on the energy system. The results are discussed in Section 3.

Data and Assumptions

For Lao case of study, data and assumption for LEAP are presented in ผิดพลาด! ไม่พบแหล่งการอ้างอิง. Key assumption is referred to sub-task 1.2, which is with constant household size from 2013-30. Based on the survey data from LECS2, LECS3, LECS4, LECS5, it is found that household size changed from 1998 – 2013; therefore, household size for MECON is assumed as given in Table 1.

Table 1: Household size change

Year	Household size, [People/HH]
1998	6.5
2003	6.1
2008	5.7
2013	5.3
2018	4.9
2023	4.5
2028	4.1
2033	3.7

2.3 Behavioural response of the households

In order to understand how individual households may respond to reduced energy consumption as a result of EE policy packages, the final sub-task involved a short questionnaire survey. This will help us to understand how reductions in the cost of electricity bills might be spent, whether households prioritise energy or other (non) essential items. For this sub-task, a questionnaire was developed (**Appendix C**) which used many of the same questions as the Task 3 survey. The questionnaire focused on characteristics of the household, current energy consumption as well as how additional, future income might be spent. Analysis of these data, also examined whether there were any differences between those households who used electricity a) solely for lighting, b) for lighting and small appliances, and c) for other energy services. Grouping the consumers will help to carry out detailed analysis and to capture the rebound effect as discussed in the introduction.

Each partner country carried out the questionnaire with at least 100 households. In Laos, 121 questionnaires were carried out in Vientiane capital, which was largely urban and sub-urban areas of Vientiane Capital, as shown in Table 2.

Table 2: Name list of survey villages

Urban	Sub-urban
Sisattanak District 1. U01 Ban Sokpaluang 2. U02 Ban Vadnak 3. U03 Ban Thongpanthong 4. U04 Ban Donenokkhoum 5. U05 Ban Phonpapao 6. U06 Ban Phonthanh 7. U07 Ban Dongsavath 8. U08 Ban Donkoy	Hadxaifong District 1. R01 Ban Salakham 2. R02 Ban Nongveng 3. R03 Ban Dongkhamxang 4. R04 Ban Nonghai

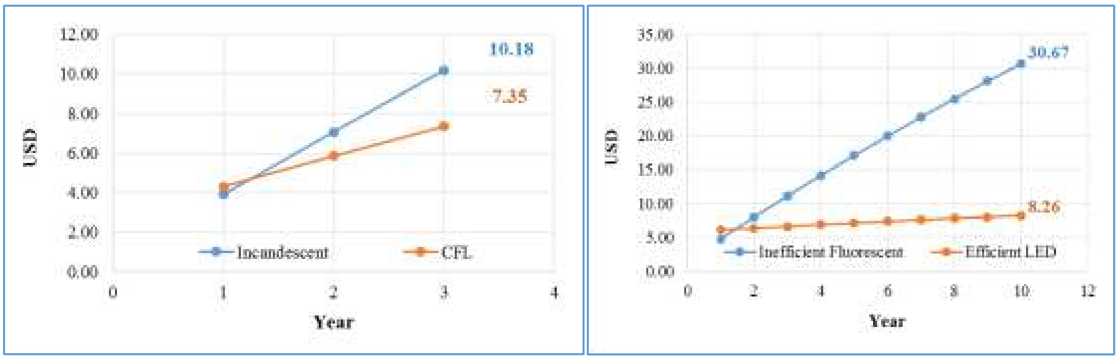
3 Results

3.1 Cost-benefit analysis

The Cost–benefit analysis (CBA) results are presented in Table 2A: - Table 11A: (without hurdle rate), and graphically illustrated hereafter.

3.1.1 Lighting devices

CBA results have shown that households do benefit from use of more efficient lighting devices, as seen from Figure 1, CFL[1] use can save household up to around $3 for whole its lifecycle (a), and LED[2] use almost 4 times cheaper in total life costs compared to Fluorescent (b), even though at the beginning, cumulative lifecycle costs of LED were higher. Breakeven points for these cases are less than two year.



(a) (b)

Figure 1: Lighting devices

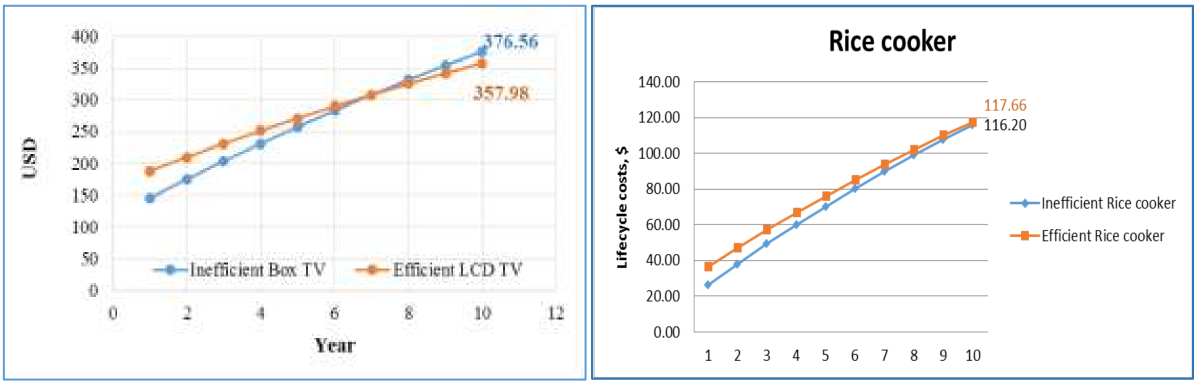
[1]CFL: Compact Fluorescent Lamp
[2]LED: Light Emitted Diode

3.1.2 Television

The use of LCD[3]TV become more benefit in long run, even though at the beginning, life costs of LCD TV were higher than cost of the box TV (Figure 2, a).According our calculation, breakeven for the efficient LCD TV is about 7 years compared to inefficient boxTV, which seems rather long.

3.1.3 Rice cooker

The Figure 2, (b) shows negligible small benefit from use of efficient rice cooker compared to inefficient one. Our survey team found that the benefits in term of energy efficiency and product purchase cost of two categories are nearly the same, but the efficient multifunctional rice cookers have the advantages in term of use convenience and cooking quality. Lao people usually use rice cooker for cooking rice only and therefore they often prefer ordinary rice cooker. It is seen from the Figure 2, (b) that breakeven for efficient rice cooker will not be reached within the proposed lifespan of 10 years.



(a) (b)

Figure 2: Television and rice cooker

3.1.4 Refrigerator

The CBA results show that the households do not benefit from the use of efficient refrigerator compared to the inefficient one (Figure 3, a). The total lifecycle costs of efficient refrigerator are higher than those of inefficient refrigerator. It is clear that breakeven for efficient refrigerator as compared to inefficient one will not be achieved within the lifespan period.

[3]LCD: Liquid Crystal Display

3.1.5 Electric Fan

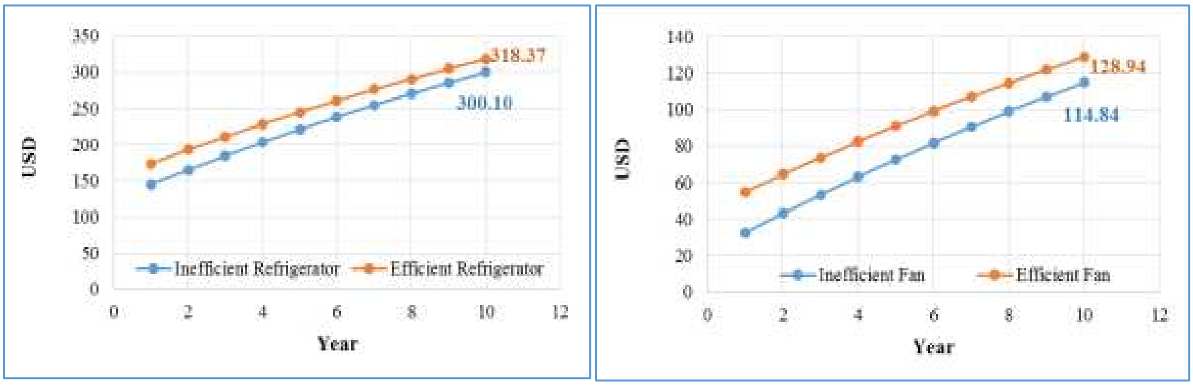
The situation for fans and the reasons are as the same as for refrigerator (Figure 3, b): less benefit in using efficient fans.

3.1.6 Air conditioning

Use of efficient Air conditioning system is clearly more benefit for household, as its cumulative lifecycle costs are significantly lower than those of inefficient one (Figure 4, a) and breakeven is just about 2 years.

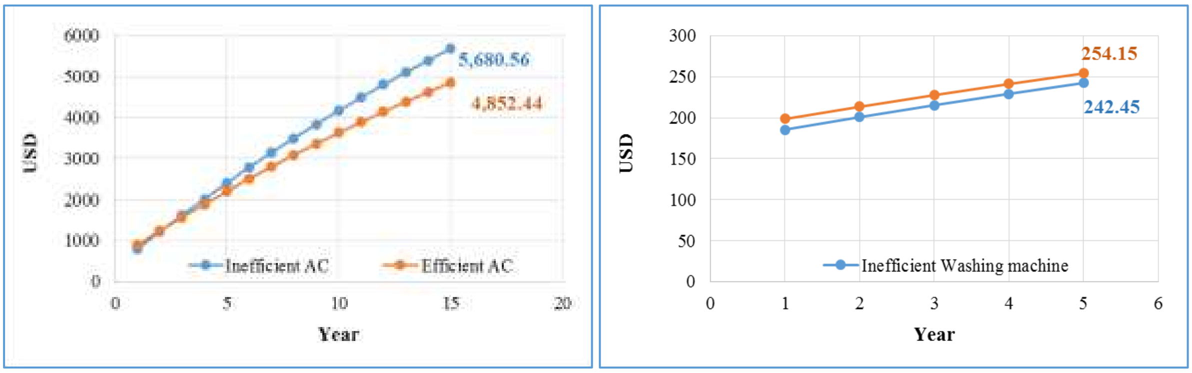
3.1.7 Washing machine

The efficient washing machines are more expensive and their total life costs are slightly higher, compared to those of inefficient one (Figure 4, b). In this case, market distortion in products price and quality probably are the cause of such results, people difficultly to distinguish the good quality from the bad one, as there no reliable data or knowledge on labelling and quality control.



(a) (b)

Figure 3: Refrigerator and Fan



(a) (b)

Figure 4: Air conditioning and washing machine

3.1.8 Electric water heater

Household is more benefit to use efficient water heater, efficient water heater costs less in long run (Figure 5).

When hurdle rates were put in to calculation the results slightly changed, less benefits observed, except for inefficient incandescent versus CFL comparison and FL versus LED lamp, as shown in Figure 6 (a) and Figure 6 (b), respectively. Here are illustrations for some selected appliances (Table).

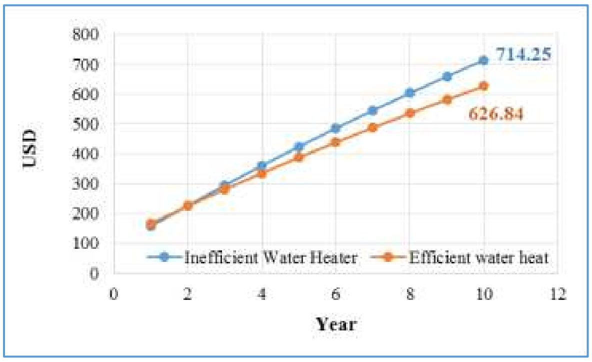
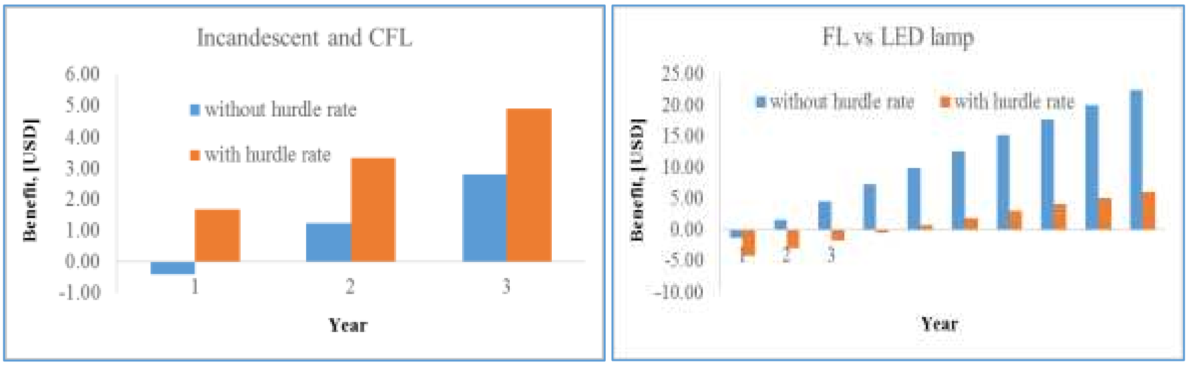


Figure 5: Electric water heater



(a) Inefficient incandescent vs CFL

(b) Inefficient Fluorescent Lamp vs LED

Figure 6: Comparison of lighting devices benefits

Total life cost benefits for TV become much smaller, compared to the case without counting hurdle rate (Figure 7). The same trends were observed for other appliances (details in Table).

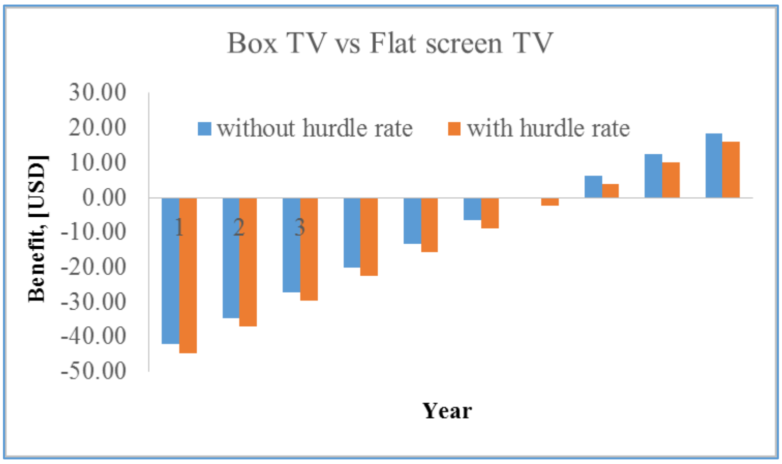


Figure 7: Comparison of television benefits

In case The CBA results in case of Lao PDR show less benefits of the use of some efficient appliances. The reason is lack of clearly distinguished difference between efficient and inefficient refrigerators. Furthermore, majority of electric appliances selling in Lao market are imported from Thailand and usually with Label Number 5 quality, either genuine or fake one. In many cases, users are confusing with circulating in the market label number 5, especially people from the country side. Thus, for example, people bought a device with label No 5 but actually they might get the inefficient one.

Other probable reasons include accuracy of the data, obtained from the surveys, for example, compared appliances were of the same size or belong to the same class.

Measures to promote use of efficient appliances by households of this group were suggested as the following:

1) Institutional intervention in term of strict control over imported and distributed in the market electric products, information sharing campaigns,
2) Financial support either directly to low income households so that they could obtain more efficient appliances or taxation measures to reduce imported efficient products;

3.2 LEAP modelling

In Lao PDR, it was estimated that the portion of MECON group will grow from 37% in 2013 to around 48% in 2030; therefore, share in energy consumption of this group will have increasing trend. This study uses the key assumptions and energy consumption data of MECON household given in Appendix B to create energy projection model in the LEAP software. LEAP simulation has projected electricity consumption of three scenarios which are business as usual (BAU) scenario, high energy efficiency (HEE) scenario, and medium energy efficiency (MEE) scenario. The HEE and MEE scenarios are developed relatively to the business-as-usual (BAU) scenario[4]. In the BAU scenario, the total final energy demand increases from 392.73kTOE in 2014 to 878.31 kTOE by 2030,an increase of 124% (Figure 8).In the MEE and HEE scenarios, final energy demand also increases, but at a lower rate than the BAU scenario. In the MEE Scenario, the final energy demand increases from 392.73 kTOE in 2014 to 778.59 kTOE in 2030, or 98%; while in the HEE scenario it increases from 392.73 kTOE to 741.00 kTOE, or 89%.Comparing the BAU with MEE and HEE scenarios, it was found that total final energy demand in 2030 would reduceby 11%for MEE, and by 16%for HEE.

[4]For more information of the BAU scenario, please see Laos country report on Task 1.2

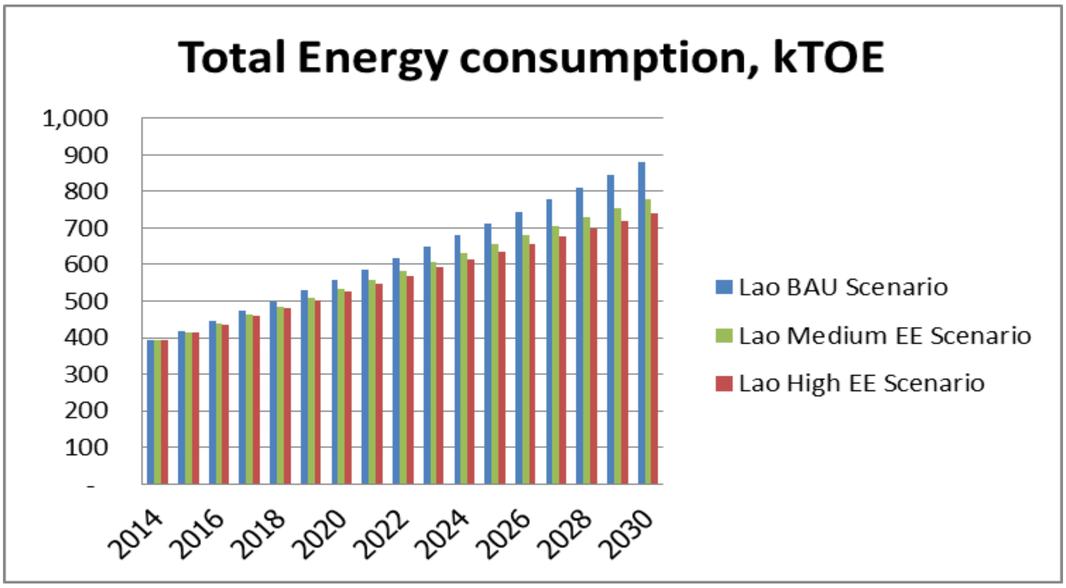


Figure 8: Final energy consumption in three scenarios for 2014-2030

As seen from the Figure 8, the total energy consumption of the Lao MECON households for three considered scenarios has an increasing trend. The increase in energy consumption among the MECON households in Laos is likely a result of increasing household incomes and/ or an increase in the number of MECON households.

Figure 9 shows the expected electricity consumption by Lao MECON households in the BAU, MEE and HEE scenarios for period 2014-2030.Compared to the BAU scenario, it was predicted that electricity consumption by Lao MECON households would be reduced by 35 kTOE (18%) and 56 kTOE (29%) for case of MEE and HEE scenarios, respectively.

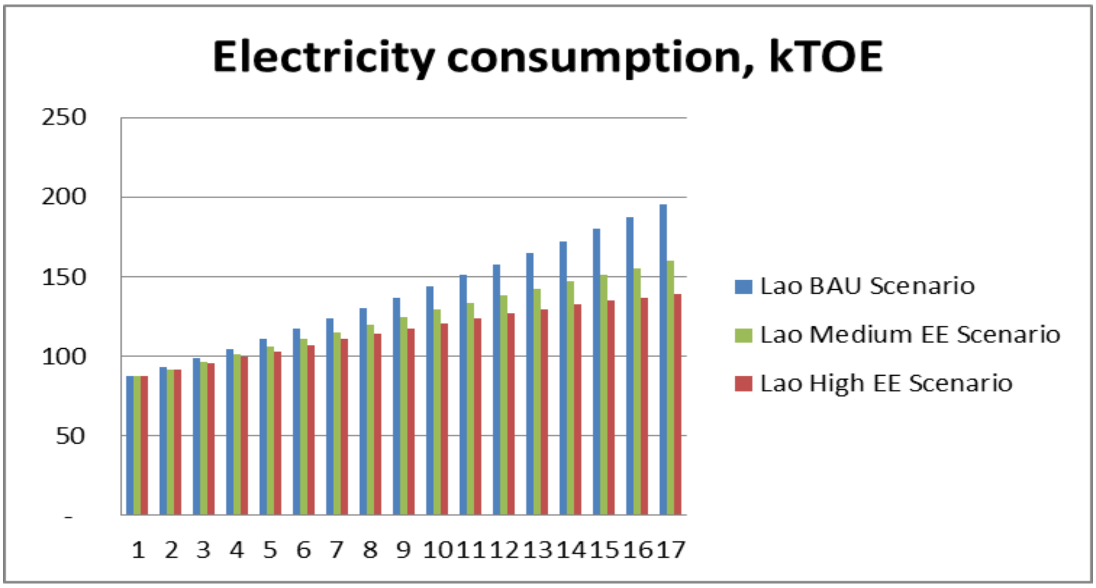


Figure 9: Electricity consumption in LAO MECON households for 2014-30

Energy consumption for cooking appliances

As shown in Figure 10, energy for cooking accounts for the highest share of total final energy consumption in Lao MECON households. Based on BAU scenario, the most available cooking devices in Lao MECON households include charcoal and biomass stoves, electric stove and LPG stove, which consume 659.39 kTOE, 25.36 kTOE, and 23.59 kTOE, respectively.

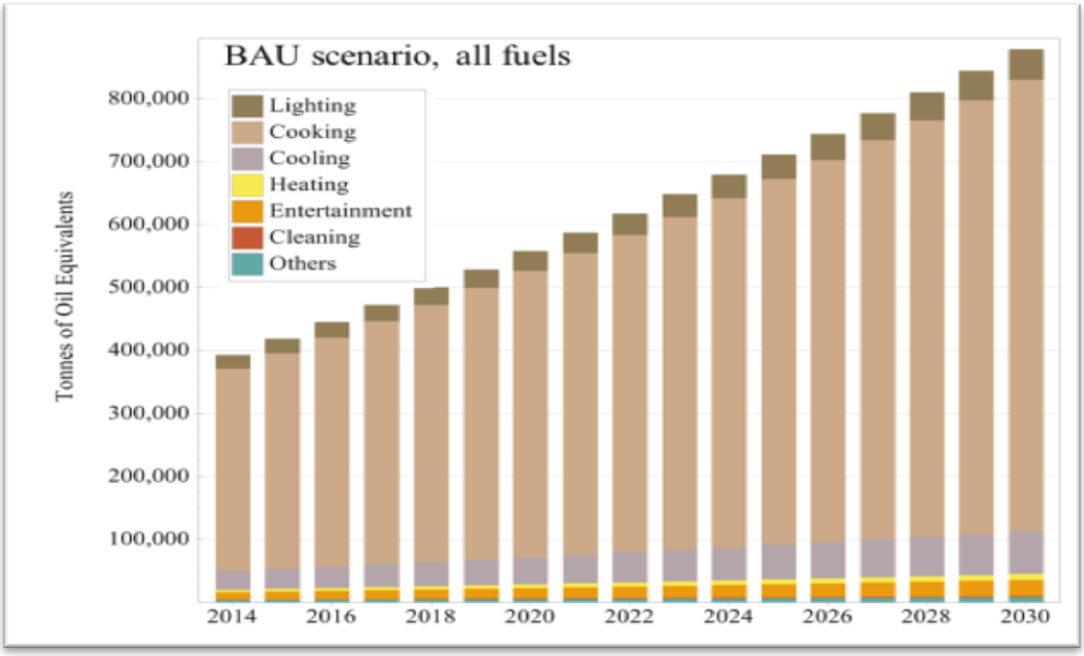


Figure 10: Final energy consumption by categories, BAU scenario 2014-30

In the HEE scenario, a complete shifting from conventional cooking devices to efficient appliances reduces final energy demand by 88 kTOE(12%) by 2030 compared to BAU scenario (see Figure 11).In the case of the MEE scenario, where it is assumed that 50% and 90% of the MECON households in 2030 would adopt efficient cooking devices such as electric, LPG, and biomass and charcoal stoves, final energy demand for cooking appliances isreducedby68 kTOE (9%) in comparison to the BAU scenario.

Energy consumption for cooling appliances

Cooling appliances contribute to the second largest share of total final energy demand in Lao MECON households. In the MEE and HEE scenarios, where it is assumed that households would have adopted more efficient cooling devices, electricity consumption by cooling appliances could be reduced by 4 kTOE (6%) and 6 kTOE (9%) for MEE and HEE scenarios respectively, compared to BAU case (Figure 12).

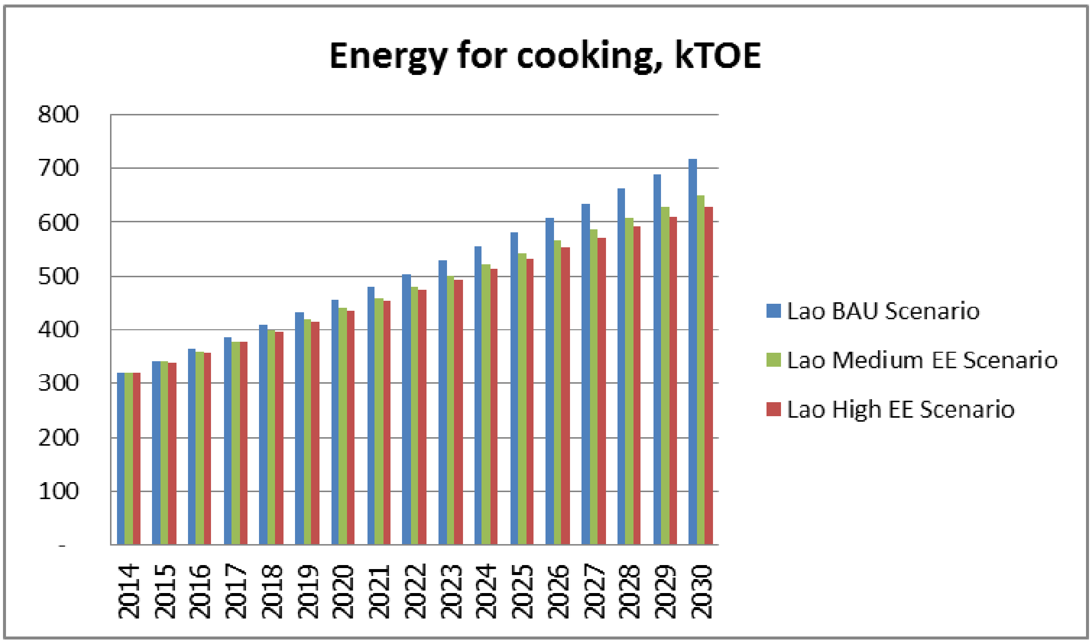


Figure 11Energy consumptions by cooking technologies for BAU, MEE, and HEE scenarios

Based on the BAU scenario, the highest electricity consumption by cooling appliances in 2030would be refrigerator (37 kTOE), followed by fan (28 kTOE) and AC (3kTOE). It was noted from the survey that electric fans are the main cooling appliance among low-income households (fans were owned by 90% of MECON households), and are also used every day. This is an important point for policy maker to consider while developing energy policies.

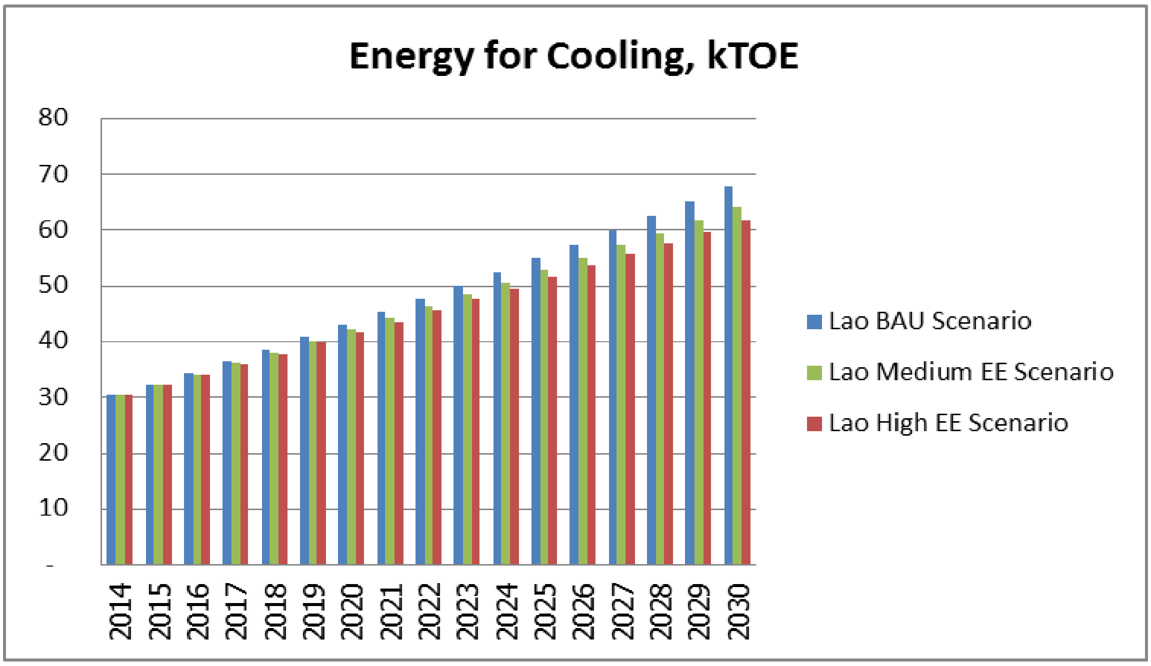


Figure 12: Energy consumptions of cooling technologies for BAU, MEE, and HEE scenarios

Energy consumption for lighting

Lighting devices accounted for the third largest final energy demand in Lao MECON households (Figure 8). Figure 13shows electricity consumption of lighting devices for the three scenarios.

It was assumed that by 2030, fluorescent lights would comprise the highest percentage in Lao MECON household and consume 46 kTOE of energy (97% of total electric consumption for lighting). As seen from Figure 13the adoption of more efficient lighting devices can lead to significant reduction in electricity consumption by MECON households. In the MEE scenario, adoption of more efficient lighting devices helps to reduce electricity demand in 2030 by 25 kTOE (52.14%) and 36 kTOE (75%) for MEE and HEE scenarios respectively, compared to BAU. This would be another important point of consideration for policy makers while drafting energy policies.

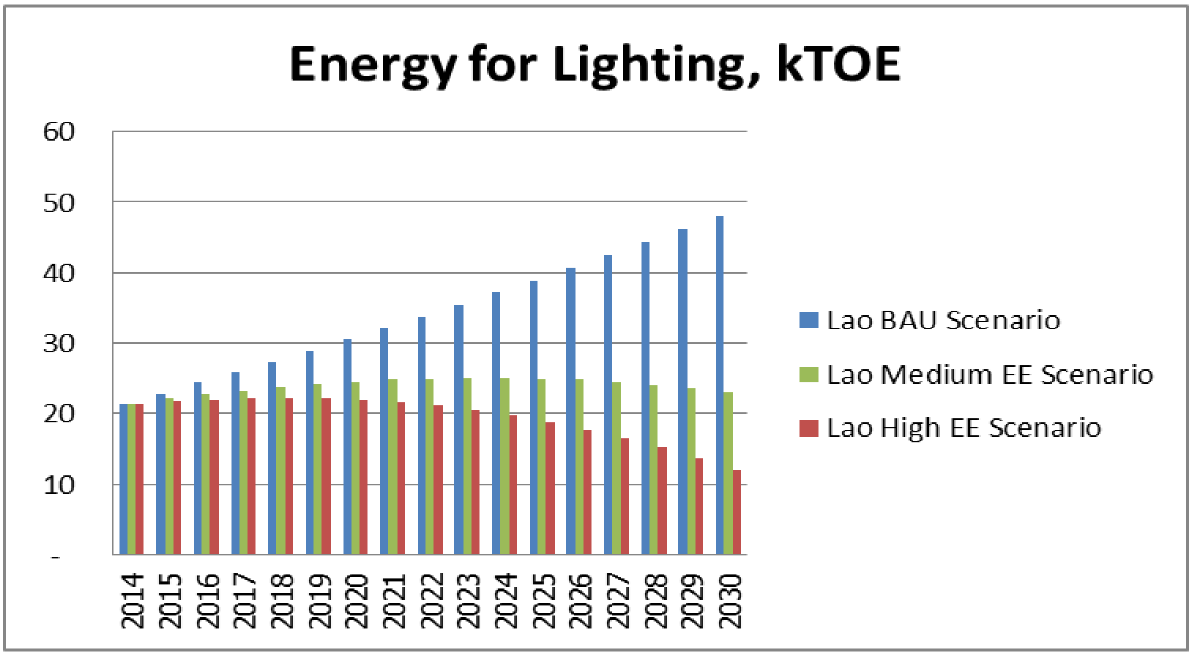


Figure 13: Energy consumptions of lighting technologies

Energy consumption for entertainment appliances

As mentioned in report Task 1.2, in 2014 TV comprises the highest final energy demand, approximately 25 kTOE, which is 96.38% of total energy demand by entertainment category in 2030. It was found that there are only two technologies, i.e. CRT (mostly) and LCD (rarer) used in low-income households. It was assumed in our modeling that by 2030, efficient TVs would replace CRTs by 40% in MEE, and 100% in HEE. By 2030, this substitution would help to reduce energy demand for TVs by 14% in HEE scenario, and by 6% in MEE scenario compared to the BAU scenario (Figure 14).

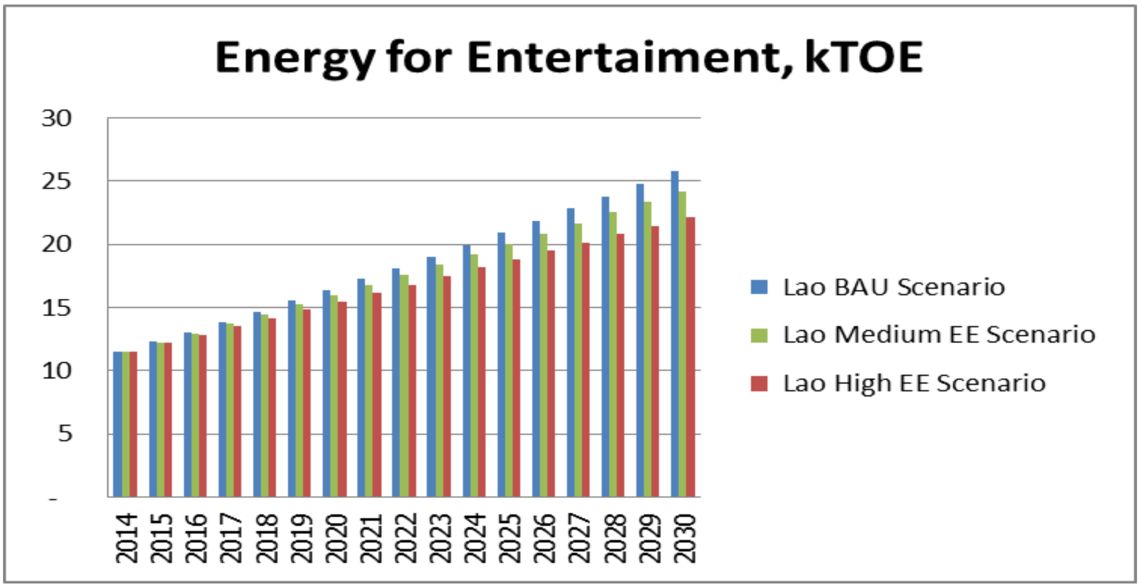


Figure 14: Energy consumption by entertainment technologies

Energy consumption for heating appliances

Main Heating appliances for Lao MECON households include electric kettles and electric water heaters (for shower). Some solar water heaters and electric air heaters are also used, in particular in Northern part of the country. Introduction of MEE and HEE scenarios would lead to energy reduction in 2030 by 0.692 kTOE (7%) and 1.531 kTOE (16%) for MEE and HEE scenarios respectively, compared to BAU scenario (Figure 15)

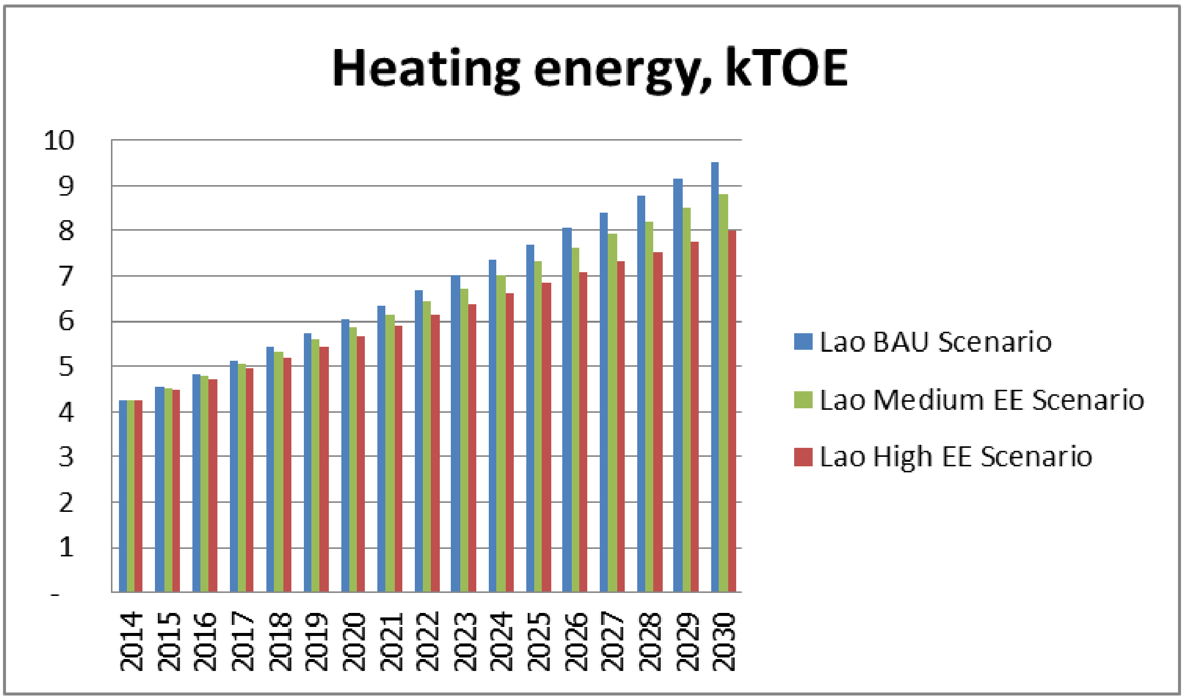


Figure 15: Energy consumptions by heating technologies during 2014-2030

Energy consumption for cleaning appliances

Cleaning appliances (washing machines and vacuum cleaners) account for only 0.17% of total energy demand by 2030. The BAU scenario projection shows that, by 2030, the electricity demand for washing machines and vacuum cleaners are1.50 and 0.05 kTOE respectively.

According to the MEE and HEE scenarios, by 2030 electricity demand of appliances in this category would be decreased by 0.166 kTOE (11%) and 0.288 kTOE (19%) as compared to BAU case (Figure 16). The HEE and MEE scenarios assumed the substitution 100% and 40% of efficient technology to the conventional washing machine and efficient vacuum cleaner, respectively.

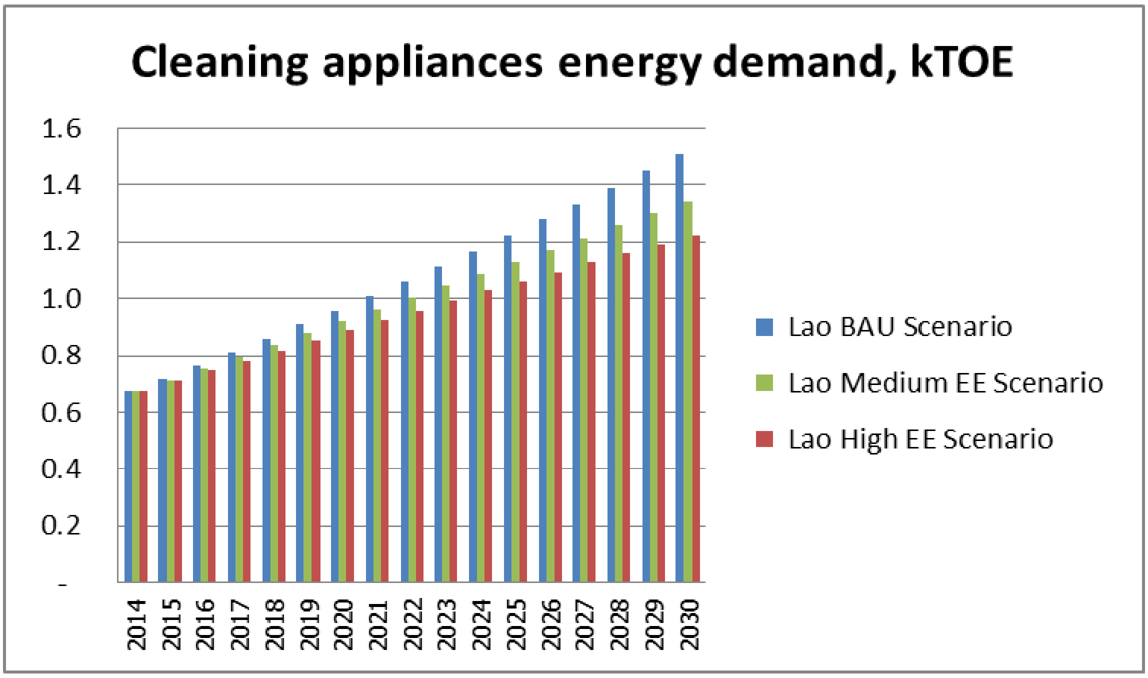


Figure 16: Energy consumptions of cleaning technologies during 2014-2030

Energy consumption for other appliances

The 'other' category of appliances here includes electric water pump and electric iron. The other category accounts for 0.93% of final energy demand. The electricity demand reduction in 2030 for HEE and MEE scenarios compared to BAU case for these appliances respectively would be around 794 kTOE (10%) and 1,611 kTOE (20%) (Figure 17).These reductions are result of the assumption of 50% and 100% replacement of conventional electric iron by the efficient one for MEE and MEE scenarios respectively.

The results of the LEAP modelling for BAU, MEE and HEE scenarios, show the benefits of the adoption of more efficient technology by MECON households, as it helps to reduce energy demand by households.

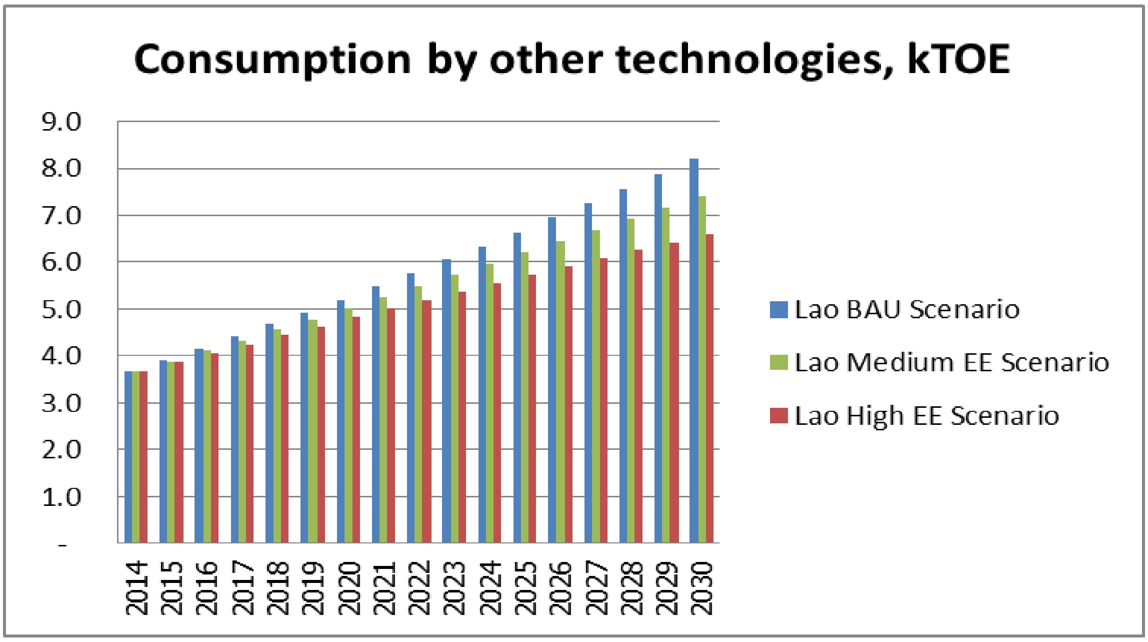


Figure 17: Energy consumptions of other technologies for different scenarios during 2014-2030

In figure 18 shown summaries of reductions in MEE and HEE as compared to BAU scenario in 2030. scenario, , the most considerable reduction is observed for lighting devices 52%followed by cleaning (11%), other appliances (10%) and cooking (9%), compared to BAU, as depicted in figure 18.However, for HEE scenario, the pictures are slightly different, most benefits is gained from the adoption of efficient lighting (75%), then other appliances (20%), cleaning (19%), heating (16%), entertainment devices (14%), cooking devices (12%),and so on. .

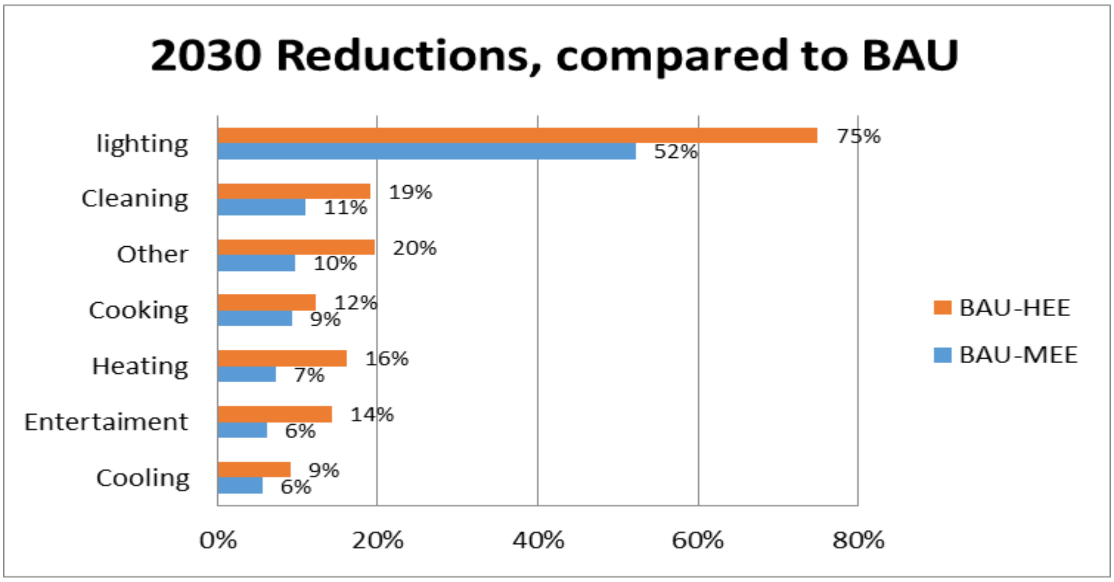


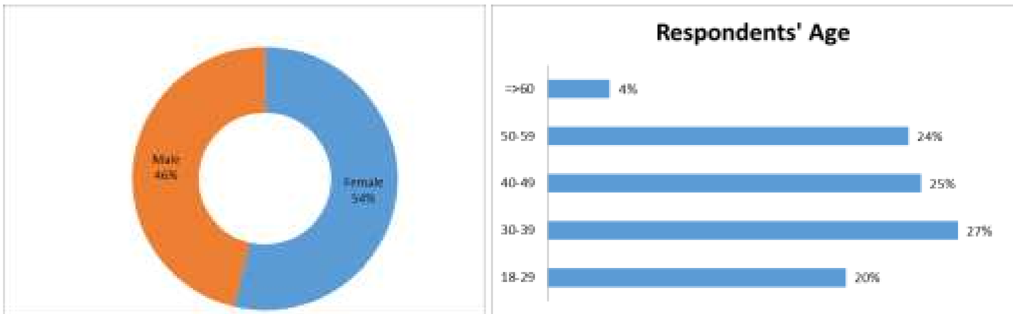
Figure 18: Summary of Energy consumption reductions in 2030 for MEE and HEE scenarios

3.3 Rebound Effect

3.3.1 Characteristics of the sample

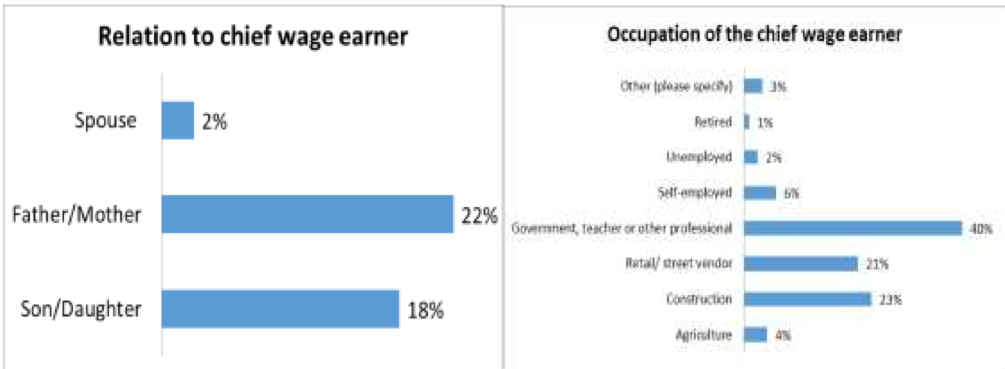
Lao Task 5 surveys were carried out in suburban areas of Vientiane Capital. Slightly more than half (54%) of respondents were female (Figure 19a), and most respondents were aged between 30-59 years old (75%) (Figure 19b).

Around 55% of respondents were the chief wage earners in the households; the remainder were parents of the chief wage earner (22%), the son or daughter (18%) (Figure 20a).A majority of respondents work as Government, teacher and other professionals (40%), followed by construction (23%), retailers/street vendor (21%), self-employed (6%), agriculture (4%), (Figure 20b). Almost 78% of respondents had secondary education or higher, while 17% had only a primary education (Figure 21).



(a) (b)

Figure 19: Respondents' sex and age



(a) (b)

Figure 20: Relation to the chief wage earner and occupation of the chief wage

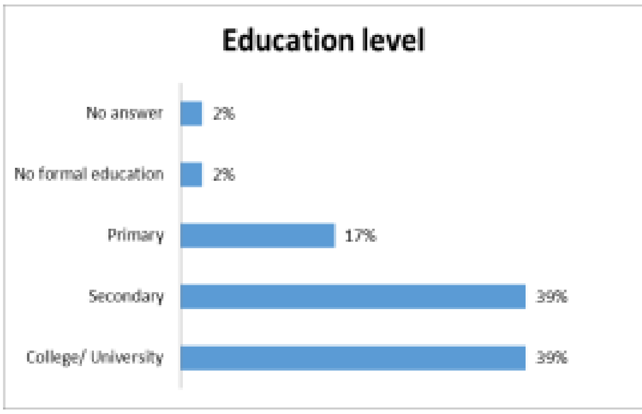
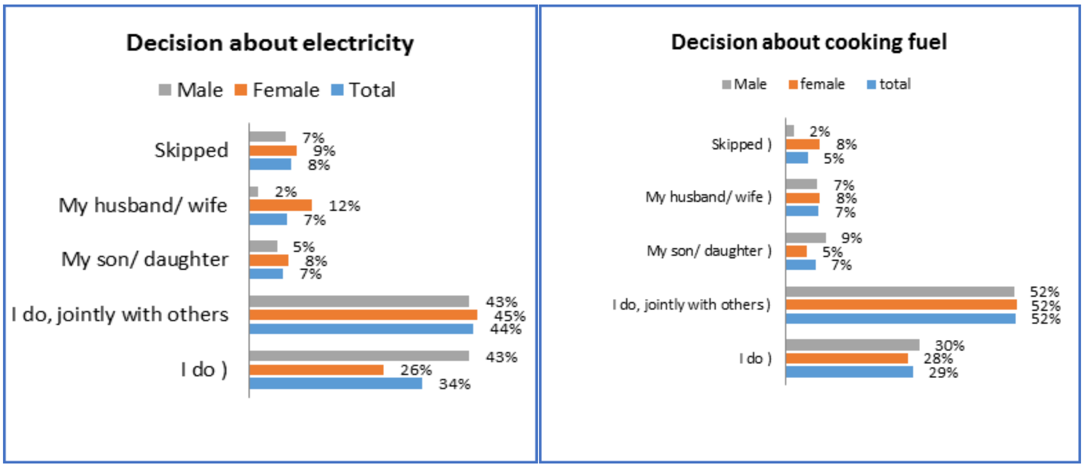


Figure 21: Education level of respondents

When respondents were asked about who in the household made decisions about electricity, 44% of respondents said that they made the decision jointly with other family members, 34% decide by themselves, while the remainder said either that their spouse or children made the decision, or that they did not know (Figure 22a).There is a difference in the genders of those who make decisions on electricity: men are more likely to make decisions on electricity themselves (43% vs 23% for female), while women tend to make decisions jointly with others (45% vs 43% for male). For cooking fuels, there was no gender difference and men and women were equally likely to make decisions about cooking fuels (see Figure 23b).



(a) electricity (b) cooking fuel

Figure 22: Decision about energy use

The survey showed that households had a mean number 4.57 persons; the maximum was 7 and the minimum was 1. Average number of children under 16 is 1.65 (max3, min 1), while average number of earning income members is 2.24 (max 6, min 1), (Figure 23)

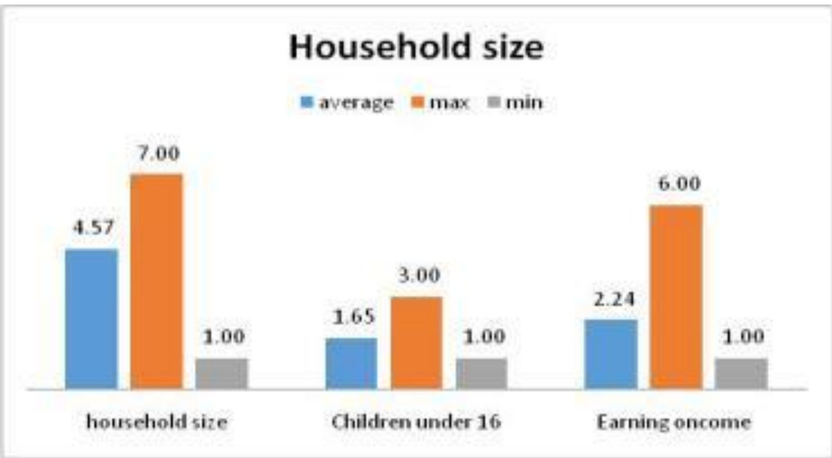


Figure 23: Household size

According to MECON definition, average per capita income is between US$ 2-5 per day or equivalent to $ 60-150 per month. Household income distribution of surveyed respondents is presented in Figure 24. The average number of household members earning an income was 2.24 (see Figure 24). Table 3 shows the results of the average per earning member monthly income. It is seen that the samples, which matched MECON group, would approximately be around 65%.

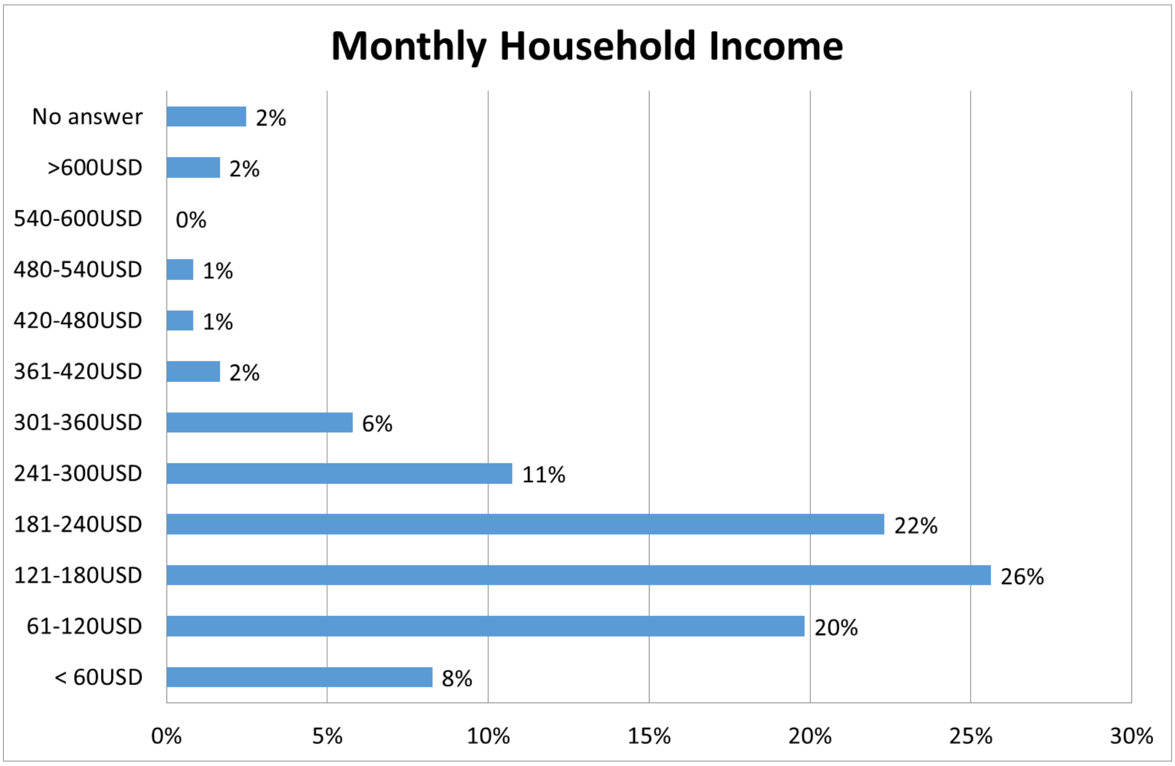


Figure 24: Proportion in average monthly income

Table 3: Per capita income per month

Household Income range (monthly)	Per earning member (monthly)	Total samples	MECON
< 60 USD	< 27	8%	
61-120USD	27 - 54	20%	
121-180USD	**54 - 80**	**26%**	**65%**
181-240USD	**81 - 107**	**22%**	
241-300USD	**108 - 134**	**11%**	
301-360USD	**134 - 161**	**6%**	
361-420USD	161 - 188	2%	
420-480USD	188 - 214	1%	
480-540USD	214 - 241	1%	
540-600USD	242 - 268	0%	
>600USD	> 268	2%	
skipped	skipped	2%	

3.3.2 Status quo (Section B)

The last month averaged expenses show that food is standing 1st (158 USD), followed by housing (52 USD), education (38 USD) and transportation (27 USD). Electricity bills together with clothing &furniture are ranked 5th (20 USD) (Figure 25). Expenses for cooking fuels, water bills, saving and others are relatively small and can be counted as least important.

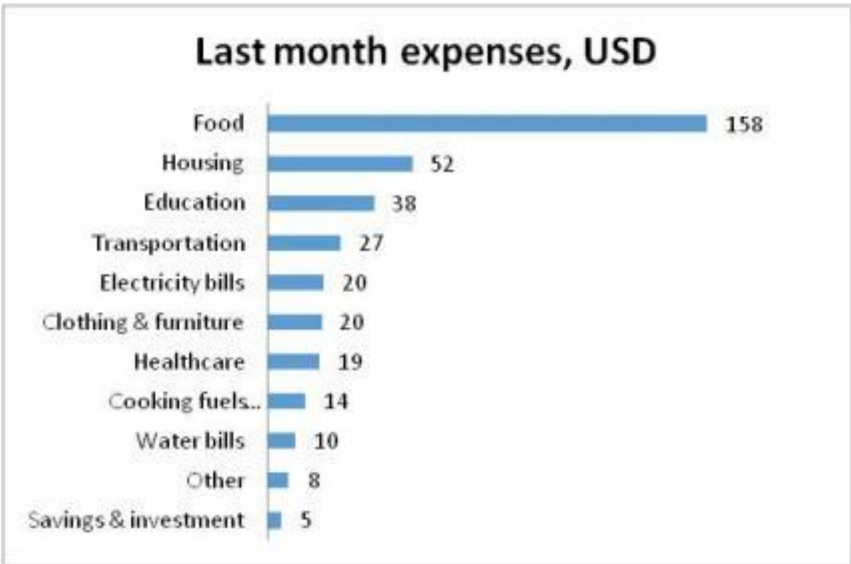


Figure 25: Last month expenses

Almost 89% of respondents pay for their electricity bill monthly when they received the bills, some 8% pay when they have money and 2% pay quarterly (Figure 26).

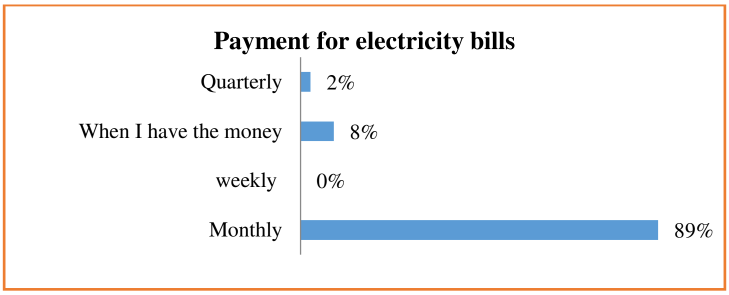


Figure 26: How do people pay for their electricity bills?

Electricity was always available for almost all (99.2%) respondents. Expenditure on energy was 'moderately' to 'completely' acceptable for 79% of respondents (Figure 27), 'slightly acceptable' for 17%.and'not at all acceptable for only 4% of respondents.

Most households used electric cooking appliances rice cooker (94%), electric hot plate (84%)[5]. The use of traditional (inefficient) and efficient biomass stoves remained high, 79% and 55%, respectively (Figure 28). The use of LPG and ownership of microwave was rarer, (19% and 8%, respectively) and kerosene was not used by any household for cooking.

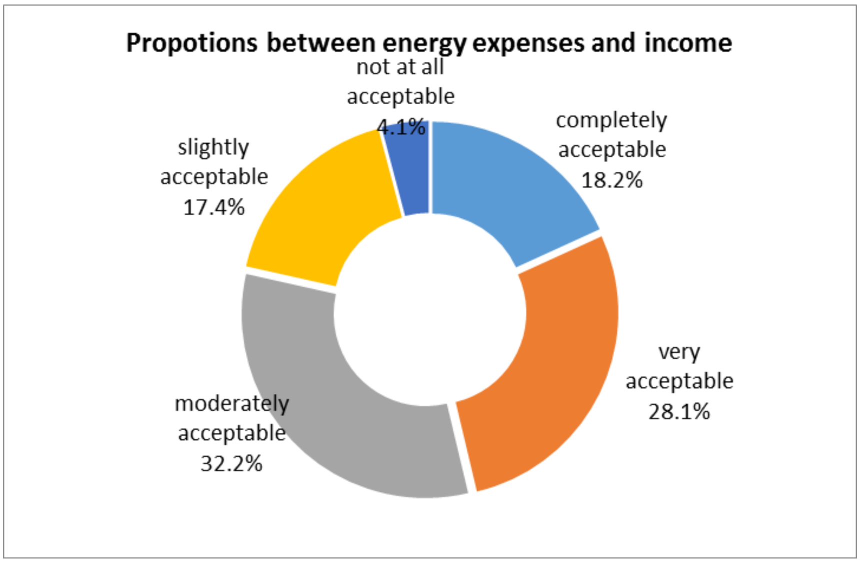


Figure 27: Acceptability on proportions between household energy expenses and income

[5]Hot plate: here people also do refer to popular electric frying pans/hot pot

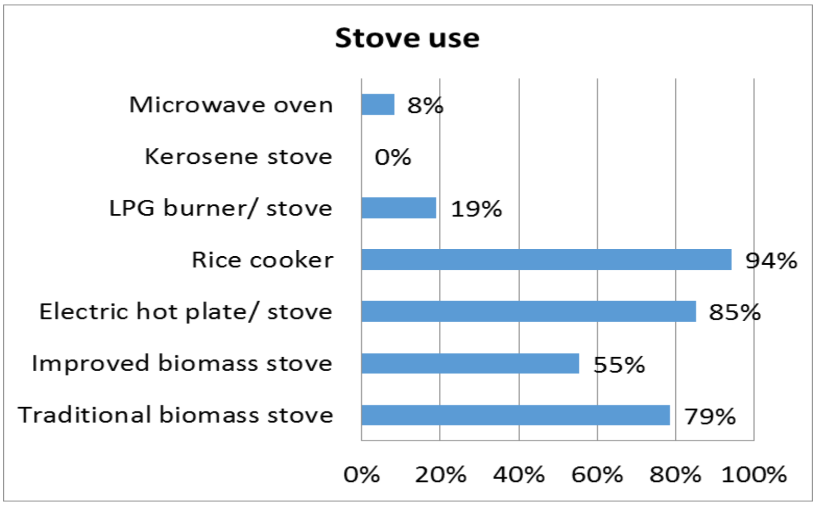


Figure 28: Stove use

Almost 96% of surveyed households use fluorescent tubes for lighting (Figure 29), followed by CFL (66%) and incandescent bulbs (33%). The use of LED and kerosene lamps was negligible. The use of candles (33%) and batteries/torch (35%) was also high; however, the surveys were conducted in grid connected areas, where candles or battery/torch are used as emergency light, for example when the power is off, for walking outside at night, or in religious ceremonies, but not for normal lighting purpose. Therefore, this was probably misunderstanding of the respondents on this matter.

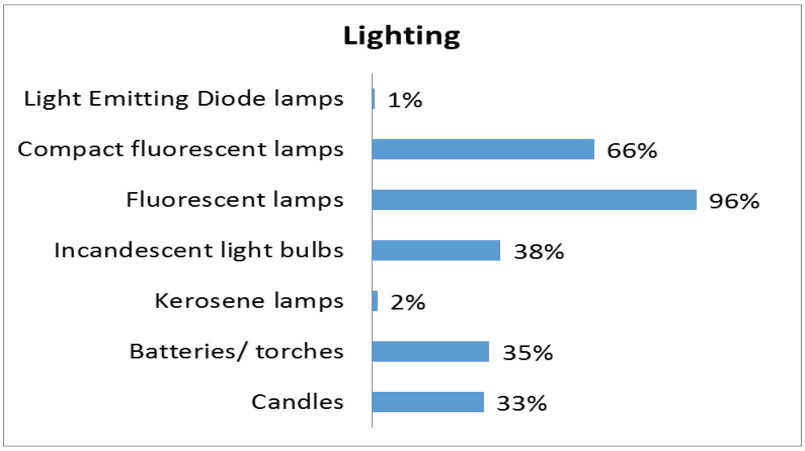


Figure 29: Lighting devices

Other appliances owned by respondents include refrigerators and mobile phones (both 99%), electric fans (98%), electric irons (87%), Box TVs (81%), electric kettles (75%), and video/DVD players (71%). Around half of the respondents possessed washing machine (50%), radio (48%), computer (45%), electric water pump (45%), hi-fi/sound systems (39%) and air conditioning unit (36%). Fewer respondents used flat screen TV, solar water heater, vacuum cleaner, and electric heaters (Figure 30)

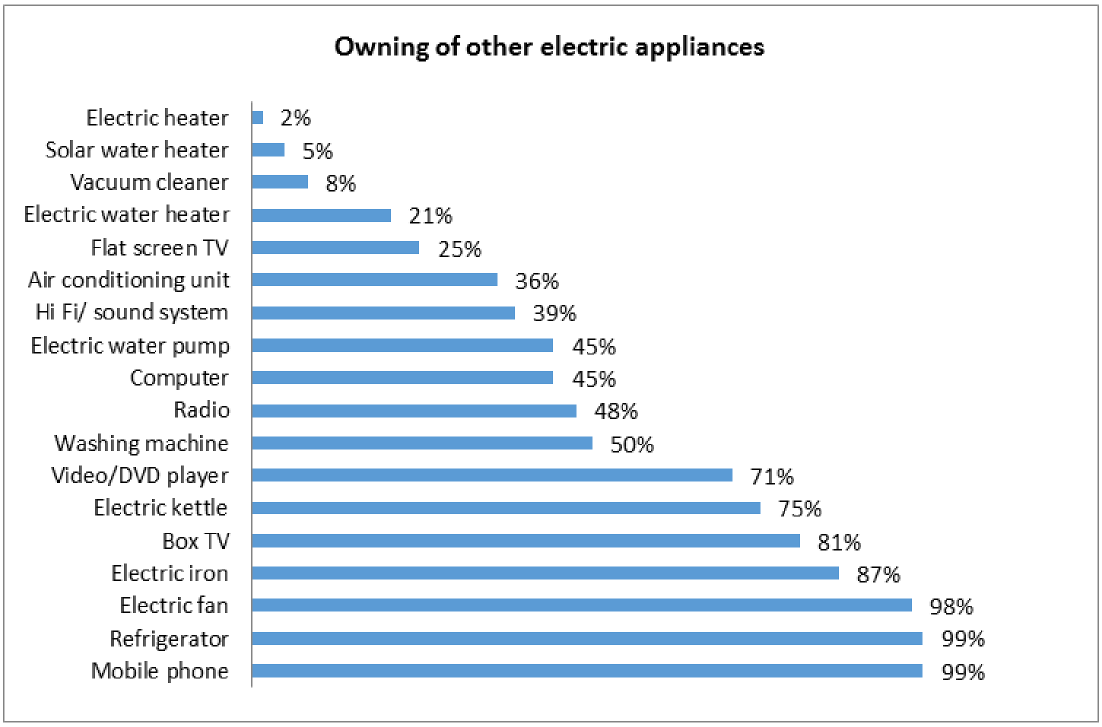


Figure 30: Owning of other Electric appliances

3.3.3 Impacts of household electricity consumptions (Section C)

It was reported that 43% of respondents had noted an increase of their electricity bill during the past six months; for 36% of respondents there had been no change, while only 0.83% had seen their electricity bills decrease, 20% didn’t know (Table 4). Possible reasons for the increase in electricity bills include, (1) pricing policy (tariff increased)[6]; or (2) seasonal change - shifting from cold dry season (lower energy consumption) to hot dry one (higher energy consumption).For the household which had noticed a decrease in the electricity bill, the respondent indicated this was because the house had been unoccupied during that period.

Table 4: Change in electricity bills over the past six months

Status	**results**
Increased	43.0%
stayed the same	36.4%
Decreased	0.8%
Don't know	19.8%

To understand household expenditure priorities, respondents were asked to indicate how they would spend the additional money if electricity bills were to decrease.It was found

[6] As a component of EDL reform, the electricity tariffs in Lao PDR have been gradually increased since 2004, until 2017. since 2004 up to

that people would spend 22% for food, 17% for education, 12% for housing, and10% for clothing and furniture (Figure 31). Cooking fuel was not priority expenditure for respondents, which ranked the lowest (4%).

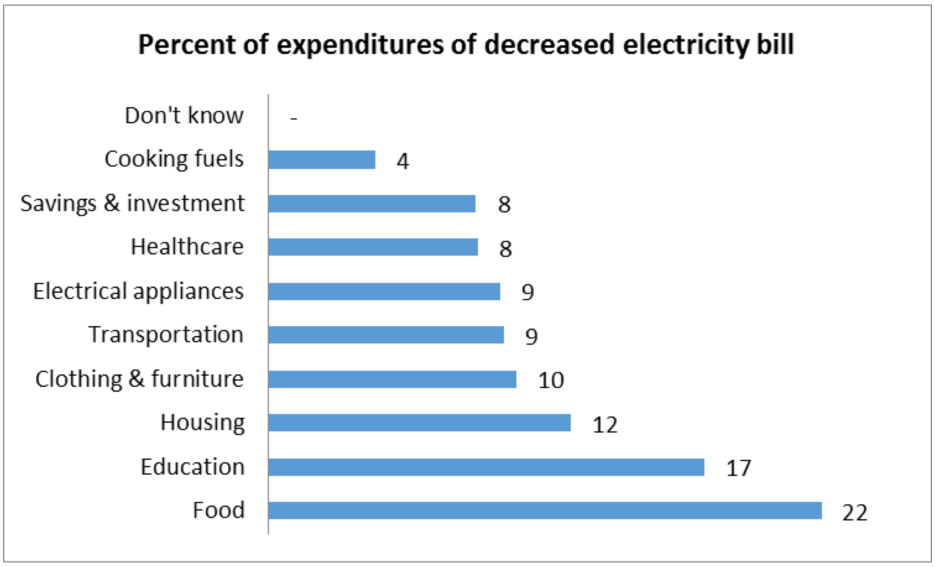


Figure 31: If electricity bills were to decrease, what percent of the money saved would you spend on the following.

Asked specifically about expenditure on electrical appliances, the results showed that around 56% of respondents would buy an appliance that they have never had before, while 22% of them would like to upgrade/replace an appliance they already have, and16% of respondents would continue to use their existing appliances more (Figure 32). Around 6% of respondents did not know or skipped the question.

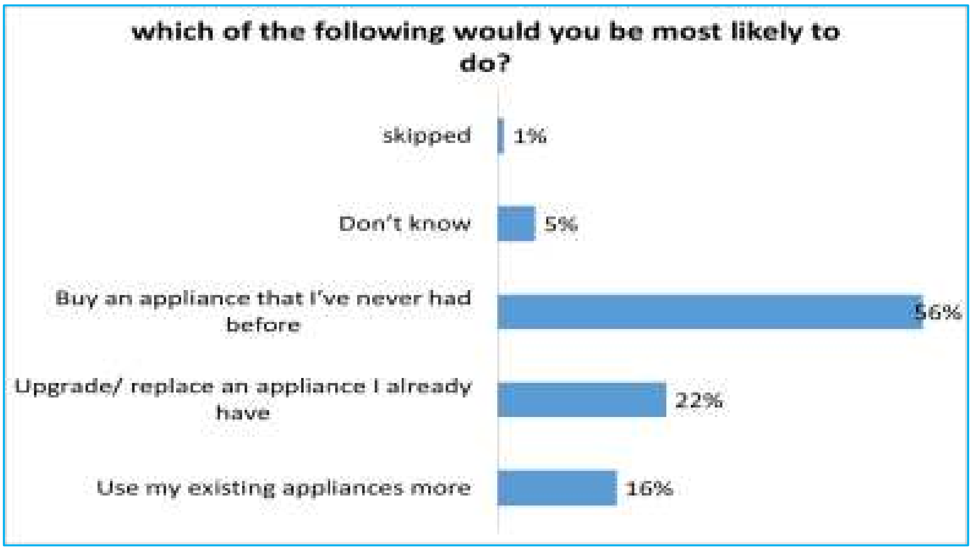


Figure 32: If you were to spend the money that you had saved through lower electricity bills, which of the following would you be most likely to do

The results suggest that MECON households are most likely to purchase new appliances. This would lead to increased electricity consumption, especially if inefficient appliances were mainly purchased.

Question C03 asks respondents to imagine that they have an extra US$ 10 extra every month, they were then asked which of 10 expenditure categories they would they spend it on. The answers were ranked in order of importance with 1 being the most important and 10 being the least important.

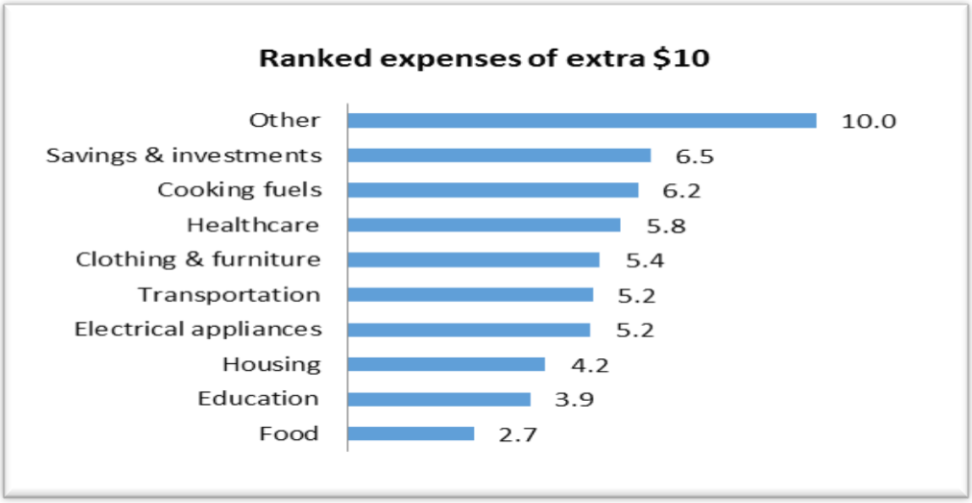


Figure 33: Ranking of expenditure of extra $10 from saved electricity bill

The results show that food was ranked the highest, while purchase of electrical appliances was fourth and cooking fuels seventh. These findings indicate that expenditure on energy, especially fuels for cooking, is not the most urgent issue for respondents. These results show that the most important expenditure categories for respondents were food, education and housing. These were followed by electric appliances, transportation, clothing, and healthcare. Cooking fuel, saving or investments were given the lowest ranking by respondents.

This raises the question of how expenditure on energy (i.e. electricity/ cooking fuels) ranks in importance in comparison to other income categories. The survey results show that expenditure on electricity bill was ranked fifth of 10 expenditure categories (Figure 33) and comprised of 5.5% of total monthly expenditure (Figure 34). Cooking fuels ranked eight and accounted for just 3.7% of the total expenditure. The results indicate that energy is not among the most important issues for respondents, rather food, housing, and education are priorities. Two possible explanations may be given for the low priority given to energy expenditure: (1) the relatively low electricity tariff in Lao in comparison to neighbouring countries; and (2) the dominance of biomass energy for household cooking, which is cheap and easily available.

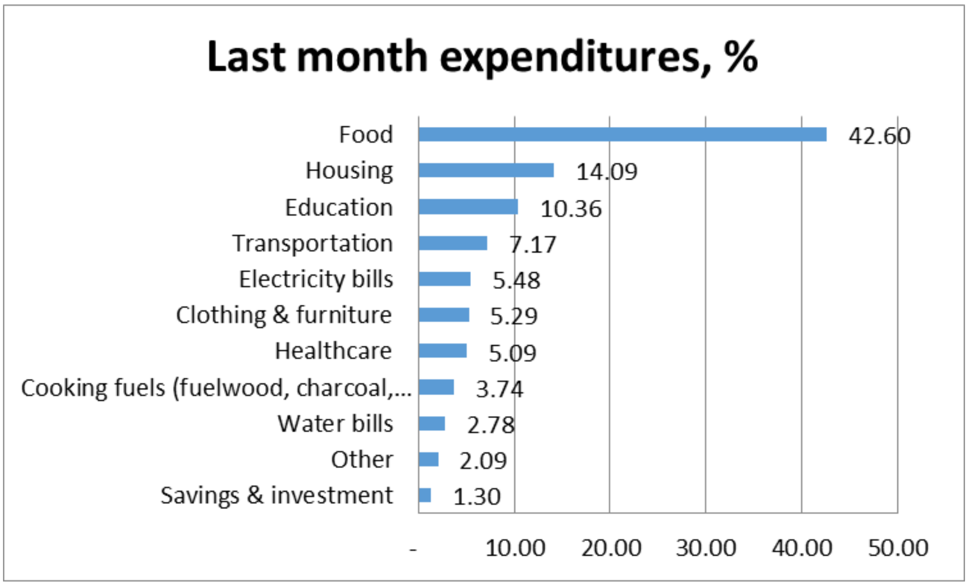


Figure 34: Percentage of last month expenses proportion

4 Discussion

It is interesting to compare the MECON survey results (in Tasks 3 & 5) with findings from other studies. The Lao Population Census (LPC) and Lao Expenditure and Consumption Survey (LECS) are the only existing reliable comprehensive studies in Lao PDR in terms of population census and expenditure. As a rule, the LPC are conducted once every 10 years and the LECS every five years. The last LPC was carried out in March 2015 and the results have not yet been announced; the most recent LECS (LECS V) was carried out between 2012-period and the results have been published recently. There results of the LECS V are therefore used for comparison with the MECON surveys.

For LECS V, 8,226 households in 515 villages were surveyed, of which 138 villages were in urban areas, 341 were in rural areas with road access, and 36 in rural areas without road access (LECS V, 2014). The MECON targeted groups is comparable to LECS V's non-poor group with an income twice above the poverty line[7], i.e. more than US$ 3 per capita per day (MECON group: 2-6 US$ per capita per day).

Although the expenditure categories varied, the results of the two studies show similar trends. For example, expenditure on food, utilities and fuel, and housing are ranked the highest (Figure 36, Figure 36 and Table 5).

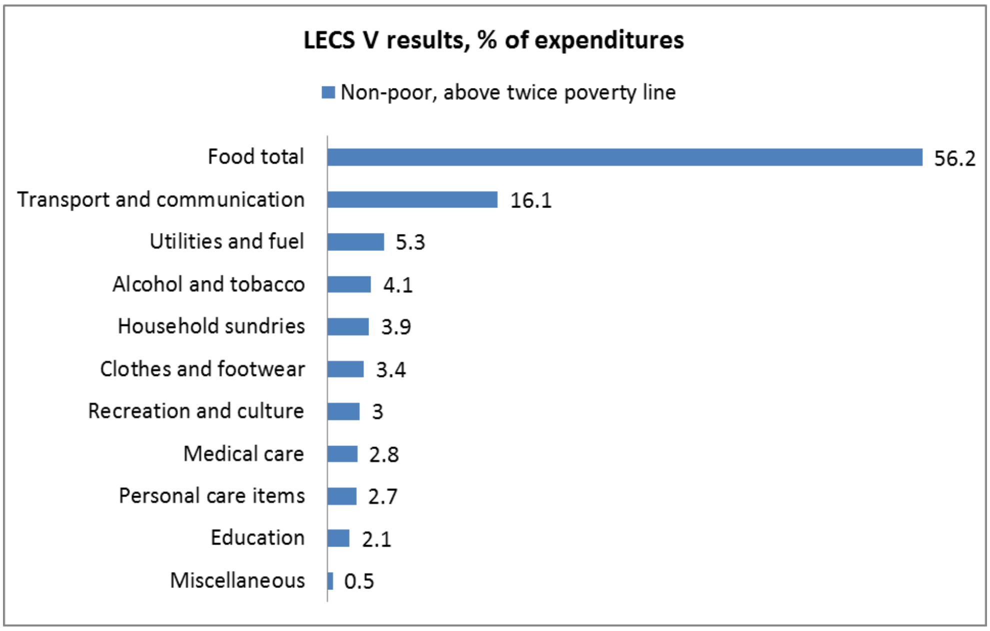


Figure 35: LECS V survey results

[7] National poverty line was set at 1.5 US$/person/day.

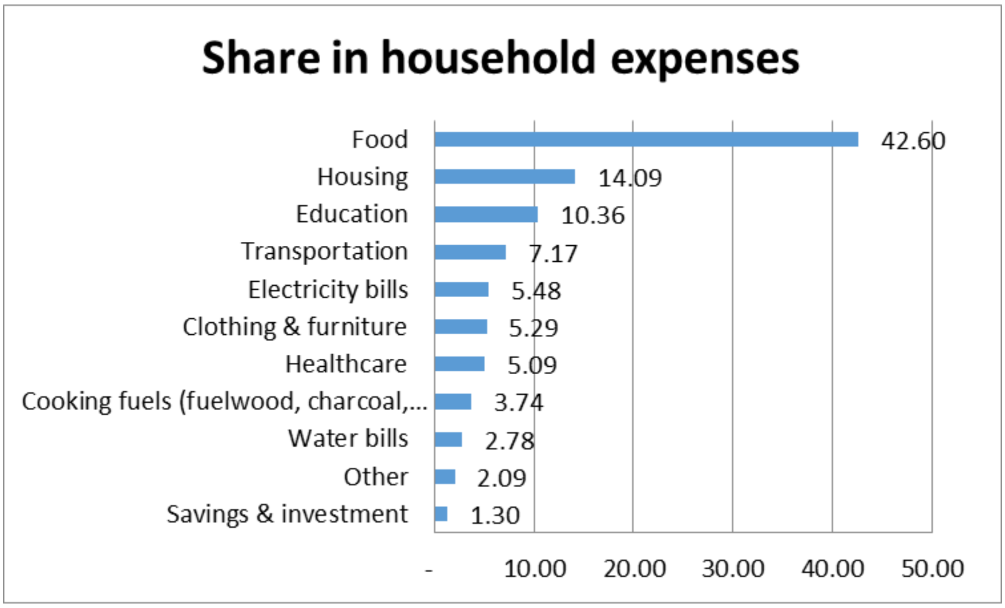


Figure 36: MECON survey results

In term of possession of electrical appliances, the results of two studies also show similar trends: TV, mobile phone, refrigerator and rice cooker are among the most popular appliances (Figure 37).

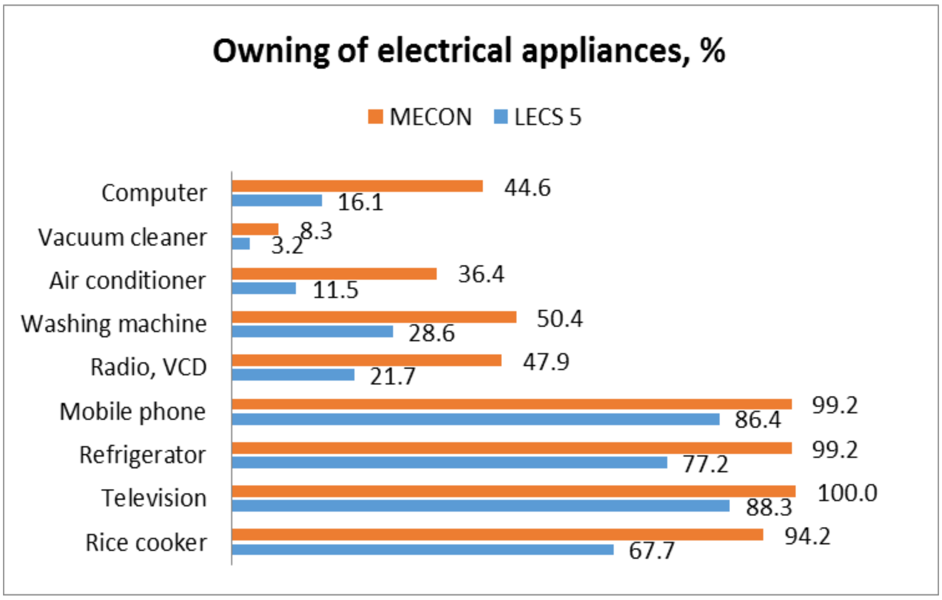


Figure 37: Possession of electrical appliances

Table 5 presented the percentage of households which own large appliances; the results of the Task 3 survey are also given here for comparison. Although the figures are different, the overall trends are similar, in particular the high percentage of TVs and refrigerators, and the lower washing machine and air conditioning devices.

Table 5: Comparison to other survey findings

Household large appliances	MECON survey		LECS V (2012/13)	
	Task 3 (2014)	Task 5 (2015)	Lao PDR total	Non-poor, above twice poverty line
Refrigerator	97%	99%	56.4%	77.2%
TV	100%	100%	75.1%	88.3%
Washing machine	68%	50%	14.8%	28.6%
Air conditioning	34%	36%	5.1%	11.5%

Another point for discussion is the lack of legal framework and measures for promoting energy efficiency and conservation, which would support stricter control over the import, distribution and use of electric appliances, as well as knowledge sharing and access to information.

A comparison of the results of the LEAP simulation and projections by the Ministry of Energy and Mines (REFERENCE) shows significant differences in household electricity consumption; the results differ by almost 50% (Table 6). However, both cases show similar, increasing trends in energy consumption in household sector and the research results presented in this report might be useful for policy maker in developing energy policies, which will help to achieve national target 10% reduction of total final energy demand by 2030 as compared to BAU.

Table 6: The comparison of energy consumption in MECON household sector obtaining from MECON LEAP model and JICA study.

Year	Total HH Electric Consumption, [kWh]	%SHARE MECON	Electricity consumption in MECON HH(based on MEM projection)[Million kWh]	Electricity consumption in MECON HH by ***MECON LEAP***, [Million kWh]
2013	1365.63	37.59	513.34	934.71
2014	1403.19	38.82	544.72	1000.52
2015	1441.78	39.98	576.42	1066.34
2016	1481.43	41.07	608.43	1133.87
2017	1522.18	42.08	640.53	1202.85
2018	1564.04	43.02	672.85	1273.54
2019	1607.06	43.89	705.34	1345.96
2020	1651.26	44.68	737.78	1419.78
2021	1696.67	45.39	770.12	1494.98
2022	1743.34	46.04	802.63	1572.19
2023	1791.28	46.60	834.74	1650.38
2024	1840.55	47.09	866.71	1730.18
2025	1891.17	47.51	898.49	1811.56
2026	1943.18	47.86	930.01	1894.50
2027	1996.63	48.13	960.98	1978.55
2028	2051.54	48.32	991.30	2063.59
2029	2107.96	48.44	1021.10	2149.97
2030	2165.94	48.49	1050.26	2237.61

5 Conclusions

The cost-benefit analysis has shown the benefits from the use of some efficient electric appliances versus inefficient ones; however, the results are uncertain for many appliances because the definition of efficient appliances in Lao is still unclear. As a result, people may face difficulties in distinguishing efficient appliances from inefficient ones.

The household survey have shown that energy expenses are not the most critical needs for Lao MECON households, compared to other needs such as food, housing, and education. Such trend found by MECON survey is similar to other existing studies’ results. Such situation, together with low income status would be a big challenge for penetrating of efficient appliances, which, as found from the survey, have higher capital costs. In this relation, significant incentives in terms of financial or other supports would be required.

LEAP simulation for different scenarios, namely BAU, MEE and HEE has shown benefits from adoption of more efficient technology in MECON households in term of total final energy consumption and electricity demand. The most considerable reduction for both scenarios is observed for lighting devices.

6 References

Birbili, M. 2000.Translating from one language to another.Social Research Update, Winter 2000.Available from: http://sru.soc.surrey.ac.uk/SRU31.html [Accessed November 2013].

Chapman, D.W. and Carter, J.F. 1979. Translation procedures for the cross-cultural use of measurement instruments.Educational Evaluation and Policy Analysis1(3): 71-76.

IEA. 2012. World Energy Outlook 2012. International Energy Agency, Paris.

Sarkar, A. and Singh, J.2010. Financing energy efficiency in developing countries: lessons learned and remaining challenges. Energy Policy 38(10): 5560.-5571.

(LSB)Lao Statistics Bureau, 2015.**Poverty Report for the Lao Consumption and Expenditure Survey, 2012-2013**.Courtesy of Lao Statistics Bureau, Ministry of Planning and Investment, Lao PDR.

(LECSV) **The Fifth Lao expenditure and consumption survey 2012/13 result**. Available at:http://www.nsc.gov.la/en/Samplesurvey.php. [Accessed on 04 August 2015].

Appendix

Appendix A

Table 1A: Data and assumptions for cost-benefit analyses (CBA)

Appliance	All surveyed households								
	Power consumption (W)	Amount of appliances per household	Hours used (hours/day)	% of households owning the appliance	Energy consumption (kWh/HH/year)	% of household owning the EE appliances	Maintenance cost, (USD)	Life time of appliances, (Years)	Capital cost, (USD)
Incandescent light bulb	50	2.82	4.57	25.56	83.40		0.00	1,125 hrs	0.62
Fluorescent light bulb	35.84	4.98	6.44	96.67	84.25		0.00	20,000 hrs	1.48
Compact fluorescent light	18.66	3.12	5.94	31.11	40.46		0.00	6,000 hrs	2.72
LED	7	0	2.71	0	6.92		0.00	100,000 hrs	5.86
Cooking appliances									
Rice cooker (EE)	464	1.03	0.65		110.08	10	7.00	5	25.47
Rice cooker (Existing)	580	1.03	0.65	90	137.61		7.00	5	14.48
Cleaning									
Washing machine (EE)	457.616	1	0.2		33.41	5.56	15.00	5	183.00
Washing machine (Exist)	572.02		0.2	40	41.76		15.00	5	169.75
Cooling appliances									
AC (EE)	2812.8	0.22	2.83		2905.48	6.9	25.00	10	548.78
AC (Existing)	3516		2.83	8.89	3631.85		25.00	10	365.85
Refrigerator (EE)		1	12		139.20	60	15.00	10	154.32
Refrigerator (Exist)			14	98.89	174.00		15.00	10	124.00
Electric fan (EE)	46.4	1.73	6.41		108.56	13.82	6.00	10	45.00
Electric fan (Existing)	58		6.41	86.18	135.70		6.00	10	21.50
Heating									

Electric water heater (EE)	1920	0.09	1.53	8.89	1072.22		10.00	10	108.00
Electric water heater (Exi.)	2400		1.53		1340.28		10.00	10	85.00
Entertainment									
TV LCD (flat screen TV)	85	0.32	6.15		190.80	30.11	14.81	10	165.00
TV CRT (box TV), 21 in.	147	0.87	6.65	98.91	356.81		14.81	10	115.00

Table 2A: CBA between Incandescent and CFL

Inefficient Incandescent							Efficient CFL				
Year (Appliance years)	Electricity Price ($/kWh)	Electricity Cons. (kWh/year)	Capital Cost ($/appl.)	Maintenance Cost ($/year)	Fuel Cost ($/year)	Life Cycle Cost ($/year)	Electricity Cons. (kWh/year)	Capital Cost ($/appl.)	Maintenance Cost ($/year)	Fuel Cost ($/year)	Life Cycle Cost ($/year)
1	0.0413	83.40	0.62	0.00	3.44	3.90	40.46	2.72	0.00	1.67	4.31
2	0.0421	83.40	0.00	0.00	3.51	3.19	40.46	0.00	0.00	1.70	1.55
3	0.0430	83.40	0.00	0.00	3.58	3.10	40.46	0.00	0.00	1.74	1.50
Total Life Cost:						10.18					7.35

Table 3A: CBA between fluorescent and LED light bulbs

Inefficient Fluorescent							Efficient LED				
Year (Appliance years)	Electricity Price ($/kWh)	Electricity Cons. (kWh/year)	Capital Cost ($/appl.)	Maintenance Cost ($/year)	Fuel Cost ($/year)	Life Cycle Cost ($/year)	Electricity Cons. (kWh/year)	Capital Cost ($/appl.)	Maintenance Cost ($/year)	Fuel Cost ($/year)	Life Cycle Cost ($/year)
1	0.0413	84.25	1.48	0.00	3.48	4.80	6.92	5.86	0.00	0.29	6.14
2	0.0421	84.25	0.00	0.00	3.55	3.22	6.92	0.00	0.00	0.29	0.26
3	0.0430	84.25	0.00	0.00	3.62	3.13	6.92	0.00	0.00	0.30	0.26
4	0.0438	84.25	0.00	0.00	3.69	3.04	6.92	0.00	0.00	0.30	0.25

5	0.0447	84.25	0.00	0.00	3.77	2.95	6.92	0.00	0.00	0.31	0.24
6	0.0456	84.25	0.00	0.00	3.84	2.87	6.92	0.00	0.00	0.32	0.24
7	0.0465	84.25	0.00	0.00	3.92	2.78	6.92	0.00	0.00	0.32	0.23
8	0.0474	84.25	0.00	0.00	4.00	2.71	6.92	0.00	0.00	0.33	0.22
9	0.0484	84.25	0.00	0.00	4.08	2.63	6.92	0.00	0.00	0.34	0.22
10	0.0494	84.25	0.00	0.00	4.16	2.55	6.92	0.00	0.00	0.34	0.21
Total Life Cost:						30.67					**8.26**

Table 4A: CBA between fluorescent and LED light bulbs

Inefficient Box TV							**Efficient LCD TV**				
Year (Appliance years)	Electricity Price ($/kWh)	Electricity Cons. (kWh/year)	Capital Cost ($/appl.)	Maintenance Cost ($/year)	Fuel Cost ($/year)	Life Cycle Cost ($/year)	Electricity Cons. (kWh/year)	Capital Cost ($/appl.)	Maintenance Cost ($/year)	Fuel Cost ($/year)	Life Cycle Cost ($/year)
1	0.0413	356.81	115.00	14.81	17.52	145.80	190.80	165.00	14.81	9.37	188.03
2	0.0421	356.81	0.00	14.81	17.87	29.65	190.80	0.00	14.81	9.56	22.11
3	0.0430	356.81	0.00	14.81	18.23	28.54	190.80	0.00	14.81	9.75	21.22
4	0.0438	356.81	0.00	14.81	18.59	27.48	190.80	0.00	14.81	9.94	20.37
5	0.0447	356.81	0.00	14.81	18.96	26.47	190.80	0.00	14.81	10.14	19.55
6	0.0456	356.81	0.00	14.81	19.34	25.49	190.80	0.00	14.81	10.34	18.77
7	0.0465	356.81	0.00	14.81	19.73	24.55	190.80	0.00	14.81	10.55	18.03
8	0.0474	356.81	0.00	14.81	20.13	23.65	190.80	0.00	14.81	10.76	17.31
9	0.0484	356.81	0.00	14.81	20.53	22.78	190.80	0.00	14.81	10.98	16.63
10	0.0494	356.81	0.00	14.81	20.94	21.95	190.80	0.00	14.81	11.20	15.97
Total Life Cost:						**376.36**					**357.98**

Table 5A: CBA between inefficient box TV and efficient LED TV

Inefficient Box TV							Efficient LED TV				
Year (Appliance years)	Electricity Price ($/kWh)	Electricity Cons. (kWh/year)	Capital Cost ($/appl.)	Maintenance Cost ($/year)	Fuel Cost ($/year)	Life Cycle Cost ($/year)	Electricity Cons. (kWh/year)	Capital Cost ($/appl.)	Maintenance Cost ($/year)	Fuel Cost ($/year)	Life Cycle Cost ($/year)
1	0.0413	356.81	115.00	14.81	17.52	145.80	190.80	165.00	14.81	9.37	188.03
2	0.0421	356.81	0.00	14.81	17.87	29.65	190.80	0.00	14.81	9.56	22.11
3	0.0430	356.81	0.00	14.81	18.23	28.54	190.80	0.00	14.81	9.75	21.22
4	0.0438	356.81	0.00	14.81	18.59	27.48	190.80	0.00	14.81	9.94	20.37
5	0.0447	356.81	0.00	14.81	18.96	26.47	190.80	0.00	14.81	10.14	19.55
6	0.0456	356.81	0.00	14.81	19.34	25.49	190.80	0.00	14.81	10.34	18.77
7	0.0465	356.81	0.00	14.81	19.73	24.55	190.80	0.00	14.81	10.55	18.03
8	0.0474	356.81	0.00	14.81	20.13	23.65	190.80	0.00	14.81	10.76	17.31
9	0.0484	356.81	0.00	14.81	20.53	22.78	190.80	0.00	14.81	10.98	16.63
10	0.0494	356.81	0.00	14.81	20.94	21.95	190.80	0.00	14.81	11.20	15.97
Total Life Cost:						**376.36**					**357.98**

Table 6A: CBA between conventional and efficient rice cookers

Inefficient rice cooker							Efficient rice cooker				
Year (Appliance years)	Electricity Price ($/kWh)	Electricity Cons. (kWh/year)	Capital Cost ($/appl.)	Maintenance Cost ($/year)	Fuel Cost ($/year)	Life Cycle Cost ($/year)	Electricity Cons. (kWh/year)	Capital Cost ($/appl.)	Maintenance Cost ($/year)	Fuel Cost ($/year)	Life Cycle Cost ($/year)
1	0.0413	137.605	14.48	7.00	5.68	26.56	110.084	25.47	7.00	4.55	36.47
2	0.0421	137.605	0.00	7.00	5.80	11.61	110.084	0.00	7.00	4.64	10.56

3	0.0430	137.605	0.00	7.00	5.91	11.15	110.084	0.00	7.00	4.73	10.13
4	0.0438	137.605	0.00	7.00	6.03	10.72	110.084	0.00	7.00	4.82	9.73
5	0.0447	137.605	0.00	7.00	6.15	10.30	110.084	0.00	7.00	4.92	9.34
Total Life Cost:						**70.35**					**76.22**

Table 7A: CBA between conventional and efficient air conditioning units

Inefficient AC							**Efficient AC**				
Year (Appliance years)	Electricity Price ($/kWh)	Electricity Cons. (kWh/year)	Capital Cost ($/appl.)	Maintenance Cost ($/year)	Fuel Cost ($/year)	Life Cycle Cost ($/year)	Electricity Cons. (kWh/year)	Capital Cost ($/appl.)	Maintenance Cost ($/year)	Fuel Cost ($/year)	Life Cycle Cost ($/year)
1	0.0413	3631.85	365.85	25.00	430.09	799.27	2905.48	548.78	25.00	344.07	900.28
2	0.0421	3631.85	0.00	25.00	438.69	420.58	2905.48	0.00	25.00	350.95	341.00
3	0.0430	3631.85	0.00	25.00	447.47	408.13	2905.48	0.00	25.00	357.97	330.83
4	0.0438	3631.85	0.00	25.00	456.42	396.06	2905.48	0.00	25.00	365.13	320.96
5	0.0447	3631.85	0.00	25.00	465.54	384.35	2905.48	0.00	25.00	372.44	311.40
6	0.0456	3631.85	0.00	25.00	474.86	373.00	2905.48	0.00	25.00	379.88	302.13
7	0.0465	3631.85	0.00	25.00	484.35	361.99	2905.48	0.00	25.00	387.48	293.14
8	0.0474	3631.85	0.00	25.00	494.04	351.31	2905.48	0.00	25.00	395.23	284.43
9	0.0484	3631.85	0.00	25.00	503.92	340.95	2905.48	0.00	25.00	403.14	275.98
10	0.0494	3631.85	0.00	25.00	514.00	330.90	2905.48	0.00	25.00	411.20	267.79
11	0.1444	3631.85	0.00	25.00	524.28	321.15	2905.48	0.00	25.00	419.42	259.84
12	0.1472	3631.85	0.00	25.00	534.76	311.70	2905.48	0.00	25.00	427.81	252.14
13	0.1502	3631.85	0.00	25.00	545.46	302.53	2905.48	0.00	25.00	436.37	244.67
14	0.1532	3631.85	0.00	25.00	556.37	293.63	2905.48	0.00	25.00	445.10	237.43
15	0.1563	3631.85	0.00	25.00	567.50	285.00	2905.48	0.00	25.00	454.00	230.41
Total Life Cost:						**5,680.56**					**4,852.44**

Table 8A: CBA between conventional and efficient refrigerators

Inefficient refrigerator							Efficient refrigerator				
Year (Appliance years)	Electricity Price ($/kWh)	Electricity Cons. (kWh/year)	Capital Cost ($/appl.)	Maintenance Cost ($/year)	Fuel Cost ($/year)	Life Cycle Cost ($/year)	Electricity Cons. (kWh/year)	Capital Cost ($/appl.)	Maintenance Cost ($/year)	Fuel Cost ($/year)	Life Cycle Cost ($/year)
1	0.0413	174.00	124.00	15.00	7.19	145.13	139.20	154.32	15.00	5.75	174.08
2	0.0421	174.00	0.00	15.00	7.33	20.25	139.20	0.00	15.00	5.86	18.92
3	0.0430	174.00	0.00	15.00	7.48	19.42	139.20	0.00	15.00	5.98	18.12
4	0.0438	174.00	0.00	15.00	7.63	18.61	139.20	0.00	15.00	6.10	17.36
5	0.0447	174.00	0.00	15.00	7.78	17.85	139.20	0.00	15.00	6.22	16.63
6	0.0456	174.00	0.00	15.00	7.93	17.11	139.20	0.00	15.00	6.35	15.93
7	0.0465	174.00	0.00	15.00	8.09	16.41	139.20	0.00	15.00	6.47	15.26
8	0.0474	174.00	0.00	15.00	8.25	15.74	139.20	0.00	15.00	6.60	14.62
9	0.0484	174.00	0.00	15.00	8.42	15.10	139.20	0.00	15.00	6.74	14.01
10	0.0494	174.00	0.00	15.00	8.59	14.48	139.20	0.00	15.00	6.87	13.43
Total Life Cost:						**300.10**					**318.37**

Table 9A: CBA between conventional and efficient electric fans

Inefficient fan							Efficient fan				
Year (Appliance years)	Electricity Price ($/kWh)	Electricity Cons. (kWh/year)	Capital Cost ($/appl.)	Maintenance Cost ($/year)	Fuel Cost ($/year)	Life Cycle Cost ($/year)	Electricity Cons. (kWh/year)	Capital Cost ($/appl.)	Maintenance Cost ($/year)	Fuel Cost ($/year)	Life Cycle Cost ($/year)
1	0.0413	135.70	21.50	6.00	5.60	32.55	108.56	45.00	6.00	4.48	54.98
2	0.0421	135.70	0.00	6.00	5.72	10.63	108.56	0.00	6.00	4.57	9.59
3	0.0430	135.70	0.00	6.00	5.83	10.22	108.56	0.00	6.00	4.66	9.21
4	0.0438	135.70	0.00	6.00	5.95	9.83	108.56	0.00	6.00	4.76	8.85
5	0.0447	135.70	0.00	6.00	6.07	9.45	108.56	0.00	6.00	4.85	8.50
6	0.0456	135.70	0.00	6.00	6.19	9.09	108.56	0.00	6.00	4.95	8.17
7	0.0465	135.70	0.00	6.00	6.31	8.75	108.56	0.00	6.00	5.05	7.85
8	0.0474	135.70	0.00	6.00	6.44	8.42	108.56	0.00	6.00	5.15	7.55
9	0.0484	135.70	0.00	6.00	6.57	8.10	108.56	0.00	6.00	5.25	7.25
10	0.0494	135.70	0.00	6.00	6.70	7.80	108.56	0.00	6.00	5.36	6.97
Total Life Cost:						**114.84**					**128.94**

Table 10A: CBA between conventional and efficient washing machine

Inefficient washing machine							Efficient washing machine				
Year (Appliance years)	Electricity Price ($/kWh)	Electricity Cons. (kWh/year)	Capital Cost ($/appl.)	Maintenance Cost ($/year)	Fuel Cost ($/year)	Life Cycle Cost ($/year)	Electricity Cons. (kWh/year)	Capital Cost ($/appl.)	Maintenance Cost ($/year)	Fuel Cost ($/year)	Life Cycle Cost ($/year)
1	0.0413	41.76	169.75	15.00	1.72	185.68	33.41	183.00	15.00	1.38	198.60
2	0.0421	41.76	0.00	15.00	1.76	15.20	33.41	0.00	15.00	1.41	14.88
3	0.0430	41.76	0.00	15.00	1.79	14.51	33.41	0.00	15.00	1.44	14.20
4	0.0438	41.76	0.00	15.00	1.83	13.85	33.41	0.00	15.00	1.46	13.55
5	0.0447	41.76	0.00	15.00	1.87	13.22	33.41	0.00	15.00	1.49	12.92
0	0.0456	41.76	0.00	15.00	1.90	0.00	33.41	0.00	15.00	1.52	0.00
0	0.0465	41.76	0.00	15.00	1.94	0.00	33.41	0.00	15.00	1.55	0.00
0	0.0474	41.76	0.00	15.00	1.98	0.00	33.41	0.00	15.00	1.58	0.00
0	0.0484	41.76	0.00	15.00	2.02	0.00	33.41	0.00	15.00	1.62	0.00
0	0.0494	41.76	0.00	15.00	2.06	0.00	33.41	0.00	15.00	1.65	0.00
Total Life Cost:						**242.45**					**254.15**

Table 11A: CBA between conventional and efficient electric hot water heater

Inefficient electric hot water heater							Efficient electric hot water heater				
Year (Appliance years)	Electricity Price ($/kWh)	Electricity Cons. (kWh/year)	Capital Cost ($/appl.)	Maintenance Cost ($/year)	Fuel Cost ($/year)	Life Cycle Cost ($/year)	Electricity Cons. (kWh/year)	Capital Cost ($/appl.)	Maintenance Cost ($/year)	Fuel Cost ($/year)	Life Cycle Cost ($/year)
1	0.0413	1340.28	85.00	10.00	65.81	157.20	1072.22	108.00	10.00	52.65	167.67
2	0.0421	1340.28	0.00	10.00	67.13	69.96	1072.22	0.00	10.00	53.70	57.78
3	0.0430	1340.28	0.00	10.00	68.47	67.79	1072.22	0.00	10.00	54.78	55.96
4	0.0438	1340.28	0.00	10.00	69.84	65.68	1072.22	0.00	10.00	55.87	54.19
5	0.0447	1340.28	0.00	10.00	71.24	63.65	1072.22	0.00	10.00	56.99	52.49
6	0.0456	1340.28	0.00	10.00	72.66	61.68	1072.22	0.00	10.00	58.13	50.84
7	0.0465	1340.28	0.00	10.00	74.11	59.78	1072.22	0.00	10.00	59.29	49.24
8	0.0474	1340.28	0.00	10.00	75.60	57.94	1072.22	0.00	10.00	60.48	47.70
9	0.0484	1340.28	0.00	10.00	77.11	56.15	1072.22	0.00	10.00	61.69	46.21
10	0.0494	1340.28	0.00	10.00	78.65	54.42	1072.22	0.00	10.00	62.92	44.77
Total Life Cost:						**714.25**					**626.84**

Table 12A: Life cycle costs without and with hurdle rate

Compared Items	without hurdle rate			with hurdle rate		
	Inefficient appliance	Efficient appliance	Benefit margins	Inefficient appliance	Efficient appliance	Benefit margins
Incandescent and CFL						
1	3.90	4.31	-0.41	3.93	2.24	1.69
2	7.08	5.85	1.23	7.11	3.78	3.33
3	10.18	7.35	2.83	10.21	5.29	4.92
FL vs LED						
1	4.80	6.14	-1.34	2.24	6.42	-4.18
2	8.01	6.40	1.61	3.78	6.68	-2.9
3	11.14	6.66	4.48	5.29	6.94	-1.65
4	14.18	6.91	7.27	6.74	7.19	-0.45
5	17.13	7.15	9.98	8.16	7.43	0.73
6	20.00	7.39	12.61	9.54	7.67	1.87
7	22.78	7.61	15.17	10.88	7.89	2.99
8	25.49	7.84	17.65	12.17	8.12	4.05
9	28.11	8.05	20.06	13.44	8.33	5.11
10	30.67	8.26	22.40	14.66	8.54	6.12
TV						
1	145.80	188.03	-42.24	151.27	195.89	-44.62
2	175.44	210.14	-34.70	180.92	217.99	-37.08
3	203.99	231.36	-27.37	209.46	239.21	-29.75
4	231.47	251.72	-20.25	236.95	259.58	-22.63
5	257.94	271.28	-13.34	263.41	279.13	-15.72
6	283.43	290.05	-6.62	288.90	297.91	-9.01
7	307.98	308.08	-0.10	313.45	315.94	-2.48
8	331.63	325.39	6.24	337.10	333.25	3.86
9	354.41	342.02	12.39	359.88	349.87	10.01
10	376.36	357.98	18.37	381.83	365.84	15.99
Rice cooker						
1	26.56	36.47	-9.91	26.56	36.47	-9.91
2	38.17	47.02	-8.86	38.17	47.02	-8.86
3	49.32	57.15	-7.83	49.32	57.15	-7.83
4	60.04	66.88	-6.84	60.04	66.88	-6.84
5	70.35	76.22	-5.88	70.35	76.22	-5.88
6	70.35	76.22	-5.88	70.35	76.22	-5.88
7	70.35	76.22	-5.88	70.35	76.22	-5.88
8	70.35	76.22	-5.88	70.35	76.22	-5.88
9	70.35	76.22	-5.88	70.35	76.22	-5.88
10	70.35	76.22	-5.88	70.35	76.22	-5.88

Refrigerator						
1	145.13	174.08	-28.95	145.13	174.08	-28.95
2	165.38	193.01	-27.62	165.38	193.01	-27.62
3	184.80	211.13	-26.33	184.80	211.13	-26.33
4	203.41	228.49	-25.08	203.41	228.49	-25.08
5	221.26	245.12	-23.86	221.26	245.12	-23.86
6	238.38	261.05	-22.67	238.38	261.05	-22.67
7	254.79	276.31	-21.52	254.79	276.31	-21.52
8	270.53	290.93	-20.41	270.53	290.93	-20.41
9	285.62	304.94	-19.32	285.62	304.94	-19.32
10	300.10	318.37	-18.27	300.10	318.37	-18.27
AC						
1	799.27	900.28	-101.00	799.27	900.28	-101.00
2	1219.86	1241.28	-21.42	1219.86	1241.28	-21.42
3	1627.99	1572.11	55.88	1627.99	1572.11	55.88
4	2024.05	1893.07	130.98	2024.05	1893.07	130.98
5	2408.41	2204.47	203.94	2408.41	2204.47	203.94
6	2781.41	2506.60	274.81	2781.41	2506.60	274.81
7	3143.40	2799.75	343.65	3143.40	2799.75	343.65
8	3494.70	3084.18	410.53	3494.70	3084.18	410.53
9	3835.65	3360.16	475.49	3835.65	3360.16	475.49
10	4166.55	3627.94	538.60	4166.55	3627.94	538.60
11	4487.70	3887.79	599.91	4487.70	3887.79	599.91
12	4799.40	4139.93	659.47	4799.40	4139.93	659.47
13	5101.92	4384.60	717.32	5101.92	4384.60	717.32
14	5395.55	4622.03	773.52	5395.55	4622.03	773.52
15	5680.56	4852.44	828.12	5680.56	4852.44	828.12
Fan						
1	32.55	54.98	-22.43	32.55	54.98	-22.43
2	43.18	64.57	-21.40	43.18	64.57	-21.40
3	53.40	73.79	-20.39	53.40	73.79	-20.39
4	63.23	82.64	-19.41	63.23	82.64	-19.41
5	72.68	91.14	-18.46	72.68	91.14	-18.46
6	81.78	99.31	-17.54	81.78	99.31	-17.54
7	90.53	107.16	-16.64	90.53	107.16	-16.64
8	98.94	114.71	-15.77	98.94	114.71	-15.77
9	107.05	121.97	-14.92	107.05	121.97	-14.92
10	114.84	128.94	-14.10	114.84	128.94	-14.10
Washing machine						
1	185.68	198.60	-12.92	185.68	198.60	-12.92
2	200.88	213.48	-12.60	200.88	213.48	-12.60
3	215.39	227.68	-12.29	215.39	227.68	-12.29
4	229.23	241.22	-11.99	229.23	241.22	-11.99

5	242.45	254.15	-11.70	242.45	254.15	-11.70
6	242.45	254.15	-11.70	242.45	254.15	-11.70
7	242.45	254.15	-11.70	242.45	254.15	-11.70
8	242.45	254.15	-11.70	242.45	254.15	-11.70
9	242.45	254.15	-11.70	242.45	254.15	-11.70
10	242.45	254.15	-11.70	242.45	254.15	-11.70
Water heater						
1	157.20	167.67	-10.46	157.20	167.67	-10.46
2	227.16	225.45	1.71	227.16	225.45	1.71
3	294.94	281.40	13.54	294.94	281.40	13.54
4	360.63	335.59	25.03	360.63	335.59	25.03
5	424.28	388.08	36.20	424.28	388.08	36.20
6	485.96	438.92	47.04	485.96	438.92	47.04
7	545.74	488.17	57.58	545.74	488.17	57.58
8	603.68	535.87	67.81	603.68	535.87	67.81
9	659.83	582.08	77.75	659.83	582.08	77.75
10	714.25	626.84	87.41	714.25	626.84	87.41

Appendix B

Table 1B: Data and assumptions for LEAP modelling and scenario analysis

Appliance	Percentage of households owning the appliance in 2014	Final energy intensity (kWh/household/year)	Final energy intensity (kg/household/year)
Lighting technologies			
Incandescent light bulb	25.56	38.95	-
Fluorescent light bulb	96.67	486.13	-
Compact fluorescent light bulb	31.11	23.46	-
LED	0.00	-	-
Kerosene light bulb	0.00	-	-
Cooking appliances			
Electric cooking stove	77.78	330.54	-
Efficient electric cooking stove	0.00	264.43	-
Rice cooker	90.00	103.14	-
Efficient rice cooker	10.00	82.51	-
Microwave oven	5.56	6.70	-
Efficient microwave oven	0.00	5.36	-
Biomass stove	55.56	-	1572.00
Efficient biomass stove	45.00	-	1257.60
Charcoal stove	85.56	-	528.00
Efficient charcoal stove	50.00	-	422.40
LPG stove	12.22	-	148.92
Efficient LPG stove	0.00	-	119.14
Kerosene Stove	0.00	-	0.00
Cooling appliances			
AC unit	8.89	307.82	-
Efficient AC unit	6.90	246.25	-
Refrigerator	98.89	432.29	-
Efficient refrigerator	60.00	345.83	-
Electric fan	86.18	339.62	-
Efficient electric fan	13.82	271.70	-
Heating			
Electric kettle	67.78	137.52	-
Efficient electric kettle	15.27	110.01	-
Electric water heater	8.89	68.59	-
Efficient electric water heater	5.45	54.87	-

Appliance	Percentage of households owning the appliance in 2014	Final energy intensity (kWh/household/year)	Final energy intensity (kg/household/year)
Entertainment			
TV (CRT/box TV)	98.91	271.28	-
Efficient TV (LCD/flat screen TV)	30.11	50.46	-
Video/DVD player	48.89	0.56	-
Radio	12.22	0.47	-
Computer	37.78	1.28	-
Hi-fi system	40.00	5.90	-
Mobile phone	95.56	8.99	-
Cleaning			
Washing machine	40.00	38.52	-
Efficient washing machine	5.56	30.82	-
Vacuum cleaner	3.33	1.64	-
Efficient vacuum cleaner	0.00	1.31	-
Other appliances			
Water pump	20.00	12.85	-
Electric iron	86.67	95.59	-
Efficient electric iron	1.45	76.47	-

Table 2B: Assumptions for High Energy Efficiency (HEE) Scenario

Appliance	Assumptions: HEE Scenario	
	% of household owning the EE appliances in 2030	**Final energy intensity (kWh/yr)**
Lighting technologies		
Incandescent light bulb	Assumed a complete phase out for Incandescent, and then 100% substitution to LED Incandescent: Interp(2014, 100, 2030, 0) LED : Remainder(100)	Incandescent to CFL: Final energy intensity reduces by 80% Incandescent to LED: Final energy intensity reduces by 90%
Fluorescent light bulb	Assumed a complete phase out for FLS, and then 100% substitution to LED Fluorescent : Interp(2014, 100, 2030, 0) LED : Remainder(100)	FLS to CFL: Final energy intensity reduces by 50% FLS to LED: Final energy intensity reduces by 75%
Compact fluorescent light bulb	Assumed a complete phaseout for CFL, and then 100% substitution to LED CFL : Interp(2014, 100, 2030, 0) LED : Remainder(100)	.CFL replaced by LED: final energy intensity reduces by 50%
LED	Assumed to penetrate the market to 30% of households LED : Interp(2014, 0, 2030, 30)	Assume Constant
Kerosene light bulb		
Cooking appliances		
Electric cooking stove	Full substitution from existing to efficient tech Exi : Interp(2014, 100, 2030,0) Eff : Remainder(100)	Efficient technology is assumed to have 20% less final energy intensity than existing one.
Rice cooker	Full substitution from existing to efficient tech Exi : Interp(2014, 90, 2030, 0) Eff : Remainder(100)	Efficient technology is assumed to have 20% less final energy intensity than existing one.

Microwave oven	Full substitution from existing to efficient tech Exi : Interp(2014, 100, 2030, 0) Eff : Remainder(100)	Efficient technology is assumed to have 20% less final energy intensity than existing one.
Biomass Stove, kg/month	Full substitution from existing to efficient tech Exi : Interp(2014, 55, 2030, 0) Eff : Remainder(100)	Efficient technology is assumed to have 20% less final energy intensity than existing one.
Improve biomass stove		
Charcoal , kg/month	Full substitution from existing to efficient tech Exi : Interp(2014, 50, 2030, 0) Eff : Remainder(100)	Efficient technology is assumed to have 20% less final energy intensity than existing one.
LPG Stove, kg/month/ one big gas tank	Full substitution from existing to efficient tech Exi : Interp(2014, 100, 2030, 0) Eff : Remainder(100)	Efficient technology is assumed to have 20% less final energy intensity than existing one.
Kerosene Stove		
Cooling appliances		
AC	Assumed to penetrate the market to 20% of households AC: Interp(2014, 8.89, 2030, 20) Full substitution from existing to efficient tech Exi : Interp(2014, 93.1, 2030, 0) Eff : Remainder(100)	Efficient technology is assumed to have 20% less final energy intensity than existing one.
Refrigerator	Full substitution from existing to efficient tech Exi : Interp(2014, 40, 2030, 0) Eff : Remainder(100)	Efficient technology is assumed to have 20% less final energy intensity than existing one.
Electric fan	Full substitution from existing to efficient tech Exi : Interp(2014, 86.18, 2030, 0) Eff : Remainder(100)	Efficient technology is assumed to have 20% less final energy intensity than existing one.
Heating		
Electric kettle	Full substitution from existing to efficient tech Exi : Interp(2014, 84.78, 2030, 0) Eff : Remainder(100)	Efficient technology is assumed to have 20% less final energy intensity than existing one.

Electric water heater	Full substitution from existing to efficient tech Exi : Interp(2014, 94.55, 2030, 0) Eff : Remainder(100)	
Solar water heater (SWH)	Assumed to penetrate the market to 30% of households SWH: Interp(2014, 0, 2030, 30) Full substitution from existing to efficient tech Exi : Interp(2014, 100, 2030, 0) Eff : Remainder(100)	Efficient technology is assumed to have 20% less final energy intensity than existing one.
Electric air Heater	Assumed existing technology is phaseout to 50% in 2030. Substitution with efficiency technology and its percentage as given below; Exi : 100 Eff : Remainder(100)	Efficient technology is assumed to have 20% less final energy intensity than existing one.
Entertainment		
TV CRT (box TV)	Full substitution from CRT to LCD Exi : Interp(2014, 69.89, 2030, 0) Eff : Remainder(100) Eff : Remainder(100)	Efficient technology is assumed to have 20% less final energy intensity than existing one.
TV LCD (flat screen TV)		
Video/DVD player		
Radio		
Computer		
Hi-fi system		
Mobile phone		
Cleaning		
Washing machine	Full substitution from existing to efficient tech Exi : Interp(2014,94.44, 2030, 0) Eff : Remainder(100)	Efficient technology is assumed to have 20% less final energy intensity than existing one.
Vacuum cleaner	Full substitution from existing to efficient tech Exi : Interp(2014, 100, 2030, 0) Eff : Remainder(100)	Efficient technology is assumed to have 20% less final energy intensity than existing one.
Other appliances		
Water pump		

Electric iron	Full substitution from existing to efficient tech Exi : Interp(2014, 98.55, 2030, 0) Eff : Remainder(100)	Efficient technology is assumed to have 20% less final energy intensity than existing one.

Table 3B: Assumptions for Medium Energy Efficiency (MEE) Scenario

Appliance	Assumptions: MEE Scenario	
	% of household owning the EE appliances in 2030	**Final energy intensity (kWh/yr)**
Lighting technologies		
Incandescent light bulb	Assumed remain 30% and phaseout of incandescent lamp. Substitution with following technology and its percentage as given below; Incandescent: Interp(2014, 100, 2030, 30) CFL : Interp(2014, 0, 2030, 50) LED : Remainder(100)	Incandescent to CFL: Final energy intensity reduces by 80% Incandescent to LED: Final energy intensity reduces by 90%
Fluorescent light bulb	Assumed remain 30% and phaseout of Fluorescent lamp. Substitution with following technology and its percentage as given below; Fluorescent : Interp(2014, 100, 2030, 30) CFL : Interp(2014, 0, 2030, 0) LED : Remainder(100)	FLS to CFL: Final energy intensity reduces by 50% FLS to LED: Final energy intensity reduces by 75%
Compact fluorescent light bulb	Assumed remain 40% and phaseout of CFL lamp. Substitution with following technology and its percentage as given below; CFL : Interp(2014, 100, 2030, 40) LED : Remainder(100)	.-CFL replaced by LED: final energy intensity reduces by 50%

LED	Assumed to penetrate the market to 20% of households LED : Interp(2014, 0, 2030, 20)	Assume constant
Kerosene light bulb		
Cooking appliances		
Electric cooking stove	Assumed existing technology is phaseout to 50% in 2030. Substitution with efficiency technology and its percentage as given below; Exi : Interp(2014, 100, 2030, 50) Eff : Remainder(100)	Efficient technology is assumed to have 20% less final energy intensity than existing one.
Rice cooker	Assumed existing technology is phaseout to 50% in 2030. Substitution with efficiency technology and its percentage as given below; Exi : Interp(2014, 90, 2030, 50) Eff : Remainder(100)	Efficient technology is assumed to have 20% less final energy intensity than existing one.
Microwave oven	Assumed existing technology is phaseout to 50% in 2030. Substitution with efficiency technology and its percentage as given below; Exi : Interp(2014, 100, 2030, 50) Eff : Remainder(100)	Efficient technology is assumed to have 20% less final energy intensity than existing one.
Biomass Stove, kg/month	Assumed 90% of efficiency tech substitutes the exiting tech in 2030 Exi : Interp(2014, 46.7, 2030, 10) Eff : Remainder(100)	Efficient technology is assumed to have 20% less final energy intensity than existing one.
Improve biomass stove		
Charcoal , kg/month	Assumed 90% of efficiency tech substitutes the exiting tech in 2030 Exi : Interp(2013, 50, 2030, 10) Eff : Remainder(100)	Efficient technology is assumed to have 20% less final energy intensity than existing one.

LPG Stove, kg/month/ one big gas tank	Assumed existing technology is phaseout to 50% in 2030. Substitution with efficiency technology and its percentage as given below; Exi : Interp(2014, 100, 2030, 50) Eff : Remainder(100)	
Kerosene Stove		
Cooling appliances		
AC	Assumed existing technology is phaseout to 40% in 2030. Substitution with efficiency technology and its percentage as given below; Exi : Interp(2014, 93.1, 2030, 40) Eff : Remainder(100)	Efficient technology is assumed to have 20% less final energy intensity than existing one.
Refrigerator	Assumed existing technology is phaseout to 30% in 2030. Substitution with efficiency technology and its percentage as given below; Exi : Interp(2014, 40, 2030, 30) Eff : Remainder(100)	Efficient technology is assumed to have 20% less final energy intensity than existing one.
Electric fan	Assumed existing technology is phaseout to 40% in 2030. Substitution with efficiency technology and its percentage as given below; Exi : Interp(2014, 86.18, 2030, 40) Eff : Remainder(100)	Efficient technology is assumed to have 20% less final energy intensity than existing one.
Heating		
Electric kettle	Assumed existing technology is phaseout to 50% in 2030. Substitution with efficiency technology and its percentage as given below; Exi : Interp(2014, 84.78, 2030, 50) Eff : Remainder(100)	Efficient technology is assumed to have 20% less final energy intensity than existing one.

Electric water heater	Assumed existing technology is phaseout to 50% in 2030. Substitution with efficiency technology and its percentage as given below; Exi : Interp(2014, 94.55, 2030, 50) Eff : Remainder(100)	
Solar water heater (SWH)	Assumed existing technology is phaseout to 50% in 2030. Substitution with efficiency technology and its percentage as given below; Exi : Interp(2014, 100, 2030, 50) Eff : Remainder(100)	Efficient technology is assumed to have 20% less final energy intensity than existing one.
Electric air Heater	Assumed existing technology is phaseout to 50% in 2030. Substitution with efficiency technology and its percentage as given below; Exi : Interp(2014, 100, 2030, 50) Eff : Remainder(100)	Efficient technology is assumed to have 20% less final energy intensity than existing one.
Entertainment		
TV CRT (box TV) TV LCD (flat screen TV)	Assumed existing technology is phaseout to 40% in 2030. Substitution with efficiency technology and its percentage as given below; Exi : Interp(2014, 69.89, 2030, 40) Eff : Remainder(100)	Efficient technology is assumed to have 20% less final energy intensity than existing one.
Video/DVD player		
Radio		
Computer		
Hi-fi system		
Mobile phone		
Cleaning		
Washing machine	Assumed existing technology is phaseout to 40% in 2030. Substitution with efficiency technology and its percentage as given below; Exi : Interp(2014, 94.44, 2030, 40) Eff : Remainder(100)	Efficient technology is assumed to have 20% less final energy intensity than existing one.

Vacuum cleaner	Assumed existing technology is phaseout to 40% in 2030. Substitution with efficiency technology and its percentage as given below; Exi : Interp(2014, 100, 2030, 40) Eff : Remainder(100)	Efficient technology is assumed to have 20% less final energy intensity than existing one.
Other appliances		
Water pump		
Electric iron	Assumed existing technology is phaseout to 50% in 2030. Substitution with efficiency technology and its percentage as given below; Exi : Interp(2014, 98.55, 2030, 50) Eff : Remainder(100)	Efficient technology is assumed to have 20% less final energy intensity than existing one.

Appendix C

Survey questionnaire

ມະຫາວິທະຍາໄລແຫ່ງຊາດ

ເລກທີແບບສອບຖາມ:--------------------------------------

ລະຫັດ ID: --------------------------------------

ວັນທີ/ເດືອນ/ປີ: --------------------------------------

ຂອບເຂດ/ ຊຸມຊົນ: --------------------------------------

ສະບາຍດີ, ຂ້າພະເຈົ້າຊື່ .... ແລະຂ້າພະເຈົ້າກຳລັງເຮັດບົດສຶກສາສຳຫລັບມະຫາວິທະຍາໄລແຫ່ງຊາດ, ຄະນະວິສະວະກຳສາດ. ຈຸດປະສົງຂອງການສຶກສານີ້ແມ່ນຄົ້ນຄວ້າເຖິງການໃຊ້ເຊື້ອໄຟ ແລະການຄາດຄະເນເຖິງການໃຊ້ເຊື້ອໄຟໃນອານາຄົດຂອງຄອບຄົວຂອງທ່ານ. ການສຶກສານີ້ໄດ້ດຳເນີນໃນ 5 ປະເທດລຸ່ມແມ່ນ້ຳຂອງ ເຊິ່ງລວມມີ: ລາວ, ໄທ, ຫວຽດນາມ, ກຳປູເຈຍແລະມຽນມາ.

ຂ້າພະເຈົ້າຈະໃຊ້ເວລາບໍ່ເກີນ 20 ນາທີໃນການເກັບຂໍ້ມູນຄັ້ງນີ້. ຂໍ້ມູນທັງໝົດນີ້ຈະຖືກເກັບເປັນຄວາມລັບ. ທ່ານ ແລະຄອບຄົວຂອງທ່ານທີ່ກ່ຽວຂ້ອງຈະບໍ່ມີຜົນກະທົບໃດໆຈາກຜົນຂອງການສຶກສານີ້. ຖ້າຫາກມີຄຳຖາມໃດທີ່ທ່ານບໍ່ປະສົງທີ່ຈະຕອບ, ທ່ານສາມາດກະທຳໄດ້ໂດຍທີ່ທາງເຮົາຈະບໍ່ຖາມເຖິງເຫດຜົນ. ສຸດທ້າຍນີ້ຖ້າທ່ານມີຄຳຖາມຫລືຂໍ້ຄິດເຫັນໃດໆໃນການສຶກສາຄັ້ງນີ້, ກໍ່ສາມາດລະບຸໄດ້.

ຂໍຂອບໃຈເປັນຢ່າງສູງໃນການໃຫ້ຮ່ວມມື.

ໝວດ A. ຂໍ້ມູນທົ່ວໄປ

ຜູ້ສຳພາດ: *ຂ້າພະເຈົ້າຕ້ອງການຢາກຈະສຳພາດຂໍ້ມູນທີ່ກ່ຽວຂ້ອງກັບທ່ານແລະຄອບຄົວຂອງທ່ານ.*

ຊື່:			
A01	ເພດ	☐ ຊາຍ☐ຍິງ	
A02	ອາຍຸ	☐ 18 – 29☐ 30 – 39☐ 40 – 49 ☐ 50 – 59☐ 60+	
	ທ່ານແມ່ນຜູ້ທີ່ຫາລາຍໄດ້ຫລັກຂອງຄອບຄົວຫລືບໍ່?	☐ແມ່ນ ☐ບໍ່ແມ່ນ	→ ຂ້າມໄປຄຳຖາມ A05 → A04
A04	ຖ້າບໍ່ແມ່ນ, ທ່ານມີຄວາມສຳພັນຍັງກັບຜູ້ທີ່ຫາລາຍໄດ້ຫຼັກໃນຄອບຄົວຂອງທ່ານ?	☐ຜົວ ຫຼື ເມຍ☐ລູກຊາຍຫຼື ລູກສາວ ☐ພໍ່ ຫຼື ແມ່ ☐ຜູ້ອື່ນໆ (ກະລຸ	

		ນາຊ ່ ວຍບອກ)________
A05	ອາຊ ີ ບຫ ຼ ກຂອງຜ ູ ້ ທ ີ່ ຫາລາຍໄດ ້ ຫ ຼ ັກໃນຄອບຄ ົ ວຂອງທ ່ ານແມ ່ ນ ຫຍ ັ ງ?	□ກະເສດຕະກອນ □ກຳມະກອນ □ຜ ູ ້ ຂາຍຍ ່ ອຍ □ພະນ ັ ກງານລ ັ ດ, ອາຈານຫລ ື ຜ ູ ້ ຊ ່ ຽວຊານ ດ ້ ານອ ື່ ນ □ເຈ ົ ້ າຂອງກ ິ ດຈະການ □ ຫວ ່ າງງານ □ກະສຽນອບັກ□ອ ື່ ນໆ (ກະລ ຸ ນາຊ ່ ວຍ ບອກ)_________
A06	ລະດ ັ ບການສ ຶ ກສາຂອງຜ ູ ້ ທ ີ່ ຫາລາຍ ໄດ ້ ຫ ຼ ັກໃນຄອບຄ ົ ວຂອງທ ່ ານແມ ່ ນ	□ການສ ຶ ກສານອກລະບ ົ ບ□ປະຖ ົ ມ□ມ ັ ດທະຍ ົ ມ □ວ ິ ທະຍາໄລຫ ຼ ື ມະຫາວ ິ ທະຍາໄລ□ບ ໍ່ ຮ ູ ້
A07	ແມ ່ ນໃຜເປ ັ ນຜ ູ ້ ຕ ັ ດສ ິ ນໃຈເລ ື ອກ ໃຊ ້ ເຄ ື່ ອງໃຊ ້ ໄຟຟ ້ າໃນຄອບຄ ົ ວຂອງ ທ ່ ານ?	□ ຂ ້ ອຍເອງ□ຜ ົ ວ ຫ ຼ ື ເມຍ□ລ ູ ກຊາຍ ຫ ຼ ື ລ ູ ກສາວ □ຕ ັ ດສ ິ ນໃຈຮ ່ ວມກ ັ ນ □ຜ ູ ້ ອ ື່ ນ (ກະລ ຸ ນາຊ ່ ວຍ ບອກ)______________________
A08	ແມ ່ ນໃຜໃນຄອບຄ ົ ວຂອງທ ່ ານເປ ັ ນ ຜ ູ ້ ຕ ັ ດສ ິ ນໃຈໃນການເລ ື ອກໃຊ ້ ເຊ ື້ ອໄຟເຊ ັ່ ນວ ່ າການປ ຸ ່ ງແຕ ່ ງອາ ຫານ ຫ ຼ ື ໃຫ ້ ຄວາມສະຫວ ່ າງໃນຄ ົ ວ ເຮ ື ອນ?	□ຕ ົ ວຂ ້ ອຍເອງ□ຜ ົ ວ ຫ ຼ ື ເມຍ □ລ ູ ກຊາຍຫ ຼ ື ລ ູ ກສາວ□ຕ ັ ດສ ິ ນໃຈ ຮ ່ ວມກ ັ ນ □ຜ ູ ້ ອ ື່ ນ (ກະລ ຸ ນາຊ ່ ວຍ ບອກ)______________________
A09	ສະມາຊ ິ ກໃນຄອບຄ ົ ວຂອງທ ່ ານມ ີ ຈ ັ ກ ຄ ົ ນ?	
A10	ມ ີ ຈ ັ ກຄ ົ ນໃນຄອບຄ ົ ວຂອງທ ່ ານທ ີ່ ມ ີ ອາຍ ຸ ຕ ່ ຳກວ ່ າ 16 ປ ີ ?	
A11	ມ ີ ຈຳນວນຈ ັ ກຄ ົ ນໃນຄອບຄ ົ ວຂອງ ທ ່ ານທ ີ່ ສາມາດຫາລາຍໄດ ້ ເຂ ົ້ າມາ ໃນຄອບຄ ົ ວ?	
A12	ໂດຍສະເລ ່ ຍແລ ້ ວລາຍໄດ ້ ແຕ ່ ລະ ເດ ື ອນໃນຄອບຄ ົ ວຂອງທ ່ ານມ ີ ເທ ົ່ າ ໃດ?	□< 480,000 (60 USD) □ 480,000–960,000 (61–120 USD) □ 960,000–1,440,000 (121 – 180 USD) □ 1,440,000–2,120,000 (181–240 USD) □ 2,120,000–2,400,000 (241–300 USD) □ 2,400,000–2,880,000 (301-360 USD) □ 2,880,000–3,360,000 (361–420 USD)

		□ 3,360,000–3,840,000 (421–480 USD) □ 3,840,000–4,320,000 (481–540 USD) □ 4,320,000–4,800,000 (541–600 USD) □> 4,800,000 □ບໍ່ສາມາດປະມານໄດ້

ໝວດ B. ການໃຊ້ພະລັງງານໃນຄົວເຮືອນ

ຜູ້ສຳພາດ: *ຂ້າພະເຈົ້າຢາກຈະສຳພາດກ່ຽວກັບການໃຊ້ພະລັງງານໃນຄົວເຮືອນຂອງທ່ານ*

ໃນເດືອນທີ່ຜ່ານມາ, ຄ່າໃຊ້ຈ່າຍໃນຄອບຄົວຂອງທ່ານແມ່ນແນວໃດ?..		
B1	ເຄຫະສະຖານ, ທີ່ຢູ່ອາໄສ (ລວມທັງ: ປັບປຸງ, ບ່ອນແປງ ອຸປະກອນ/ເຄື່ອງໃຊ້ໃນຄົວເຮືອນ.....)	
B2	ອາຫານແລະການແຕ່ງຢູ່ຄົວກິນ (ລວມທັງ: ເຂົ້າ)	
B3	ເຊື້ອໄຟ ສຳລັບປຸງແຕ່ງເຊັ່ນ: ຖ່ານ, ຟືນ ອື່ນໆ	
B4	ຄ່າໄຟຟ້າ	
B5	ຄົມມະນາຄົມ ຫຼືຄ່າເດີນທາງ (ລວມເຖິງເຊື້ອໄຟ)	
B6	ຄ່ານ້ຳປະປາ	
B7	ຄ່າການສຶກສາ(ລວມເຖິງຄ່າລົງທະບຽນແລະອຸປະກອນທີ່ໃຊ້ໃນການຮຽນ)	
B8	ເຄື່ອງນຸ່ງຫົ່ມ&ເຄື່ອງໃຊ້ໃນຄົວເຮືອນ (ສະບູ່, ແຟັບ, ເຄື່ອງສຳອາງ, ເສື້ອຜ້າ,ຖ້ວຍ, ໆລໆ)	
B9	ການປິ່ນປົວພະຍາດ	
B10	ຝາກປະຢັດ, ກອງທຶນ, ການລົງທຶນ ອື່ນໆ	
B11	ລາຍຈ່າຍອື່ນໆ (ກະລຸນາຊ່ວຍ ບອກ)...	

ຜູ້ສຳພາດ: *ສະເພາະການນຳໃຊ້ພະລັງງານໄຟຟ້າ*

B12	ທ່ານຈ່າຍຄ່າໄຟຟ້າແບບໃດ?			□ຈ່າຍລ່ວງໜ້າ □ຫຼັງຈາກໄດ້ຮັບໃບບິນ		
B13	ວິທີການຈ່າຍຄ່າໄຟຟ້າຕົ້ນຕໍແມ່ນ			□ອາທິດ□ເດືອນ □ງວດ□ຫຼັງຈາກຫາເງິນໄດ້ □ບໍ່ໄດ້ຈ່າຍ		
B14	ໄຟຟ້າໃນຄົວເຮືອນຂອງທ່ານ ມາເປັນປົກກະຕິຫຼືບໍ່?	ບໍ່ມາ □	ດົນໆມາ □	ມາບາງຄັ້ງ □	ຂ້ອນຂ້າງປົກກະຕິ □	ມາເປັນປົກກະຕິ □

B15	ທ ່ານຄ ິດວ ່າຄ ່າໄຊ ້ໄຟຟ ້າ ແລະເຊ ື້ອໄຟໃນຄອບຄ ົວຂອງ ທ ່ານສ ົມດ ຸນກ ັບລາຍຮ ັບ ທ ີ່ ຫາມາໄດ ້ຫລ ືບ ໍ່, ຮ ັບໄດ ້ຫ ຼືບ ໍ່?	ຮ ັບ ບ ໍ່ ໄດ ້ ☐	ຮ ັບໄດ ້ໜ ້ອຍໜ ື່ງ ☐	ພ ໍຮ ັບ ໄດ ້ ☐	ຮ ັບ ໄດ ້ ☐	ບ ໍ່ມ ີ ບ ັນຫາ ☐

ຜ ູ້ສຳພາດ: ລຳຫ ຼັບການປ ຸ່ງແຕ ່ງອາຫານ, *ທ ່ານໃຊ ້ຫຍ ັງດ ັ່ງລ ຸ່ມນ ີ້**** ຖ ່າຍຮ ູບພ ້ອມ***

B16	ເຕ ົາແບບທຳມະດາ	☐ ໃຊ ້ ☐ ບ ໍ່ໃຊ ້
B17	ເຕ ົາຟ ືນຫ ຼືເຕ ົາຖ ່ານແບບປະຢ ັດ	☐ ໃຊ ້ ☐ ບ ໍ່ໃຊ ້
B18	ໝ ໍ້ກະທະໄຟຟ ້າ	☐ ໃຊ ້ ☐ ບ ໍ່ໃຊ ້
B19	ໝ ໍ້ຫ ຸງເຂ ົ້າ	☐ ໃຊ ້ ☐ ບ ໍ່ໃຊ ້
B20	ເຕ ົາກ ໍາສ (LPG)	☐ ໃຊ ້ ☐ ບ ໍ່ໃຊ ້
B21	ເຕ ົານ ້ຳມ ັນກ ໍາສ	☐ ໃຊ ້ ☐ ບ ໍ່ໃຊ ້
B22	ເຕ ົາອ ົບທ ີ່ວໄປ/ໄມໂຄເວບ	☐ ໃຊ ້ ☐ ບ ໍ່ໃຊ ້

ຜ ູ້ສຳພາດ:*ສຳຫ ຼັບໃຫ ້ຄວາມສະຫວ ່າງ, ທ ່ານໃຊ ້ຫຍ ັງດ ັ່ງລ ຸ່ມນ ີ້**** ຖ ່າຍຮ ູບພ ້ອມ***

B23	ທຽນ	☐ ໃຊ ້ ☐ ບ ໍ່ໃຊ ້
B24	ໝ ໍ້ໄຟ ຫ ຼືໄຟສາຍ	☐ ໃຊ ້ ☐ ບ ໍ່ໃຊ ້
B25	ຕະກຽງ	☐ ໃຊ ້ ☐ ບ ໍ່ໃຊ ້
B26	ດອກໄຟປ ້ອມ	☐ ໃຊ ້ ☐ ບ ໍ່ໃຊ ້
B27	ດອກໄຟນ ີອອນ	☐ ໃຊ ້ ☐ ບ ໍ່ໃຊ ້
B28	ດອກໄຟປະຢ ັດ(ດອກຕະກຽບ)	☐ ໃຊ ້ ☐ ບ ໍ່ໃຊ ້
B29	ດອກແສງໄດໂອດ(ດອກ LED)	☐ ໃຊ ້ ☐ ບ ໍ່ໃຊ ້

ຜ ູ້ສຳພາດ: *ຢ ູ່ໃນຄ ົວເຮ ືອນຂອງທ ່ານມ ີຫ ຼືໃຊ ້ເຄ ື່ອງ ປະກອນໄຟຟ ້າດ ັ່ງລ ຸ່ມນ ີ້ຫ ຼືບ ໍ່*

B30	ໂທລະທ ັດ (ແບບທຳມະດາ)	☐ ໃຊ ້ ☐ ບ ໍ່ໃຊ ້
B31	ໂທລະທ ັດຈ ໍ LCD/LED	☐ ໃຊ ້ ☐ ບ ໍ່ໃຊ ້
B32	ໂທລະສ ັບມ ືຖ ື/ Tablet	☐ ໃຊ ້ ☐ ບ ໍ່ໃຊ ້
B33	ຕ ູ້ເຢ ັນ	☐ ໃຊ ້ ☐ ບ ໍ່ໃຊ ້
B34	ວ ິທະຍ ຸ	☐ ໃຊ ້ ☐ ບ ໍ່ໃຊ ້
B35	ເຄ ື່ອງຫ ຼິ້ນCD/DVD	☐ ໃຊ ້ ☐ ບ ໍ່ໃຊ ້
B36	ຄອມພ ິວເຕ ີ/ Laptop	☐ ໃຊ ້ ☐ ບ ໍ່ໃຊ ້

B37	ພັດລົມ	□ ໃຊ້ □ ບໍ່ໃຊ້
B38	ເຄື່ອງປັບອາກາດ	□ ໃຊ້ □ ບໍ່ໃຊ້
B39	ກາຕົ້ມນ້ຳໄຟຟ້າແບບປະຢັດ/ແບບທຳມະດາ	□ ໃຊ້ □ ບໍ່ໃຊ້
B40	ເຕົາລີດ	□ ໃຊ້ □ ບໍ່ໃຊ້
B41	ເຄື່ອງເຮັດນ້ຳອຸ່ນໄຟຟ້າ	□ ໃຊ້ □ ບໍ່ໃຊ້
B42	ເຄື່ອງເຮັດນ້ຳອຸ່ນພະລັງງານແສງຕາເວັນ	□ ໃຊ້ □ ບໍ່ໃຊ້
B43	ຈັກຊັກເຄື່ອງ	□ ໃຊ້ □ ບໍ່ໃຊ້
B44	ປໍ້ານ້ຳໄຟຟ້າ	□ ໃຊ້ □ ບໍ່ໃຊ້
B45	ເຄື່ອງດູດຝຸ່ນ	□ ໃຊ້ □ ບໍ່ໃຊ້
B46	ເຄື່ອງຂະຫຍາຍສຽງ	□ ໃຊ້ □ ບໍ່ໃຊ້
B47	ເຄື່ອງເຮັດອາຍອຸ່ນ(ເຕົາຜິງໄຟໄຟ້)	□ ໃຊ້ □ ບໍ່ໃຊ້
B48	ອື່ນໆ (ກະລຸນາຊີ້ບອກ)	

ໝວດ C. ຜົນກະທົບ

ຜູ້ສຳພາດ: *ທ່ານຈະມີວິທີໃດໃນການໃຊ້ຈ່າຍເງິນທີ່ສາມາດຫາມາເພີ່ມດ້ວຍວິທີໃດ, ຖ້າຫາກທ່ານຈ່າຍຄ່າໄຟຟ້າຫຼືຄ່າເຊື້ອເພີງອື່ນຫລຸດລົງ*

C1	ທ່ານໄດ້ສັງເກດບໍ່ວ່າຄ່າປັ່ນໄຟໃນຄົວເຮືອນຂອງທ່ານໃນ 6ເດືອນທີ່ຜ່ານມາ ເປັນແນວໃດ?	□ຫຼຸດລົງ □ເພີ່ມຂຶ້ນ □ພໍປານເກົ່າ □ບໍ່ຮູ້ □ ຂຶ້ນໆ-ລົງໆ	→C2,C3 [ບໍ່ຕ້ອງຖາມຂໍ້ C4] →ຂ້າມໄປC4 →ຂ້າມໄປC4 →ຂ້າມໄປC4 →ຍ້ອນຫຍັງ, ຊ່ວງໃດ?
C2	ຍ້ອນສາເຫດອັນໃດຈຶ່ງເຮັດໃຫ້ຄ່າໄຟຟ້າໃນຄົວເຮືອນຂອງທ່ານຫຼຸດລົງ?		
C3	ເມື່ອພວກທ່ານສາມາດປະຢັດເງິນຈາກຄ່າໄຟຟ້າໄດ້, ຂ້າພະເຈົ້າສົນໃຈວ່າ, ພວກທ່ານຈະນຳເອົາເງິນເຫຼົ່ານັ້ນໄປເຮັດຫຍັງໃນລາຍການດັ່ງສະໂດ້ສະເໜີມານີ້? ແລະທ່ານຈະໃຫ້ເປີເຊັນຄວາມສຳຄັນຂອງລາຍການດັ່ງກ່າວຄືແນວໃດ?	.......ເຄຫະສະຖານ, ທີ່ຢູ່ອາໄສ ....ອາຫານ ....ເຊື້ອໄຟເຊັ່ນ: ຖ່ານ, ຟືນອື່ນໆ ....ເຄື່ອງໃຊ້ໄຟຟ້າ ....ຄົມມະນາຄົມ ....ການສຶກສາ ....ເຄື່ອງນຸ່ງຫົ່ມ&ເຄື່ອງໃຊ້ສ່ວນຕົວ	

		.......ການປ ່ ່ ນປ ້ ອພະຍາດ ....ຝາກປະຍ ັ ດ ແລະການລ ົ ງທ ຶ ນ ....ບ ໍ່ ່ ຮ ູ ້ ....ອ ື ່ ນໆ (ກະລ ຸ ນາຊ ່ ອຍບອກ)
	ກ ່ ລະນ ີ ພ ່ ປານເກ ່ າ: ຍ ້ ອນສາເຫດ?	
	ກ ່ ລະນ ີ ເພ ີ່ ມຂ ື້ ນ: ຍ ້ ອນສາເຫດ?	
	ກ ່ ລະນ ີ ບ ໍ່ ຮ ູ ້ : ຍ ້ ອນສາເຫດ?	
C4	ສ ົ ມມ ຸ ດ ພວກທ ່ ານສາມາດປະຢ ັ ດເງ ິ ນຈາກ ຄ ່ າໄຟຟ ້ າໄດ ້ , ຂ ້ າພະເຈ ົ ້ າສ ົ ນໃຈວ ່ າ, ພວກທ ່ ານຈະນຳເອ ົ າເງ ິ ນເຫ ຼ ົ ່ ານ ັ ້ ນໄປ ເຮ ັ ດຫຍ ັ ງໃນລາຍການດ ັ ່ ງສະໄດ ້ ສະເໜ ີ ມາ ນ ີ ້ ? ແລະທ ່ ານຈະໃຫ ້ ເປ ີ ເຊ ັ ນຄວາມ ສຳຄ ັ ນຂອງລາຍການດ ັ ່ ງກ ່ າວຄ ື ແນວໃດ?	.......ເຄຫະສະຖານ, ທ ີ່ ່ ຢ ູ ່ ອາໄສ ....ອາຫານ ....ເຊ ື ້ ອໄຟ ເຊ ັ ່ ນ: ຖ ່ ານ, ຟ ື ນ ອ ື ່ ນໆ ....ເຄ ື ່ ອງໃຊ ້ ໄຟຟ ້ າ ....ຄ ົ ມມະນາຄ ົ ມ ....ການສ ຶ ກສາ .... ເຄ ື ່ ອງນ ຸ ່ ງຫ ົ ່ ມ&ເຄ ື ່ ອງໃຊ ້ ສ ່ ວນຕ ົ ວ ....ການປ ິ ່ ນປ ົ ວພະຍາດ ....ຝາກປະຍ ັ ດ ແລະການລ ົ ງທ ຶ ນ ....ບ ໍ່ ່ ຮ ູ ້ ....ອ ື ່ ນໆ (ກະລ ຸ ນາຊ ່ ອຍບອກ)

C5	ສ ົ ມມ ຸ ດວ ່ າທ ່ ານ ສາມາດປະຢ ັ ດເງ ິ ນໄດ ້ ຈາກການຫ ຼຸ ດຜ ່ ອນຈ ່ າຍຄ ່ າໄຟຟ ້ າ, ທ ່ ານມ ີ ຄວາມຕ ້ ອງການຢາກເຮ ັ ດຫຍ ັ ງ ຫ ຼ າຍທ ີ່ ່ ສ ຸ ດໃນລາຍການດ ັ ່ ງຕ ໍ່ ່ ໄປ ນ ີ ້ ?	□ໃຊ ້ ເຄ ື່ ່ ອງໃຊ ້ ທ ີ່ ່ ມ ີ ຢ ູ ່ ແລ ້ ວ □ຊ ື ້ ເຄ ື່ ່ ອງໃຊ ້ ທ ີ ່ ຍ ັ ງບ ໍ່ ່ ທ ັ ນ ເຄ ີ ຍມ ີ □ປ ັ ບປ ຸ ງ/ປ ່ ຽນ ເຄ ື ່ ອງໃຊ ້ ທ ີ ່ ເກ ົ ່ າ □ບ ໍ່ ່ ຮ ູ ້ □ ອ ື ່ ນໆ (ກະລ ຸ ນາຊ ່ ອຍ ບອກ)…………………
C6	ສ ົ ມມ ຸ ດວ ່ າທ ່ ານສາມາດປະຢ ັ ດເງ ິ ນໄດ ້ ເດ ື ອນລະ 80,000ກ ີ ບ, ຢາກຮ ູ ້ ວ ່ າ: ທ ່ ານ ຈະນຳເອ ົ າເງ ິ ນຈຳນວນດ ັ ່ ງກ ່ າວໄປໃຊ ້ ເຮ ັ ດຫຍ ັ ງໃນລາຍການທ ີ ່ ໃຫ ້ ມາ ດ ັ ່ ງນ ີ ້ ? ກະລ ຸ ນາ ໃຫ ້ ລະດ ັ ບຄວາມ ສຳຄ ັ ນແຕ ່ 1-9. ໝາຍເຫດ: "1" ໝາຍເຖ ິ ງ: ສ ໍ າຄ ັ ນຫ ຼ າຍ	.......ເຄຫະສະຖານ, ທ ີ່ ່ ຢ ູ ່ ອາໄສ ....ອາຫານ ....ເຊ ື ້ ອໄຟ ເຊ ັ ່ ນ: ຖ ່ ານ, ຟ ື ນ ອ ື ່ ນໆ ....ເຄ ື ່ ອງໃຊ ້ ໄຟຟ ້ າ ....ຄ ົ ມມະນາຄ ົ ມ ....ການສ ຶ ກສາ

	"9" ໝາຍເຖິງ: ສໍາຄັນໜ້ອຍທີ່ສຸດ	.... ເຄື່ອງນຸ່ງຫົ່ມ&ເຄື່ອງໃຊ້ສ່ວນຕົວ ....ການປິ່ນປົວພະຍາດ ....ຝາກປະຢັດ ແລະການລົງທຶນ ....ບໍ່ຮູ້ ....ອື່ນໆ (ກະລຸນາຊ່ວຍບອກ)

ສຸດທ້າຍນີ້, ທ່ານຄິດວ່າຍັງມີຫຍັງເພີ່ມເຕີມອີກບໍ່ ໃນການສໍາພາດຄັ້ງນີ້ ທີ່ຍັງບໍ່ທັນຄົບຖ້ວນກ່ຽວກັບການນໍາໃຊ້ພະລັງງານໄຟຟ້າແລະເຊື້ອໄຟອື່ນໆ?

ຂໍຂອບໃຈເປັນຢ່າງສູງໃນການໃຫ້ຄວາມຮ່ວມມື!

Appendix D

LECS V's Survey results

Expenditure items	Rural areas				Urban areas				Lao PDR average
	Poor	Non-poor, below twice poverty line	Non-poor, above twice poverty line	Rural average	Poor	Non-poor, below twice poverty line	Non-poor, above twice poverty line	urban average	
Food	83.6	75.1	60.6	**73**	79.5	70.8	**56.2**	**63.6**	**62.71**
Clothes and footwear	0.9	2	2.9	**2**	0.8	2.3	**3.4**	**2.8**	**2.68**
Utilities and fuel	7	6	5	**5.9**	3.8	4.7	**5.3**	**4.9**	**5.19**
Household sundries	1	2.1	3.4	**2.2**	1.6	2.5	**3.9**	**3.2**	**3.41**
Medical care	0.6	1.5	2.8	**1.7**	1.2	1.6	**2.8**	**2.2**	**2.51**
Transport and communication	3.8	7.4	14.5	**8.6**	8.5	11.1	**16.1**	**13.6**	**13.13**
Education	0.1	0.5	1	**0.5**	0.4	0.7	**2.1**	**1.4**	**1.22**
Personal care items	0.5	0.9	2	**1.1**	0.8	1.2	**2.7**	**2**	**1.98**
Recreation and culture	0.3	0.9	1.9	**1**	0.8	1.4	**3**	**2.2**	**2.43**
Alcohol and tobacco	1.7	3.2	5.4	**3.5**	2.2	3.2	**4.1**	**3.6**	**4.26**
Miscellaneous	0.4	0.4	0.6	**0.5**	0.3	0.5	**0.5**	**0.5**	**0.48**