

Household energy consumption perspectives for MECON group in Laos

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Abstract:

Household energy consumption of New Modern Energy CONsumers (MECON) group in Lao PDR is presented in this paper. MECON group is group of people earning between 60-150 USD per month and electrified household with monthly electricity bill less than 7 USD. The forecasted household energy consumption is very important in Laos because household sector represents the highest energy consumption comparing to other sectors. Therefore, energy consumption in household for MECON group is considered for case study for energy policy and planning for household sector because it is the second largest share after the low income group. LEAP is used as tool to simulate the energy consumption in MECON group in LAOS for up to the year 2030.

Keywords: Energy consumption and demand for household; MECON; 2-5 USD income

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1. Introduction

According to data in year 2010, the total populations of Laos were 6.4 million, and in average, there were 5.7 people per household. In urban areas, the average household size is a bit smaller with 5.4 people per household (UNESCAP, 2011). The population with the income of 60-150 USD per month (MECON group) shares about 31%; which is equivalent to 1.852 million people. The group covers the second largest share of total population in Laos, as shown in Fig. 1, (PovcalNet, 2014). Considering, the energy consumption by sector, the energy consumption in residential sector is found to be the largest, followed by transportation sector; covering 51% and 26% of the nation energy consumption, respectively. The percent shares of energy consumption by sectors are shown in Fig. 2.

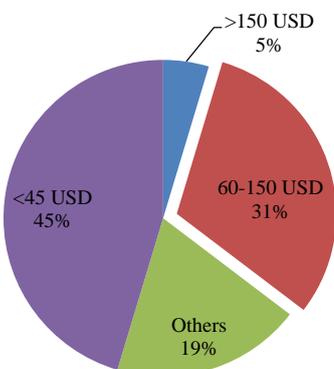


Fig. 1 Percent share MECON population in Lao PDR, (PovcalNet, 2014).

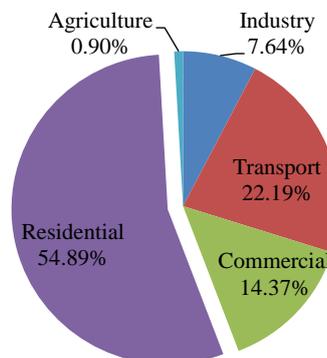


Fig. 2 Energy consumption by sectors in 2010, (MEM, 2010).

As shown in Fig. 3, the traditional fuels, including firewood and charcoal are still main sources of energy used in Lao P.D.R. as they represent about 65.5% of the total energy consumption by fuel type. The traditional fuels which are considered as local energy sources are generally consumed by people for cooking and heating, (LECS4, 2009). Hydro electricity is considered as local energy product and its consumption is about 9.08% of total energy consumption. Considering electrical energy, the largest electricity consumption is in residential sector, covering 42.31% of the overall electricity consumed nationwide, as depicted in Fig. 4, (MEM, 2010).

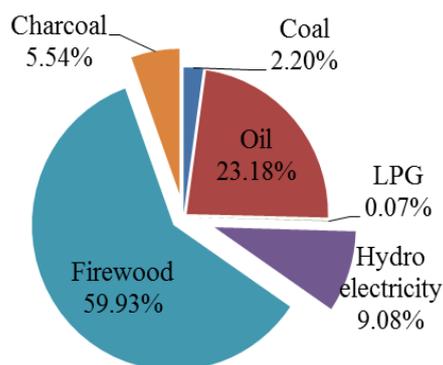


Fig. 3 Energy consumption by fuel type in 2010, (MEM, 2010).

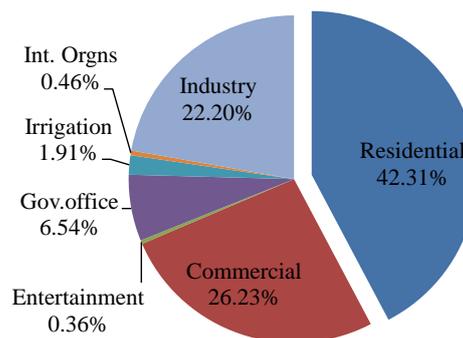


Fig. 4 Electricity consumption by sectors in 2010, (MEM, 2010).

With the main energy uses being in residential sector, household energy consumption perspective plays very important role in enabling the policy makers develop effective and comprehensive energy policy for energy reduction in the country. The MECON group who has growing incomes and improving living standard; would be the main energy consumer in the country.

Long term energy consumption projection of the MECON group up to 2030, requires reliable and considerable amount of data, therefore, the survey must be conducted on household appliances and behavior on energy use in the MECON group.

2. Methodology

In order to conduct the survey with large number of explanatory variables, five main categories influencing residential energy consumption in household were considered including weather and location, physical characteristics of dwelling, appliance and electronic stock, occupancy and occupant behavior, (Kavoursian, et al., 2012). The survey was conducted in three different locations throughout the country, including the northern, middle and southern parts of Laos. The different weather conditions in the 3 regions are expected to alter the energy usage of households in the regions. There are 28 samples for Xieng Khaung province, 175 samples for Vientiane capital, and 72 samples for Champasak province.

2.1 Calculation equation for energy consumption per year

Unit consumption or energy intensity in LEAP, U , can be calculated following Eq. 1.

$$U = \frac{kPt_a}{1000} \quad (1)$$

k	:Coefficient factor for appliance,	[-]
U	: Unit consumption by device,	[kWh/year]
P	: Electric power of device,	[W]
t_a	: Annual usage hour of device,	[h/year]

t_a is experimentally obtained in average for each household device per household of whole survey data.

3. Survey results

From year 2008 to 2012, Lao population increased from 6.14 - 6.65 million people (UNESCAP 2011), there was an average domestic GDP rate between 8 per annum. The economic growth rate between 7.8-8.5 percent during the five-year period has resulted in rising domestic energy consumption, (LECS4, 2009). The energy consumption growth rate is 3.73% per year from 1990-2010, (MEM, 2010).

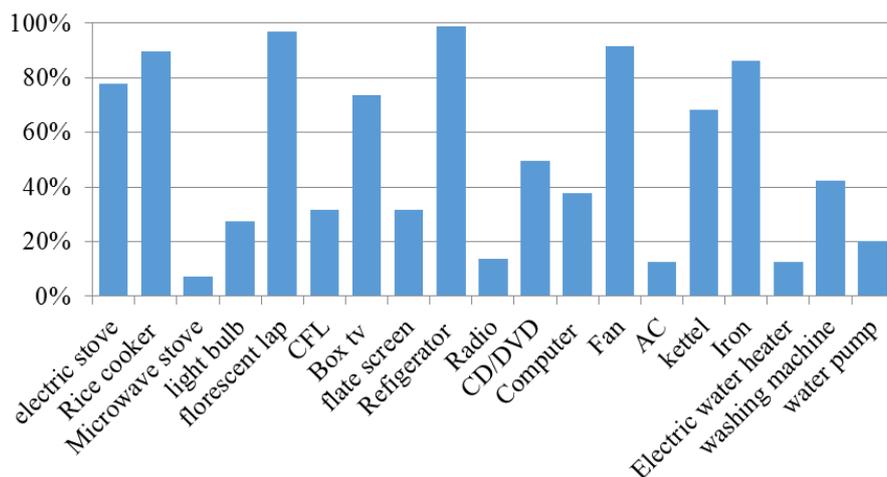


Fig. 5 Activity level of household equipment in MECON group.

According to the MECON household survey results shown in Fig. 5, the activity levels of electric appliances are high because 100%, 99%, 92% and 89% of the houses are equipped electric lamp, refrigerator, fan and rice cooker, respectively. The uses of energy efficient products are in good trend as in lighting, 96.84% and 31.58% of the houses use fluorescent lamps and the more modern CFL and LED lamps, respectively. Energy efficient refrigerators are used in 58% of the houses surveyed.

Besides that, MECON household size in urban is around 4.42 persons with monthly electricity bill of approximately 6.4 USD. Other key parameters using in the LEAP model is given in table 1. The main electric energy consumption of each house is divided into cooking, cooking, lighting, electric appliances, hot water heater, and others, shown in Fig. 6.

Table 1 Key assumption parameters and values

Parameters	Values	Unit
Base year	2013	
End year	2030	
Lao population	6.77	Million people
Population grown rate	2	%
Urban HH size	5.4	people/HH
Urban population share	30.64	%
MECON HH size	4.42	people/HH

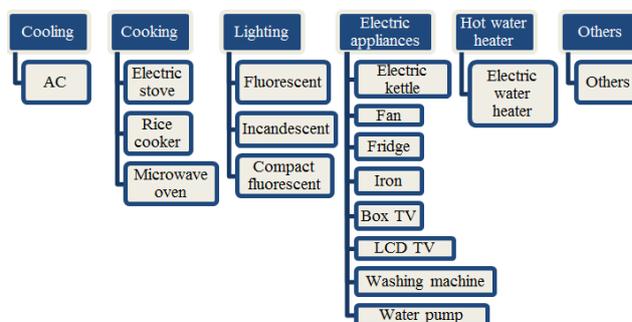


Fig. 6 household appliances groups.

4. Forecasting of Energy demand of MECON household using LEAP

Electricity consumption in HH sector (urban area only) projection from 2014 to 2030 is obtained from the available data of year 2005 to 2013 basing on LINEAR function. It is used for validation of electricity consumption projected using LEAP Model. Therefore, LEAP Model is used for forecasting the electricity consumption in HH up to year 2030, to see the differences of each HH appliances consumption.

The obtained data, such as average time use and number of units of appliance per household (year 2013) from the household survey is used in the LEAP model to forecast the BAU energy consumption in MECON group in year 2030. It is found that the energy consumption is increasing following the growth of population. Energy consumption of MECON group is 604.12 million kWh per year in 2013, and it will be around 1542.15 million kWh per year in 2030 (BAU scenarios). It

means 2.55 times increase in energy consumption in MECON group for household sector. The highest energy consumption is electric appliances, consuming 318.64 kWh (52.7%), followed by 118.42 kWh (19.6%), 90.58 kWh (15%), and 63.5 kWh (10.51%) for lighting, cooking and cooling respectively, illustrated in Fig. 7.

The largest energy consumption devices are fan, fluorescent lamp, and refrigerator, as depicted in Fig. 8. It can be noted that common devices and small energy consumption devices can cause high energy consumption because people tend to use carelessly.

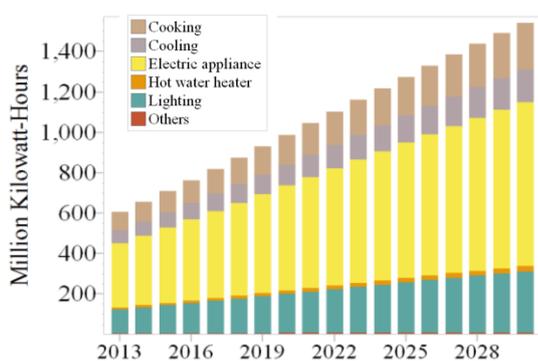


Fig. 7 Group of energy consumption forecasting in MECON household.

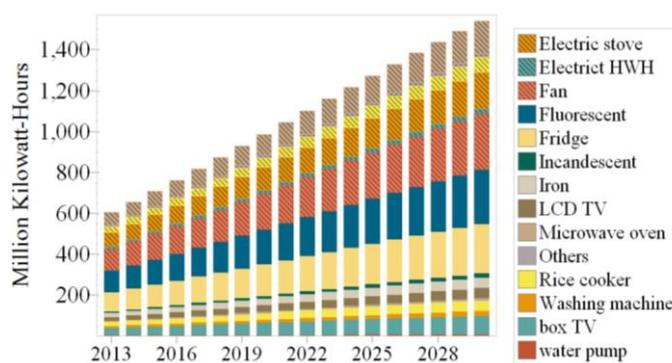


Fig. 8 Household appliances energy consumption forecasting in MECON household.

5. Conclusion

Based on the survey result, the uses of efficient products are in good trend and new products with energy efficient technology are becoming available steadily. The MECON group is growing every year, from 32% in 2009 to 48% in 2030. People having better income tend to buy more electrical products to have more convenient lifestyle and with awareness on energy efficiency, they would prefer efficient products for using at home. High number of people, 66.91%, have good understanding on energy efficiency labelling and they understand No.5 label. According to the projected result, in 2030, the energy consumption by MECON group will increase more than twice, therefore the group must be carefully considered in any energy reduction measures. Small and widely used products will have considerable share in total energy consumption as the amount of unit used is high and the duration of use is usually long.

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7. References

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