



# Household lifestyle effect on residential electrical energy consumption in Indonesia: On-site measurement methods



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## ABSTRACT

Household lifestyle is increasingly influenced by income level, flexibility of work, family pattern and daily life of electric appliance usage that affect residential energy consumption. The aim of this research is to investigate the effects of household lifestyle on residential energy consumption. This research used cross-section analysis and on-site measurement methods focusing on household lifestyle using life schedule data. The results have pointed out that household lifestyles were closely related to energy consumption. Cooking activities consumed more energy compared to the other four activities due to number of electric appliances usage, included permanently used appliances and intermittently used appliances. In terms of family patterns, households with big families are expected to have, higher the energy consumption, but the average energy consumption per person is smaller due to the sharing of equipment. Household with retired or housewife and government employee generally consume more energy due to longer hours spent at home. This study also found that power consumption (operation and standby mode), number of appliances and operating hours are the three aspect that will plays an important role to decrease residential energy consumption in the future.

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## 1. Introduction

It has been widely recognized that the residential sector is one of the key contributors to total energy consumption and greenhouse gas emission in most countries. A report was released in 2008 by International

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Energy Agency that energy consumption in the residential sector was 29% of total global energy demand, and it was even higher in non-OECD countries with a 36% share (EIA, 2011). The increase of residential energy was estimated to be 1.1% per year, from 52 quadrillion Btu in 2008 to the estimated 69 quadrillion Btu in 2035 (EIO, *Energy International Outlook*, 2011). Energy consumption in residential sectors was investigated by many researchers across the world. The researchers have identified several factors affecting residential energy consumption, such as a household behavior (Mohammad et al., 2013, Chen et al., 2012, Ouyang and Hokao, 2009, Green and Ellegard, 2007), occupancy and household income level (Fong et al., 2007), pattern of household (Permana et al., 2008), electric appliance ownership (Genjo et al., 2005, Chen et al., 2013, and Wijaya and Tezuka, 2012, Sugiura et al., 2013), and the selection of energy source (Nakagami et al., 2008). Wijaya et al., analyzed the potential electricity saving in households in terms of technology use, social and economic characteristics in two different cities of Indonesia; Bandung and Yogyakarta. Nuryanti and Scorpio (2007) also analyzed the accessibility of energy consumption in the household sector. In addition, Pranadji et al. (2010) conducted a survey to analyze the household behavior regarding the use of household fuel in Bogor, Indonesia. From an urban context, authors also carried out a further study to investigate the urban energy consumption in Padang, a local city of Indonesia (Sukarno et al., 2015). In the residential sector, the findings showed that electricity consumption was spread to the residential sector (92%), followed by commercial sectors (5.32%), public sectors (1.92%), the government (1.28%), and only 0.04% in the industrial sector. Even though many researchers put through studied energy consumption in the residential sector, most of the studies focused on the developed countries and only a few carried out studies in developing countries especially in Indonesia. From these findings, it is clear that the largest amount of electricity is consumed in housing. Furthermore lifestyle is one of the important aspects that dictate the residential energy consumption pattern (Fong et al., 2007). However, only a few of these studies took into consideration aspects of household lifestyle, such as family pattern, income level, ownership of home appliances, and residential location.

With an average growth of 2.6% per year, the Indonesian population could be predicted to reach over 300 million by the year 2025. The large population and recent economic growth have resulted in an improvement of the overall living standard in Indonesia. Besides, lifestyles in the modern cities of developing countries are becoming energy intensive and people have been conspicuous and overly consumptive (Gupta, 2011). According to Monetary Policy of Indonesian Bank, this growth was driven by household expenditure and infestation. Related to the household expenditure, this increase comes from sales of non-food index, household appliances, information technology devices, and spare parts (IB, 2013). Hence, lifestyle aspects should be made a priority to understand residential energy consumption, particularly in developing countries.

The purpose of this study is to investigate the household lifestyle aspects of the residential energy consumption. Lifestyle aspects include the family patterns, occupations, home appliance ownership, and housing area. The energy consumption is investigated based on the life schedules of each family member. To limit the scope of discussion, Padang, the capital city of West Sumatera province, was selected for the case study.

## 2. Research methodology

### 2.1. Survey and data collection

Since there is no data set related to household energy consumption in the urban context, the authors had to conduct an independent survey to collect data for this study. Padang was selected as the case study. The total population of Padang is about 844,316 with an averaged family size of about 6 (Padang in figure, 2012). The sample size was determined to be 97 considering 95% confident level 10% margin of error. Hence, in this research a sample of 210 households covering each district were collected, and the responses were obtained through a door to door survey. The sample sizes in each district were proportional to the total number of household each district of Padang. However, the selected households surveyed in each district depended on the readiness of the respondents to participate. Random sampling was used in this survey to ensure each household had equal chance to be selected. Table 1 shows the characteristics of each district and the number of households surveyed for the study.

Generally, the questionnaire consisted of three parts; part one was an interview regarding the general characteristics of the respondent, the household lifestyle and energy consumption. Part two consisted of household appliances, and the respondent's average monthly electricity consumption of each home appliance. The last part of the questionnaire was about household daily life activities (Table 2).

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