



Economic and demographic determinants of household energy use in Turkey



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H I G H L I G H T S

- We examine several factors affecting households' energy preferences in Turkey.
- Monthly income of households has significant effect on energy choices.
- Ages of persons have also influence on energy choices.
- Health concerns easiness in use is important choice factor for old households.
- Urban and rural dwellers choose natural gas and conventional fuels, respectively.

A R T I C L E I N F O

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This paper analyzes several economic and socio-demographic factors which affect households' energy choices in Turkey. The data is obtained from the Household Budget Surveys (HBS) conducted by the Turkish Statistics Institute (TÜİK). The multinomial logit model is used to identify households' energy choices. The most important finding of the study is that monthly income of households or household welfare in general has significant effect on energy choices. It is also important to note that ages of persons have influence on energy choices. Indeed, health concerns easiness in use was found as criteria referred to particularly by household heads at age 50 and over when making energy choices. As far as settlements are concerned, the most salient characteristic of urban dwellers vis á vis rural dwellers is their dominant preference for natural gas while rural dwellers have their choice for more conventional fuels.

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1. Introduction

Rapid increase in human population and pace of technological advances combined further increase energy consumption and need over the years. Rapid depletion of energy sources accompanied by ever-rising need for energy is the harbinger of future problems that mankind has to face with.

Since 1950, while world population doubled, energy demand increased six-fold. Total world population which is estimated as 6.4 billion today will reach 7.2 billion in 2015 and 8.9 billion in 2050 according to UN projections. Naturally energy consumption will increase along with this population growth. Developing economies, including China in the first place, will be consuming more energy than other countries. According to the projections of

the International Energy Agency, the world demand for energy will increase by 1/3 and reach 240 million barrels of PEE by 2015. The important point here is the question how this demand will be met in coming years. Given the question, important steps that need to be taken include the following: assigning importance to investments that would help meet the demand in the long run by exploring different sources of energy; development of a well-planned energy saving program for the future years by identifying factors that affect firms' or households' choices in energy use and ensuring the implementation of policies articulated in this regard.

It must also be noted that energy use depends upon their accessibility/availability as well as energy costs. 2010 Future Energy Leaders Declaration aims to provide universal access to energy in the countries struggling to meet their basic needs, help them improve their ways of life, and set them on the path of lasting development. Their goal will be to create balanced energy mixes to satisfy the demand and promote the social uplift of urban, rural and isolated populations. Also, it must be formulated according to the availability of local resources, so as to be

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regionally relevant and flexible. Education and awareness on the benefits of reducing energy consumption can be achieved by holding a series of activities and events involving schools, local businesses and retailers the village raised awareness on energy efficiency and helped residents make better energy choices, manage energy expenses and lessen the impact of energy use on the environment. They outline goals and frameworks in delivering accessibility, availability and acceptability of energy for all (see *Future Energy Leaders Report (2010)*).

In this context, it becomes increasingly important to identify various factors affecting energy sources used by households and taking policy decisions accordingly for the future. Looking at the relevant literature a range of studies on households' energy choices is observed. While identifying preferred energy types and their sources, points taken into account include prices, accessibility, dependence to other countries in accessibility as well as environmental and health effects of any given preference. At this point, it is vital to explain three points. First of all, consumers can make choices however this may not be well-grounded for every case. One example rural people will be forced or encouraged to use wood or other low quality energy sources, which are locally available or either free or cheap. Other example preference for natural gas will depend also on the availability of a distribution network. The fact that more income implies higher levels of consumption of higher quality energy carriers (such as electricity or natural gas) is discussed in the literature. The second issue is that different end users need different energy carriers, and different carriers are produced from different primary sources. For instance, laptops can only work with electricity and not with coal directly, therefore the end use power to run a laptop must be performed by the energy carrier electricity, which may be generated from hydro, coal, natural gas, or else, but probably not from oil, which will be used to produce fuels as energy carriers. Lastly, final energy mix depends on the GDP structure of the economy, since every economic sector has different energy carrier demands. Transportation needs fuels and less electricity, whereas services need more electricity, households need natural gas (for heating) and fuels, industry needs first natural gas, then electricity then fuels, but agriculture needs fewer fuels.

In a study focusing on factors affecting households' energy preferences, the research has focused on the influence of population size on energy use. The results indicated that population size is an important factor in future energy demand. However, other demographic factors such as, an influence of aging and urbanization, changes in lifestyles, and changes in household size have effects on energy use. Previous studies concentrated on direct energy and indirect energy use by households. Direct energy is consumed in the household for space heating and cooling, water heating, lighting, appliance use, transportation, and other energy services while an indirect energy is consumed by the household in the production and transport of other goods. Indirect energy is mostly explained by demographic factors as important to explaining cross-sectional variation in energy use. In fact, energy use literature has identified household characteristics as key determinants of direct residential energy demand (O'Neill and Chen, 2002). Household size has an important effect on both energy use per household and on a per capita basis as well (Ironmonger et al., 1995; Vringer and Blok, 1995, 2000). In India, Ekholm et al. (2010) and Farsi et al. (2007) find that higher the level of education of household head, more appropriate the preference is in terms of health is and any increase in the income level of household head has its implication on energy preference. Based on multinomial logit model projection, Rao and Reddy, (2007) find that household size and level of education play an important role in energy preferences. As the level of education gets higher, more modern types of energy are preferred. They also find that energy preferences vary with respect to urban and rural environments whereby urban dwellers

prefer energy types more appropriate to our times. In his work geared to exposing the total energy need of households in India by using simple least squares method, Pachauri (2004) focused on such factors as the size of dwelling, age of household head, household size and level of education of household head. In micro-econometric analysis of households' electricity and natural gas demands in Denmark, Petersen (2002) finds that households' level of electricity consumption depends on the number of children in the family, total household spending, household size and age composition in the household. He also found that while there was positive correlation between natural gas consumption and household size/total household spending, there is no such correlation between natural gas consumption and household's age composition. Held (1983) made clear that household income is the dominant factor in determining energy choice. In their study, Held (1983) and Olsen (1983) found the level of education as an influential factor in energy preferences (Sardianou, 2005). Van Raaij and Verhallen (1983) found household size as a factor directly influencing energy preference and use. Ritchie et al. (1981) found a positive correlation between family income and energy use. In the context of the literature summarized above, the purpose of this study is to identify economic and socio-demographic factors affecting households' energy preferences in Turkey. To our knowledge, the previous studies have not used household data to elaborate the need for efficient utilization of energy sources in Turkey. In this sense we believe that this study will contribute an empirical literature on Turkish households' energy choices. The organization of the paper is as follows. Section 2 summarizes the background information about the energy use in Turkey. Section 3 of the study gives explanations concerning the data set and methods used. While in Section 4 results are obtained, evaluations and policy suggestions are given in Section 5.

2. Energy background in Turkey

The part presents information about the energy use in several European countries and particularly Turkey. This background information would be very important to understand the energy choices of the Turkish household's. Table 1 below gives quantitative information concerning energy consumption by households and service providers in some European countries and Turkey in 2008. Energy sources in Table 1 include solid fuel, petroleum, natural gas, renewable energy, electricity and others. Table 1 shows that Poland is the leading country in preference of solid fuel. Petroleum is the most preferred source of energy in a range of countries including Belgium, Germany, Spain and France. On the other hand, the Netherlands, England and Italy have their preference for natural gas. In preference for renewable sources of energy, Turkey and Portugal are ahead of others. Electricity is the type of energy with the fastest growth in use. In industrialized and developing countries, the level of development of societies and living standards are measured by the extent to which electricity systems are developed and per capita electricity consumption. In 2008, while annual per capita electricity consumption was 8486 kwh for industrialized countries, world average is 2782 kwh. The figure for Turkey is 2400 kwh. With the exception of Norway and Spain, preference for electricity as a source of energy has more or less the same share in all countries.

Turkey had other primary sources of energy including natural gas by 22.65%, domestic coal by 16.77%, hydraulic energy by 6.33%, imported coal by 4.93%, liquid fuel and others by 1.15% (Türkiye Enerji Raporu, 2008). Turkey has a large, young and increasingly urban population, which will continue to drive energy consumption growth. Total energy consumption rose by 5.2% 2011. Since 2001, electricity consumption has increased at the very rapid pace of 6.3% per year which is much faster than final energy consumption. In addition for

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