



Specific heating consumption in the residential sector of Serbia—Example of the city of Kragujevac



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ABSTRACT

In this paper, the specific consumption of the heat energy supplied by three most utilized heating systems (district heating, gas and electricity system) in the residential sector of the city of Kragujevac (Serbia) is analysed. Required data are provided by combining data from local utility companies with national census results. Comparison of present tariff systems shows that consumers in the residential buildings are the most motivated for energy savings if they use electricity or gas as energy source. The specific energy consumption in district heating system shows relatively high quantities, primarily as a consequence of dominant unmotivating tariff payment system. The average heat consumption from gas and electricity sources relatively fits to EU average, but the electricity consumption of the electric heaters is not acceptable in long term. Low electricity price in Serbia and high price of unit of energy from district heating system of the city of Kragujevac (and Serbia) will lead to an increase of electric energy consumption which will cause additional problems related to covering of that consumption from domestic energy sources.

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1. Introduction

Scientific and technological development has contrived to modern society high level of thermal comfort that requires high energy consumption. In the year 1995 each of 6 billion people on the planet Earth consumed 2 kW, while the resident of USA consumed 13 kW of energy consumption [1]. Although in 2009 developed countries reduced their energy consumption per capita (US 10.3 kW, EU 4.8 kW) global energy consumption per capita has grown up to 2.37 kW [2]. These are a very high quantities considering that the physiological functioning of human requires only 120 W [1]. Parallel to the increasing need for the energy consumption the awareness of the need for more efficient use of energy was increasing too, especially in developed countries. More efficient use of energy is encouraged by states that impose law restrictions and subsidies. However, the strongest influence on increasing energy efficiency has a market and rising prices of practically all energy sources.

To form a strategy to reduce specific energy consumption it is necessary to analyze the final energy consumption by sector. It is common that these sectors be divided into industry, transportation and buildings. Furthermore, the energy consumption in buildings is divided into residential and non-residential sector (commercial and

public buildings). In the EU these shares (2009) has been as following: 41% for the building sector, 32% for the transportation sector, 25% for the industry sector (and 2% for the agriculture) [3]. In 1990, energy consumption in the EU industry had a share of 34% and in the building sector 36%. These data confirm the trend in developed countries that energy consumption moves from the building to the industry sector [1]. With the exception of the southernmost states of the EU, all the other consumes significant amounts of final energy in the building sector for space heating (60–80%) (the average for the EU is 67%) [3].

This share decreases slightly (in 1997 it was 71%) on account of increase of energy consumption of lighting and electrical appliances. The average specific consumption of final energy in the residential sector of the EU was 200 kWh/m² a, while the non-residential sector consumed significantly more 300 kWh/m² a [3]. Although new buildings in the EU consume considerably less energy for heating, the average consumption of the existing residential sector according to the mentioned data was 134 kWh/m² a (data for 2009). Within the total energy consumption in the residential sector (2009), the most consumed is gas (39%) and electricity (25%), while coal as an energy source is almost completely eliminated (3%). The share of district heating in the EU is relatively low (7%), and it is still pronounced in the Baltic and East European countries, although even there this share decreases.

Serbia, as a potential member of the EU is burdened with very unfavorable indicators in the energy sector. In comparison with the 1989 in 2000 Serbia had 2.5 times lower gross domestic product

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