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AWARENESS ON ENERGY SAVING NEEDS IN SERBIA IN LOW-RISE HOUSES

Abstract: *Since the global environmental crisis, energy concerns increase in priority, and it is important to understand house residents' position on energy savings in different countries. This paper presents results of the 2011 public opinion survey in Serbia in city of Kragujevac. The survey examines the awareness of the Serbian public on energy savings in low-rise housing. The investigation found out that about 43% of respondents do care about energy saving when they build the house and 94 % when they operate the house. The reasons to save energy are almost always financial gain. The highest number of respondents saves energy by its rational use. However, almost 50% of respondents are not well educated how to save energy requiring some public action in this direction.*

Keywords: *Survey, Energy saving, Public action, Energy efficiency*

1. INTRODUCTION

Since the global environmental crisis, energy and environmental concerns have increased in priority in building construction and operation. It is important to understand position of people with different role on energy savings in different buildings and countries during entire building life cycle. This is done by using questionnaire surveys.

By questionnaire surveys, energy efficiency efforts are examined in different types of buildings such as hospitals, administration buildings, schools, universities, industry office building, hotels, departments, and residential buildings. In China, Nepal, and Scotland, energy-efficiency efforts are explored related to municipal heating in hospitals, administration buildings, schools and universities [1, 2]. For industry office building in tropical zone, questionnaire survey revealed potentials for sustainable

improvement in building energy efficiency [2]. Ali et al. [3] designed and distributed a survey to hotels' managers and departments' supervisors to understand the environmental performance in the tourist accommodation sector in Jordan. A telephone survey in England and Wales investigated an interest in purchasing mitigation and adaptation improvements against their concern about climate change, and attribution of responsibility for action in old residential buildings [4]. Wang et al. [5] studied the survey status of energy consumption and energy-efficiency management of new rural residential buildings in Hangzhou, China and energy efficiency awareness and willingness. Watts et al. [6] evaluated energy efficiency priorities, an awareness of the domestic energy performance certificates scheme, and recognition of its potential for homebuyers for low-rise residential houses.

By questionnaire surveys, different

people were approached such as architecture students, architects, LEED accredited personal, hotel managers, department supervisors, users (homeowners) of different buildings. A survey of the architecture students revealed their awareness on building energy efficiency technologies [7]. A survey of architects was conducted to assess their view on the barriers and incentives to implementing and sustaining energy conservation strategies in their projects [8]. A web-based anonymous survey of LEED accredited professionals revealed their awareness, and confidence in research work in the construction research of green buildings [9]. Bichard and Kazmierczak [4] investigated interest of homeowners in purchasing mitigation and adaptation improvements. Seitz et al. [10] approached the consumers to find the most desired attributes of home air-conditioning systems. Ma et al. [11] studied the resident attitudes of residents on energy-saving household appliances. Watts et al. [6] surveyed homebuyers on their energy efficiency priorities, an awareness of the domestic energy performance certificates scheme, and recognition of its potential.

This paper presents results of the examination of the home owners of low-rise residential houses in Serbia in city of Kragujevac on energy used in their houses. The examination is done of the 165 home owners by a questionnaire survey. The survey examines awareness of the homeowners on energy savings during the house construction and operation. It investigates their reasons for energy saving, knowledge on the energy savings, electricity tariffs, and fuel prices. It discusses how their energy saving awareness depends on their income and energy saving knowledge.

2. METHOD

This paper presents results of the 2011 survey in Serbia in city of Kragujevac on the lighting use in low energy houses. The general research approach is based on the structured questionnaire survey. The questionnaire is specially designed for this study. This is chosen because it allows a large number of subjects to be studied. The data collection technique is hand-delivered, self-administered survey. This method is chosen because it could efficiently reach a large sample, and allowed ease of response. The questionnaire is a more effective alternative to interviews because it enabled a greater proportion of the population to be reached within a limited time frame. Respondents are requested to base their responses on the home that they live in. A summary of the survey findings was available to respondents who are interested in the research to encourage participation.

Table 1. Sex of residents and a location of the house

Sex of residents		
Male	Female	
51.8%	48.2%	
Location of house		
City core	Suburb	Country-side
37%	36%	27%

Participants: All printed material, including text, illustrations, the hundred and sixty people responded to the survey. Each of respondents owns and lives in a house located in the municipality of Kragujevac, Serbia. Number of residents is 660. The sex of residents is given in Table 1. Half of residents are male and half of them female. No control was kept over the demographic and socio-economic characteristics of participants, so consequently the sample constituted large families and people living on their own, and people in different professions and retired. The location of houses in the municipality is given in Table 1. The houses are almost evenly distributed

between city core, suburb, and countryside. Total area of houses is given in Table 2. Almost half of houses have area less than 120 m² and rest greater than 120 m². Number of stories in the house is given in Table 2. The most houses have number of stories less than 3. Age of houses is given in Table 3. Most of houses are above 20 years old. Net income in households is given in Table 3. The most of residents have income below 12k €.

Table 2. Total area of houses

Total number of houses			
<80 m ²	80-120 m ²	120-200 m ²	>200 m ²
19%	34%	36%	11%
Number of stories			
1	2	3	
38%	55%	7%	

Table 3. Age of house and net income in households

Age of house (a)		
<20 a	20-40 a	>40 a
31%	52%	17%
Net income in households (€)		
<6k	6-12k	>12k
42%	33%	21%

3. RESULTS AND DISCUSSION

Figure 1 shows the survey results on the investigation of reasons for energy saving. The investigation reveals that 41% of respondents would save energy due to combined economic reasons and environmental care, 51% due to the purely economic reasons, 2 % due to the purely environmental care, and 6% does not have any reason (see Fig.1). Finally, this means that the energy will be saved 92% due to the economic reasons and 43% due to the concern for environment. In conclusion, the highest percentage of respondents is motivated to save energy due to economic reasons. This implies that the government

subsidies are of crucial if the energy saving would be increased.

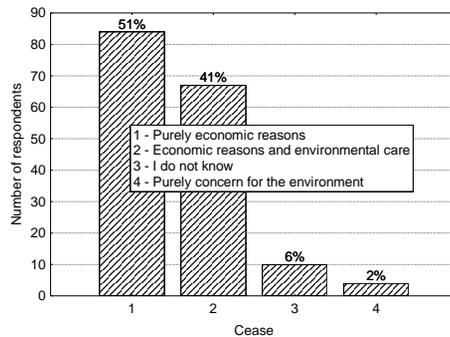


Fig.1 What are the reasons for saving energy?

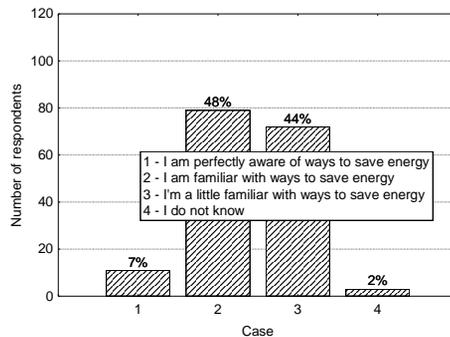


Fig.2a What is the dominant way to save energy?

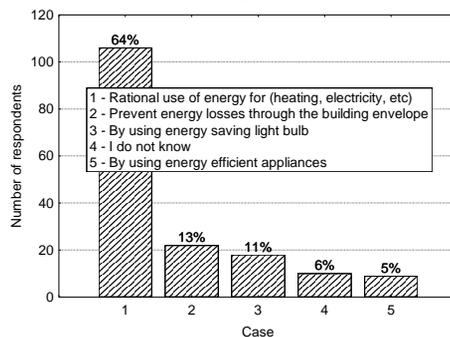


Fig.2b How much are you familiar with ways to save energy?

Figure 2a shows the results of survey about the familiarity of respondents with ways to save energy. The investigation found out that 7% of the respondents are perfectly aware of the ways to save energy, 48% are familiar, 44% are little familiar, 2% are not familiar, and 2% do not know.

and 2% are not at familiar all. This practically means that 55% of respondents are familiar, and 46% are not familiar with ways to save energy. However, as almost 50% of respondents is not educated well how to save energy, this requires some public action in this direction probably in general education.

Table 4. Taking care about energy saving during house construction and operation

Construction		Operation	
Yes	No	Yes	No
43%	57%	94%	6%

Figure 2b shows the results of survey what is the dominant way to save energy. This investigation records that 13% of respondents would prevent the energy losses through the building envelope; 64% of respondents would use energy rationally, 6% would save electricity by using energy saving light bulbs, 11% by using energy efficient appliances, and 6% does not know about it. In conclusion, the highest number of respondents would save energy through its rational use for heating, lighting and appliances.

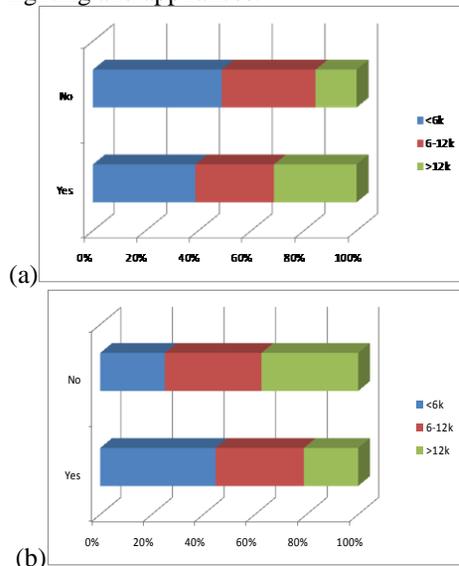


Figure 3. Influence of the total net income of household to energy saving

during (a) the house construction and during (b) the house operation

Table 4 shows the results of the survey if the respondents take care about energy saving during the house construction and operation. During house construction, 43% of respondents would take care about energy savings. Then, 57% of respondents would not take care about the energy savings. During house operation, 94% of respondents would take care about energy savings. Then, 6% of respondents would not take care about the energy savings. In conclusion, during house operation, more survey participants take care about energy saving than it is the case during the house construction.

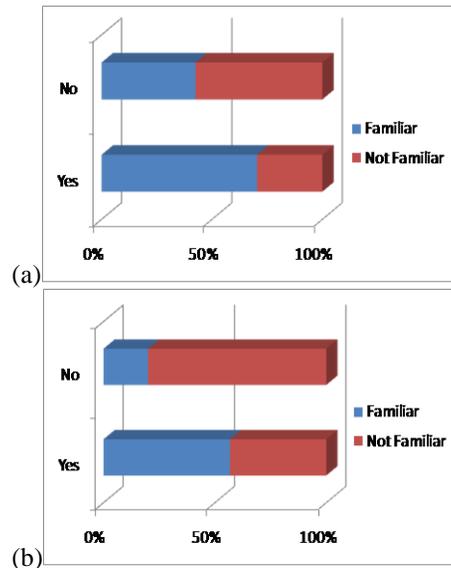


Figure 4.a Familiarity with the ways to save energy during the house (a) construction and (b) operation

Figure 3a shows the influence of the total net income of the household to the energy saving attitude during the house construction and Fig.3b during the house operation. The investigation shows that respondents with lower income take less care about the energy saving during house construction than that did the respondents

with higher income. However, the respondents regardless of income take care about the energy saving during the house operation.

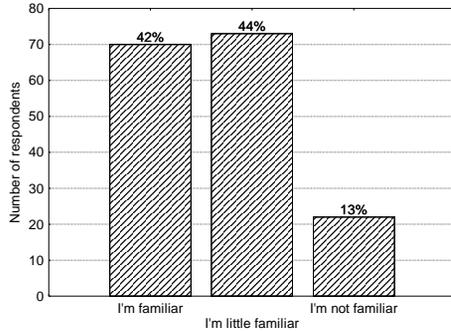


Fig.5 a) Do you know the price of energy that you use?

Figure 4a shows the influence of the familiarity with the ways to save energy to the energy saving attitude during the house construction, and Fig 4b during the house operation. The investigation shows that respondents that are less familiar with ways to save energy take less care about the energy saving during house construction than the respondents that are more familiar with ways to save energy. Furthermore, regardless of familiarity with ways to save energy, the respondents take care about the energy saving during house operation.

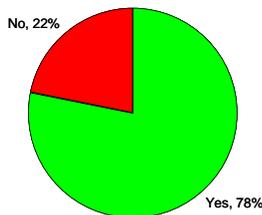


Fig.6 Do you try to control your electricity consumption to comply in beneficial pay zones?

Figures 5 and 6 show the knowledge of the energy prices of the respondents. Figure 5

shows that 42% of respondents know the price of the fuel they use. Figure 6 shows that 78% of respondents will try to control the electricity consumption to comply in beneficial pay zones. In conclusion, the residents do have knowledge of the energy prices they use. This means that they are very interested about the energy and especially money savings.

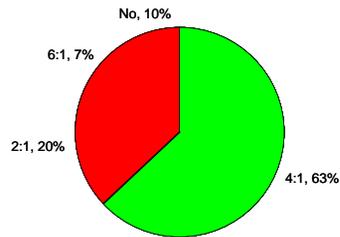


Figure 7 Do you know the ratio of the expensive and cheap tariff for electricity,

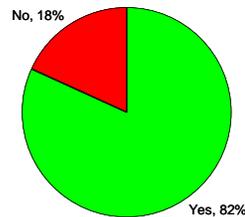


Figure 8. Do you know in what time there is cheap tariff begin.

Figure 7 shows the results of the answer to three questions in connection with electricity tariff for households. Figure 8 shows that 62% of respondents are aware that the ratio of the expensive and cheap tariff for electricity is 4:1. Figure 6b shows that 82% of respondents are aware when the cheap electricity tariff begins. In conclusion, when they have the knowledge about the electricity tariff, they can easily save energy and money.

5. CONCLUSION

This paper presents results of the 2011 public opinion survey in Serbia in city of Kragujevac. The survey examines the awareness of the Serbian public on energy savings. The investigation found out that

- (1) The highest percentage of respondents is motivated to save energy due to economic reasons.
- (2) Almost half of respondents are not educated well how to save energy.
- (3) The highest number of respondents would save energy through its rational use.
- (4) More residents take care about energy saving during the house operation than during its construction.
- (5) The residents with lower income take less care about the energy saving during house construction than that with higher income.

(6) The residents that are less familiar with ways to save energy take less care about the energy saving during house construction than the respondents that are more familiar with ways to save energy.

- (7) The energy saving during house operation does not depend on the income or familiarity of residents to save energy.
- (8) The residents do have knowledge of the energy prices they use.
- (9) The residents have the knowledge about the structure of the electricity tariff.

The residents are very interested about the energy savings due to the money savings. However, if the energy saving would be increased, the government subsidies are crucial. In addition, some public action in education on energy savings is necessary.

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