

STUDY ON THE ENERGY USE BEHAVIOR OF THE ELDERLY RESIDENTS IN THE COLD AREA OF CHINA- USING OLD COMMUNITIES IN TIANJIN CITY AS EXAMPLE

[Ye Qing, Post-doc, School of Architecture, Tianjin University, 18222163223, qingye@tju.edu.cn]

[Du Yawei, School of Architecture, Tianjin University, 13720135882, duyawei@tju.edu.cn]

[Zhao Qiang, Tianjin Planning and Natural Resource Bureau, 13821151837, bianshilan@126.com]

[Song Kun, School of Architecture, Tianjin University, 13820837073, imsongkun@126.com]

[Shu Ping#, School of Architecture and Art Design, Hebei University of Technology, 13132014938, 13132014938@163.com]

Overview

As of Dec. 2017, the population of elderly people above 60 reached 240 million in China, which account for 17.3% of the total population. The elderly residents spend 19-22 hours per day at home on average, much longer than 10-12 hours per day of the younger people. Therefore, the behaviors of elderly residents play an important role, especially in the residential building low-carbon/energy-saving field. In this study, the elderly residents in urban and suburban areas of Tianjin were selected as survey objects, whose behaviour data of using heating, refrigeration, refrigerator and television was tracked for a period of one year, in order to summarize the energy use behavior of elderly users, and to draw suggestions for energy-saving measures for elderly residents.

Methods

Tianjin, the third most aging city in the country, lies in the cold zone of China. In this study, 50 elderly residents aged between 60 and 90 years old living in different old residential areas in urban and suburban areas (the elderly live alone or live with his/her partner, the samples exclude cases where elderly residents living with their children) were selected and tracked for 1 year by means of questionnaire records. The data collected in the questionnaires was classified into the following categories: heating (divided into municipal central heating and domestic heating), cooling use (air conditioning and fan), refrigerator and TV use. Among them, heating and cooling are limited to early November to mid-march of the next year (person /month *50 person =250 copies), June to September (person /month *50 person *4 months =200 copies), and refrigerator and TV use are samples tracked throughout the year (person /month *50 persons *12 months =600 copies). Finally, effective data was input into SPSS to form the energy use behavior database of elderly residents, which can provide support for the further interpretation of energy use behaviors of elderly residents.

Results

1. According to the data of this study, the energy use behaviors of these 50 households are as follows:

2. According to the indoor testing temperature measuring, the temperature gets stays between 20-25°C for in 76% apartments, and 18-20°C in 20% apartments, while below 18°C in 4%. Under the circumstance of central supplied heating, the residents of 10% of the residents will turn down the heating radiator when they leave the apartment for a while while short time left, and 40% will turn down the equipment for long time leaving when they leave the apartment for a relatively longer time. But as to self-heating, no matter with the gas or the electronic, 100% of the residents (including those living in urban area and those in suburbs) will turn down the radiator.

3. For the cooling methods, 85% residents will choose to use fans as their first choice, especially in June. And 95% residents will choose air conditioner as the cooling methods in the middle of the summer time. Including among them, the elderly people will who set temperature to 26-30°C as the cooling temperature which occupied take up 84% of the sampled users, while 12% of the users will set the temperature to 22-25°C. Only 4% of the users will choose to set the temperature below 22°C.

As to the length of the cooling hours, in June, 90% of the residents use the air conditioner for 1-2 hours, 10% of them will use longer than 2 hours. During July and August, 12% of the elders use it longer than 8 hours, 24% between 6-8 hours, 58% between 4-6 hours, 4% between 2-4 hours, and 2% is below less than 2 hours. In addition, due to the urban heat island effect, the temperature of the cities and suburbs in summer demonstrates more obvious differences: the average summer temperature difference is between 0.5 and 1.5°C. The temperature difference between sunset and night is the most evident, and the maximum temperature difference can reach 1.5 to 2.5°C, so during sunset to night time in summer, urban and rural elderly residents show very different behaviors: the

average number of air conditioning cooling hours of suburb elderly residents is less than their urban counterparts, by 1 to 1.2 hours per day.

4. Fridge usage. The situation of refrigerator fridge usage is a little bit complicated, as it refers to several aspects,. fFor instance, the contain volume of the fridge, the energy consumption of the cooling outputfridge and so on. Therefore, the study chooses 2 behaviors to collect the datacollects 2 sets of data: whether the resident bought the an energy-saving fridge (a fridge includewith the an levels of the energy-saving level label) and whether the elders would turn down the temperatureset the fridge to the energy-saving model.

100% of the residents chose the an energy-saving fridge., among 76% of the residents chose the a first classification class energy-saving fridgelabel (best);, 18% chose the a second classification class energy-saving labelfridge.;, and 6% chose the a third classification class energy-saving labelfridge.

But 86% elders don't know how to adjust the temperature of the fridge, and 14% of them will turn downadjust the temperature to save energy.

5. Using rate of the TV is 100% of the elderly residents own and use a TV. According to the data, 60% elders use TV for 4-6 hours, ; 10% of them use it for 2-4 hours, ; 15% for 1-2 hours, ; and the most interesting number result is that 15% of the users use it TV longer than 8 hours, and sometimes even longer than 12 hours.

Conclusions

1. Background: The research indicates that energy saving behavior has no relations with education background, gender, and income.

2. Heating: In case of central supplied heating, Tianjin municipality charges a flat rate according to the heating area, instead of actual consumption. Compare to the self-heating residents who use the natural gas, it is indicated that the motivation for energy conservation of self-heating residents is much stronger than the ones using central supplied heating. Thus, the study suggests adopting actual energy consumption tariff which can be more effective towards energy consumption.

3. Air conditioning: Tianjin is very hot in summer, so air conditioning is a must for elderly residents. When using air conditioners, most elderly residents choose energy saving mode and set a relatively comfortable temperature, i.e., 26 to 30 C°. In the comparison with the energy use behavior of elderly suburban residents, it can be found that the urban heat island effect causes the air-conditioning cooling time of elderly urban users to be longer than that of suburban users. Therefore, increasing green plants in old communities and expanding the park area between community clusters can reduce the heat island effect in a direct and convenient way, thus reducing the cooling energy consumption in summer.

4. Refrigerator: in the purchase process of refrigerators, all elderly residents will choose energy-saving refrigerators due to the popularity of energy-saving labels and their linkage with prices and subsidies. However,after the purchase, the lack of awareness of energy-saving methods results in many elderly people not knowing how to adjust and use the energy-saving mode of refrigerator, which puts forward the requirements for relevant professionals, that is, the publicity and popularization of energy-saving awareness should be raised and the corresponding knowledge should be updated.

5. Usage of TV. The study indicates that elderly people tend to use TV more than others, due to their emotion needs. Some of them watch TV all day long. This study suggests that accessible facilities and indoor/outdoor venues for elderly activities be built in communities, to conserve energy, and also to satisfy the emotion need of the elders for them to stay healthy.