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Research on the Current Situation of Energy Consumption and Energy-Saving Measures in Resi-Dential Quarters in Chengdu

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Abstract: *With the development of my country's science and technology and economy, people's living standards have also been greatly improved, but with the improvement of material and living standards, it has also brought a series of environmental problems, among which carbon dioxide emissions are particularly prominent. This paper takes the energy consumption during residential operation as the topic, through the investigation and comparative analysis of the energy consumption status of several residential quarters in Chengdu, to find out the existing problems, and to give relevant energy-saving measures.*

Keywords: *Residential, Energy consumption, Energy saving measures*

1. Introduction

With the development of my country's science and technology and economy, people's living standards have also been greatly improved, but with the improvement of material and living standards, it has also brought a series of environmental problems, among which carbon dioxide emissions are particularly prominent. As the largest developing country in the world, China's total energy consumption ranks first in the world, and its carbon dioxide emissions account for a quarter of the world's total. This also makes my country's environmental problems increasingly prominent. The climate problem is no longer a problem for our country, but also a major problem facing the world. Faced with such a severe carbon emission situation, my country announced at the 75th United Nations General Assembly in 2020 that carbon dioxide emissions will strive to reach a peak by 2030 and achieve carbon neutrality by 2060.

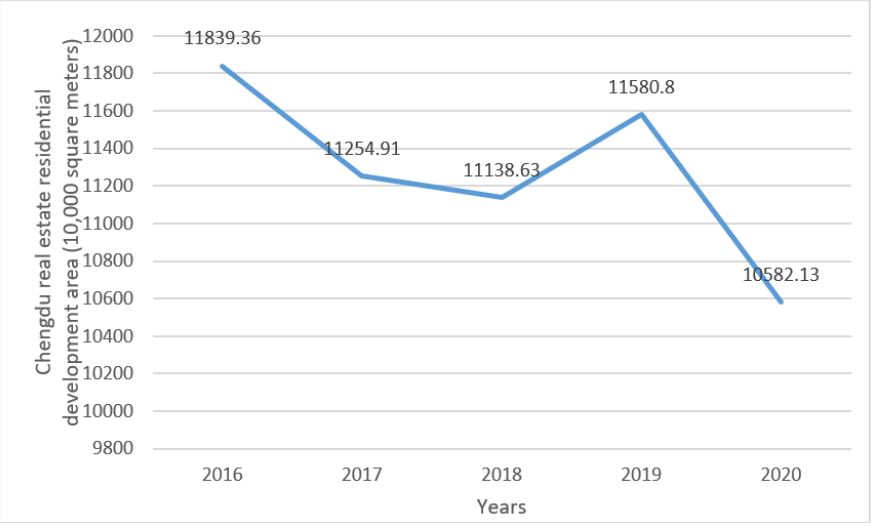

Image source: Data source: Chengdu Bureau of Statistics Statistical Yearbook

Figure 1: Chengdu's real estate and residential development area from 2016 to 2020

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Over the past 20 years, Chengdu is undoubtedly one of the most changed cities in China. The once dilapidated bungalows have now become countless high-rise buildings. Every year, thousands of people flock to this city full of Vibrant city. However, with the continuous improvement and improvement of the living standards of Chengdu residents and the popularization of household appliances and automobiles, the energy consumption of Chengdu residents has remained high. a trend.

According to the 2021 Chengdu Bureau of Statistics Statistical Yearbook data in Figure 1 [1], from 2016 to 2020, the development area of real estate and residential projects will remain around 110 million square meters each year, indicating that the annual real estate and residential projects in Chengdu have always maintained steady growth. In one of the trends, according to the "Civil Building Energy Consumption Standard" (GB/T 51161-2016), the access value of energy consumption per unit building area is 5-9 (kgce/m^2) and the middle value is 7 (kgce/m^2) for calculation., an annual increase of 770,000 tons of standard coal may be added to the residential operation process.

2. Sample

The data for this survey comes from nine energy-saving reports on recently newly built residential quarters provided by a well-known engineering consulting company in Chengdu. The data sources are authentic and reliable. Because of the need to protect customer privacy, the names of each residential community are replaced with capital letters. All data in this survey are annual consumption.

Table 1: Energy consumption data of residential quarters in Chengdu

Project name	Construction area (m^2)	Lighting system (10,000 kW h)	Socket system (10,000 kW h)	Air conditioning system (10,000 kW h)	Ventilation system (10,000 kW h)	Power (10,000 kW h)	Transformer and distribution loss (10,000 kW h)	Natural gas (10,000 Nm^3/a)
AA	157730.42	31.34	117.42	142.71	16	13.93	11.25	24.66
BB	377785.87	188.64	240.18	240.18	23.53	81.2	27.08	59.15
CC	593633.43	187.77	229.35	405.74	34.91	83.23	41.32	54.91
DD	545141.5	697.31	1580.13	450.98	35.24	72.58	45.13	13.02
EE	286492.79	144.25	199.85	271.13	14.37	43.48	23.56	52.96
FF	278984.47	85.29	133.08	164.66	20.01	55.9	16.06	31
GG	183047.81	70.84	81.67	122.31	15.12	33.08	11.31	22.36
HH	274105.54	136.17	164.08	220.98	20.08	76.75	21.63	52.8
II	302167.91	154.32	187.49	256.86	22.52	87.29	24.8	62.07

Note: Energy saving report from a well-known engineering consulting company in Chengdu

After integrating the data, from the overall data point of view, the power consumption is mainly the socket system, the air conditioning system, and the lighting system, respectively, ranking the top three, of which the socket power consumption accounts for 37.11%, the air conditioning system accounts for 28.79%, and the lighting system accounts for 21.82%. After the annual electricity consumption and the annual gas consumption are converted into the standard, it can be seen that the total annual electricity consumption is 88.79%, and the annual total gas consumption is 11.21%.

3. Existing problems

3.1. Transformer does not meet energy efficiency class

From the 9 energy-saving reports in this survey, most residential quarters have transformers that do not meet the secondary energy efficiency requirements in the "Three-phase Distribution Transformer Energy Efficiency Limits and Energy Efficiency Grades" (GB 20052-2013) at the beginning of the design. Compared with the old transformer, the no-load loss of the new transformer will be greatly reduced, the noise level will be low, and the economic benefit will be high [2]. If the old transformer is still used, it will bring huge losses to the power of the entire residential area. It will also be required to replace the transformer during the energy saving review.

3.2. The water pump does not meet the energy efficiency class

According to the energy-saving evaluation value requirements in "Limited Values of Energy

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Efficiency and Energy-Saving Evaluation Values of Clean Water Centrifugal Pumps" (GB19762-2007), among the 9 energy-saving reports in this survey, 4 reports have the problem of oversized pump selection. The selection of the pump is too large, which usually affects the water pressure problem in the process of residential water use, and secondly, it will not save energy during use, which is not only a problem of energy consumption, but also a waste of water resources [3].

3.3. Lack of energy-saving management system

According to the property management person in charge of the nine residential areas, there is no reasonable energy conservation management system in the nine residential areas. , maintenance, and did not carry out professional energy-saving training for the logistics support department.

4. Energy saving measures

4.1. Residential Equipment Energy Saving Measures

Electrical equipment in a residential area is the main component of energy consumption during the operation of a residential area. If there is no reasonable and efficient energy-saving management measures for equipment, it will inevitably lead to a large amount of excessive energy consumption. According to the current situation of residential energy consumption in Chengdu, energy-saving management of equipment in residential areas can effectively promote energy conservation in residential areas, while satisfying the daily life of residents in residential areas, it can also make residential areas more comfortable.

At present, the equipment of residential quarters in Chengdu is mainly divided into two types: public equipment and private equipment. The energy-saving measures for these energy-consuming equipment include:

(1) For energy-saving measures for transformers, the most advanced and energy-efficient models should be selected for installation and equipment for the transformers in the residential area from the beginning of design. The second is to optimize the operation of the transformer. When multiple transformers are running at the same time, the load can be reasonably allocated according to the actual load size, which can effectively reduce power loss and operating costs. Optimize the design on the power supply route, minimize the distance from the transformer to the power supply location, and reduce the loss of power transportation. In terms of power factor, the power grid requires that the power factor of the user shall not be lower than 0.93, and the corresponding reduction of the transformer efficiency corresponds to the reactive power compensation of the transformer to improve the power factor, which can also reduce the loss of the transformer during the transmission process [2].

(2) For the energy-saving measures of pumps and fans, pumps and fans with high energy efficiency ratio should be selected, and frequency conversion intelligently adjust the speed. The pumps should be selected according to the height of the floor and the water consumption. The size of the assembly should not be disproportionate.

(3) Energy-saving measures for road lighting, mainly to choose reasonable standard value of road lighting, choose energy-saving lamps as much as possible, no compensation for single lamp, improve line power factor, reduce line loss, and reasonably set lighting arrangement according to residential road conditions, and control the lighting switch in an intelligent way [4]. For daily lighting maintenance and management, it should be strictly in accordance with the requirements of "Architectural Lighting Design Standards" (GB 50034-2013), and the management should follow the following regulations: Professionals are responsible for lighting maintenance and safety inspections and keep maintenance records, and full-time or part-time personnel are responsible for Lighting runs. Establish a system for cleaning light sources and lamps, and wipe them regularly according to the number of times specified by the standard. Replace the light source regularly according to the lifespan or lighting time of the light source and to maintain the average illuminance. When replacing the light source, the same light source as the original design or actual installation should be adopted, and the main performance parameters of the light source should not be arbitrarily changed.

(4) Energy saving of residents' private equipment is mainly carried out from the aspect of encouragement. First, residents are encouraged and encouraged to buy energy-saving gas stoves, water heaters, etc. For a series of household appliances such as refrigerators, air conditioners, washing machines, TVs, etc., try to choose the energy efficiency of Class II or above. equipment, encourage

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energy-saving behavior, low-carbon life.

4.2. Residential Energy Conservation Management System

After the construction of the residential area is completed, a special property management department should be established or introduced, and managed through a special logistics property management department, responsible for the normal operation, enclosure and maintenance of facilities and equipment, responsible for daily energy conservation work, and strengthen the professional quality of logistics staff. improvement. The top management communicates with the relevant property management units and should make commitments to establish, implement, maintain and continuously improve the energy management system; formulate and implement energy policies and goals as part of the organization's development direction and strategic goals; communicate energy conservation the importance of energy conservation, and enhance the awareness of energy conservation among all employees; ensure that appropriate resources are provided for the energy management system [5]. For some equipment that operates all year round and operates according to the seasonal climate, such as water pumps, elevators, fans, air conditioners, etc., the operating parameters need to be recorded regularly. The recorded data should not simply be regarded as the basis for the operator to arrive at the post, but should be used to discover the operation parameters. The problems existing in it are used as the basis for analyzing the reasons and judging the improvement and transformation.

Energy measurement is the most important part of the entire life cycle of a project from construction to operation. It is managed by the measurement agency under the property management department. Through energy measurement management, it promotes the implementation of quantitative energy management, so that energy consumption has data. Equipped with appropriate professionals in the energy metering institution, responsible for the management, verification, testing and maintenance of energy metering. In order to implement the unified management of energy measurement, the measurement department must establish and improve the specific management system related to energy measurement. Water, electricity and gas are measured separately, commercial and residential are measured separately, and air-conditioning and other power consumption in public buildings are measured separately.

4.3. Energy saving promotion

The electricity consumption for air conditioning, lighting, domestic gas, and domestic water in residential buildings is largely related to the energy-saving awareness of building users [6]. The energy-saving publicity for households and commercial users should be strengthened. It is recommended that users refer to relevant energy efficiency standards when selecting air conditioners, lighting fixtures and other electrical appliances, and select equipment whose energy efficiency value meets the requirements of energy saving evaluation value (level 2) or energy efficiency limit value. The decoration shall not damage the building's thermal insulation structure, etc., into the agreement and strictly follow it. At the same time, according to the actual situation, relevant personnel should be regularly organized to carry out extensive and in-depth publicity on energy conservation and water conservation, improve energy conservation and water conservation awareness, and make energy conservation a conscious action for everyone.

5. Conclusions

Although living standards are getting higher and higher, the problem of residential energy consumption is becoming more and more serious at this stage. By analyzing the energy consumption of residential communities in Chengdu and conducting actual investigations on residential buildings in various regions, it is still found that living standards and energy conservation levels are not positively correlated. In order to fundamentally solve the energy-saving problem, it is necessary to supervise and guide relevant departments, and to establish relevant policies, as follows:

The first is to strengthen energy-saving education, improve the concept of low-carbon consumption of residential residents, and establish correct energy-saving values. The degree of energy-saving education of residents has a certain relationship with energy-saving behaviors. Second, increase the income of residential residents, improve the ability of residential residents in low-carbon consumption, and improve the quality of life. Third, the relevant policies and regulations of the government system, strengthen the supervision of community managers, and improve the power of action in energy conservation measures. Fourth, do a good job of energy conservation publicity, transmit the concept of

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energy conservation and low carbon consumption in different media and different platforms, and conduct energy conservation knowledge guidance to different degrees for different age groups and different income groups. Fifth, promote the production and design of energy-saving equipment, and promote the comprehensive and sustainable development of society.

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