

# The Difficulties and Solutions of Terminal Consumption under the Goal of "Double Carbon" in Realizing Carbon Neutrality Approach—Take Household Consumption as an Example

Erdan Zhang<sup>1\*</sup>

<sup>1</sup>College of Resources and Environment, Shanxi University of Finance and Economics, Taiyuan, Shanxi, China

**Abstract.** With the change of social economy, industrial structure and cultural background, China has realized that in order to achieve the goal of carbon peaking and carbon neutrality (the "double carbon" goal), end-consumption behavior has gradually become an important factor affecting carbon emission reduction. Based on the analysis of the necessity of carbon emission reduction research in end-consumption behaviors, this paper mainly refers to some data in the report "Carbon Drag -- Analysis of Low-carbon Potential of Large Urban Residents Consumption" published by Urban Carbon Peak International Cooperation Platform. This paper analyzes the current situation of "carbon consumption" in end-consumption behavior and its carbon emission reduction potential from the five aspects of residents' clothing, food, housing, transportation and use, and discusses the problems affecting carbon emission reduction in end-consumption behavior. It is found that residents' low carbon awareness in some fields is weak, and there is resistance to the implementation of green low-carbon behavior. On this basis, this paper provides suggestions on related issues: government enterprises and the public need to work together to improve residents' awareness, increase production quantity at the supply side and improve carbon emission reduction policies.

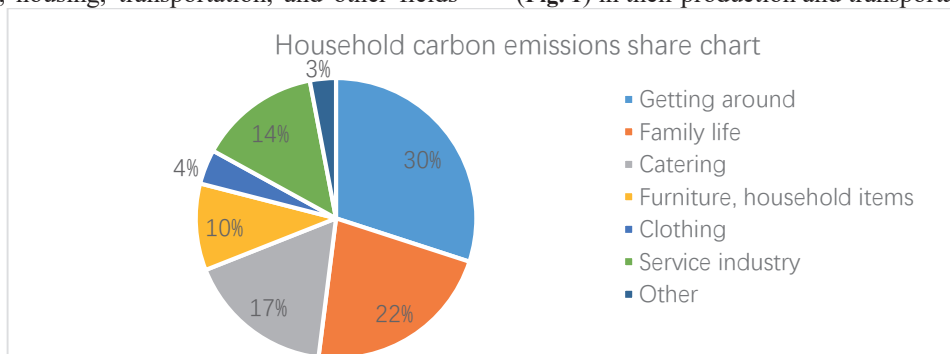
## 1 Introduction

With the development of social economy, urbanization has changed the global environment at an unprecedented speed and scale, and human life activities have released a large number of CO<sub>2</sub> and other temperature chamber gases into the atmosphere, resulting in a series of malignant changes such as global climate warming. Controlling CO<sub>2</sub> emissions has become a huge challenge facing all countries in the world. On 22 September 2020, at the General debate of the 75th session of the United Nations General Assembly, the Chinese President announced: "China's carbon dioxide emissions will strive to peak before 2030 and achieve carbon neutrality by 2060 [1]. With the proposal of China's carbon peak and carbon neutralization target (hereinafter referred to as the "double carbon" target), it has become an important means to actively seek the carbon emission reduction path. On the basis of adhering to a game of China, strengthening the top-level design and overall planning, Chinese must force from both ends of production supply and consumer demand side and promote the system [2]. In the end consumption behavior, with the continuous improvement of people's living standards, the carbon emission caused by household consumption increases rapidly as the second largest group of energy consumption. As the basic unit of social terminal consumption, the carbon emission caused by household consumption cannot be ignored more and more.

As can be seen in the reports of low carbon life and low carbon consumption behavior of households (2020) and the analysis of low carbon potential for consumption of large urban residents, the energy consumption and CO<sub>2</sub> emissions of households account for a large proportion of total energy consumption and CO<sub>2</sub> emissions. On the one hand, a large amount of carbon emissions are generated by the direct use of energy in the consumption of residents. On the other hand, the consumption of goods in the process of production also produces a large amount of energy consumption and carbon emissions. Relevant studies have shown that nearly half of energy consumption and CO<sub>2</sub> emissions come from household consumption. Therefore, it is very important to study the carbon emission of household consumption for realizing carbon emission reduction. In this context, this paper selects household consumption as the research object to explore carbon emission and carbon emission reduction. If Chinese realize carbon emission reduction from the household consumption field, people must first determine the main ways and ways of carbon emission. Household consumption carbon emissions usually include two kinds of direct carbon emissions and indirect carbon emissions (See Table 1), among which the carbon emissions caused by household consumption include not only the carbon emissions generated by daily cooking, heating, travel and other direct energy consumption, but also indirect carbon emissions. That is, the carbon emissions of products and services consumed by individuals in various fields such as

\* Corresponding author: 202017020142@stu.sxufe.edu.cn

clothing, food, housing, transportation, and other fields (Fig. 1) in their production and transportation.



**Fig. 1** Household carbon emissions share chart. (Picture credit: Original)

**Table 1.** Sources of household carbon emissions [3-6]

Category	Consumption Category	Consumption Behavior
Direct carbon emissions	Direct household energy	Consumption of fossil fuels
	Private transportation	Cars that run on fossil fuels, motorcycles
Indirect carbon emissions	Food	Consumption of grain, beans, milk, fats, meat, poultry and related products
	Clothing	Consumption of clothing and clothing accessories, shoes, hats,
	Residential	House decoration, daily maintenance and repair consumption; hot water, electricity, collective heating
	Household goods and services	Consumption of household appliances, furniture and equipment, etc
	Transportation and communication	Transportation and related various service fees, maintenance fees and vehicle insurance consumption
	Education, culture and recreation	education services, recreational articles and service consumption
	Medical care	Consumption of medical care devices, medicines and health products and medical services
	Other supplies and services	Personal accessories, luggage, hotel accommodation, beauty salon and bathing, insurance and other social protection consumption

## 2 Analysis of carbon emission in terminal consumption behavior and the necessity of research

At the beginning of the issue of carbon emission, most countries in the world pay attention to the impact of production on carbon emission and the research on relevant emission reduction measures. However, with the development of social economy, the transformation of industrial structure and the change of cultural background, on the one hand, The rapid development of economy and the change of residents' consumption structure make residents consumption increase energy consumption and carbon emission (including carbon emission generated by energy use and product production and transportation) while driving economic growth. On the other hand, as China begins to enter an aging society, new population

and fertility policies are gradually introduced, and the changes in the consumption structure and lifestyle of residents will produce new carbon emission links, which will bring more challenges to the goal of "double carbon". Therefore, it is particularly important to achieve the goal of "double carbon", to reduce carbon emission from the consumption end. Terminal consumption behavior has also become an important factor affecting carbon emission reduction. Of the total global greenhouse gas emissions, 65 percent or more carbon emissions come from household consumption, indicating that household consumption is an important component of global carbon emissions. The greenhouse gases produced by household consumption account for about 50% of China's greenhouse gas emissions. Research on Chinese household carbon emissions shows that in China, the energy consumption caused by meeting household daily needs and the inevitable CO<sub>2</sub> emissions will be significantly more likely to exceed the industrial sector

that has long been in the first place in demand and emissions. The household consumer sector has become a key part that should not be ignored in the eyes of carbon emission reduction policy designers and relevant researchers. Therefore, the realization of energy conservation and emission reduction targets and the formulation of relevant policies should focus not only on the outside of the ministry of industry, but also on the family sector.

### 3 Analysis of "carbon consumption" in household consumption and the potential of carbon emission reduction

#### 3.1 Clothing and other aspects of consumption

Most residents have high consumption frequency of clothing and shoes, but they have little consideration for their low-carbon environmental protection factors. More consideration is made of its comfort, durability and

fashion. At the same time, when residents buy new clothes or shoes, only nearly 50% of the purchase consideration is actually necessary, but also means that the consumption of 50 percent of clothing or shoes is not necessary at present. However, according to the study of "the impact of clothing on the environment: evidence from the United States and three European countries", According to Sohnu et al., 8%~10% of global greenhouse gas emissions are carbon emissions generated in the process of clothing production and consumption by residents [7]. According to the principle of conservatism, the total emission of pure cotton shirts produced in China from cotton planting to use was estimated [8]. At the same time, according to the calculation in the report of "analysis of low carbon potential for consumption of large urban residents", the carbon emission reduction in the clothing consumption area of only large cities (with a population of more than 10 million) by 2030 can reach 79.34 kg CO<sub>2</sub> / human. At the same time, consumers' shopping frequency, shopping considerations and choices in terminal consumption have great potential for carbon emission reduction (Table 2).

**Table 2.** Estimating the emission reduction potential of clothing

Type	2020 Emission Reduction Potential	2030 Emission Reduction Potential	Unit
Reduce clothing	Reduce clothing purchases by 10%	Reduce clothing purchases by 15%	
	24.81	37.22	kgCO <sub>2</sub> e/person year
Renting clothes *	That is equivalent to buying 1 less piece	That is equivalent to buying 5 less piece	
	8.42	42.12	kgCO <sub>2</sub> e/person year
Total	24.81-33.23*	37.22-79.34*	kgCO <sub>2</sub> e/person year

Note: \* Applicable to some people

This potential is predicted to reduce emissions by at least 160.63 kgCO<sub>2</sub> / person by 2030 [11].

#### 3.2 Food consumption

In the study of the carbon emission generated by terminal consumption in food consumption, the content of leftovers, leftovers treatment and reasons is more concerned. According to the study on low carbon life and low carbon consumption behavior in the family (2020), the frequency of leftovers produced by business banquets is the highest and the frequency of waste is very high. The second is a family/friend dinner, but nearly 80% choose to pack leftovers. At the same time, studies have shown that the leftovers at work are the least frequent, but often result in as much as 62 percent of the waste frequency due to poor eating or trouble [9]. According to research by J. Poore and T. Nemecek [10], eating meat and egg milk produces a lot of carbon emissions, including the production process and the consumption and digestion of residents, and reducing eating vegetarian food at the same time has become the best way to reduce carbon emissions in food consumption. In household consumption, the carbon emission reduction potential of food consumption is more about changing eating habits, increasing vegetarian consumption and reducing meat consumption, and reducing food waste and thus reducing the carbon emission corresponding to garbage disposal (CD action).

#### 3.3 Residential consumption

China's residential carbon emissions are mainly concentrated in coal and electricity. With the development of society, natural gas and electricity have become two growth points of carbon emission of Chinese residents. Residents' residential consumption activities mainly include the application of heating, refrigeration, cooking and other energy-consuming equipment, collectively referred to as residential electrical appliances. The carbon emission of residents in different regions is different in residential consumption behavior, and the carbon emission is different in different times. For example, due to the very cold winter in northern China, there is a very high requirement for heating. In winter, more greenhouse gases generated by CO<sub>2</sub> and other temperature Chambers generated by heating are produced, while in southern China, carbon emission is more carbon emission generated by summer refrigeration. Residents should give priority to the factors of low energy saving/use cost and low carbon environmental protection when buying electrical appliances. At the same time, residents should pay attention to the energy efficiency labeling of household appliances and have a high awareness of them.

In terms of electrical use, China has made effective publicity. Finally, the treatment of old appliances also produces some carbon emissions. In the household consumption of terminal consumption, the carbon emission reduction potential generated by household residential consumption is more reflected in the treatment of old household power, as well as the continuous improvement of residents' awareness of energy conservation and environmental protection, and the selection of energy-saving appliances. Assuming that all households use energy-efficient appliances by 2030, the average person will cut emissions by 84.07 kgCO<sub>2</sub>e a year [11].

### 3.4 Travel

Driving, using public transport, bicycles or electric cars is the main way for residents to commute. According to research, people use more public transportation, bicycles, electric cars or walking when commuting is less than 2 kilometers on the day, but when commuting is two kilometers away, the proportion of residents commuting to drive gradually increases. At the same time, the private car ownership of residents is relatively high, but most people will switch to public transportation commuting in order to respond to green travel and reduce the use of private cars due to the influence of urban traffic conditions. At present, some cities in China have launched the "limit number" policy, which reduces the number of cars used by residents and promotes the development of electric vehicles to achieve some carbon emission reduction, and the public will actively respond to relevant policies. In the household consumption of terminal consumption, the carbon emission reduction potential generated by household travel consumption is the change of commuting environment, national policy appeal and the popularization of new energy travel tools. Assuming that China plans to achieve a carbon peak in the year 2030, all cars are replaced as electric cars, which will reduce carbon emissions by 144.59 kgCO<sub>2</sub> man/year (Table 3) [11].

**Table 3.** Estimation of emission reduction potential of private cars

Type	2030 Emission Reduction potential	Unit
private cars	All private cars travel by electric vehicle	-
	144.59	kgCO <sub>2</sub> e/person · year

### 3.5 Use of articles

The use of items mainly includes electronic entertainment devices (such as mobile phones, game consoles, etc.), disposable products, packaging and sharing economic items (such as sharing bicycles, sharing charging treasure). Most residents take 1-2 years to replace electronic entertainment equipment. Due to the pursuit of trend and the continuous improvement of equipment requirements, the group will change the frequency of entertainment equipment, and the treatment of old electronic equipment is also an important content in carbon emission reduction.

Because of the inconvenient or forget, residents use the common disposable products more often, especially plastic bags, disposable tableware, disposable paper cups. This phenomenon also reflects the residents' determination to reduce the use of disposable products without forming ideas or forming habits. In addition, there are also great problems in the disposal of garbage by residents, including garbage classification and other phenomena, logistics industry has become a rapidly developing industry in recent years. With the development of network e-commerce and express logistics, the use of packaging in the process of commodity mailing has also increased sharply. According to the calculation of carbon traces, the average emission reduction for each green package is 40g, and the green package includes environment-friendly express bags (biodegradable plastic bags and biomass plastic bags) and non-adhesive cartons. In the household consumption of terminal consumption, the carbon emission reduction potential generated by the consumption of household use items is mainly reflected in the frequency of switching of electrical entertainment equipment and the treatment mode of old equipment. Garbage classification treatment; Commodity packages reduce excessive packaging and use green packaging problems; The promotion of Shared economy and the publicity and cultivation of related awareness and habits of disposable goods.

## 4 Existing problems of terminal consumption carbon emission

### 4.1 Low carbon awareness of residents in some areas is weak

The high degree of low carbon consumption cognition has a great impact on residents' consideration of whether their daily consumption behavior has low carbon environmental protection. Although current household terminal consumption has huge carbon emission reduction potential, it still has no important role in carbon emission reduction. Family residents pay high attention to energy-saving household appliances in terms of living and travel, but they have a low degree of cognition. They are more superficial and believe that low carbon is contradictory to a good life. There are questions about whether low carbon will reduce the quality of life. And more Chinese residents agree to use it in the province rather than reduce consumption, and have a one-sided understanding of the nature of low-carbon life. Residents have less carbon considerations for the two parts of "clothing and shoes" and "daily diet". According to the summary of the influencing factors of household consumption, families tend to enjoy clothes and shoes and diet when they consume. Therefore, practical trends are Face and other reasons are more concerned, which also shows that residents lack low-carbon knowledge storage and distribution in this field.



## 4.2 Low carbon implementation has resistance and lack of depth understanding

At present, China lacks specific policy system to conduct relevant guidance, and there are problems such as imperfect market rules, market monopoly and inadequate supervision. Taking the residents' use of disposable items as an example, the use of disposable items is high frequency, and the use of plastic bags, disposable tableware and paper cups is only a lot more. Restrictions on the use of disposable items have only lasted for a few years and have not been universal for a long time. China's goal of "double carbon" is a comprehensive green transformation battle that involves economic and social development [2]. However, at present, the supply of low-carbon consumer products on the supply side is insufficient, and the number of green and low-carbon products in the market is small. For example, the consumption of "residential appliances", "travel", "disposable items" and other aspects of the significance of energy efficiency signs, the support of low-carbon travel methods for long-distance commuting, and the situation and problems of providing one-time items if merchants actively provide them. At the same time, its consumer demand does not effectively promote the green change on the supply side.

## 5 Suggestions

In order to promote the realization of carbon emission reduction in terminal consumption, it is necessary to improve the low-carbon cognition of residents and the concept of green consumption, mobilize the enthusiasm of residents to participate in carbon emission reduction actions, and make low-carbon consumption mode develop in clothing, food, housing, transportation and use. Residents will also increase the quantity of production on the supply side, improve its production level, actively encourage manufacturers to innovate, improve low-carbon production technologies and reduce production costs. At the same time, China should further improve relevant policies on carbon emission reduction. With the proposal of the "double carbon" target, China will face more challenges, and it needs to make detailed and far-reaching plans for supply and demand, and improve the carbon emission reduction policy as soon as possible. People should also pay attention to making a large number of correct interpretation of relevant policies, publicity and education, raise attention, promote in-depth cognition and play a guiding role. It is also necessary to improve the social, cultural and cognitive aspects, and improve the corresponding facilities and other conditions. In both directions, it is necessary to introduce systems or policies that are appropriate to local conditions and times, and strive to form a favorable development relationship and green consumption pattern promoted by the government, enterprises and the public.

## 6 Conclusion

This paper mainly studies the end-consumption behavior

under the "two-carbon" goal, taking household consumption as an example, and conducts the current situation understanding and potential analysis of residents' clothing, shoes, food, transportation, residential electrical appliances, articles used, etc. Through research and data comparison, it is concluded that among the five aspects of residents' clothing, food, housing and transportation, food, housing and travel have greater carbon emission reduction potential, which is also the direction of future carbon emission reduction development trend. Then, this paper discusses the problems existing in end-consumption behavior affecting carbon emission reduction: 1. Low carbon awareness of residents in some areas is weak, 2. Low carbon implementation has resistance and lack of depth understanding. Finally, relevant suggestions for improvement are proposed. It requires the joint efforts of the country, enterprises and residents, and the mutual promotion of both the supply side and the demand side, so as to achieve the goal of "double carbon".

## References

1. Z. Liu, "Carbon Peak" and "Carbon Neutrality" - The Only Way to Green Development People's Daily **8** 13 (2021)
2. J. Liu, Promoting the realization of the goal of "Double carbon" requires both ends to exert force, in League Report **1** (2021)
3. Y. Wang, F. Li and X. Sun, Resources Sci., **41** 1201-1212 (2019)
4. S. Bin, H. Dowlatabadi, Energy Policy, **33**, 197-208 (2005)
5. X. L. Zhang, Y. Wang, Ener. Policy, **102**, 116-124 (2017)
6. J. Liu, L. Yan, N. Ding, et al. China Population, Resources and Environment, **27**, 155-158 (2017)
7. J. Sohn, K. S. Nielsen, M. Birkved, Sustainable production and consumption, **27**, 2153-2164 (2021)
8. C. Wang, L. Wang, X. Liu, et al. Journal of Cleaner Production, **108**, 464-475 (2015)
9. Research on Household low-carbon life and low-carbon consumption Behavior (2020)
10. J. Poore, T. Nemecek, Science **360**, 987 (2018)
11. Carbon footprint. Analysis of low-carbon consumption potential of large urban residents (Carbon footprint 2020)