

Identification of Influencing Factors of Rural Energy Poverty in China

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Abstract—In order to alleviate energy poverty problem in China's economic and social progress, it is significant to identify, evaluate and analyze the influencing factors of energy poverty to further overcome difficulties. Chinese government correctly understand that the actual situation of rural household energy poverty and real demand plays an important role. Under the premise of analyzing the relevant literature, this paper identifies three aspects of the influencing factors. This result is useful for further research.

Keywords: *influencing factors, energy poverty, markets factors, environmental factors*

I. INTRODUCTION

Energy poverty originated from fuel rights movement of 1982 in UK, the central idea was the inability to buy energy services. In 2002, the international energy agency (IEA) defined energy poverty as a lack of access to the use of electricity and clean cooking utensils and a reliance on other solid fuels such as conventional biomass energy for cooking^[1]. At present, energy poverty is very seriously treated in the world. In 2013, IEA estimated that 1.3 billion people worldwide do not have access to electricity, and 3 billion people rely on traditional biomass energy for cooking. 95% of these people are concentrated in Asia and Africa. Meanwhile, the international energy agency (2012) predicts that by 2030, 1 billion people will still have no access to electricity and 2.6 billion will have no access to clean cooking fuels[2].

After a long period of development, China has become the world's largest energy producer and consumer, forming an energy supply system with comprehensive development of coal, electricity, oil, natural gas, new energy and renewable energy. Although China has made great achievements in energy development, it is also confronted with such challenges as great pressure on energy demand, many constraints on energy supply, serious damage to the ecological environment caused by energy production and consumption, and overall backward energy technology. With the acceleration of urbanization and industrialization, the demand of rural residents for modern energy is also expanding. From the perspective of energy consumption structure, the proportion of rural commodity energy is rising rapidly, but non-commodity energy still accounts for a large proportion. In 2015, coal and coke accounted for 35.50%, oil 12.58%, electricity 11.65%,

LPG 12.85%, straw, firewood and biogas 15.26%, 11.44% and 0.99%, respectively, of China's rural energy mix.

Energy poverty is closely related to people's livelihood. It is clear that during the 13th five-year plan period, China's economic development will enter a new normal, the growth rate of energy consumption will slow down, the quality and efficiency of development will be prominent, supply-side structural reform is urgent, energy transformation is a long way off. If we want to achieve sustained and stable economic development, we must strengthen the support for rural economic development. The inefficient energy use structure and technology in rural areas have great potential for energy saving. Strengthening the research on energy poverty in rural areas will bring new opportunities for China's future development. Therefore, paying attention to rural energy poverty will be a huge challenge for China and even the world in the coming decades. To solve the problem, we need to understand the cause of the problem. The cause of energy poverty are many, Douglas F. Barnes, Shahidur R. Khandker, Hussain A. Samad (2011) argue that the consumer's demand for energy, such as by family factors (such as the education level, assets, health, the strength of the preference, specific energy) and community factors (such as energy prices, rural infrastructure, general wage structure, commodity prices, etc.) mutual influence[3]. Li Kangan, Liu Chunfeng, Wei Yiming (2011) found that factors such as low education level, low household income level and slow development of clean energy in rural areas of various provinces and cities in China could restrict the choice of clean energy for energy poor people to a certain extent and set obstacles for alleviating energy poverty[4]. Wei Yiming, Liao Hua, Wang Ke, Hao Yu (2014) pointed out that the energy ladder hypothesis holds that with the improvement of economic development level and income, energy used in family life gradually moves towards clean and efficient modern energy[5].

II. REVIEW OF THE FACTORS AFFECTING ENERGY POVERTY

A. Research of market economic factors in energy poverty

The impact of economic factors on energy poverty is crucial. This paper focuses on the economic variables influenced energy poverty in the price mechanism and constructs the research system. After reviewing the literature, it

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is concluded that previous economic studies on energy poverty mainly focus on energy price, energy supply and demand, economic development and other aspects.

In energy prices, Wang Jun (2010) suggests that energy price level and price distortion caused by China's energy, economic and environmental development has brought the huge challenge, the present stage because of the social security system, resources tax and fee system, resources development and compensation mechanism, and the lack of price regulation mechanism and so on, to make our country energy price reform pace is too slow[6]. It is proposed that effective measures should be taken to adjust government functions and improve supervision methods, establish compensation mechanism for resource development, perfect social security system and establish energy futures market, which will promote the process of energy price reform in China and promote the marketization of energy price. Zhao Xiaoshu (2011) adopted the energy price fluctuation data and general price level records of China for more than 10 years for measurement, used VAR model for simulation, discussed the transmission mechanism between energy price and general price level, calculated to what extent they could influence each other and calculated the lag effect[7]. Therefore, a series of policy guidelines can be obtained. The study of energy price will also provide an important reference for the progress of the market-oriented reform of energy price. According to Li Xiaoyue, Lu Yan (2008), when China's energy price needs to be in line with the international market, the change of international energy price urges China to pay attention to the cooperation with energy producing and consuming countries and establish a market-dependent energy price formation mechanism[8]. Therefore, it is necessary to accelerate the price reform of resource products, effectively establish a price formation mechanism reflecting the market supply and demand, the degree of resource scarcity and the cost of pollution loss, actively carry out the construction of energy financial market system, and improve the relevant laws and regulations. In the cycle model established for energy price forecasting, energy price is almost completely determined by demand. In this cycle, the quantity demanded is adjusted according to the change in price, but its response lags behind the change in price.

In terms of energy supply and demand, Meng Lingjun (2013) concluded that China's energy demand is mainly affected by the development level of its national economy, industrial structure, energy price, urbanization process, population, technological development level, energy policies published by the government and relevant institutions and other factors[9]. Yang Suchang (2012) used VAR model to calculate the impact of price, economic growth, industrial structure, urbanization level, energy consumption structure, population, technological progress level, ecological and environmental policies and other factors on energy demand[10].

B. Research of the factors of energy poverty farmers

In terms of family income, Alemu Mekonnen and Gunnar Kohlin (2009) study the Ethiopian urban families living fuel selection problem, the estimated results show that with the increase of income, urban families are more likely to choose and use a variety of types of fuel, rather than electricity to

replace straw clean fuels such as solid[11]. Masih and Masih(1997) pointed out the neutral structural compliance relationship between energy supply and actual income with the framework of multi-econometric economic model[12].

Omar R. Masera, Barbara D. Saatkamp, Daniel M. Kammen(2000) found that the traditional cooking habits and way of life is also the important factors that affect family life, a lot of families are still choose traditional biomass fuels for cooking[13]. Ding Shijun, Yang Hanming (2001) studied the correlation between household energy use and rural poverty. The energy consumption of poor farmers is mainly traditional energy, and the influence of energy use on poverty is analyzed from the aspects of energy use and production, traditional energy use and family activities, modern energy use and women's labor[14]. Qiao Zhaoqi (2010) learns from the individual characteristics, family status, development purposes and 15 factors such as alternative energy, for farmers families in poverty areas of northwest Yunnan firewood consumption and alternative energy are analyzed, and puts forward to the training of farmers and promote knowledge about saving firewood, and combining the promotion which has the function of dual energy-saving stove to guide and promote farmers firewood consumption reduction[15].

In terms of gender, by investigating the resource of daily life, decision-making and control from three aspects, Clancy Joy. S. Skutsch, M. Batchelor, S (2002) explored the relationship between the gender, the energy and poverty, and put forward the energy poverty and gender related issues, including men and women in the family who decision-making problems of energy and benefit, the consequences of women using biomass energy family, women how to deal with energy problems such as poverty[16]. On this basis, the author believes that future research should focus on the gender characteristics of energy. The special relationship between women and energy makes it easier for women-run projects and businesses to improve cookers and related equipment, the study said.

C. Research of environmental factors in energy poverty areas

In terms of energy endowment, Douglas F. Barnes, Shahidur R. Khandker, Hussain A (2011) believed that energy poor areas were often related to limited resources and fragile ecological environment[17]. Energy poverty leads to serious health losses in China. According to the study, improving the energy consumption structure is not the first choice for rural residents. Mirza, B., and Szirmai A(2010) found that most of the households had serious energy shortage problem, and quite a lot of rural households used non-convenient energy and spent a lot of time collecting or buying household energy[18]. In terms of policies, Liu Changhai (2012) studied China's policies on solving rural energy poverty and found that there was a lack of national rural energy law and its legal effect was not significant[19]. Xiao yunlai et al. (2010) analyzed the influencing factors of cooking energy use in poverty-stricken counties, showing that income had a certain impact on cooking energy use in poverty-stricken areas, but it was not the most important factor. Biological abundance, energy endowment, land degradation, labor education, government behavior, transportation and market conditions all have different impacts

on energy poverty[20]. Based on the resource endowment, developing new energy and improving the education, transportation and market conditions of the labor force can help the poor areas break through the vicious circle of energy shortage and poverty.

III. IDENTIFICATION OF FACTORS AFFECTING ENERGY POVERTY

Based on existing research in the field of energy poverty, by summarizing theories, forms, measures, effects (such as literature) on energy poverty, reading energy poverty reports on the Internet, focusing on the World Health Organization, and the authority of international energy agencies (such as energy) Poverty surveys and on-site surveys of energy use in rural areas have found that few literatures provide a unified description of their influencing factors, which will be detrimental to the alleviation of energy poverty. This paper divides the influencing factors into three categories: regional market economic factors, farmers' own factors and environmental factors. This research is helpful to provide a strong basis for relevant government departments to analyze local energy poverty problems. The main factors leading to energy poverty, and thus targeted implementation of policies to alleviate energy poverty.

A. Market economy factors

The formation of energy poverty has a certain correlation with the role of market economy. Straw, coal and electricity, as commercial energy, occupy an absolute dominant position in the consumption of rural energy. Local industrial structure, economic development and energy prices have a significant impact on local energy poverty.

1) GDP

Energy poverty is inseparable from economic development. Energy poverty in developed countries than developing countries relatively weak some, economic development is in good condition, of residents' living standard is higher in pay more attention to the use of clean energy, energy efficiency is also higher, on the contrary, economic development is relatively backward area, energy poverty phenomenon is serious, relatively heavy burden on residents' energy, low use efficiency.

2) Energy supply

The quantity and quality of all kinds of commodity energy supply, to a certain extent, affect the way farmers use commodity energy. The shortage of supply will increase the use of biomass energy such as straw and firewood. At the same time, the price of energy will be further increased through market regulation.

3) Energy prices

The price of goods determines the demand. Although the use of commodity energy is increasing year by year, the price of energy has always been the hot spot of energy development. At present, all areas of the country has basically realized electricity, but due to the price of electricity, some areas still can not be used in cooking. Natural gas is more expensive than electricity, and it will take time for it to spread across the country. The straw and firewood used in cooking in rural areas

are generally the stalks of crops such as wheat and corn, which are not cost effective but more affordable. Coal, as the largest energy used by the nation, also often appears in cooking in rural areas.

B. Factors of farmers

Farmers are the main energy users in rural areas, and they are an important part of the current situation of energy poverty. Both family and individual factors play an important role in the choice of energy use. Different factors promote and restrict each other.

Energy use involves every aspect of family life. The amount and structure of household energy consumption is closely related to the characteristics of household energy use.

1) Gender

In the cooking activities in rural areas, the main characters are mostly women, who are often the gatekeepers of the expenditure pointed out by the family and often disguised as economical commodities, as well as the choice of energy.

2) Age

People of different ages also have different choices about how to use energy. In rural areas, most young adults with the ability to work and learn go out for work. There are many left-behind children and empty-nesters. Many children learn to live and cook at a young age.

3) Family energy habits.

Due to the limitation and influence of family cooking utensils and behavior habits, family energy habits are difficult to change. This is also a major reason why most farmers still use straw, firewood and other non-clean energy. In the north, most rural areas use traditional heated kang to burn fire for heating and water for cooking in winter. This kind of cooking utensils and structure doomed the farmers to use firewood. Although with the development of the new countryside, there are more and more heating facilities such as gas and heating, and even the promotion of banning the cooking tool of kang has been promoted, most rural areas still use it.

4) Arable land area.

For farmers living mainly on arable land, the area of arable land determines the income. Meanwhile, the larger the arable land area is, the higher the output of straw and firewood will be. The choice of energy will be more inclined to biomass energy, and the more serious the phenomenon of energy poverty will be arable land area.

5) Average annual household income.

Income determines consumption, and according to the energy ladder hypothesis, households with high incomes tend to use clean cooking energy, while the use of non-solid energy such as coal and firewood increases as income decreases.

6) Housing area.

The living space of a house affects the type and amount of energy consumed. After investigation and research, the larger the living area, the corresponding heating area, the number of home appliances will increase, the use of energy will be greater, more types. At the same time, the household

income determines the housing area to some extent, and the two have mutual influence on energy poverty.

7) *Education level.*

In rural areas, the imbalance of education level has been a major obstacle to development. When it comes to energy use, the more educated individuals are, the more open they are to new things, and the more aware they are of the importance of clean energy.

8) *Profession.*

Most rural residents earn their living from agricultural activities, but some rural factories also provide more employment opportunities for rural residents. Rural residents with different occupations also have different energy choices. The more diverse your family members are, the more diverse your family can be.

C. *Regional environment factors*

The problem of energy poverty in this paper mainly focuses on rural areas, which has its own regional division. At the same time, different rural areas also exist different energy use.

According to the different energy endowments, the regions with abundant water energy have abundant electric power resources and high utilization rate of electric power. The area that coal resource is rich, burning coal is main life to use energy.

Bio-abundance has a certain influence on the use of firewood, that is, the higher the bio-abundance is, the lower the bio-abundance is, the more limited or unstable the source of firewood is, and the higher the ratio of coal used by farmers. The location and topography of rural areas also affect the local energy use structure. At the same time, the influence of local traffic and urbanization level on energy structure is also very important.

IV. CONCLUSION

The problem of energy poverty involves all aspects of society, economy, production, life, environment and policy, and its causes are even more complex and diverse. This paper summarizes some factors that affect energy poverty through reference to the existing literature and investigation on the energy use habits of farmers. At the same time of establishing the influence factor system of energy poverty, the factors are classified and summarized into market economy factors, farmers' own factors and regional environmental factors.

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