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Energy poverty in China: An index based comprehensive evaluation

Ke Wang [a,b,*], Ya-Xuan Wang [a,b], Kang Li [a,b], Yi-Ming Wei [a,b]

[a] Center for Energy and Environmental Policy Research, Beijing Institute of Technology, Beijing, China
[b] School of Management and Economics, Beijing Institute of Technology, Beijing, China

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ABSTRACT

Energy poverty has got increasing attention during the latest three decades. Measuring energy poverty is the premise of policy making to alleviate energy poverty. There is no unified energy poverty measurement that has been widely accepted. This paper reviews the commonly used energy poverty measurements through classifying them into three categories: energy service availability, energy service quality, and satisfaction of energy demand for human's survival and development. This paper also analyzes the suitability of the commonly used energy poverty measurement for China from the prospective of data availability and index applicability. Furthermore, we construct a new energy poverty comprehensive evaluation index in this study, and the index is illustrated to evaluate regional energy poverty in China. The evaluation results indicate that China's energy poverty showed an alleviating trend from 2000 to 2011, and during this period, China's energy service availability improved slightly; energy consumption cleanliness showed no significant change; energy management completeness decreased with fluctuations; and household energy affordability and energy efficiency improved continually. In addition, China's regions show different characteristics of energy poverty. For example, Middle reaches of Yangtze River region showed the worst energy availability and Eastern coastal region showed the worst energy management completeness. Several policy implications for energy poverty alleviation are also proposed in this study, including, for instance, increasing investment on energy infrastructure, and spreading energy management organization in rural area; decreasing relative cost on household commercial energy consumption, and encourage the utilization of modern, clean and efficient household energy consumption equipment.

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* Correspondence to: Beijing Institute of Technology, Beijing 100081, China. Tel.: +86 10 68914938.
E-mail address: kewang2083@gmail.com (K. Wang).

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1. Introduction

Energy poverty is a pressing issue which should be addressed, as it could restrict the realization of Millennium Development Goals[1], deprive the basic rights of some society's members and hinder sustainable development of international society. In 2011, about 1.3 billion people worldwide lacked access to electricity and 2.6 billion people relied on traditional use of biomass for cooking [1]. It is predicted that, in 2030, there will still be 1 billion people lack access to electricity and 2.6 billion people lack access to clean cooking facilities [2]. Although China has experienced unprecedented economic growth in recent years, energy poverty still exists in China's household sector. Energy poverty, which performed as unfair resources distribution, unsustainable energy consumption structure and high energy costs in China, could hinder the progress of ensuring and improving the people's wellbeing, and restrict the realization of China's social economy medium and long-term development goals.

The “energy poverty” used in this paper represents the concepts of fuel poverty and energy poverty, as China's energy poverty has the features of both of them [3]. Energy poverty concept was originated from the British fuel use rights movement in early 1970s, and the core concept was inability to purchase energy services. Boardman defined energy poverty as that households could not afford adequate energy services [4]. Hills proposed a new definition of energy poverty called “low income high cost” [5]. Both of these definitions are refined and then officially adopted by UK government [6]. The above mentioned energy poverty concepts are often used in developed countries such as UK, which focus on energy costs and define energy poverty from economic perspectives.

Some scholars and organizations define energy poverty in terms of access to energy services. United Nations Development Program (UNDP) expanded energy poverty as “an absence of sufficient choice in accessing adequate, affordable, reliable, quality, safe and environmentally benign energy services” [7]. IEA defined energy poverty as a lack of access to clean and commercial fuels, efficient equipment and electricity and a high dependence on traditional biomass, which is mostly burned in inefficient and polluting stoves [8]. IEA's concept of energy poverty has been widely used in developing countries.

Human basic energy needs which include lighting, cooking and heating, are considered as a significant perspective to study energy poverty. Appreciating the complex nature of energy poverty, the United Nations Secretary General's Advisory Group on Energy and Climate Change [9] and Sovacool et al. [10] expanded the dimension of basic energy needs.

Designing and constructing an energy poverty comprehensive index is the basis to understand and identify energy poverty. Scientific evaluating energy poverty is the basis and guarantee for formulating scientific policies to alleviate energy poverty and implementing relevant policies. In order to provide the theoretical supports for constructing energy poverty comprehensive measurement index, this paper reviews the energy poverty measurements which have been used, and analyses the applicability of these energy poverty measurements for China from the prospective of data availability and content suitability. Furthermore, this paper constructed a novel energy poverty comprehensive evaluation index for China, based on those indicators which could be directly applied, and according to data availability and the characteristics of social and economic development in China. Current characteristics of energy poverty of China's eight economic regions and 30 provinces were summarized, and furthermore, the energy poverty alleviation policies were proposed based on the comprehensive evaluation results of China's energy poverty.

The paper is organized as follows. The Section 2 classifies the main energy poverty measurements into three categories: energy service availability, energy service quality, and satisfaction of energy demand for human's survival and development. Then, this section reviews and compares the main energy poverty measurements. The Section 3 analyses the suitability of the main energy poverty measurements for China from the prospective of data availability and index applicability. The comprehensive evaluation index for evaluating China's energy poverty and the methodology are introduced in the Section 4. The Section 5 analyses the results of energy poverty comprehensive index of China's 30 provinces, and summarizes the main characterizes from four dimensions: energy services availability, energy consumption cleanliness, energy management completeness, and household energy affordability and energy efficiency. The Section 6 and Section 7 compare energy poverty of China's eight economic regions. Policy implications of energy poverty alleviation for China's 30 provinces are addressed in the Section 8, and the final section concludes the whole paper.

[1] The Millennium Development Goals are eight international development goals established following the adoption of the United Nations Millennium Declaration in 2000: to eradicate extreme poverty and hunger, to achieve universal primary education, to promote gender equality and empower women, to reduce child mortality, to improve maternal health, to combat HIV/AIDS, malaria, and other diseases, to ensure environmental sustainability, and to develop a global partnership for development.