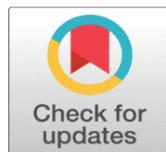


# ENERGY POVERTY AND ITS EXISTENCE IN INDIA: A CRITICAL ANALYSIS

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## ABSTRACT

Energy is the main key for economic, social and physical development. Without energy we cannot access to basic services like safe drinking water, lighting, cooking, health care and education etc. Energy poverty is defined in different way by different researchers. Most of researchers are stated energy poverty is the unable access to modern energy for basic needs such as lighting and cooking. However, there is no single universal accepted tool for energy poverty estimate. Present study tries to find out whether energy poverty exist or not in India with the help of researchers have studied about energy poverty by using different approaches.

**Keywords:** Energy, Economic, Cooking, Lighting, Energy Poverty

## 1. INTRODUCTION

Energy is the most essential tool of development and is considered as instrumental to stimulate economic, social and physical development. Energy takes most important role in providing basic services such as safe drinking water, lighting, cooking, health care, education, etc. It also enables for better standards of living and fuelling economic and income generation activities. Energy is the main key that connects economic growth, increased social equity, and an environment that allows to the world to strive. The access to clean and affordable modern energy services is central to socio-economic liberation (Nussbaumer et al., 2013). Energy services refer to the utility of energy desired by the consumer such as transportation, a warm room, or light; and modern refers to a relatively high degree of convenience in obtaining those services, i.e., energy services that are access through the use of energy sources which are other than traditional sources such as firewood, animal dung, and crop residue. United Nation Development Program (UNDP) set 17 Sustainable Development Goals (SDGs) in 2015 and among these goals SDG 7 is affordable and clean energy. The

target 7.1 of SDG 7 comprise of SDG 7.1.1 universal access electricity and SDG 7.1.2 universal access to primary use of clean fuels and technologies achieved by 2030

So many researchers are done about energy poverty all over the world as well as in India. Different researchers are view energy poverty in different way. Still there is no single uniform definition of energy poverty universal acceptable. It varies from time to time and from one geographical region to another. Different countries apply different approaches on basis of geographical region and climate conditions. Foster et al. (2000) defined a fuel-poor home as one whose energy use falls short of meeting essential energy requirements. The absence of access to modern, sustainable energy services and goods is what the World Economic Forum (2010) characterized as energy poverty. It exists in all situations when there are insufficient reasonably priced, dependable, high-quality, safe, and ecologically responsible energy services available to promote development. The European Union defines energy poverty as a state in which households lack access to basic energy products and services. According to the World Bank, those who are poor have less access to power and are more likely to stay that way if they don't make any connections. Energy poverty is a multifaceted issue that takes into account factors like calorie consumption, life expectancy, housing quality, literacy, and energy access, among others. Two indications are included in the non-income dimension: the use of traditional cooking fuels such firewood, charcoal, and dung, and the absence of access to electricity (Njiru and Letema, 2018). Inability of a home to provide socially and monetarily essential levels of domestic energy services is the definition of energy poverty, dynamic, multifaceted phenomena (Mkomba et. al, 2021).

This paper is attempted find out whether energy poverty exists or not in India on basis earlier research done by different researchers in different way. It is a theoretical analysis and an assumption; is it prevail energy poverty in India; on the basis of research evidence from different researchers. It also tries to identify different approaches of energy poverty.

## 2. METHODOLOGY

The present study is based on secondary data. The data taken from different journal that are extensively study on energy poverty and especially those are applying different approaches to measure energy poverty in India. Thus the present study confines only those research articles which are the familiar to the energy poverty. On basis of earlier study different approaches of energy poverty, it attempted to find out whether energy poverty exists in India or not?

## 3. DIFFERENT APPROACHES OF ENERGY POVERTY

Many researchers all over the world different approaches of energy poverty were used. There is no specific universal measure of energy poverty. Among these different approaches some of important approach can be discussed:

### 3.1. LACK OF ACCESS TO ENERGY SERVICES

This approach was most importantly characterized by international agencies like the United Nations and International Energy Agency (IEA), who are maintaining indicators on basis of different energy sources. According to this approach energy poor are those who unable access to energy services and the income and the prices are the barrier access to energy. The physical access leads into consumption. Generally, income and prices affect ability access to energy; however government policies have role in household choice and availability of energy sources. They have introduced energy development index (EDI), but focused on indicators physical access to energy. The EDI is constitute of four indicators, i.e., (I) per capita commercial energy, which is considered indicator of overall economic development of a nation, (II) per capita electricity consumption in the residential, which is considered the indicator of reliability and consumer's ability to pay for electricity services, (III) share of modern fuels out of total residential sector energy use, which is indicator of the level of access to clean cooking fuels; and (IV) rate of population access to electricity. EDI approach enables the construction of index, but unfortunately does not influence in more complicated policy dimensions, pricing and income. Furthermore, it does not considered biomass which is major source of energy in the developing countries, so the IEA has started reporting on the use traditional biomass.

### 3.2. PHYSICAL ENERGY NEEDS

Various methods based on physical energy requirements were introduced, including a significant method proposed by Bravo et al. (1979). This method takes into account the energy needed for household activities such as cooking and lighting. According to this approach, the average household in a tropical country like India requires approximately 27.4 kgOE per capita per month to meet essential direct energy needs. Another method, developed by Goldemberg (1990), considers a wider range of energy consumption and addresses energy poverty, setting the minimum energy requirement at 32.1 kgOE per capita per month. Additionally, Modi et al. (2005) introduced a more universal approach based on surveys from international agencies, organizations, and countries. According to this approach, the minimum energy requirement for household cooking and lighting is 50 kgOE. It is evident that these approaches make different assumptions and yield significantly different results in evaluating minimum energy requirements.

### 3.3. PHYSICAL ENERGY NEEDS

This method considers assign values for various types and end-use energy. According to Practical Action (2010), the energy poverty index is derived from various indicators involving cooking and heating, electricity, and machine-driven power. There is a ranking of services from zero to five scale units based on category, where five is the highest level of service. This method is suitable in that it considers three dimensions of energy poverty, but it is also complex, it mixes end uses and is rather ignorant in the weighting to measure energy poverty

### 3.4. ENERGY AFFORDABILITY

Energy poverty can also be defined by affordability. According to affordability approach the households are energy poverty those who are use energy below the expenditure or income poverty line (Foster et al., 2000). This method can be applied directly with a household energy since the expenditure poverty line is clearly defined around the world in most countries. This approach considered income poverty households are the energy poverty, but in reality it is not happened always. That is why the income poverty is based general economic and social policies which are distinct from the energy policies that reflect the energy basket of minimum goods and services.

### 3.5. ENERGY ACCESS AND LEVELS OF USEFUL ENERGY CONSUMPTION

Energy poverty can be defined by considering both the availability and utilization of different energy sources and services (Pachauri et al, 2004). This approach examines the energy consumption patterns and the rate at which people gain access to energy resources over time in order to determine the extent of energy poverty. However, this method is not ideal for establishing a clear energy poverty threshold that can be universally applied to identify households as energy poor, and it is also difficult to implement and monitor.

### 3.6. MULTI-DIMENSIONAL APPROACH

Multidimensional Energy Poverty Index (MEPI) first time proposed by Nussbaumer et al. (2012) and created by the Oxford Poverty & Human Development Initiative (OPHI) with the association of United Nations Development Program (UNDP). The MEPI captures the set of energy deprivations that may affect a person. It is composed of five dimensions representing basic energy services with six indicators. Each indicator has assigned different weights and sum of weights of different indicators is 1. A person is identified as energy poor if the combination of the deprivations faced exceeds a pre-defined cut-off score i.e.,  $k = 0.33$ . The MEPI is the product of a headcount ratio and the average intensity of deprivation of the energy poor. The multi-dimensional energy poverty index given by Nussbaumer et al., 2012 focuses on more than one energy deprivations but the weights given to various dimensions are then subject to a sensitivity analysis (Gupta et al., 2020).

Sadath and Acharya (2017), Acharya and Sadath (2019) developed theoretically improved approach to draw and measure the multi-dimensional energy poverty, while these are not efficient in their approach and do not widely capture the multi-dimensionality of energy poverty in reality. Sometimes, the multi-dimensional approach analyses are not

consistent, considered only to specific limited geographical region. For instance, the study done by Yadava and Sinha (2018) is limited to only a set of forest fringe villages.

Most recently, Gupta et al. (2020) developed a new and more comprehensive approach to draw energy poverty in India by applying multi-dimensional energy poverty index. It approaches the question of energy poverty drawing from the strong linkages between accessibility and affordability and constructs a comprehensive energy poverty index by considering a wider set of 15 key indicators pick up various crucial dimensions of energy supply at household level. By using principal component analysis (PCA), the weighing is done more scientifically. However, this method is also considered the households energy requirement and affordability but fail to capture the whole economic system and welfare of the society.

#### 4. ENERGY POVERTY IN INDIA

Throughout analysis we found different approaches of energy poverty and these approaches are applied by so many researchers in India. Every approach found that energy poverty exist India. Pachauri et al. (2004) have applied two-dimensional measure of energy poverty and energy distribution that constitute the elements of access to different energy types and quantity of energy consumed. The extent of energy poverty and changes in energy distribution pattern are analysed by applying this measure to Indian household survey data for 1983–2000. It is found that energy poverty exist in India, but it has been declining from more than 75% to less than 40% during 1983–84 to 1999–2000.

Khandker et al. (2012) in their analysis they stated that income poverty and energy poverty correlate highly with each other in urban areas in India, while this correlation does not exist in rural India. They found that 57% of households are energy poor while 22% are income poor in rural. But, the energy poverty is 28% compare to 20% that are income poor in urban.

Sadath and Acharya (2017) have made an all-inclusive valuation of the extent and numerous socio-economic implications of energy poverty in India through multi-dimensional energy poverty index (MPEI). Basically, they considered 3 indicators, i.e., lighting (electricity), cooking (access to LPG and stove type) and additional measures (firewood, dunk cake, crop residue, kerosene and coal/carcoal). All these three indicators are weighted equally 33.33 and household is considered energy when it get score 33.33 or above. They found that 60% of households are energy poverty in India. In the cities Delhi and Chandigarh it is below 10% of households are energy poverty. In some states like Goa, Mizoram, Manipur, Nagaland, Arunachal Pradesh and Sikkim 50% of households are energy poverty. In states Rajasthan, Bihar, Uttar Pradesh, Jharkhand, Orissa, Chhattisgarh, and Madhya Pradesh, more than 70% of the households are energy poverty, while like in Kerala, Tamil Nadu and Jammu & Kashmir 40% of the households are energy.

Gupta et al. (2020) developed a new wider approach in measuring Household Energy Poverty Index (HEPI) using National Sample Survey unit level data, considering a set of 15 key energy indicators indicating multiple dimensions of energy and assign weights by using principal component analysis (PCA). They divide households into four different categories, i.e., 'least energy poor', 'less energy poor', 'more energy poor' and 'most energy poor'. They revealed that energy poverty exist in India, though in varying degrees across the different geographical areas. All over India HEPI score is found to be 2.76, which is quite high compared to the lowest value of Delhi as 1.82. It was found that around 29% households i.e. more than 1/4th of total households in the country, falls under 'most energy poor' category, and 65% households in the country are in the 'more and most energy poor' groups implying the wide-scale prevalence of energy poverty in the country. Bihar is the poorest state in overall energy index with a HEPI value of 3.47. Comparison of urban and rural areas showed that urban areas are found to be more energy secure and less energy deprived than rural areas. The mean HEPI for North Eastern states of India is found to be 3.23, which is above all Indian average index, indicating persistent of high degree of energy poverty in this region.

Thus throughout the analysis of the paper we have found that energy poverty exist in India since researchers have presented energy poverty existent in India by using different approaches of energy poverty. They also identified different factors affect the energy poverty such as socio economic factors as well as geographical region. It is notable that multi-dimensional approach become popular and widely consider set of multiple indicators. Now-a- days this approach is commonly used by researchers, organizations and government agencies. There is scope for this approach universal acceptable in future, if international organizations and nations are work together extensively on it, just like Multi-dimensional Poverty Index (MPI).

## 5. CONCLUSION

Energy poverty exists in India since all researchers are found energy poverty by applying different approaches. The determinants of energy poverty in India are socio-economic factors as well as geographical factors as stated by different researchers. Generally income has positive relationship with modern energy services but it may not be always possible. The level of education, age, occupation head of the household, family size, and level of women education etc. are the main common factors that affect in accessing modern energy services in India. The energy poverty is variation on the basis of geographical region; especially north-eastern region is most energy poor in India. The availability of firewood leads to use dirty fuels even purchasing capacity of modern fuels like LPG, Natural gas, electricity etc. Taste and preference to food prepared by traditional biomass is also a factor that rural household uses dirty fuels.

The government agencies and non-governmental organisation should organize frequently awareness programmes about the practice of modern energy and its benefits. Women education should be given priority since foods are prepared by mostly women in the household that enables understand the use of dirty and clean fuels. Local and central government should be focussed on geographically that energy poverty can be eradicated simultaneously.

## CONFLICT OF INTERESTS

None.

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