**Gauging energy poverty in India: A multidimensional approach**

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**Introduction:** In 2016 United Nations (UN) launched 17 Sustainable Development Goals (SDGs) by replacing the UN’s 8 Millennium Development Goals (MDGs) to tackle poverty, inequality and climate change in the next one and half decade. Clean and efficient energy services are the central for economic development and well being of humans. Deprivation of clean fuel for cooking and lack of access to electricity hinders the prospects of economic as well as human development particularly in developing nations like India. Energy demand in India is increasing due to increased population and rapid economic growth.

The broader interpretation of poverty has been considered as lack of income has allowed the emergence of concept of multi-dimensional aspect of poverty. Among many dimensions one is the concept of energy poverty, though, it is not recognized in poverty assessment. The concept of energy poverty is complex and multi-dimensional and there is no common consensus on its definition and measurement. However, there is a consensus that energy poverty is the deprivation of basic energy needs and access to modern, clean and efficient energy. Measurement of energy poverty is important to identify those who are affected more due to use of fuels along with the magnitude and intensity. Identification of the energy poor is important in order to formulate the policy measures to fight energy poverty and put it in regional and national agendas. This paper focuses on the measurement of basic energy poverty in India using adapted energy poverty index.

**Methods:** The methodology used is an adapted version of Multidimensional Energy Poverty Index (MEPI) developed by Nussbaumer et al. (2011) which on the other hand is based on Alkire Foster’s (2007) methodology to measure Multidimensional Poverty Index. Same methodology has been followed to compute the multidimensional deprivation scores, but dimensions have been altered to include the index to measure deprivation of the basic energy needs and index to have adequate energy services for 10% of income. These indexes are inspired by the Energy Access and Consumption Matrix developed by Pachauri et al. (2004) and Boardman (1991) respectively. Apart from these two dimensions, other dimensions have been kept same as it is in original methodology are Energy used for cooking and lighting. These dimensions are weighted in such a way that the sum of weights is equal to 1. In MEPI energy used for cooking service/dimension is given the largest weight. This is an important dimension when we measure energy poverty. The dimension of lighting is also given high importance which is measured through the access to electricity. Cooking, lighting, access to basic energy services (quantity of consumption) and 10% measure are assigned with the weights 0.4, 0.1, 0.3 and 0.2 respectively. Those households which are not using LPG, kerosene, natural gas/biogas or electricity as primary fuel for cooking are deprived in that dimension. Also, households which do not have electricity as primary source energy for lighting are deprived in lighting dimension. In the dimension of access to basic services households are deprived if their per capita daily kWh consumption is less than threshold i.e., 0.79 kWh. Those households where expenditure on energy consumption to the total consumption expenditure exceeds 10 percent are deprived in 10% measure dimension. The multidimensional cut off is set to 0.4 which means that an individual is multidimensionally derived either if they don not use modern cooking fuels and have access to electricity for lighting, or if they do not use minimum amount of energy and their expenditure on energy is more than 10 percent of their total expenditure or any three dimensions combined.

**Results:** The results reveal that most of the total population in rural areas are dependent on the solid fuels for their cooking. In rural areas more than three fourth of the population is dependent on the solid fuels whereas one fifth of the urban population is dependent on the solid fuels for their cooking. Overall, MEPI score in India is 0.472 and in rural areas MEPI is higher (0.58) than urban areas (0.19). Among states, Empowered Action Group (EAG) states which includes Bihar, Chhattisgarh, Rajasthan, Madhya Pradesh, Jharkhand, Odisha, Uttarakhand and Uttar Pradesh have highest energy poverty except Uttarakhand. Among various dimensions, more than 50% population is poor in cooking and consumption (in kWh) dimensions. Also, the results show that there is a negative correlation between HD and MEPI i.e., if the state has high HDI score, they have least energy poverty.

**Conclusions:** In order to attain the targets of the SDGs particularly the goal 7 it becomes important to increase the focus on energy access and energy deprivation. This paper is an attempt to identify multidimensional nature of energy poverty and will help in creating awareness regarding energy poverty.