

Energy Poverty and the Gender Divide

Abstract

More than a billion people (mostly rural) all over the world are still living in energy poverty, which is defined as the inability to access and afford modern cooking fuels and the lack of a bare minimum electric lighting to read or for other household and productive activities. To fulfil their energy needs, households use traditional sources of energy, mainly biomass, animal dung and sometimes kerosene. These fuels emit lot of harmful smoke and gases leading to health hazards like chronic heart disease, lung problems, cancers and neurodegenerative diseases such as dementia, Alzheimer's and Parkinson's diseases. In this population, women, girls and school-aged children bear most of the brunt as women cook all the meals for the household, with children assisting them with small chores. Another problem is school absenteeism, especially among girls, because of time spent in collecting firewood from jungles. Lack of energy also leads to low productivity, hence keeping these households in the clutches of poverty. Case studies in the present paper shed light on the micro level situation in Asian villages. Hence, it is important to study the extent and causes of energy dearth as well as the implementation of effective, sustainable and affordable solutions, which is the objective of this paper.

Keywords: *energy poverty, women health hazards, school absenteeism, rural areas, traditional sources of energy, biomass*

I. Background and objective

Access to modern energy sources is particularly crucial to human development, as it is difficult to carry out certain basic household, social and productive activities without them. The inability to access and afford modern cooking fuels and the lack of bare minimum electric lighting to read or for other household and productive activities after sunset is a kind of poverty called energy poverty. More than a billion people (mostly rural) all over the world are still living in this kind of poverty. Energy poverty interacts with other expressions of poverty and therefore it is essential to discuss the issues that surround it, including the gender aspects (Clancy et al. 2003).

There are many energy requirements in a household such as basic lighting, cooling/heating, cooking, phone charging and using other electric appliances. If you do not have access to basic electricity, then daytime hours become more important for almost all activities. Moreover, you start preparing for kerosene, candles, torches etc. to illuminate the house before it darkens. In the absence of modern cooking fuels like LPG cylinder or piped gas, most households tend to use wood (mainly), animal dung or kerosene as cooking fuel. To enable this, family members have to go to nearby forests to gather firewood, which takes several hours in a week. This increases the time they spend on cooking and this process emits lot of harmful smoke and gases, leading to health problems. Women, girls and school-aged children bear the primary responsibility for fetching firewood, cooking and other domestic work. The women stay at home for a longer period managing the house, thus being more exposed to indoor pollution generated due to cooking. This also holds true for the children of the house because they either assist their mothers in the work (especially girls) or return from school during lunch break and stay back.

Since so much time is spent on collecting fuel for lighting, cooking and heating, it keeps them (women and children) away

from more productive activities (Barnes and Toman 2006; Saghir 2005) for income generation and attaining school education, thus making them disproportionately affected by energy poverty, especially in developing countries. Along with these household tasks, women also share the duty of enhancing household income by working in fields, selling home made products on the roadside and sometimes running side businesses in order to improve their standard of living. Children also participate in these activities with their mothers, which leads to school absenteeism and low enrolment rate (Levison et al. 2018). Table 1 shows the access to clean fuels and electricity in India and ASEAN countries:

In the table, we can observe that India and most ASEAN countries do not have 100 per cent access to clean fuels for cooking. Laos PDR is the worst among these, where only 5.6 per cent of the population has safe fuels to cook their meals. The rest are dependent on firewood or crop residue, which has major implications on health of the family members, especially women of the house. In India, only 40 percent of the population can access safe cooking fuels and rest are dependent heavily on biomass or kerosene. In the case of electricity, Cambodia is the worst in rural electrification, while for India, approximately only 78 per cent of the rural population has access to electricity.

This problem of lack of availability of modern sources of energy is still very prevalent in many parts of the world even though there are major technological breakthroughs globally. However, innovations and technological development have led to a greater divide between the haves and have nots. In some places, people have access to the latest scientific innovations making their life easier and comfortable, whereas in other parts of the world, people do not even have access to a safe source of energy to fulfil their basic needs. Hence, it is very important to explore the causal relationship between energy poverty and socio-economic conditions prevalent in economies. This would

Table 1: Access to electricity and clean fuels for cooking in India and ASEAN countries

2016	India	Philippines	Indonesia	Thailand	Laos PDR	Cambodia	Malaysia	Myanmar	Vietnam	Brunei
Access to electricity, urban population (%)	98.46	96.90	99.74	100	97	100	100	89.4	100	100
Access to electricity, rural population (%)	77.62	86.25	94.77	100	80.3	36.4	100	39.79	100	100
Access to clean fuels and technologies for cooking (% of population)	41.05	43.22	58.3	74.5	5.62	17.69	96.3	18.4	66.6	100

Source: www.worldbank.org

enable us to suggest real world solutions to alleviate energy poverty and investigate the gap between what is required and the prevailing government policies adopted in such countries. To make sure that the solutions are successful, it is vital to look at some actual cases and the extent to which these suggested solutions have been implemented.

In the following sections, the paper attempts to draw attention to the basic questions: who are the energy poor; what are the causes of this kind of poverty; what are the implications of the lack of electricity and access to clean fuels for health and quality of life prevailing in some Asian countries including India; and, what are the possible ways to eliminate or reduce this adversity? We will also discuss two case studies, which would shed light on the actual ground level situation in remote and poor villages, the attempts made to alleviate energy poverty and whether these steps have made any significant impact on the living conditions of the inhabitants.

II. Who are the energy poor?

There is no standard metric for energy poverty because there is no single, universally accepted understanding of what it is to be below the energy poverty line (Culver 2017), though there is a large body of literature that discusses how to measure income poverty (Barnes et al. 2011; Fahmy 2011; Heindl 2015; Hills 2012; Khandker et al. 2012; Morrison and Shortt 2008; Pachauri et al. 2004; Pachauri and Spreng 2011; Walker et al. 2014). It is important to have a structured approach to the manner in which energy poverty is defined, measured, monitored, recorded and reported. Understanding energy poverty, specifically for Asian region, is central to any efforts to alleviate it in the area. We want to understand energy poverty specifically for Asia because the definition differs depending upon the climate, needs and resources.

According to the first official definition of energy poverty, which

is still unofficially used in a few countries, “a household is said to be energy poor if it needs to spend more than 10 per cent of its income on fuel to maintain an adequate level of warmth” (Boardman 1991). Therefore, the share of households' expenditure covering their energy costs is an important indicator to point out energy poverty. Pachauri and Spreng (2004) state that if people do not get a basic minimum level of energy required for survival, they are suffering from energy poverty. The basic minimum is built on the basic energy accessibility, requirements and consumption. According to Nassbaumer et al. (2012), a person is identified as energy poor if the combination of the energy resource deprivations faced by a household exceeds a pre-defined threshold. For this, it defines the minimum requirements of a household separately, for rural areas and urban areas. For a rural area, basic needs are defined as cooking, basic lighting and cooling and charging a communication device, whereas in an urban area, the basic energy is required for cooking, basic lighting, use of electrical appliances and gadgets and travelling to work. A basic threshold is defined and all the households which do not fulfil that threshold level criteria are categorized as energy poor. Barnes et al. (2011) proposed an energy poverty line below which all would be considered energy poor. Energy poverty line is the average final energy consumption of the households whose total incomes fall within ten percent of the national poverty line (Foster et al. 2000). Energy poverty line is the level at which people use the bare minimum energy (derived from all sources) needed to sustain life. Besides these definitions, the International Energy Agency (IEA) categorizes all those as energy poor who lack access to modern energy services. These services are defined as household access to electricity and clean cooking facilities (e.g. fuels and cooking stoves that do not lead to indoor air pollution).

Based on existing literature, we arrive at a definition that people/households that are not able to access modern, safe and non-polluting energy sources to fulfil their basic lighting,

cooking, heating and livelihood needs are energy poor. Apart from minimum household activities, they are unable to use energy for commercial, productive or livelihood needs.

III. What leads to energy poverty?

Energy poverty is caused by an intricate combination of factors. Firstly, people are energy poor due to lack of physical availability and infrastructure to provide energy. Many villages in remote areas are not connected to the main grid and hence there is no access to electricity. It is the lack of adequate infrastructure, which acts as an impediment to accessibility to all (Kangawa and Nakata 2008). Moreover, it is difficult to provide safe energy modes for cooking as well as other requirements. This may be attributed to the remoteness and low density of the villages, making them an unprofitable venture for investors. Secondly, energy poverty might arise due to lack of income and hence purchasing power. There is a limited capacity of households to pay for energy services because they have low income levels and negligible wealth which makes affordability difficult (Birol 2007; Khandker et al. 2012). Due to this, it becomes tough to attract investment towards supply of safe energy in poor and remote areas. Illegal connections and electricity theft become common, as many households are not able to pay cost-reflective tariff rates (Buzor 2016). Theft is also substantial in slums and areas with informal settlements, whose inhabitants often do not meet the legal requirements to become regular customers of electricity companies (Mukwaya 2016). A third cause is high energy prices and high costs of supplying safe energy. Besides their low incomes, these households are vulnerable because of market-driven energy prices (Middlemiss and Gillard 2015; Sagar 2005). Additionally, because a low population density and a very high percentage of poor households characterize rural areas, it results in high costs of supply for each unit of energy consumed (The World Bank 2010). Fourthly, the lack of infrastructure to provide safe energy is

another factor: an obstacle to rural/urban electrification in many countries with low access rates is the insufficient generation capacity of the main electricity system. Lastly, population growth and migration from rural to urban areas is another cause of energy poverty: due to increase in population (and hence labor force) without a proportionate increase in employment opportunities, people are forced to migrate from villages to cities, thus putting pressure on the existing infrastructure in the cities which calls for increased demand for energy sources.

Therefore, the main challenges for the authorities, government, agencies and energy poor themselves are the quality of life, energy costs and supply issues, stability of household income, health risks and social relations within the household and outside. In evaluating these challenges, we find that those who are energy vulnerable have limited capability to reduce their own vulnerability (Middlemiss and Gillard 2015). Hence the authorities have to step in to solve this tricky and persistent problem.

IV. The consequences

The health risk factor

People under the poverty line are mostly energy poor too. It is estimated that approximately two thirds of these are women, quite a few of whom live in female-headed rural households (Clancy 2003). It is essential to keep in mind that men and women have different energy requirements and might have different notions of sustainable livelihood. Moreover, women and men have dissimilar access to resources and decision making. Women's access to decision making within the household and community is constrained, limiting their ability to influence practices and resource division (Clancy 2003), one of them being energy. Women cook all the meals for the household, with children assisting them with small chores. They use biomass for cooking, which has a number of

repercussions for women, children and all the members present inside the house. The fuel quality is low and when burnt, it gives off quantities of smoke and particulates leading to indoor air pollution, which has severe negative effects on health and premature deaths due to pollution (Grey 2017; Lacroix and Chaton 2015; Sagar 2005; Sovacool 2012).

Das et al. (2017), in their study on the impact of household air pollution on health, confirmed that indoor pollution is related to various cardiopulmonary health evils, including chronic obstructive pulmonary disease, acute coronary syndrome (Fatmi et al. 2014), cardiovascular ailments (Brook et al. 2010) and blood pressure (Peña et al. 2015). The emissions are also associated with cancers of various types, mainly lung, mouth, pharynx etc. (Bruce et al. 2015; Seow et al. 2014). A recent study finds associations between long-term exposure to PM_{2.5} among adults (>65 years) and neurodegenerative diseases such as dementia, Alzheimer's and Parkinson's diseases (Kioumourtoglou et al. 2016). Pregnant women's exposure to firewood fumes during their third trimester is related to school-going children's low scores in neuropsychological tests (Dix-Cooper et al. 2012). Moreover, there are problems of phlegm, dry cough, wheezing, sneezing, chest stiffness, bronchial disorders, backache and eye discomfort when exposed to high heat while cooking (Choi et al. 2015; Khushk et al. 2005; Smith-Sivertsen et al. 2009). This trend is mainly prevalent in the Asian and African countries. In addition, the use of these unsafe cooking fuels is accompanied by the absence of proper ventilation, which aggravates the problem. A lack of decent ventilation or a chimney locks the smoke inside the house for a longer time.

Another related aspect is school absenteeism. Besides the available literature reviewed, we also conducted a survey in a remote village of Ladakh in March 2018, where it was revealed that due to lack of proper and regular fuel availability, women

and children have to often go to nearby forests to collect firewood and have to spend two to three hours on each trip, a few times a week.. The interview of the local people revealed that they require firewood for cooking as well as for heating up their homes. Ladakh is situated at 14,000 feet above sea level and the temperature goes down to -20 degrees. Hence they require fuel to heat up their homes all through the year, especially during winters. Besides this, they use kerosene to light lamps after sunset, which generates harmful fumes.

The equity aspect of energy

Energy has an equity facet too: poor families use much less energy than wealthier ones in absolute terms. They either do not or hardly boil water for drinking and other hygiene purposes, which increases the possibility of water-borne diseases. These ailments lessen the ability of poor individuals to improve their livelihoods and increase their vulnerability. This not only prevents adult family members from working efficiently but also negatively impacts children's education. Their possibilities for education and income generation are restricted by the absence of modern energy sources, and as a result, these families and communities are likely to remain trapped in poverty (UNDP 2010).

Moreover, if there is no electricity and communication devices, these families are not updated about the happenings around the world. They miss out most of the opportunities which can bring them out of this trap. They are unable to benefit from the innovations, development and deployment of new technologies and achieve a better standard of living.

Low productivity and lack of employment opportunities

Poverty and energy inadequacy go hand in hand, with energy overheads accounting for a significant percentage of household incomes in many developing economies (Sovacool 2012). Families

with no access to modern fuels end up spending a disproportionate part of their income and still suffer from low productivity. Educational impact relates to time spent out of school as well as increased absenteeism due to respiratory illnesses (Bouzarovski and Petrova 2015; Sagar 2005). Furthermore, it is estimated that women and children across the globe spend a combined 200 million hours per day collecting water.

Lack of access to energy also prohibits manufacturing and commercial activities, which could have generated employment for the local population. The village in Ladakh covered in our case study is mainly dependent on farming activities for its livelihood. Another village in Philippines which does not have electricity and is dependent on firewood and kerosene for cooking and heating has fishing and farming as its main livelihood activities. There are no major commercial activities in such rural areas. Farming activities are also largely manual, without any usage of mechanization techniques. Hence the population is unable to come out of the vicious circle of poverty.

Hence the absence of modern energy sources for cooking and lighting impacts the well being of the people. Health, education and employment prospects are greatly impacted and people feel frustrated and helpless in the absence of any solution available to come out of this nasty spiral of poverty.

V. The case of two villages

Two case studies of two different villages were developed as part of a project sponsored by Economic Research Institute of ASEAN Region, Jakarta, Indonesia, which covered a village in Ladakh, India, and a village in San Jose Island, Philippines. They shed light on the state and extent of energy poverty prevailing in the region. They also revealed the attempts made by the villagers or the government to eliminate energy poverty from the area. The village in Ladakh has been adopted by an NGO, Global Himalayan Expedition (GHE) where they have

provided solar energy off grid solutions. This has enabled people to access electricity, which has improved their livelihood prospects and quality of life even after sunset. The village in Carabao Island has been recently provided with a diesel operated micro grid, which has brought electricity to 80 per cent of the houses and has improved the commercial activities and hence the income level of the villagers.

V.1 Chenmo village, Ladakh, India

Chenmo is a very remote village at the level of 13,000 feet in the Himalayan region of India, where the population is around 200 people. It experiences extreme weather with the minimum reaching -20 to -30 degrees. Due to geographical reasons, it is impossible to connect the village to the main grid. For their cooking and lighting needs, they are largely dependent on firewood, yak dung and kerosene. They use a *chulha* in which they use yak dung as the primary fuel. Houses are equipped with traditional chimneys but they are not very effective and people suffer from health problems. Moreover, due to very cold weather, they are required to heat up their homes by burning wood, which further leads to indoor pollution. There are not many sources of earning and they depend on farming. Women mainly stay at home and children go to a local school in the first half of the day. Due to the use of traditional *chulha* and firewood in order to keep their house warm, women suffer from various ailments like cough and asthma. After school, children also stay at home to assist their mothers or to take rest, which leads to inhaling of smoke and particulates resulting in respiratory problems. Poor geography and lack of income generating sources had driven this village into poverty.

However, recently it has been provided with a micro grid based on renewable energy, which is cheaper and hence affordable. The tariffs are not very high. Moreover, community members are trained to run and maintain the micro grid in the long run.

Women are given training to repair them if there is any fault. This way, women are empowered and are more appreciated in the local society. Electricity has brought tourism in the village because it is located in a beautiful place, which has led to more livelihood options arising from the tourism industry.

V.2 San Jose island, Philippines

As opposed to a small village in Ladakh, San Jose island inhabits a much bigger village with more than 10,000 people. It has a tropical weather with plenty of rainfall. The main source of livelihood is farming, along with allied agricultural activities. Besides farming, fishing is also pursued and the village has many small shops, which give livelihood to the villagers. Women are mainly stay at home mothers or sometimes help in farming activities. The households depend on firewood for cooking needs and a few better-off families have LPG for cooking purposes. Families dependent on wood either buy wood from nearby shops or go to jungles to collect it. It depends on the income level of the family, whether they can afford to buy wood or have to go all the way (and spend two to three hours thrice a week) to fetch free wood. This is primarily done by women members of the household, who are sometimes accompanied by young children. The village is not grid connected and they depend on a diesel based microgrid which is provided by a governmental agency. They have to pay monthly tariff for this electricity and the microgrid provides lighting, charging points and points to connect other basic electrical appliances. However, they are spending more than proportionate income on buying all sources of energy combined and still do not have access to clean cooking fuels. The most affected part of the population is women, who have to fetch the wood, cook all the meals and bear the indoor pollution. This has led to constant coughing and quick aging in many women. Girls of the family are also more involved in domestic work, thus facing the same consequences as the older women of the house.

V.3 Lessons learnt from the case studies

The villages are still suffering from energy poverty because a big proportion of the households do not have access to clean fuels for cooking and the major burden goes to females and young children. However, rural electrification in both these villages has improved the quality of life and enhanced economic activities, thus leading to higher household income per capita.

VI. The way out

The case studies have clearly shown that health implications are severe with prolonged use of wood or charcoal for cooking. The Indian government has been promoting LPG connections for all rural households. However, the success rate is still unknown. Given the high rates of population growth, the rate of deforestation and lags in the delivery of LPG or other modern energy services, it will become more difficult to sustain on biomass in the coming years. Energy poor population would start burning crop residue, which is far more inferior as a fuel. Increasing dependence of households relying on inferior biomass has implications for human health. Promoting cooking stoves that significantly reduce fuel consumption could reduce the burden of disease from indoor pollution if it allows households to have sustained access to higher quality fuel wood.

Regarding electricity, many organisations have been developing affordable and sustainable microgrid solutions based on renewable energy. These solutions are mainly suitable for off-grid and remote areas, which are almost impossible to connect to the main grid. This enables households to have regular and good quality electricity, which will enhance the standard of living, boost the productive and commercial activities as well as improve school and other public infrastructure. This will improve health conditions, reduce school absenteeism and would help families to come out of the vicious circle of poverty. Households will not depend on

kerosene, wood, crop residues and other forms of biomass for heating and lighting up their homes after dark, which is the main source of indoor pollution and related health ailments.

VI. Implications and conclusion

This malicious cycle of energy poverty needs to be broken. The access to modern energy sources and levels of energy consumed are key dimensions that need to be analysed. Therefore, to improve the well being of the poor, two elements are needed; firstly, to improve access to efficient energy sources; and secondly, to ensure that they get an adequate quantity of energy by making modern energy sources affordable. For this, strong and urgent national level steps are required to pull people out of this trap. The government has to step in to cover those rural areas, which are not profitable enough for private investors. A few steps have been taken to provide LPG for cooking purposes but the authorities have to go deep inside those areas which are still untouched.

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