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Review

Analysis of energy as a precondition for improvement of living conditions and poverty reduction in sub-Saharan Africa

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This paper examines the link between availability of energy and improvement of living condition and poverty reduction in sub-Saharan Africa. It argued that modern sources of energy are required for the improvement of living standards; may be by helping to create jobs and by boosting productivity. For energy exporters, particularly oil producers, they provide revenues that may bring about sustainable poverty reduction. And the supply of energy improve living conditions by providing better lighting of homes, cleaner fuels for cooking and heating. The study found that, essential aspects of human welfare (leading long and productive life, enjoy good health, have access to knowledge and education opportunities, have the potential to earn sufficient income to supply themselves with ample nutrition, shelter and other material and aesthetic needs) may improve only if modern energy becomes available for all; yet there are nearly 2 billion people still without electricity in developing countries. The study also found that, energy can have major favorable effects in remote rural areas and renewable energy technologies offer a key prospect in areas where the grid cannot reach. Reliance of the poor on their natural surroundings indicates that any step towards poverty alleviation should incorporate environmental and economic sustainability as a priority for sustainable livelihoods. This paper is a contribution in a process towards the use of energy to be one of the instruments to reduce poverty in developing countries especially in Africa.

Key words: Energy, poverty reduction, human development, standard of living.

INTRODUCTION

Poverty is regarded as one of the world's most fundamental burning issues, which needs to be addressed through socio-economic development. Poverty is conceptualized in material terms as not having access to adequate levels of food, water, clothing, shelter, sanitation, health care and education. This can be translated into people having insufficient income. A better life and an improved standard of living are fundamental aspirations. But for billions of people a better life means getting access to basic needs such as food, health services, housing and clean water. None of these basic needs can be provided without energy.

Energy is one of the most essential inputs into sustaining people's livelihoods, at the most basic level it is a precondition of cooked food, boiled water and warmth. Lack of access to clean and affordable energy is considered a core dimension of poverty. It has been well known for a long time that poor people tend to use biomass as their energy carrier. In many areas, there are increasing biomass supply shortages, which add to women's burden whose responsibility is to collect fuel.

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However, despite the fact that around 2 billion people use biomass fuels, there have been little attempts to analyze the energy-poverty nexus in depth (James and Hidieki, 2007). Partly, this can be explained by the fact that the biomass in rural areas is collected at zero monetary cost mainly by women and children, and so it falls outside of national energy accounts. As a consequence decision makers are not aware of the full significance of biomass energy and policies and strategies fail to address the issues.

Fifteen (15) years ago, in Copenhagen, global leaders at the World Summit for Social Development described poverty eradication as an ethical, political and economic imperative, and identified it as one of the three pillars of social development. Poverty eradication has since become the overarching objective of development, as reflected in the internationally agreed development goals, including the Millennium Development Goals (MDGs), which set the target of halving global extreme poverty by 2015.

Yet, global poverty levels have changed very little over the past two decades except in China and East Asia, the total number of people living in poverty has not changed much but the living standard of those integrated in the economic process has improved considerably and to some extent, in India. Viewed in terms of the wider definition of poverty adopted by the 1995 Social Summit "…a condition characterized by severe deprivation of basic human needs, including food, safe drinking water, sanitation facilities, health, shelter, education and information.", which includes deprivation, social exclusion and lack of participation, the situation today may be even more deplorable than a money income poverty line would suggest (UN, 2009).

Energy is crucial, but in the search for solutions it is important to understand that energy supply is not a goal in itself, but only a means through which peoples' needs can be met. People need heating, lighting, the ability to cook food and transportation energy is a basic input into all human activities. At the most simplistic level: producing food requires energy inputs to prepare the land, for harvesting the crops, transporting, processing and cooking the food. The more complex the activities become, the more complex the energy inputs. In the South, the energy input, at least for poor people, is in the form of human and animal energy, whereas in the North fossil fuels are the main input. One major difference between energy use in the North and South is that, in the North, energy reduces physical effort and drudgery. One of the reasons behind this difference is that poor people do not have the money to buy improved energy services to make their lives better. The first part of the paper, explores the implications of being poor on the type of energy used and, in particular, the gender dimensions of energy and poverty. The second part of the paper, examines the assumption that if income generation is the answer to poverty, then what do women want to enable them to generate income and what is the role of energy in this process?

Objectives of the study

Poverty is a global challenge and its alleviation is among the international institutions overarching goals. The purpose of this study was to develop a methodology and approach that would enable a poverty reduction analysis of the energy projects, as well as to identify means to enhance their impact on poverty reduction. This paper seeks to evolve a methodology for the estimation of direct and indirect impacts of energy projects on poverty alleviation and also the enhancement of such impacts. The field study:

(a) Identified the linkages between access to energy/electricity and poverty alleviation in general.
(b) Quantified the impacts of access to modern energy on poverty alleviation and related development issues.
(c) Drew lessons learned which may improve the impact of energy projects on poverty alleviation poor countries.
(d) Contributed to the development of a methodology for the monitoring of impacts of energy projects on the poor.
(e) Reviewed recent analyses of energy-poverty linkages by the World Bank and other international agencies and literature in rural areas. It broadly focused, including, for example, women's time inputs to energy-consuming household work such as food processing, cooking and fuel wood collection.
(f) Explained how the MDGs can be achieved through energy for the poorest and most isolated communities.

LITERATURE REVIEW

Energy is considered an important input to achieving sustainable development, including the reduction of poverty. Although in the 1990s, policy makers and international organizations (most significantly, including the World Bank) let rural electrification and rural energy supply in general fall out of favor due to the problems of converting energy supply into a profit making business in times of economic reforms (IDS, 2003), the topic of energy for poverty reduction has now been placed back on the agenda (Barnes, 2007). The recognition of the contribution of energy to implementing the MDGs for sustainable development and/or national poverty reduction strategies is widespread (WSSD, 2002; DFID, 2002; UN, 2002; UNEP, 2005; IDA, 2005).

The 'energy challenge' to meet the first MDG (eradication of extreme poverty and hunger) has two components: income generation and household cooking needs. The former component is formulated as follows:

"Energy inputs such as electricity and fuels are essential to generate jobs, industrial activities, transportation,

commerce, micro-enterprises and agriculture outputs."

This recognition has led to a climb of the topic 'productive uses' of energy on the agendas of many development agencies, including bilateral donors and the Global Environment Facility and its implementing and executing agencies UNDP, UNEP, World Bank, FAO, UNIDO and regional development banks (White, 2002). More recently, the partnership Global Network on Energy for Sustainable Development (GNESD), which was established to strengthen the links between MDGs and energy, stresses the importance of energy to generate income so that the poverty cycle can be broken (GNESD, 2007; Koenders, 2007).

Research in the field of energy supply for income generation shows consensus on the fact that energy can improve opportunities for income generation, but that the evidence is often anecdotal (Fluitman, 1983; Rogerson, 1997; Fishbein, 2003; Meadows et al., 2003; Ramani and Heijndermans, 2003) or measured by tracking use of energy before and after an intervention rather than the impact on poverty itself (Barnett, 2000). This lack of understanding of actual productive uses of energy is also found in the field of renewable energy projects even though such projects often have a poverty reduction objective and claim to have impacts on income generation (Etcheverry, 2003). Barnett (2000) explained that one of the main problems of evaluating impacts of energy on poor people is formed by the many local factors that can influence outcomes, thereby making attribution of outcomes to energy as only one of the influencing factors difficult. Studies that rise above the anecdotal and project evaluation level have attempted to build knowledge on the topic of the impacts of modern energy on income generation. Among the most extensive and influential empirical research projects studying micro level impacts of energy on income generation are the Energy Sector Management Assistance Programme (ESMAP) study of social and economic benefits of rural electrification in the Philippines (ESMAP, 2002) and ENPOGEN, a large scale study performed for the World Bank into impacts of energy on poverty and gender in three countries (China, Indonesia, Sri Lanka). These studies were developed in response to the low understanding of the causal relationship between energy and poverty reduction. They take a demand perspective on rural energy interventions, which is necessary, as stated in the ENPOGEN study (Winrock International et al., 2003) to counter the prevailing supply-driven paradigm that dominates the rural energy sector.

On the topic of income generation through household enterprises, the ENPOGEN study warns that the proportion of households benefiting from electricity for income generation is small (Massé, 2003), although it does increase with time elapsed after access to electricity (Madon, 2003). On the other hand, it is suggested that economic impacts, where they exist, may be significant. Where the executive summary (Ramani and Heijndermans, 2003) indicates that incomes are double in enterprises using electricity, suggesting that this is because of the use of electricity, the underlying reports provide more detailed information which explains and partly weakens this finding. Both the Sri Lanka and Indonesia case studies indicate higher incomes in enterprises using electricity compared to those not using electricity. In both cases, more affluent households were found to be able to benefit more from electricity use in income generating activities.

General considerations on energy and poverty

Understanding poverty

Poverty is regarded as one of the world's most fundamental issues, which needs to be addressed through development. Poverty can be defined in many different ways. Some attempt to reduce it to numbers, while others argue that a more ambiguous definition must be used. In the end, a combination of both methods is best. Today, most economists and social workers use two ways to define poverty, social and statistical.

At the UN's World Summit on Social Development, the 'Copenhagen Declaration' described poverty as "…a condition characterized by severe deprivation of basic human needs, including food, safe drinking water, sanitation facilities, health, shelter, education and information." After that, 117 countries adopted a declaration and program of action which included commitments to eradicate "absolute" and reduce "overall" poverty.

Absolute poverty was defined as "a condition characterized by severe deprivation of basic human needs, including food, safe drinking water, sanitation facilities, health, shelter, education and information. It depends not only on income but also on access to services."

Overall poverty takes various forms, including "lack of income and productive resources to ensure sustainable livelihoods; hunger and malnutrition; ill health; limited or lack of access to education and other basic services; increased morbidity and mortality from illness; homelessness and inadequate housing, unsafe environments and social discrimination and exclusion. It is also characterized by lack of participation in decision-making and in civil, social and cultural life. It occurs in all countries: as mass poverty in many developing countries, pockets of poverty amid wealth in developed countries, loss of livelihoods as a result of economic recession, sudden poverty as a result of disaster or conflict, the poverty of low-wage workers, and the utter destitution of people who fall outside family support systems, social institutions and safety nets (UN, 1995).

Statistical definitions of poverty include the definition used by the World Bank, which defines poverty as any

income below US $1.25 a day for the poorest countries and US $2 a day for poor developing countries according to 2005 purchasing power parity (PPP) (Ravalion, 2003; UNDP-HDR, 2005; Noble et al., 2004).

The World Bank estimates that about 1.4 billion people live below the international poverty line of US$1.25 a day in 2005, equivalent to more than one-fourth of the developing world's population (Khanna and Paci, 2010). Poverty incidence declined from 52% of the global population in 1981 to 42% in 1990 and 25% in 2005. That proportion is expected to be 15% by 2015 (World Bank, 2009a).

The last financial crises have slowed the pace of poverty reduction, created new risks for the income poverty target under Goal 1 and impaired progress toward other MDGs. Because of the crises, the World Bank estimates that about 40 million more people became hungry in 2009 and 64 million more people were living on under US$1.25 a day, or in extreme poverty, by the end of 2010 (Habib et al., 2010)

The painful reality of the crises is not confined to income poverty. The World Bank estimates that by 2015, 1.2 million more children under five may die, 350,000 more students may not complete primary school and about 100 million more people may remain without access to safe water.

The World Bank predicted a contraction of the world economy in 2009 by between 0.5 and 1.0%, which was supposed to add another 60 million people to the ranks of the poor in developing countries. This prediction was based on the World Bank's new international poverty line - $1.25 PPP dollars a day in 2005 - and on the parametric assumption that a decline of growth by 1% adds 20 million people to the ranks of the poor (World Bank, 2008, 2009b). As noted in the aforementioned World Bank press release: New estimates for 2009 suggest that lower economic growth rates will trap 46 million more people on less than USD 1.25 a day than was expected prior to the crisis. An extra 53 million people will be trapped on less than USD 2 a day. This is on top of the 130 to 155 million people pushed into poverty in 2008 because of soaring food and fuel prices (Lin, 2008).

Number of people living on less than US$ 1.25 dollar a day represents the most publicized example of an income-focused approach to poverty. Based on this measure, the last 20 years have seen significant reductions in the depth and severity of extreme poverty in the developing world. In absolute terms, extreme income poverty has fallen substantially, with the number of people living on less than $1.25 a day having declined from a high of 1.9 billion in 1981 to a low of 1.4 billion in 2005. In relative terms, the proportion of people living in extreme poverty dropped from 52.0 to 25.7% during this period (Chen and Ravallion, 2008).

Notwithstanding the continued growth in the world's population, the absolute number of people living in extreme poverty has fallen, regardless of whether the poverty-line income threshold is set at $1.25 or raised to $2 or $2.50 per day. This has occurred in the midst of an expanding global economy, which has resulted, on average, in higher per capita incomes in both developed and developing countries (Sachs, 2008; UN, 2005). Since the 1960s, gross domestic product (GDP) in low-income countries has grown at an average of 4.1% per annum, while GDP in middle-and high-income countries has grown at an average of 4.2 and 3.2% per annum, respectively (Soubbotina, 2004).

Energy's links with poverty reduction

There are still many people in the world who do not have access to electricity or other forms of modern energy. In total, nearly 1.6 billion people out of the total population of 6.5 billion do not have electricity access, and 2.5 billion depend on biomass (OECD, 2006). The single country with the highest number of people lacking access to modern energy is India, the country which forms the case for this research. Despite high rates of economic growth in India, 44.5% of the Indian population does not have an electricity connection to their home, and reliance on biomass amounts to 69% (WEO, 2006). The number of people lacking access to modern energy in India approaches that for the whole African continent. All over the world, the people without access to modern forms of energy are typically the poor, and this lack of access to energy is one of the major factors making it difficult for them to improve their lives.

A substantial and influential body of policy makers believes that creating energy access will make it possible for the poor to improve their lives by creating an income, as the quotes below show:

"Access to energy is central to poverty alleviation. […]. Access to affordable energy services is critical for increasing agricultural productivity, encouraging economic activity, generating employment and income opportunities and improving the quality of life particularly for women and children." World Summit on Sustainable Development in 2002 (UN, 2002).

Clearly, energy for the sake of energy is not useful. Its utility lies in facilitating human development. The energy sector has strong links with poverty reduction through income, health, education, gender and the environment. These links suggest that the energy sector needs to focus increasingly on working with other sectors to ensure that the poor benefit as much as possible from greater access to energy supplies. So there should be a framework for analyzing the role of the energy sector and role of energy services on poverty reduction. Figure 1 shows a framework for establishing development goals to guide the selection of policies and program to achieve specific target.

Apparently, the paths through which energy could

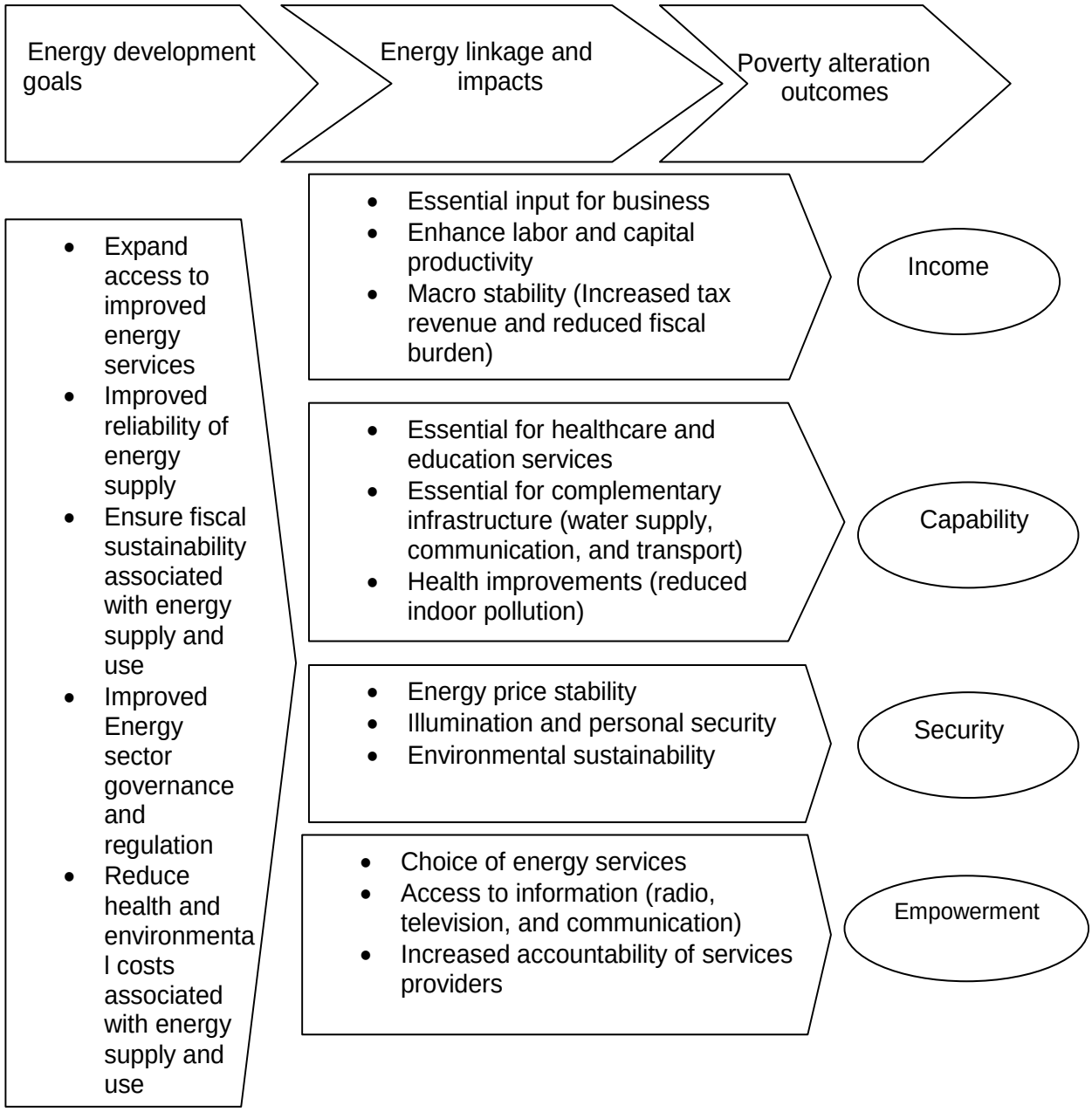

Figure 1. The Energy-poverty framework. Source: Addison, 2007 " Energy Sector Strategy".

contribute to increasing incomes for the poor are diverse. From an economic growth perspective, energy use in industry is the driving force behind poverty reduction. More direct impacts of energy on poverty reduction can occur when energy is used by the poor to generate or increase their income through new or improved opportunities for small enterprises or for farming (Sen, 1999; Schulte Nordholt, 2004; Cabraal et al., 2005). Such uses of energy for income generation are often called productive uses of energy.

Increasing income

Perhaps the most important way the energy sector can improve the lives of poor people around the world is by helping to increase their meager income. To begin with, modern energy can greatly increase their productivity. Petroleum fuels power motorized transport that speeds the movement of goods between outlying areas and markets; and power agricultural activities that help expand crop production. Electricity enables poor house

holds to engage in activities that generate income - by providing lighting that extends the workday and powering machines that increase output and it raises the productivity of small businesses and shops and powers telecommunications.

All this is reflected in the strong correlation between energy consumption and national income. Most economic activity would be impossible without energy, even the small and medium-scale enterprises that are the main source of jobs for the poor. The kind of economic growth that creates jobs and raises incomes depends on greater and more efficient use of energy.

Contributing to better health

Modern energy helps improve health in many ways. By powering equipment for pumping and treating raw water, it helps ensure a clean water supply, reducing the incidence of waterborne diseases, especially in slums. By boosting agricultural production and household incomes, it helps reduce the malnutrition that is such a big factor in child mortality. And by allowing households to switch to kerosene or liquefied petroleum gas (LPG), it enables the poor to avoid cooking with biomass fuels like wood and dung, whose emissions cause respiratory ailments that are the fourth leading health risk in developing countries (WHO, 2002). Modern energy also helps improve health indirectly.

Electricity enables health clinics to refrigerate vaccines, operate medical equipment, and provide treatment after sunset. It allows the use of modern tools of mass communication needed to fight the spread of HIV/AIDS and other preventable diseases. And through its benefits for education, it leads to higher literacy among women, which translates into better health for children.

Supporting education

For poor people everywhere, access to modern energy services frees time for education-time that would otherwise be spent collecting traditional fuels or in other menial work. It also frees children to attend school, by boosting productivity and thus allowing adult labor to substitute for child labor. For both adults and children, electric lighting in homes enables them to study after their daytime activities. And in rural areas, modern energy helps retain teachers by improving their quality of life.

A survey in Nicaragua illustrates the relationship between education and household electricity use. It was found that the percentage of a family's children that attend school is highly correlated with the availability of electricity. Among rural households in Nicaragua, 72% of children living in a household with electricity attend school, compared to 50% of those living in a household without electricity.

Improving women's quality of life

Increasing access to energy brings disproportionate benefits for women - in health, education and productive activities - since in many parts of the world, it is they who spend more time than men cooking and collecting water and fuel. Modern cooking fuels free women from the burden of collecting and carrying large loads of fuel-wood and from exposure to smoke from primitive cooking stoves. And modern energy for lighting and motive power enables women to develop cottage industries that can increase their incomes. A survey of women's time use in rural India shows how access to electricity can benefit women. The probability that a woman will read is strongly related to whether the home has electricity.

Indeed, regardless of income level, virtually no reading takes place in households without electricity. About 11% of the sample reported spending some time reading on the day of the survey - and these women reported doing so for about an hour a day on average. Averaging this time across all the households shows that higher-income women spend more time reading than lower-income women. But among lower-income women, those in households with electricity have a much greater likelihood of reading than those in households without electricity. Moreover, lower-income women have a lower literacy rate than higher-income women and so would have a lower possibility of reading. Thus, the high-quality lighting made possible by electricity appears to make it more likely that women will read in the evening regardless of their income level (Figure 2).

Energy dimension of poverty: energy poverty

Energy poverty has been defined as the absence of sufficient choice in accessing adequate, affordable, reliable, high quality, safe and environmentally Benign Energy Services to support economic and human development. Energy poverty interacts with other manifestations of poverty, including lack of access to essential human services as shown as follows.

Energy as a contributor to essential human service

Reliable and affordable energy supplies are absolutely required to meet even the most basic human daily needs of the world's poor people. These include:

Cooking: Energy for cooking (and heating in cold climate) is one of the life's most basic needs. It is estimated that approximately 95% of staple foods (such as rice, grains, green bananas, etc.) need cooking before they can be eaten.

Safe drinking water: Supplying safe water would not be possible without energy for pumping and clean fuels for

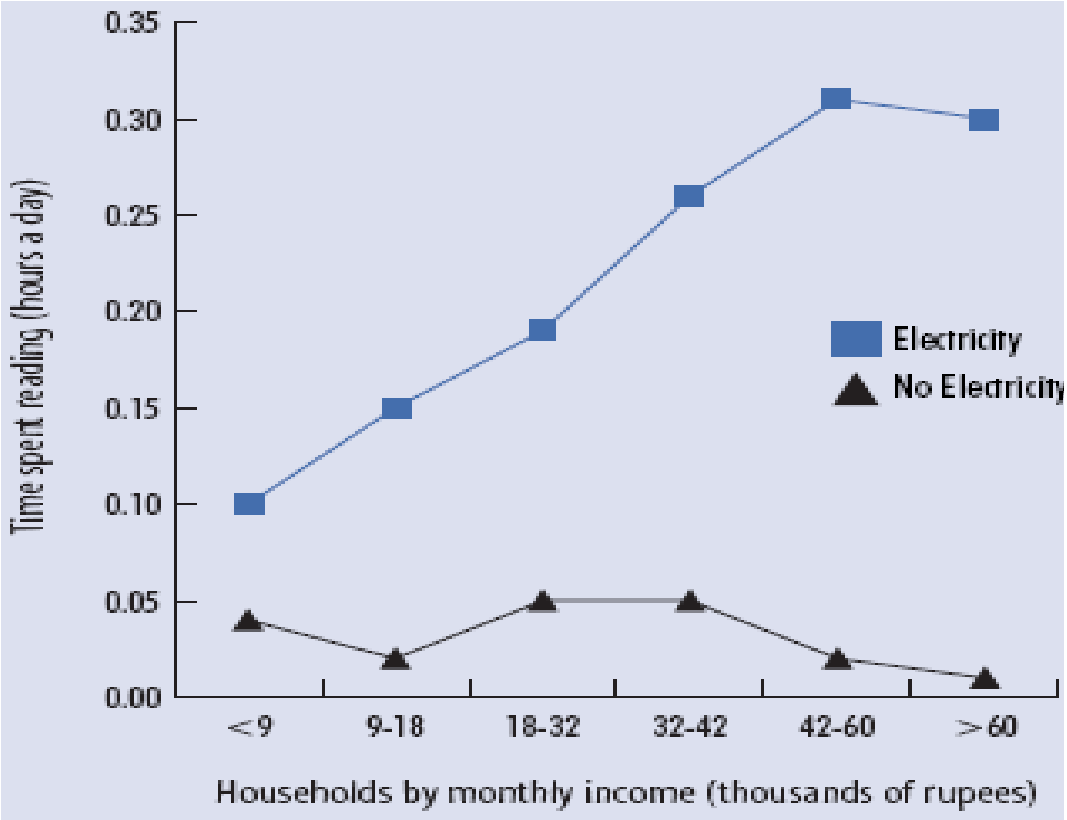

Figure 2. Household income, electricity and time spent reading by women, rural India 1996.
Source: Energy Sector Management Assistance Programme (ESMAP), Energy Survey (1996).

boiling water. Without energy for pumping and/or boiling ware, people would be often forced to rely on water from streams polluted by cattle or human effluent.

Lighting: Energy for lighting allows people to study and/or carry out income-generating activities at night.

Healthcare: Energy is needed for powering vital equipment in rural health centers such as refrigeration for vaccines and other medicines, sterilization of equipment, and lighting, as well as transport facilities.

Education: Energy is needed to provide lighting in schools, allowing extended classes and power modern learning equipment such as overhead projectors and computers.

Communication: Electricity supply is required for powering radio and/or TV sets, as well as information and communication technology (ICT), that are necessary for households, farmers, schools and others living in remote areas to access critical information.

Agricultural needs: Many crops need processing, such as grain milling for flour, so that they can be used for the preparation of food. Without mechanical power, this can be an enormously time consuming, almost back-breaking task, particularly for women and girl children. To explain this, Figure 3 shows energy poverty linkages

According to a report of the International Energy Agency (IEA), Sub-Saharan Africa has the lowest electrification rate of any major world region with only 23% of its population having access to electricity (IEA, 2002). Generally, more than 500 million Africans are still without access to electricity. Statistics show that more than 83% of the Africa's population living in rural areas has no access to electricity, while more than 92% of rural Sub-Saharan Africa' s population is still without access to electricity.

Access to electricity

More than a quarter of humanity does not have access to electricity (Table 1). It will take 80 years to light up Africa under current trends. Over 1.6 billion people do not have access to electricity. Table 2 shows the percentage of rural households with access to electricity in the South, although this does not make a judgment on the quality of

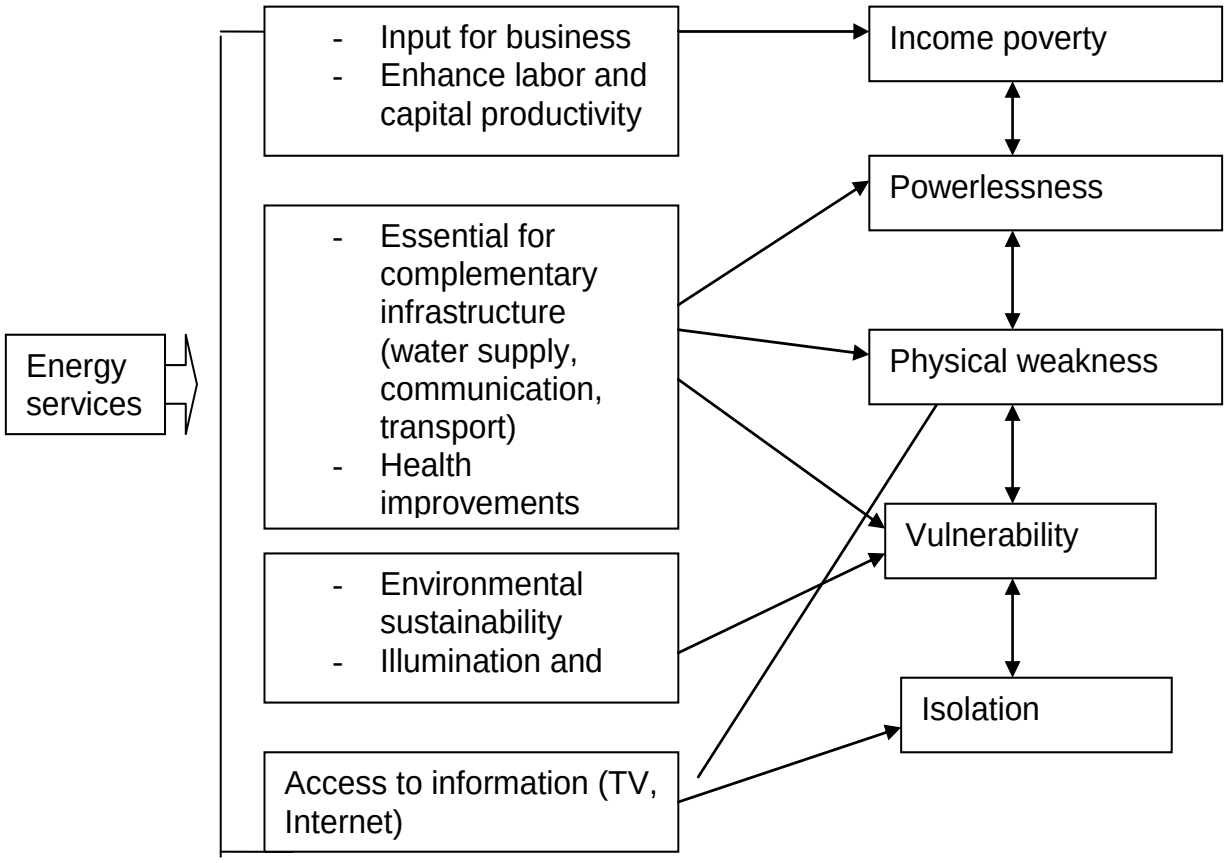

Figure 3. Energy poverty linkages. Source: TERI (2000).

Table 1. Electricity access in 2000.

Region	Population without electricity (millions)	Population with electricity (millions)	Electrification rate (%)
Developing countries	1634.2	2930.7	64.2
Africa	522.3	272.7	34.3
Developing Asia	1041.4	2147.3	67.3
Latin America	55.8	359.9	86.6
Middle East	14.7	150.7	91.1
Transition economics	1.8	351.5	99.5
OECD	8.5	1108.3	99.2
World	1644.5	4390.4	72.8

Source: World Energy Outlook (2002).

supplies which is often very poor in many areas of developing countries. If current trends continue, by 2030 1.4 billion people will still not have electricity. At the current rate of connections, it would take more than 40 years to electrify South Asia and almost 80 years for Sub-Saharan Africa. There are quicker, often cheaper and certainly more sustainable ways of delivering the modern energy services that people need through the expansion of renewable energy sources.

Current pattern of energy use in rural Africa

The bulk of energy consumed by rural poor households is derived from locally available traditional biomass fuels in the form of wood fuel, agricultural residues and dung. Cooking accounts for between 90 and 100% of household energy consumption. The rest is the energy consumed for lighting, provided either by firewood (cooking fire), kerosene lamps and candles. Space

Table 2. Percentage of rural population with access to electricity.

Region	Percentage of rural population with access to electricity
South Asia	19
China	94*
Sub-Saharan Africa	4
Rest of Africa	21
Latin America	27

*In China, there are still 70 million people with no electricity.
Source: Rural Energy Services: A handbook for sustainable energy development, Anderson et al., ITDG Publishing, London, (1999).

heating is required in areas with cold climates and is often catered for by energy used for cooking.

The most common method of cooking with traditional biomass fuels throughout rural areas in Sub-Saharan Africa countries is the open heart or three-stone fire, which typically transfers only 5 to 10% of the fuels' energy content into the cooking pot and is responsible for harmful indoor air pollution. Improving combustion efficiency through use of "improved" cooking stoves could thus result in fuel savings and help alleviate the adverse impact on health of women and children and other damaging effects of traditional biomass energy use.

The predominance of traditional biomass fuels as the dominant source of energy for cooking, despite its inefficiency and harmful health effects, could be attributed to its availability as a "free" source of energy. In most cases, firewood is collected and not purchased. However, gathering firewood requires large amounts of human energy and time, and the burden tends to fall more heavily on women and children. It is estimated that, in rural Sub-Saharan Africa, many women carry 20 kg of firewood daily over a distance of 5 km on the average.

Although lighting uses relatively limited amount of energy, it is an important household energy service. Kerosene is the most widely used modern energy source for lighting, but its use involves relatively high costs for kerosene lamps and fuel. Firewood is another important fuel for lighting, particularly for the poorest households, because it does not require additional investment. For high-income households, electricity (either from the grid, diesel generators or photovoltaic (PV) systems) is an option; but electricity is not a ready option for low-income households for lighting due to its high up-front costs (electric light fittings).

Energy and power are needed at all stages of agricultural production, including land preparation, cultivation, irrigation, harvest, post-harvest processing, storage and transport of agricultural inputs and outputs. Despite the many advantages that could be gained from it, the degree of agricultural mechanization is generally low in most of Sub-Saharan Africa countries.

Limited use of mechanized agricultural practices in Africa means that the bulk of agricultural energy input for the basic agricultural activities is provided by human and animal power. The heavy reliance on human labour, particularly women, combined with low calorie intake may explain the low and declining levels of agricultural productivity in much of Sub-Saharan Africa. Animal power can alleviate human drudgery and increase agricultural production, as it can provide transport, pull implement, lift water and power crop processing.

Small-scale rural industries are comprised of agro-based (food processing, fish smoking, beer brewing, tobacco curing, tea drying, etc.), and non agro-based industries (brick making and charcoal production, small-scale mining, pottery, blacksmithing, carpentries and village workshops). The energy needs of rural industries comprise lighting, process heat, motive or shaft power and electricity. Traditional biomass fuels remain the major source of process heat for most rural industries, while a steady transition from traditional to modern energy sources is taking place with increases in rural electrification and greater availability of other commercial energy sources.

Access to energy services and the MDGs

Energy plays a critical role in underpinning efforts to achieve the MDGs and improving the lives of poor people across the world. Although the MDGs do not make any specific reference to the role of energy to reduce poverty, access to energy services is a crucial element in achieving the goals. The link between access to energy services and poverty reduction can be highlighted as follows:

1) Halving poverty by 2015 will not be reached without energy to increase production, income and education, create jobs and reduce the daily grind involved in having just to survive.
2) Halving hunger will not come about without energy for more food production throughout the food chain (ploughing, planting, harvesting, processing and marketing).

Consequently, the role that energy services can play in helping to achieve the MDGs and improve the lives of the

poor, as well as the direct and indirect energy-poverty links can be outlined as follows:

A) To halve extreme poverty:
1) Access to energy services facilitates economic development, including micro-enterprise, increased productivity from use of machinery, income-generating and livelihood activities from extended lighting and improved local employment creation.
2) Access to clean and efficient fuels reduce the large share of household income spent on cooking, lighting and space heating.
3) Access to modern energy services can also assist in bridging the “digital divide” from ICT.

B) To reduce hunger and improve access to safe drinking water:
1) Energy services can help improve access to pumped drinking water and cook food since the majority of staple foods (such as rice, grains and green bananas) need to be cooked.
2) Energy services can also improve productivity throughout the food chain (tillage, planting, harvesting, processing, transport, etc.) and reduce post harvest losses through better preservation (for example, drying and smoking).
3) Energy for irrigation helps increase food production and access to nutrition.
4) Clean water helps improve health.
5) Increased health and nutrition open up opportunities for employment and income generation.

CONCLUSION

For people living in poverty, the most pressing priority is the satisfaction of basic human needs, which includes access to food, shelter, water supply and sanitation and other services that will improve their standard of living, such as healthcare, education and better transport. But it is generally recognized that although energy is not a basic need, it is required as a crucial input for providing other essential human needs. The satisfaction of the basic needs and poverty alleviation efforts cannot be achieved without improving access to better energy services.

Access to modern energy services can contribute directly to poverty alleviation by (1) improving the quality of life through better lighting, access to cleaner cooking fuels and safe drinking water, etc.; and (2) improving effective delivery of social services through ensuring reliable heating, lighting, refrigeration of vaccines and other medicines, sterilization of equipment in health centers, as well as providing lighting to schools, thereby allowing people to study at night, and improving their employment prospects. Access to modern energy services can also contribute indirectly to poverty alleviation by improving productivity and enabling income generation through improved agricultural development (irrigation, crop processing, storage and transport to market) and through non-farming employment, including micro-enterprises.

Access to affordable and reliable energy services can also play a crucial role in underpinning efforts to achieve the MDGs. The goal of halving poverty by 2015 will be achieved only if affordable and reliable energy supplies are provided to increase production, income and education. Halving hunger will require the provision of adequate energy services for more food production throughout the food chain. Increasing access to safe drinking water will require the provision of adequate energy services for pumping and boiling water. Gender equity in education cannot be achieved as long as girl children are drawn from school to collect traditional biomass fuels for family subsistence.

Renewable energy technologies (RETs) have the potential to help improve access to energy services for poor people living in rural areas of Sub-Saharan Africa. There is a variety of technologies that can convert biomass into more convenient energy carriers, such as gaseous and liquid fuels, process heat, mechanical power or electricity, which can be used in energy-efficient conversion devices (cook stoves, electric lamps, motors, refrigerators, etc.) to provide energy services. Renewable energy sources (biomass, solar energy, wind power, and small hydropower) can be converted into the most versatile of energy carriers, electricity.

RET-based systems can contribute to providing improved energy services for the rural, poor and alleviate poverty in Sub-Saharan Africa. However, widespread diffusion of RET-based systems faces strong institutional, technical and financial barriers that need to be overcome in order to improve their contribution to poverty alleviation. One of the most challenging barriers is how to overcome the high initial cost of RET-based system. This requires the creation of innovative financing mechanisms, such as micro credit, that can provide households and small businesses with access to capital, via loans that typically include flexible repayment schemes, fee schedules that match customer income streams and longer repayment terms.

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