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Universal Energy Access: Moving from Technological Fix to Poverty Reduction

Summary

Despite much progress in expanding energy systems in developing countries, an estimated 1.3 billion people do not have access to electricity, and around 2.8 billion people do not have access to clean cooking facilities. Instead, they rely on traditional fuels – predominately animal dung, crop residues and wood – for the majority of their energy needs.

In order to tackle this problem, a key pillar of the United Nations Sustainable Energy for All (SE4ALL) initiative is to ensure universal access to modern energy services by 2030. The SE4ALL initiative provides an opportunity to build consensus on what constitutes energy access and how it can help bring people out of poverty. But if it is to succeed where others have failed, it needs to do things differently.

Firstly, the initiative must move beyond viewing energy access as simply providing a grid connection. This narrow understanding ignores the complexity of energy access and fails to appreciate alternative approaches that may be more appropriate. For instance, energy is needed for multiple uses, e.g. heating, lighting, cooking, entertainment and productive activities. These uses require different forms and amounts of energy, which are determined on the basis of the specific needs and demands of individuals and communities, as well as their impacts on other resources and activities. Furthermore, access to modern energy services means more than simply availability of supply. Affordability, quantity, quality and sustainability are vital elements in determining the extent of energy access.

Secondly, the SE4ALL initiative must consider the wider context and constraints within which energy access initiatives are pursued. Energy access is not an end in itself: rather, it offers the means to meet basic needs and improve livelihoods. For this to happen, diffusion of energy technologies and services must adequately deal with deeper barriers related to technologies; infrastructures (e.g. local manufacturing, installation and maintenance capabilities); markets; government policies and regulation; user practices; social norms; and cultural meaning.

Limitations of traditional approaches to energy access

Around the world, billions of people remain dependent on traditional fuels – predominately animal dung, crop residues and wood – for the majority of their energy needs. Such "energy poverty" has a serious impact on living standards and productivity. When burnt, traditional fuels often produce hazardous chemicals with negative health impacts, especially when used indoors. They also require substantial time and effort to collect – a burden which usually falls upon women and children – significantly reducing the time available for education and productive activities.

It is widely accepted that alleviating such "energy poverty" requires a concerted effort to expand access to modern energy services, i.e. those that are clean, efficient and reliable. For example, to achieve the SE4ALL initiative's goal of universal energy access by 2030, the Organisation for Economic Co-operation and Development (OECD) and the International Energy Agency (IEA) estimate that annual investment will need to increase to more than five times the level invested in 2009 (from US$ 9.1 billion per year to approximately US$ 48 billion per year). But what does it really mean to have access to modern energy services? And will energy access automatically lead to alleviation of energy poverty?

Under the auspices of the World Bank, the SE4ALL initiative is currently developing a set of criteria against which energy access milestones can be assessed and validated. There has been a tendency within national governments and the international development community to frame energy access in a narrow way, following a binary yes / no approach aggregated at the household level. For example, national governments routinely measure access in terms of national grid expansion. The World Bank has tended to determine access to modern energy services on the basis of household survey questions such as: Does your household have electricity or is the house connected to an electricity supply? The success of an energy access intervention is then measured by the number of household connections generated. Similarly, the World Health Organization uses household survey data to determine access to modern cooking fuels, with fuel choice categorised as "modern" (electricity, natural gas, LPG, kerosene and biogas) or "solid" (biomass and coal).

Framing energy access in this way implies that energy needs can be met with a single technological fix – electricity – ignoring behaviour, practices and needs that necessitate other forms of energy supply and associated services. Simply considering whether or not someone "has electricity" or is "connected to an electricity supply" ignores the different types of energy services people need and the affordability, reliability and quality of that supply. Furthermore, focussing on energy access does not inform us about wider constraints that hinder energy access from helping people improve their lives.

Pursuing a broader understanding of energy access

The complexity of energy access is best understood in terms of three elements: demand for energy access encompasses a diversity of energy needs beyond simply the desire for electricity; the energy sources, carriers and technologies used to meet these diverse needs vary in modernity; and meeting demand requires that energy supply is not only available, but also affordable and adequate.

Energy service needs are varied: Individuals, households and communities require energy services in different forms in order to meet a variety of basic, entrepreneurial and societal needs. Examples include heat for cooking; light for reading and working at night; electric power for radio and television; and mechanical power for agricultural processing and transport. These needs can be defined in terms of energy service standards, with a set of minimum standards defining the energy poverty line. As part of the multi-donor Energising Development (EnDev) partnership, the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) has developed a five-tier set of energy service standards based upon the extent to which electricity needs are met:

- *Minimum needs:* Typically a small solar-PV lantern providing 50 lumens or 100 lux over 0.1 sq. metres for 5 hours per person per day;
- *Partial needs:* Typically based on battery use providing 3 kWh electricity per person per year for lighting above the minimum level and other uses, such as radio and phone;
- *Basic needs:* Typically a small off-grid system providing 10–20 kWh electricity per person per year for lighting, radio, TV, telephone;
- *Advanced needs:* Grid or mini-grid providing 100 kWh electricity per person per year for lighting, radio, TV, telephone, fan, video, fridge. Supply is often unstable;
- *Full needs:* Stable grid access providing 1,000 kWh electricity per person per year.

There are different degrees of "modernity", and the most modern option may not be the most appropriate: The multiple energy needs of individuals, households and communities can be met with a range of energy sources, carriers and technologies. Different combinations will vary in terms of how "modern" – i.e. clean, efficient and reliable – they are. For example, a water pump may be powered by different energy carriers (i.e. human, diesel, electricity). The electricity in particular can be derived from many different energy sources (i.e. fossil fuels, renewable energy or nuclear power) and a range of technologies will then be available to suit each carrier – some more efficient and appropriate than others.

In order to tackle this varying modernity, Practical Action, an international NGO, has developed the concept of an Energy Supply Index (ESI). The ESI identifies the different energy sources and technologies used in the phased transition from traditional to modern energy services. The ESI for household cooking, for example, starts from 0 for use of non-standard solid fuels, such as plastics, increases to 1 for use of solid fuel in an open or three-stone fire, and goes all the way up to 5 for the use of only liquid or gas fuels or electricity, and associated stoves. This rating scheme incorporates modernised traditional energy sources and carriers, such as efficient cook-stoves. It is important not to ignore these "more modern" options: they may be more appropriate if the "most modern" options face considerable barriers.

Energy supply is not always affordable or reliable: Having access to modern energy services is an ongoing process. If an energy supply is available, it may not be affordable to many people. Even if it is available and affordable, supply may fluctuate in quantity and quality such that it is insufficient to adequately meet individual, household and community needs. The sustainability or longevity of supply is also important: on one day the quantity and quality of supply may be sufficient, but on another day it may not be. Table 1 highlights questions that policy-makers must address when considering these five dimensions of energy supply.

Table 1: Dimensions of energy supply

Availability	In the case of electricity, is there a connection? To a village or house, an individual or community access point? Can one be considered to have access if they can go to their neighbour's house?
Affordability	What does it cost to gain access to the energy supply? Is there a connection fee for electricity supply? How much does a new stove cost? Then, what are the ongoing running and maintenance costs? Infrastructure, distribution and fuel costs?
Quantity	How many lumens does a light produce and for how long can it stay that bright? How much woodfuel is required for adequate heating and how long does it take to collect?
Quality	What is the efficiency and reliability of the energy supply? Are there brownouts (a drop in voltage) and blackouts (total loss of power) within an electric power supply system? How efficient and reliable is a stove?
Sustainability	Is energy supply consistently available, affordable and of decent quantity and quality: i.e. not just on the day that monitoring and evaluation takes place? Is this modern energy supply easier to manage than traditional fuels? Do people turn back to traditional fuels, and if so, why?

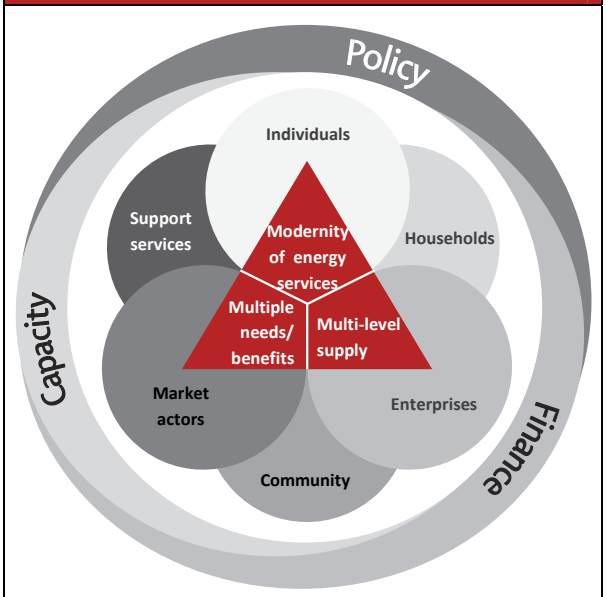
Sources: UNDP (2011); OECD / IEA (2011); Practical Action (2012)

From energy access to better lives

In order to implement the broader approach to energy access, and to reach the ultimate aim of helping people to improve their lives, initiatives must deal with three important issues: how to engage with the wide network of actors involved in defining energy needs and managing energy supply; how to address socio-economic and cultural power relations within this network; and how to link energy services with productive activities.

The transition from a traditional energy system to one based upon modern energy services is not simply a case of transferring technological hardware. Decades of experience have shown that the diffusion of new technologies is a complex and non-linear process. Myriad barriers – e.g. technical, financial, political, cultural, human capacity – can hinder individuals and communities from gaining access to modern energy services. There is increasing recognition that to address these barriers, efforts to increase energy access must be embedded within the wider energy "ecosystem", depicted in Figure 1.

Figure 1: Energy access ecosystem



Source: adapted from Practical Action (2012, 73)

The "ecosystem" approach emphasises the **importance of networks** between people, organisations and processes involved in articulating the demand for – and managing the supply of – modern energy services. There are various sets of actors that play a role in defining multiple needs for – and providing consistent supply of – different modern energy services. The dynamics of the system and the interactions of actors within it are shaped by the existence (or lack) of policy frameworks, the capacity of actors and financial support mechanisms. This implies that energy access initiatives must incorporate a broad range of stakeholders in their design and implementation in order to contend with and successfully overcome multiple interrelated barriers.

Of course, even if barriers to access are overcome, there is still no guarantee that access will be sustainable in the long term. The "ecosystem" concept highlights the fact that, in reality, networks between people, organisations, functions and processes constitute **a web of power relations**. These power relations may affect the ability of the poor to derive use from modern energy services in such a way that enables them to permanently move out of energy poverty and overall poverty. For example, limited property rights may make it difficult for individuals or households to secure a regular electricity contract or may leave them without the collateral to secure credit for starting income-generating activities. Therefore, the impact of energy access is not separate from the wider context, but defined by it.

An important way to ensure that energy access is sustainable in the long term and helps people break out of the energy-poverty cycle is to pursue energy access initiatives that specifically combine the delivery of energy services for basic needs with productive activities. This is not easy, as noted in a review by the United Nations Development Programme of 17 energy access programmes and projects. In most cases, energy access initiatives focus on simply ensuring energy supply for addressing basic needs. Programmes that complement energy service livelihood require considerable coordination and stakeholder engagement, both of which are politically and institutionally demanding.

Moving towards universal energy access

The need for expanding access to modern energy services is overwhelming. Experience shows that approaches to energy access that prioritise technical solutions – such as providing a grid connection, or an improved cooking stove – do not work in isolation. Energy access based upon long-term, sustainable diffusion of energy technologies and services requires more than simply supplying physical hardware. Energy needs are various, technology options are diverse and "access" comes in degrees. Moreover, evidence shows that overcoming barriers related to finance, capacity, politics and culture – the ecosystem – are critical for the success of energy access initiatives.

It is imperative that these issues are taken onboard while the UN SE4ALL initiative is still in its infancy and in the process of defining and developing guidelines on energy access. Germany is an influential development partner in the field of energy with extensive experience developing more sophisticated energy access indicators. We call upon German development cooperation to support the international development community to move beyond traditional understandings of energy access and embrace a more nuanced approach that fosters diverse solutions. Only then can the laudable goal of universal energy access be possible and have a truly transformative impact on people's lives.

Literature

OECD / IEA (Organisation for Economic Co-operation and Development / International Energy Agency) (2011): World energy outlook 2011, Paris

Practical Action (2012): Poor people's energy outlook 2012 : energy for earning a living, Rugby, UK: Practical Action Publishing

UNDP (United Nations Development Programme) (2011): Towards an "energy plus" approach for the poor : a review of good practices and lessons learned from Asia and the Pacific, Bangkok

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