2 Energy as an enabler of universal access to health care

Health is both a prerequisite for and an outcome of sustainable development (United Nations, 2012). Good health is integral to attainment of all of the Millennium Development Goals (MDGs) (World Health Organization, 2013a). Three of the eight MDGs specifically address priority health issues, while other MDGs address health indirectly (Box 1).

Box 1. Health and the MDGs

Three MDGs relate specifically to critical health issues:

MDG 4: Reduce child mortality

MDG 5: Improve maternal health

MDG 6: Combat HIV/AIDS, malaria and other diseases

In addition, MDG 1 (Eradicate extreme poverty and hunger) has a clear health component linked to nutrition. Nutritional adequacy for children, pregnant women and lactating mothers is particularly important.

Also, Target 7C under MDG 7 (Ensuring environmental sustainability) aims to halve the proportion of people without sustainable access to safe drinking water and improved sanitation. This is the main risk factor for diarrhoeal diseases, one of the leading killers of children under the age of 5.

Health facilities are on the frontlines of disease control and response for:

- ***Infectious diseases of poverty and maternal/child health:*** Many primary care interventions have been developed and implemented, such as: HIV anti-retroviral treatment; DOTS, the 5-point package for "directly observed treatment" that is the central component of the Stop TB Strategy for tuberculosis; community-based distribution of antimalarial medication; oral rehydration for diarrhoea; scale-up of vaccines against polio, measles and other vaccine-preventable diseases; and training of/access to skilled midwives.
- ***Noncommunicable diseases:*** Addressing this growing burden in poor countries is a critical health concern: nearly 80% of deaths from cardiovascular diseases and diabetes and 90% of deaths from chronic obstructive pulmonary disease are now occurring in low- and middle-income countries (Alwan et al., 2011). In response, WHO and its Member States have significantly increased attention to and investment in prevention, diagnosis and treatment for conditions such as heart disease, cancer, diabetes, high blood pressure and chronic respiratory diseases like chronic obstructive pulmonary disease (World Health Organization, 2013).

Lack of electricity, however, remains a neglected barrier to effective provision of health services in many developing countries. Often-cited anecdotal examples include lack of lighting for child delivery, refrigeration for blood and vaccines, and of power for equipment sterilization, basic medical devices and provision of emergency and other services at night (Voluntary Service Overseas, 2012). Scale-up of noncommunicable disease prevention and control will require more energy than is available in many health facilities, particularly since NCD detection and treatment require additional equipment (e.g. imaging equipment for cancer detection).

Meanwhile, new medical technologies are creating opportunities to make more efficient use of available energy for improved health services. Examples include low-energy devices that can run on batteries or directly from solar panels; these range from small medical devices such as fetal heart monitors and blood glucose monitors to larger appliances such as solar-powered refrigerators. Optimal use of these emerging medical technologies requires access to cost-efficient and reliable energy sources.

Additionally, communication is a critical enabler of access to public health education and information in an era of rapid global and regional disease transmission, pandemic alerts and extreme weather. Mobile phone-based "tele-health" applications have been extremely effective in supporting activities such as remote health worker consultations, ongoing training and education, and home treatment for the elderly, disabled and chronically ill (Barlow et al., 2007; Wootton et al., 2009).

Improving public health requires universal health coverage as well as adequate access to health services. Strong and effective health facilities that offer a range of primary preventive and treatment services are crucial. A comprehensive framework for *Strengthening of health systems to improve health outcomes* was set forth by WHO (World Health Organization, 2007), and incorporated into a 2009 Member States resolution aimed at advancing primary health care, including health systems strengthening (World Health Organization, 2009b). It identified six key building blocks of health systems as:

- Service delivery
- Health workforce
- Information
- Medical products, vaccines and technologies
- Financing
- Leadership and governance

The provision of energy plays a key role in strengthening health systems across all of these areas. It is a critical enabler of health services delivery (e.g. lighting, powering medical equipment) and helps attract and retain skilled health workers, especially in rural areas (Practical Action, 2013). A European Commission (2006) study on renewable energy in the health sector summarizes how energy access can positively impact health and health service provision (Table 1).

Current status of electricity access in health facilities: available data

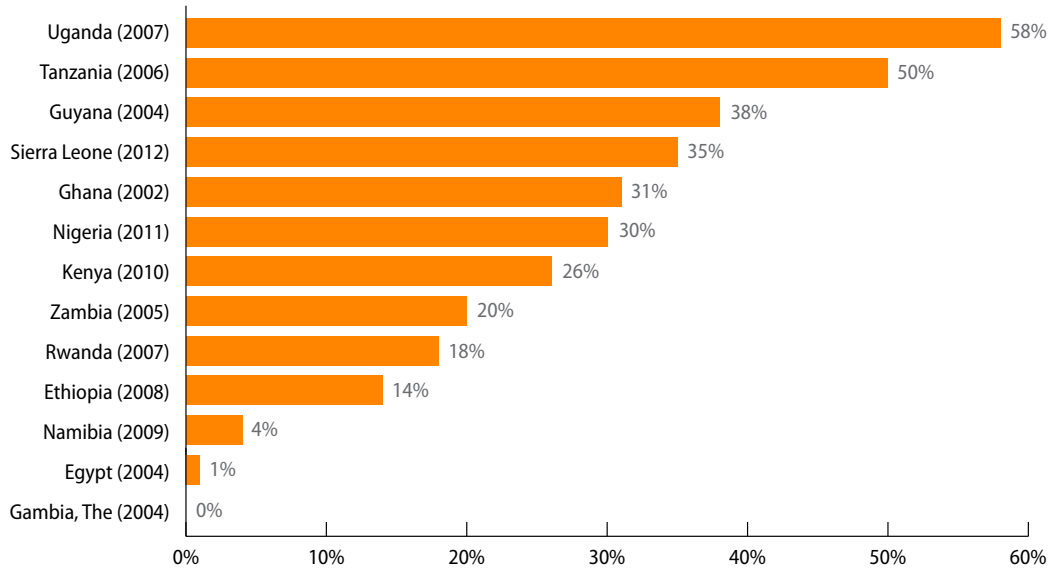
Reliable data on energy access among health facilities in developing countries is sparse. An initial WHO-led review (Adair-Rohani et al., 2013) found nationally representative data for only 14 developing countries globally; 11 of these were in sub-Saharan Africa (Fig. 2). However, even this slim set of data yields striking findings regarding the widespread lack of electricity access. Among the 11 African countries assessed an average of 26% of health facilities did not have any access to electricity. Only 34% of hospitals on average had "reliable" electricity (defined as no outages of more than two hours in the past week) across the eight countries for which such data was available. Little additional data was available on the capacity and quality of electricity supplies.

Table 1. Potential impacts of stable energy provision on health services performance

Medical services	• Prolonged opening hours with general lighting and security lights provided • Wider range of services implemented, because more qualified staff are attracted to stay • Improved emergency surgical services • Better obstetric emergency care (many maternal deaths are due to birthing complications) • Improved management of childhood illnesses • Better management of chronic conditions • Improved referral system (radio communication system between peripheral and referral units) • Better sterilization procedures leading to fewer complications • Improved planning and quality assurance
Health and safety	• General cleanliness improves with adequate lighting and water available • Inpatients feel more comfortable and secure • Staff feel more secure • Security lights provided during evening open hours
Disease prevention and treatment	• Improved cold chain and vaccine storage conditions will yield lower immunization failure rates and better immunization coverage • Improved testing for HIV and TB • Evening awareness sessions are possible with general lighting and TV/VCR
Staff recruitment and retention	• Better job satisfaction for staff because of better living and working conditions • Staff will want to stay longer in a place where there are better living and working conditions • Electricity in staff houses means continued medical education is possible • Easier recruitment of staff to locations with electricity and water • Easier to train staff because of improved lighting, equipment and TV/VCR
Administration and logistics	• Better administration, since it can be done in the evening • Better communication between health facilities and better planning of transport logistics

Source: *(European Commission, 2006).*

Fig. 2. Health-care facilities with no electricity access



Source: *Compiled from* (Adair-Rohani et al., 2013) *for sub-Saharan Africa; data for Guyana and Egypt is from the Service Provision Assessment (SPA) of USAID's Measure Health initiative* (United States Agency for International Development, 2013).

In countries with data from multiple years, progress in electrification was apparent. In Rwanda, for instance, the overall proportion of facilities with electricity access increased from 58% to 82% between 2001 and 2007, and in Kenya the proportion of facilities with electricity access increased from 65% to 74% between 2004 and 2010. More timely and detailed analysis can clarify current trends and highlight what works and what does not in terms of health sector energy provision.

Health facility infrastructure surveys typically cover a limited set of energy use indicators. These typically include whether a facility has grid access, a portable generator or a solar power source, and frequency of power interruptions. Such surveys are usually undertaken at national level by ministries of health, and at international level by WHO and other multilateral and bilateral health and development agencies (International Health Facility Assessment Network, 2013).

Among the early survey tools were the Service Provision Assessments (SPA) implemented under the MEASURE Demographic and Health Survey programme, supported by the U.S. Agency for International Development (2013) and WHO's Service Availability Mapping (SAM) (World Health Organization, 2009). A more recent tool, the Service Availability and Readiness Assessment (SARA), developed jointly by WHO and USAID, aims to harmonize diverse approaches to facility assessment in a freely available tool supported by WHO-led training (World Health Organization, 2013b). SARA measures infrastructure and equipment available in health facilities in relation to provision of specific services, based on minimum service standards. "Tracer indicators" are used to reflect the presence or absence of key infrastructure and thus readiness for service provision (see Annex 2). SARA provides a consistent methodology for annual country-led monitoring of health service delivery, providing statistically representative national data that can be compared between countries. This survey tool is receiving considerable uptake, with over a dozen surveys completed in 2011–2013. The GAVI Alliance and the Global Fund to Fight AIDS, Tuberculosis and Malaria began collaborating with WHO to expand use of the tool to more African and South-East Asian countries in 2014.

Research into links between energy access and health services provision

While it is clear many modern interventions cannot be delivered without electricity, few studies provide empirical evidence of the links between energy access rates of health facilities and actual health outcomes of treatment. A systematic global literature review identified only about a dozen articles out of 417 titles considered that included information on the impact of electricity access, or lack thereof, on health outcomes or health worker performance (Aranda et al., 2014; UBS, 2011). The search did not identify a single study in which linking energy access and health outcomes was the primary objective.

The impacts are difficult to measure due to the many contributing and confounding factors that need to be controlled, including staff skills and knowledge, availability of medicines, proximity to treatment and time-lag before measureable improvements. Most currently available evidence about health impacts of inadequate energy access in health facilities is thus derived from case studies and anecdotal evidence. However, such impacts may be assessed indirectly using proxy indicators, such as:

(i) **Facility performance indicators: operating hours and clinic visits.** Night-time health service provision or total hours of service provision per day have been used to evaluate the intermediate impact of energy access on health outcomes. The World Bank (2008) analysed health facility survey data from Kenya and Bangladesh and found that electrified clinics are open on average four more hours per day in Kenya, and one more hour per day in Bangladesh.

(ii) **Analysis of health services indicators in relation to the availability of electricity and/or electrical equipment.** Data on availability of specific types of electrical equipment in health facilities is captured by existing WHO/SARA and USAID/Measure Health surveys, as well as by some national government infrastructure surveys (Adair-Rohani et al., 2013). Some of this data can be compared with data on provision of specific services, such as immunization coverage. For instance, the World Bank (2008) reviewed vaccine refrigeration capacity in health facilities in selected countries, finding refrigerators more widely available in clinics with electricity (Table 2). However, clinics lacking electricity did not have lower immunization rates, possibly due to use of strategies such as mobile immunization teams and immunization campaigns in areas where refrigeration was unavailable. This points to the diverse set of factors that influence health-care delivery and actual health outcomes.[v]

(iii) **Analyses of health workers' attitudes and performance**. Health workers' attitudes and motivation can be affected by energy access in health facilities as well as in the surrounding community. A study (World Health Organization, 2010) on rural health worker retention noted that community electricity access was a key factor in attracting and retaining qualified health workers. The WHO study cited a World Bank study (Chaudhury N, 2003) that found Bangladeshi health workers preferred living in electrified communities, and this in turn reduced absenteeism in health facilities. Conversely, a civil society report about job satisfaction among Ugandan health workers describes the dissatisfactions expressed by both health workers and patients when electricity is unreliable or unavailable in clinics or hospitals. The report refers to health worker complaints about "non-functioning operating theatres, erratic or non-existent electric power," as well as other energy-related problems such as unreliable access to clean water and lack of communication technologies. Midwives and maternity nurses emphasized risks to women giving birth at night, when "assisting deliveries by the light of a mobile phone or candle begged from a patient, they were forced to delay episiotomies until daylight" (Voluntary Service Overseas, 2012).

Table 2. Cold chain vaccine storage features in association with rural health clinic electrification

	Ghana (2003)		Egypt (2002)		Kenya (2004)	
	Clinics with electricity	Clinics with no electricity	Clinics with electricity	Clinics with no electricity	Clinics with electricity	Clinics with no electricity
	72.8%	27.2%	98.6%	1.4%	77.5%	22.5%
Clinic vaccine facilities	**Among clinics with electricity**	**Among clinics with no electricity**	**Among clinics with electricity**	**Among clinics with no electricity**	**Among clinics with electricity**	**Among clinics with no electricity**
A. % with refrigeration for vaccine storage	64.2	40.7	51.3	0.0	71.9	67.3
B. % with ice used for vaccine storage	2.6	6.2	0.6	0.0	0.6	0.0
C. % with no vaccine storage	21.9	37.2	11.6	0.0	3.3	7.1
% Total clinics with immunization services (A+B+C)	**88.7**	**84.1**	**63.4**	**0.0**	**75.7**	**74.5**

Source: *Welfare impact of rural electrification* (The World Bank, 2008) based upon DHS data from USAID/Measure Health Facility Survey.

[v] The fact that access to refrigeration did not necessarily correlate with immunization rates reflects the ways in which workaround solutions are found to overcome access barriers, as when health districts whose clinics lack refrigeration stage vaccine campaign days.