National Surgical, Obstetric, and Anesthesia Planning Intervention Toolkit

A Resource from the Program in Global Surgery and Social Change, Harvard Medical School

Domain: Interventions to improve basic utilities e.g water, oxygen, power, waste, internet and their impact on health

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Brief Synopsis

There is a small body of evidence describing interventions to improve basic utilities such as water, power, oxygen and waste in healthcare facilities surrounding surgery. Most interventions are integrated within country-wide electrification/water supply plans. USAID guidelines for energy services in Zambian health facilities assess options for improving the facility-wide power supply at several different types of health facilities. The report focuses on cost-effective and practical solutions to health facility energy challenges. Successful national initiatives in Nepal and Turkey have been implemented to improve healthcare waste management systems. Most electrification, oxygenation or water provision initiatives described in the literature are facility-based, in collaboration with NGOs or international aid organizations. *We do not endorse a surgical plan taking responsibility for municipal water and electric systems, but rather advocating for that responsibility to be taken up by the Ministry of Infrastructure/Public Service.*

Guidelines

1. Powering Health, Electrification Options for Rural Health Centers (USAID, 2006)
   http://www.poweringhealth.org/Pubs/PNADJ557.pdf

   Powering Health is a resource for health professionals seeking to electrify health facilities that currently lack power or to ensure uninterrupted power for facilities that are connected to an unreliable power grid. Information is provided to help the user weigh the pros and cons of various energy systems with a focus on appropriate solutions and special considerations for off-grid rural hospitals and health centers.

2. Powering Health, Options for Improving Energy Services at health facilities in Zambia (USAID, 2009)
   http://www.poweringhealth.org/Pubs/zambia_assessment_report.pdf

   With support from the USAID's Bureau for Economic Growth Agriculture and Trade, Office of Infrastructure and Engineering/Energy Team in Washington, DC, and CDC-Zambia, a team of energy specialists visited Zambia, interviewed stakeholders in the health and energy sectors, and visited a representative sample of seventeen health

facilities to assess their energy supply conditions. This report presents the results of this assessment along with recommendations for improving energy service at these facilities. A technology neutral approach was taken for all analysis in the report, although special consideration is given to the applicability of renewable energy because of local stakeholder interest.

3. Renewable Energy for Rural Health Centers (National Renewable Energy Laboratory, 1998)
   https://www.nrel.gov/docs/legosti/fy98/25233.pdf

   Guide is written primarily for decision-makers within government ministries or private agencies that are involved or interested in health clinic electrification using renewable energy (RE) technologies. The purpose of this guide is to give the reader a broad understanding of the technical, social, and organizational aspects of health clinic electrification. It aims to help its readers accurately assess their health clinic's electrical needs, select appropriate and cost-effective technologies to meet those needs, and lastly, to put into place an effective infrastructure to install and maintain the hardware.

4. Individualized Rapid Assessment tool (IRAT)
   http://www.who.int/water_sanitation_health/facilities/waste/hcwmtool/en/

   This rapid assessment tool is a part of an overall strategy developed by WHO which aims at reducing the disease burden caused by poor health care waste management (HCWM) through the promotion of best practices and the development of safety standards.

Interventions

WASTE MANAGEMENT

1. Healthcare waste management (HCWM) committee

Reference: Sapkota, B., Gupta, G. K., & Mainali, D. (2014). Impact of intervention on healthcare waste management practices in a tertiary care governmental hospital of Nepal. *BMC public health*, *14*(1), 1005.

Web link: 10.1186/1471-2458-14-1005

Type: Facility-based
Intervention description:

- The Individualized Rapid Assessment tool (IRAT), developed by the United Nations Development Program Global Environment Facility project, was used to collect pre-interventional and post-interventional performance scores concerning waste management.
- A healthcare waste management (HCWM) committee representing various departments was formed

- Training program, related to HCWM, was conducted for physicians, nurses and waste handlers. The study included responses from pediatrics, medicine and orthopedics wards, and waste handlers.

Outcome:
The HCWM policy and Standard Operating Procedures (SOP)s were developed after the interventions, and they were consistent with the national and international laws and regulations. The committee developed a plan for recycling and waste minimization. Health professionals, such as doctors, nurses and waste handlers, were provided training on HCWM practices.

Organization: Government of Nepal Civil Service Hospital
Cost: This research did not receive any grant from any public or commercial funding agency, or not-for-profit sectors.
Considerations:
It is important to integrate the hospital waste management system for facility based surgical services (OR/surgical ICU etc) with the rest of the hospital to improve system efficiency.

2. Improvement and modification of the routing system for healthcare waste collection

OXYGEN

1. District-level oxygen concentrator system

Reference: Enarson, P., La Vincente, S., Gie, R., Maganga, E., & Chokani, C. (2008). Implementation of an oxygen concentrator system in district hospital paediatric wards throughout Malawi. *Bulletin of the World Health Organization*, *86*(5), 344-348.

Web link: 10.2471/BLT.07.048017

Type: Facility-based
Intervention description:
- Develop a curriculum and training materials;
- Train staff on use and maintenance;
- Retrain electromedical departments on maintenance and repair;
- Conduct training once concentrators arrive in the country;
- Distribute concentrators once staff has been trained.

Outcome:
- Provision of a source of oxygen in every paediatric ward in all district hospitals;
- Training of electrical engineering and health personnel in the use, maintenance and repair of oxygen concentrators; and
- Setting-up of high-dependency rooms or areas for severely ill children where oxygen is administered.

Organization: Government of Malawi, the International Union Against Tuberculosis and Lung Disease and the Bill and Melinda Gates Foundation
Cost: Grant-funded program
Considerations:
A challenge is to ensure that routine maintenance occurs and that systems are in place for ongoing distribution of available spare parts. Improved communication between clinical, nursing, engineering and programme administration staff is likely to assist in meeting these challenges. Countries seeking to implement such a programme should ensure that, where high staff turnover is likely to be present, adequate support is available for ongoing training and regular supervision.

ELECTRICITY

1. Photovoltaic (PV) Systems for Rural Health Facilities in Developing Areas

Reference: Al-Akori, A. (2014). PV Systems for Rural Health Facilities in Developing Areas.

Web link: http://www.iea-pvps.org/fileadmin/dam/public/report/technical/IEA-PVPS_T9-15_2014_PV_for_rural_health_facilities.pdf

Type: Facility based
Intervention description:

- 100 healthcare facilities in rural areas in Tanzania and Ethiopia were equipped with PV systems of a total capacity of 3.4kW each. The systems are mainly designed to provide energy for lighting, lab equipment, computer, printer and TV set of CTCs, as well as lights and TV for staff houses.

Outcome:

Organization: German Agency for International Cooperation and USAID
Cost: The turn-key cost for a small scale stand-alone PV system is USD 6,000 per kW. However, the investment costs of the systems vary, based on technology used and local economic aspects (i.e. taxes, transportation and installation costs). At Lugala Luthern Hospital, Tanzania, the investment costs of the installed PV systems vary from USD 7,480 per kW for the larger systems to USD 16,890 per kW for the smaller systems
Considerations:

- Building up a strong institutional framework is the key success factor for PV projects. This factor can be achieved through establishing an efficient management system, assigning clear roles, tasks and responsibilities to working staff and specialists.
- While PV systems are a mature technology, many projects failed in the past due to the poor quality of system components including batteries, charge controllers and inverters. PV system components should comply with one of the recognized international standards

2. Solar Suitcases for Hospitals

Reference: Humphreys, G. (2014). Harnessing Africa's untapped solar energy potential for health.

Web link: https://wecaresolar.org/

Type: Facility-based
Intervention description:
600 solar suitcases, now factory-made, have been deployed in more than 25 countries of sub-Saharan Africa as well as Haiti and the Philippines since 2008.

Outcome:
Organization: We care Solar, with support from WHO and UN
Cost: http://wecaresolar.org/wp-content/uploads/2011/08/2012-Pricing-Sheet-Final.pdf

- Solar Suitcase PRIME costs $1,495
- Solar Suitcase MATERNAL costs $1,595

Considerations: This intervention is fully dependent on international donor aid. This should be considered a temporary measure and is not a sufficient substitute for a provincial energy system.

3. Kalungi Hospital Water and Electrification

Reference: Powering Health, Electrification Options for Rural Health Centers (USAID, 2006)

Web link: http://www.poweringhealth.org/Pubs/PNADJ557.pdf

Type: Facility-based
Intervention description:
The project at Kalungi Hospital involved the electrification of the hospital, as well as the provision of clean water to the hospital and local community. A preliminary assessment was completed in the initial phases to determine the energy demands and the appropriate technology to meet those demands. Due to insufficient wind resources and the high cost of fuel, a photovoltaic system (PV) presented the best available option to meet the power needs of Kalungi. To meet the electrification goal, a 1.6 kW solar array was installed at the hospital to serve the electricity needs onsite. This includes 80 energy-efficient lights, a refrigerator, and diagnostic equipment. To provide clean water, a 2.6 kW solar array was installed several kilometers away at a well site. To cover the cost of ongoing maintenance and operations, the Kalungi Hospital sold excess water to the surrounding community. The revenue was used to train two long-standing hospital employees to maintain the electrification and water systems. Funds were also used to hire a security guard to keep the electrification system secure from thieves at all hours. In addition, Solar Energy Uganda Ltd., the group responsible for purchasing the system, offered a 5-year warranty for the water pump and a 25-year warranty for the PV system.

Presumed Outcomes:

Water provision

- Clean drinking water for community (100,000 people): In addition to the spigots installed at the Health Clinic, three spigots were installed in the local community in order to give the local residents access to clean, potable water
- Less likelihood that the local spring will be contaminated by animals or people collecting water since the area has been secured and the communal spigots are more convenient
- Less likelihood of water-borne illnesses at the hospital, including dysentery
- Improved cleanliness and hygiene at the health clinic
- Better overall community health – the doctor in charge expects to see significantly reduced incidences of dysentery and other ailments transmitted through unclean water

Electrification

- Extended clinic hours, including services to patients throughout the night
- Continued study for nursing students at night
- Capability to sterilize medical instruments
- Fuel savings of approximately $25,000/year
- Power for diagnostic equipment such as microscopes
- Refrigeration of vaccines, medicines, and diagnostic supplies
- Extended computer use and capability
- Increased surgery load; better overall patient care locally
- Less likelihood of patient transport to Masaka District facility for care

Organization: The Coca-Cola Company, Solar Light for Africa, Ltd. (SLA), Solar Energy Uganda, Ltd. (SEU), Geneva Global Foundation/Global Environment & Technology Foundation (GETF)/United States Agency for International Development
Cost: USD$121,000 (Includes contractor and equipment costs; excludes overhead/administrative costs)
Considerations:
The intervention is resource intensive, costly and highly dependent on international donor aid.

Additional Resources:

1. Franco, A., Shaker, M., Kalubi, D., & Hostettler, S. (2017). A review of sustainable energy access and technologies for healthcare facilities in the Global South. *Sustainable Energy Technologies and Assessments*.