Energy Management

Most humanitarian interventions - and especially the ones performed during emergencies - take place in remote or jeopardised communities with a poor availability and/or limited reliability of the electrical public grid. To operate, humanitarian organisations premises are frequently equipped with at least one independent power supply, either as back up in case of grid failure or as the primary method of producing electricity. Independent power supplies include batteries, generators and solar-electric equipment.

Purchasing, installing and running such equipment requires important investments that can be reduced with proper sizing and energy demand management. Electricity is not cheap, and running a generator can become quite expensive. Energy production also has an environmental impact and has the potential to damage the perception of organisations.

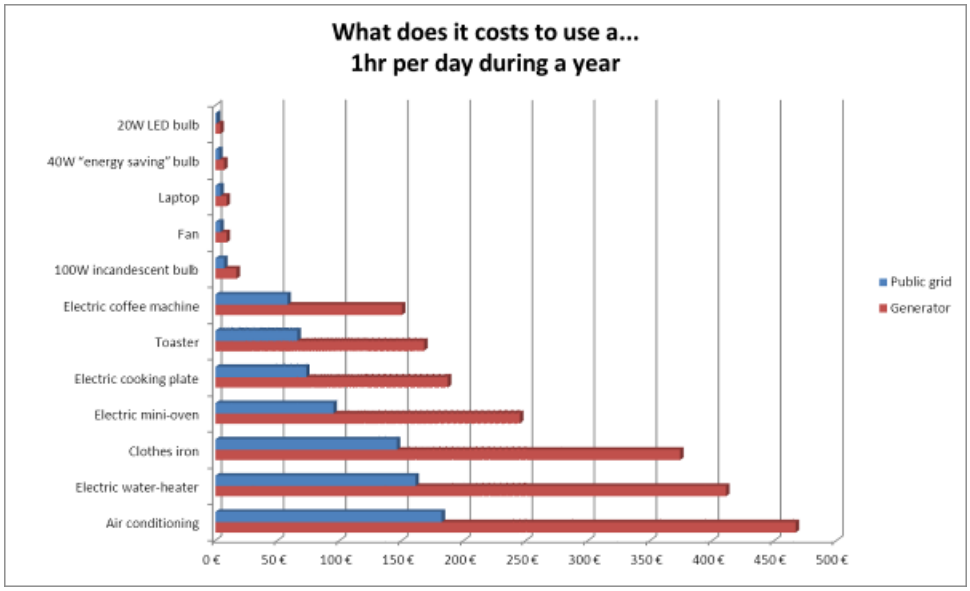
It is often possible to reduce electricity consumption without degrading the quality of service by improving the energy management, focusing on reducing the demand, and choosing the correct supply.

- **Energy Demand Management**: Minimise energy consumption without reducing the quality of service and avoid unnecessary energy consumption.
- **Energy Supply Management**: Select the best main and back-up power supplies in accordance with the situation, properly sized to optimise investment and running costs.

To manage both demand and supply, a proper diagnostic to understand the installation power and energy needs is required. Continued diagnostics will be necessary at each step of the energy management process, mainly:

- To calculate the total energy and power needs of a planned operating environment and help size the power supplies (generator, solar, or other).
- To identify the appliances and services that account for a significant part of the total energy and power needs.
- To understand the variation of the power and energy needs within a day and identify the peak periods.

A complete diagnostic may also be useful in reporting, audits and/or studies purposes.



Adapted from, ACF

Energy Demand Management

It is normal to take electricity for granted, however energy always comes at a cost. To improve the way the energy is used, avoid unnecessary consumption and minimise the inevitable without degrading the quality of the service. It is important to think in terms of service instead of devices, and try to find the most effective solutions to accomplish the required service.

Example:

Service Requirement: A cool working environment is required, not air conditioning.

Fulfilling the Service Requirement: Consider choosing the room location least likely to heat up, installing white curtains that allow light to enter but reduce the heat, increase the insulation in a room, and then installing an air conditioner.

With the help of the energy diagnostic:

- **Identify high-impact services** to understand what services have significant impact on power and energy consumption and when the peak periods occur.
- **Examine potential alternatives** – working tools, refrigerators, and lighting are obvious consumers of electricity and hard to avoid. Other consumers of energy offer other possibilities, such as water heaters and stoves. Consider possible solutions according to feasibility and initial cost, energy consumption and running cost and service quality.
- **Reduce losses, increase efficiency** by choosing efficient and well-sized appliances according to the purpose and number of users, and by using them in a way that maximises their efficiency, such as cleaning and maintaining equipment and appliances to increase their efficiency.
- **Reduce unnecessary use** by switching off and unplugging appliances when not in use. It may be required to display posters or leaflets to reminder users.
- **Optimise consumption over time,** identifying peak periods and if possible, avoid or postpone the use of the most powerful appliances during peaks or when running on battery/solar back-up systems. Mark powerful appliances who's use can be postponed, such as those for comfort or non-urgent tasks, and differentiate those used for work, security, communications.

Energy Supply Management

Proper selection of main and back-up power supply will have a large impact not only on cost savings, but in the way the energy consumption is optimised. The chosen combination must be able to:

- Deliver enough power for the installation.
- If possible, guarantee a 24/7 availability of electricity in the building.
- Ensure a minimum quality (limited voltage drop or frequency fluctuations).
- Minimise costs.
- Run and operate safely.
- Keep the impact on the local environment as low as possible, including reducing smoke, vibrations, noise during the night, ensure good living and working conditions and prevent neighbourhood conflict.
- Minimise the global environmental impact.

The decision on the type of main power supply will depend mainly if the building is connected to the public electricity grid. Connection to a public grid is considered optimal where available and should be the first option if available. If there is no grid, or the grid is not reliable, then a generator be considered.

A back-up or generator can and will be required if a grid runs the risk of power outages, or when a redundant electrical system is required as an essential safety measure.

There are multiple options for a back-up system, including batteries, solar or smaller generators. There are other things to take into account when selecting a back-up system, including what and how reliable the main source is.

Buying a generator may not be very expensive, but generators require fuel and maintenance and running costs can be quite high. Inversely, battery and solar systems require significant investments but will have very low running costs. Initial and running costs must be considered when choosing a power supply.

Estimated Operating Costs:

Proposed Back-up	Initial Cost	Total Cost After 1 Year	Total Cost After 2 Years
2kVA Generator	600 €	14,600 €	28,800 €
Battery System	4,800 €	9,300 €	13,900 €
Solar (cove ring 30% of energy needs)	6,500 €	9,600 €	12,900 €

Main, Back-up and Possible Combinations

Public Grid + Generator

In many contexts, the main power supply is the electricity provided by the local power company. A back-up is a generator should be able to cover all electricity needs of the installation excluding appliance marked as non-essential. (See energy demand management).

Advantages	Disadvantages
• Simple and cheap • Locally available • Limited nuisances	• Short outages occur as the generator must be started when the grid go down • UPS and/or regulator necessary • Fuel supply and stock necessary • Maintenance required for the generator even if it is rarely used

Recommended For

- Building connected to a public grid with long unpredictable outages
- Building connected to a public electricity grid in a deteriorated security context
- Building connected to a public electricity grid and used for a limited duration
- Emergency back up when required

Generator + Generator

In a generator only configuration, electricity is provided by a two or more generators. For using two generators:

- Both generators can either be identical or capable of producing the same amount of power, and can be used interchangeably and following a detailed use plan.
- One generator can be smaller than the other, and be used as a back-up only. In the case of two differently powered generators, the smaller unit it will not need to or be able to cover the entire electricity needs of the operating context, and may need to be wired specifically to power essential items only (see energy demand management).

Advantages	Disadvantages
• Locally available • Limited initial costs • Well-known technology	• High running cost • Short outage as generators are switched • UPS and/or regulator required • Fuel supply and stock required • Limited reliability and frequent maintenance • Time consuming to manage • Permanent noise and maintenance hassle

Recommended For

- Isolated building with high energy needs
- Isolated building used for a limited duration
- Emergency back up when required

Grid + Batteries

In this configuration, the main power supply is the electricity provided by a local power company, while the back-up is a battery system that provides a limited autonomy to the installation in case of outage.

Advantages	Disadvantages
• 24/7 electricity without outage and micro-outage • High reliability • Good electricity quality • Easy to add solar supply • Limited nuisances	• Grid dependent • Local procurement and maintenance not always possible • Battery room required • Higher initial cost than a generator • Back-up generator may still be necessary • Limited lifespan of the batteries (2 to 5 years) and possible environmental impact of batteries disposal

Recommended For

Advantages	Disadvantages

- Building connected to a public grid with short and frequent outages
- Building connected to a public grid with night outages
- First step towards solar system installation

Generator + Batteries

In this configuration the main power supply is a generator that provides electricity during peak hours. The back-up is a battery system that accumulates electricity when the generator is running and supplies the installation during low consumption hours.

Advantages	Disadvantages
• 24/7 electricity without outage or micro-outage • No nuisance during low consumption hours • Good electricity quality • Better reliability and service-life of the generator • More flexibility on power consumption • Easy to add solar supply	• Fuel supply and stock required • Minimum daily running duration for the generator to reload batteries • Local purchase and maintenance may not be possible • Battery room required • Higher initial cost than generator alone • Back-up generator may still be necessary • Limited lifespan of the batteries (2 to 5 years) and possible environmental impact of battery disposal

Recommended For

- Isolated office or compound
- First step towards Solar system installation

Public Grid OR Generator + Solar

In this configuration, electricity is provided by the main source - grid or generator - during peak hours and by solar system during the day. A battery system accumulates electricity from all sources and supplies the installation when they are off.

Advantages	Disadvantages
• Same as “grid/generator + battery” • Lower nuisances • Fuel saving, best cost/efficiency ratio on the long run for isolated building • Very reliable back-up power supply	• Could require some time to be installed. • Local purchase and maintenance may not be possible • Battery room and a large open surface required • High initial cost • Limited lifespan of the batteries (2 to 5 years) and possible environmental impact of battery disposal

Recommended For

- Isolated guest-house
- Isolated building with limited energy needs
- Isolated building in area where fuel supply is very difficult and/or very expensive
- Building where security context impose a very reliable and totally autonomous back-up power supply, such as places with possible hibernation requirements.