MINISTRY OF PUBLIC UTILITIES, ENERGY, LOGISTICS & E-GOVERNANCE

"Building a green future via Service, Innovation & Transformation!"

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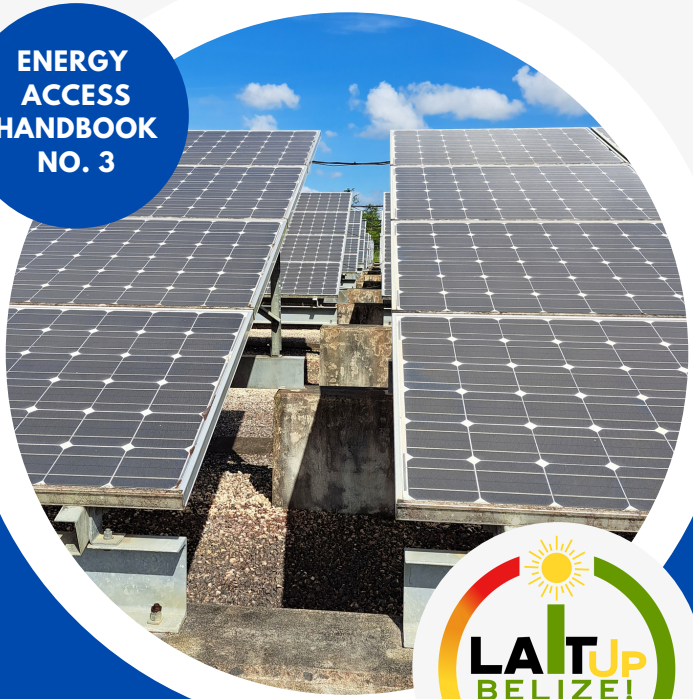
ENERGY ACCESS HANDBOOK NO. 3



LAIT UP BELIZE!

Mini-Grid Electricity

Everything you need to know...

The purpose of the handbook

The Government of Belize is promoting the universal energy access policy to provide energy access to unserved communities in the country by 2030. Currently there are two mini-grids: one piloted in La Gracia, and the other in Indian Creek. A grant has been established between the European Union (EU) and the Belize Electricity Limited (BEL) under the EDF-11 agreement of which BEL will implement the installation of three mini-grids on behalf of the Government, to provide electricity to five unserved communities in rural areas of Belize.

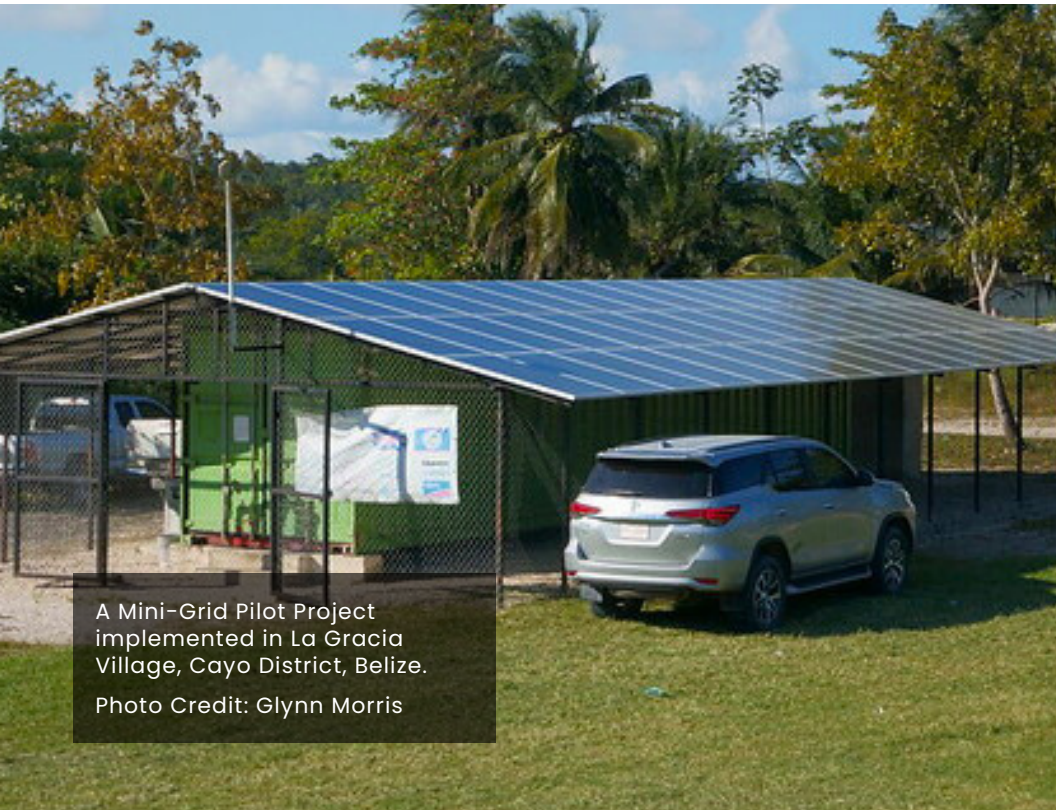
This handbook / manual is intended to provide you - as the end user of a mini-grid electricity access - with as much useful information to understand the system and to make the best of your electricity access.

CONTENTS

PAGES

A Mini-grid Project in Indian Creek village, which also supplies electricity to the villages of Golden Stream and Medina Bank in Toledo District, Belize.

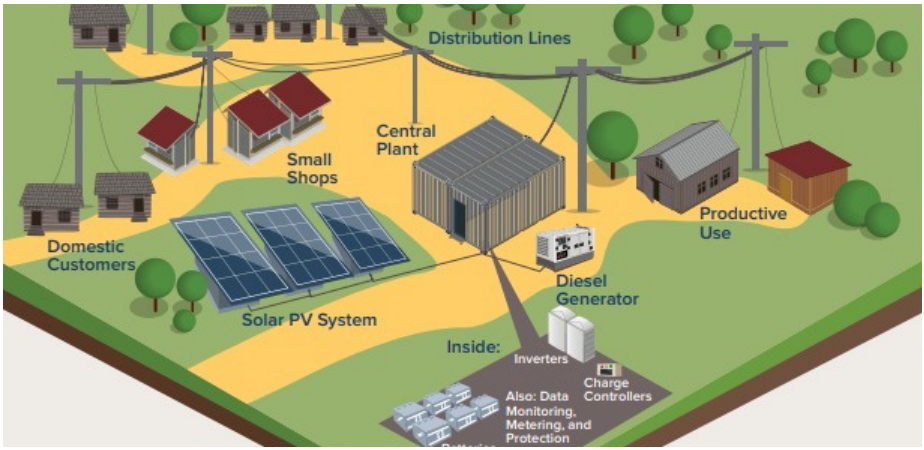
Photo Credit: SMART Energy



A Mini-Grid Pilot Project implemented in La Gracia Village, Cayo District, Belize.

Photo Credit: Glynn Morris

1



Introduction to Mini-grid systems

What is a mini-grid?

A mini-grid is an electricity distribution network with its own electricity generation and storage system that is not connected to the national grid. This means that it is not connected to the main supply of electricity in the country. The mini-grid generates its own localized energy on a smaller scale, stores the energy on a battery system, converts it to usable and safe electricity and then distributes the electricity to the local customers.

What are the benefits of a mini-grid system?

Reliable and Accessible Electricity: Mini-grid systems provide a reliable and consistent source of electricity to users, particularly in areas with limited or no access to the main power grid. Users can enjoy round-the-clock electricity, which improves their quality of life and enables them to carry out daily activities without interruptions.

Energy Independence: Mini-grids promote energy independence by generating electricity locally. Users are not reliant on centralized power plants or distant transmission lines, which can be susceptible to outages or disruptions. This independence allows users to have more control over their energy supply and reduces their vulnerability to external factors.

Increased Productivity and Economic Opportunities: Access to electricity through mini-grids unlocks various economic opportunities for users. It enables businesses to operate more efficiently by powering machinery, tools, and equipment. Additionally, electricity access can foster the growth of small-scale enterprises, such as shops, workshops, and service providers, which rely on reliable power supply for their operations.

Improved Education and Healthcare: Electricity plays an important role in education and healthcare. Mini-grid systems power schools and educational institutions, facilitating better learning environments with lighting, computers, and audio-visual aids. In healthcare facilities, electricity enables the operation of medical equipment, refrigeration for vaccines and medicines, and lighting for surgeries and emergency services.

Environmental Sustainability: Depending on the energy sources used, mini-grid systems can contribute to environmental sustainability. If powered by renewable energy sources like solar, wind, or hydro, they have a lower carbon footprint compared to traditional fossil fuel-based power generation. This reduces greenhouse gas emissions, mitigates climate change, and promotes cleaner and greener energy alternatives.

Cost Savings: Mini-grid systems can potentially offer cost savings to users compared to other alternatives. In regions where access to electricity is limited, alternative sources like diesel generators or kerosene lamps can be expensive. Mini-grid systems, especially those powered by renewable energy, can provide a more affordable long-term solution, potentially reducing energy costs for users.

Community Empowerment: Mini-grid systems often involve community participation and engagement. Users have the opportunity to take part in the decision-making process, maintenance, and management of the system. This fosters a sense of ownership and empowers local communities, promoting sustainable development and fostering a stronger sense of self-reliance.

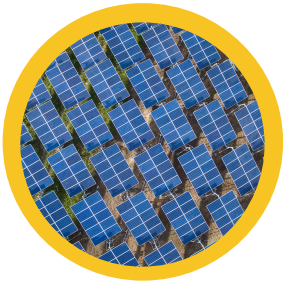
How does the mini-grid system operate?

The mini-grid operation is a localized electricity grid using standard electricity networks, metering, billing and customer service – that are supplied with electricity which is generated on site from a local energy source - such as solar energy - and stored in batteries. It also utilizes generator power - from diesel fuel - for periods of peak demand. Inverters and control equipment are used to convert the energy into safe and useable electricity. The electricity is then distributed to the various premises using distribution lines similar to a standard BEL electricity network.

The scheme aims to provide the same standard of service that BEL supplies from the main electricity grid. Customers are required to pay for a nominal registration fee for connection, a fixed minimum charge and a standard BEL electricity rate that is regulated by the Public Utilities Commission (PUC).

What are the main elements of the mini-grid?

Generation & Storage



Solar Farm Site

Solar Panel Mounting Structure

Battery Storage & Control Room

Distribution Electricity Network

Electricity Distribution Poles, Transformers & Wires
connects the electricity generation & storage systems to customers in the community

Grid to House Connection

Service Entrance
provided on a concrete column

Electricity Meter
to supply the house with electricity from the power line

Main Breaker Panel
to distribute the electricity safely to various areas of the building, as the centralized location of the electrical system in a building

Lights & Sockets
to which the power is supplied from the main breaker panel

Battery storage and control room at Solar Energy Solutions Belize (SESB)

Photo Credit: Luis Larregola

2

How to get the maximum benefit from your Electricity Access

Electrical Appliances and Household Wiring Tips

1. **Purchase Reliable and Certified Appliances**
   When buying electrical appliances, choose reputable brands from trusted manufacturers. Look for certifications such as UL (Underwriters Laboratories) or other recognized testing agencies, which indicate that the appliance has undergone safety testing.

2. **Read and Follow Manufacturer Instructions**
   Always read and follow the manufacturer's instructions and safety guidelines for installing, using, and maintaining electrical appliances. This ensures that you use the appliance correctly and avoid potential hazards.

3. **Avoid Overloading Circuits:**
   Each electrical circuit has a maximum load capacity. Avoid plugging in too many appliances or devices into a single outlet or circuit. Distribute the load across multiple outlets or circuits to prevent overloading, which can lead to overheating, tripped breakers, or electrical fires.

4. **Use Surge Protectors:**
   Protect sensitive electronic devices from power surges by using surge protectors or power strips with built-in surge protection. Surge protectors help safeguard against voltage spikes and fluctuations that could damage appliances or electronics.

5. **Inspect Cords and Plugs:**
   Regularly check the power cords of appliances for any fraying, cracks, or exposed wires. Damaged cords should be replaced promptly to avoid electrical shocks or fire hazards. Similarly, ensure that the plugs are in good condition and fit snugly into the outlets.

6. **Keep Appliances Away from Water:**
   Water and electricity are a dangerous combination. Keep electrical appliances away from water sources such as sinks, bathtubs, or wet floors to minimize the risk of electrical shock.

7. **Properly Ground Appliances:**
Appliances that require grounding, such as refrigerators, washing machines, and dryers, should be properly grounded according to local electrical codes. Grounding helps divert electrical faults and protects against electric shock.

8. **Use GFCI Outlets:**
Ground Fault Circuit Interrupter (GFCI) outlets are designed to detect ground faults and quickly interrupt the circuit to prevent electrical shock. Install GFCI outlets in areas prone to moisture, such as kitchens, bathrooms, and outdoor areas.

9. **Don't Overlook Warning Signs:**
Pay attention to warning signs such as flickering lights, buzzing sounds, or frequently tripping breakers. These could indicate underlying electrical issues that need to be addressed by a qualified electrician.

10. **Hire a Professional Electrician:**
For any electrical installations, repairs, or modifications in your home, it is best to hire a licensed electrician. They have the expertise and knowledge to ensure proper wiring, adherence to electrical codes, and overall safety.

Remember...
electrical work can be hazardous. If you are unsure or uncomfortable handling any electrical tasks, it's always best to consult a qualified electrician for assistance.

How much electricity and what type of appliances can I use with my electricity access?

Energy access is measured in Tiers, based on a spectrum of service levels and attributes. There is a variety of different types of energy products and services that end users may or may not have access to on a mini-grid. Tiers for electricity is determined based on availability, duration, affordability, legality, quality and reliability.

The World Bank introduced a universally adopted method of measuring energy access called the multi-tier framework (MTF). Tiers 0 and 1 access mean little or no access to energy, Tiers 2-3 a low level of access, and Tiers 4-5 roughly equivalent to the levels for access and types of technologies in common in western countries. The energy access project being implement in Belize is a **Tier 4** design.

Tier Level	Tier 0	Tier 1	Tier 2	Tier 3	Tier 4	Tier 5
Typical power loads for appliances	Candle	Light	Light, TV, Fan	Light, TV, Fan, Cooker	Light, TV, Fan, Cooker, Refrigerator	Light, TV, Fan. Cooker, Refigerator, Washer
Hours of power supply	0 Hr	4 Hrs	4 Hrs	8 Hrs	16 Hrs	23 Hrs

For your smart assessment, here are some appliances ranked by electricity/power load demand, compared by power rating in watts and cost per typical usage. The cost per typical electricity usage in BZD is estimated by the standard social rate of $0.22 per kWh*.

Phone Charging
3 - 7 watts
>1 cent per hour

Alarm Clock
1 - 2 watts
1 cent per 24 hours

LED Light
10 watts
2 cents per 6 hours

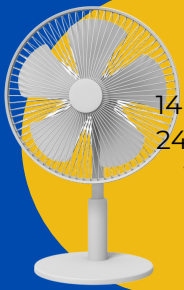
Laptop Charging
60 watts
2 cents per hour

PUC rates schedule for period July 1, 2021 - June 30, 2024

Florescent Light
13 - 15 Watts
3 cents per 6 hours

Blender
300 Watts
6 cents per 10 minutes

Television
30 - 50 watts
12 cents per 6 hours



Fan
14 - 45 watts
24 cents per 12 hours

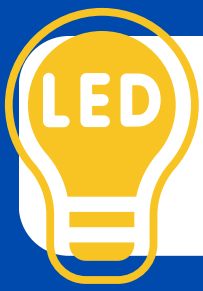
Iron
1000 - 2000 watts
36 cents per half hour

Sterio Radio / Speaker
400 watts
84 cents per 6 hours

Washing Machine
400 - 1400 watts
1.15BZD per 3 hours

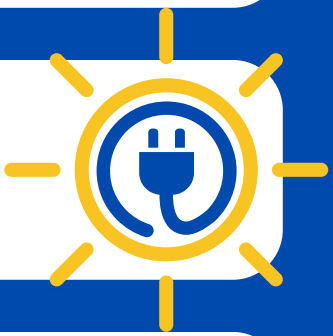
Refrigerator
100 - 200 watts
1.70 BZD per 24 hours

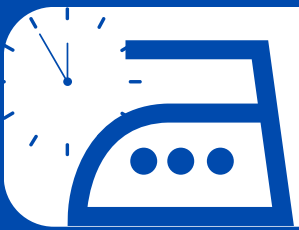
ENERGY SAVING TIPS



Use LED light bulbs instead of fluorescent or incandescent

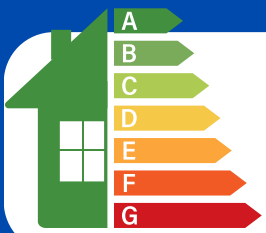
Use electrical appliances with heavier power loads during the peak sunlight hours





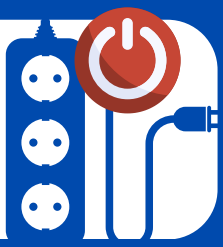
Iron during peak sunlight hours and complete as much as you can for the week instead of doing so daily.

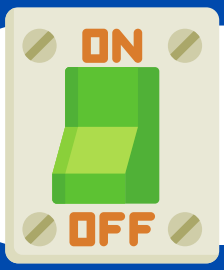
Use a timer on the refrigerator, freezer or other running appliances



Use energy efficient (EE) appliances with EE labelling to consume less electricity than the typical market appliances.

Unplug or switch off stand-by mode on appliances by using a power supply outlet with a switch off or on option.



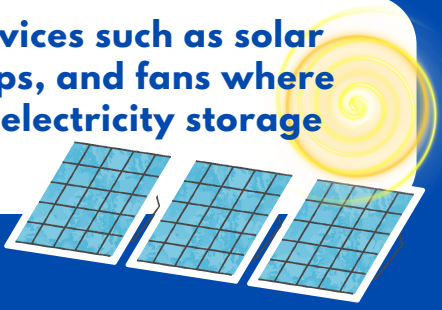


Turn off lights and fans when leaving the room

Boil water on the gas stove instead of using a water heater

Use smart devices that turn themselves off when not in usage

Use solar powered devices such as solar chargers, radios, lamps, and fans where you can improvise on electricity storage from the main system



3

How to purchase your electrical appliances

1. What are you going to use the appliance for?

Determine the features and the capacity that you are looking for and determine how often you will use the appliance.

2. How much can you afford to spend?

Price often determines quality. It might be important to consider spending a little more for a higher quality appliance that will provide durability and reliability.

3. How much energy will it use?

The matter of cost doesn't end when you purchase the appliance, hence you must also take into consideration the operating costs for electricity and the impact on your monthly energy bill.

4. Does the appliance have a guarantee or warranty?

Guarantees and warranties provide a level of assurance that the product will not become faulty in a short period of time and that it will be replaced if a fault occurs.

5. What do other people think about the appliance?

It may be useful to seek reviews online for the product or from persons you might know that has previously purchased the appliance to verify performance and efficiency.

6. Is it environmentally friendly?

Choosing sustainable and efficient electrical appliances limits carbon footprint and contributes to national Climate goals. Learning to identify energy efficient (EE) labelling is helpful when determining EE appliances.

The Belize Bureau of Standards is introducing energy efficient appliance labels for lights, refrigerators and air-conditioners to help customers make better decisions when buying appliances.

4

Information Resources

- **Energypedia** - https://energypedia.info/wiki/Mini_Grids
- **Caribbean Centre for Renewable Energy & Energy Efficiency** - www.ccreee.org
- **United Nations SDG 7** - https://sdgs.un.org/goals/goal7
- **EU Energy Community** - www.energy-community.org
- **Solar Energy Industry Association** - www.seia.org/initiatives/about-solar-energy
- **Belize Bureau of Standards** - https://bbs.gov.bz/

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