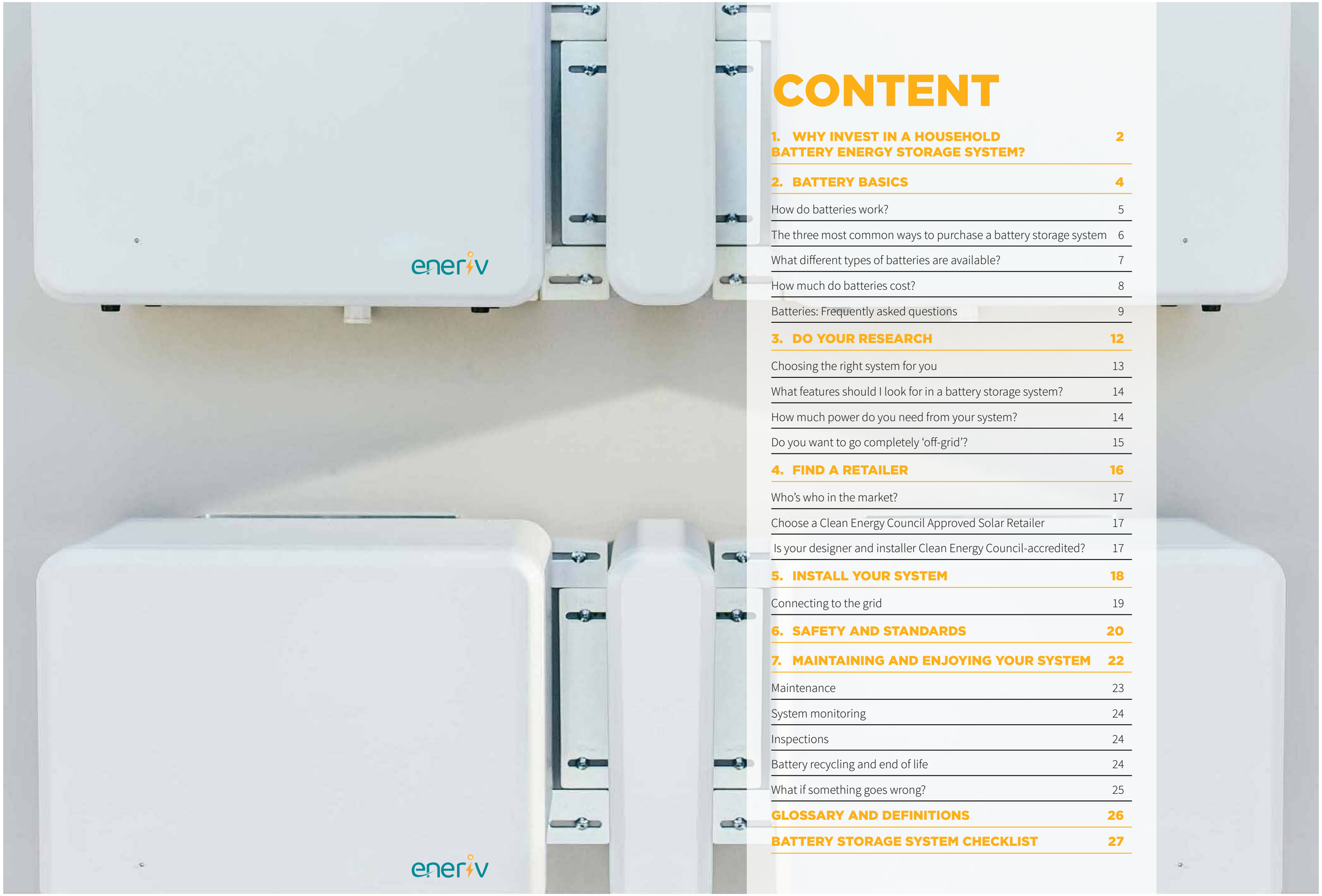
GUIDE TO INSTALLING RESIDENTIAL SOLAR SYSTEM



CONTENT

WHY INVEST IN A HOUSEHOLD BATTERY STORAGE SYSTEM?

Battery storage allows you to store electricity generated by solar panels during the day for use later, like at night when the sun has stopped shining. While batteries were first produced in the 1800s, the types of battery storage systems that can store solar power and provide electricity to households are fairly new.

Battery storage is an exciting new technology, but there are many things to consider before you invest in a system for your home.

Installing a battery storage system* can provide a number of benefits when used in conjunction with solar panel system, grid and generators in a country without stable 24 hours supply

1

* The overall system that is constructed for your home or business is called a 'battery energy storage system'. For the purpose of this guide, we have used the term 'battery storage system'.

A BATTERY STORAGE SYSTEM CAN:

Help reduce your reliance on electricity from the grid

Maximise the energy from your solar panels by allowing you to capture the solar energy that would normally be sent to the grid and save it for your own usage later in the day

Eliminate or Reduce your diesel and fuel cost depending on you Energy Storage capacity

Provide electricity to your home during power outages (depending on your system)

Reduce your exposure to future electricity price rises

BATTERY BASICS

The significant reduction in the cost of battery storage systems in recent years means that installing a battery is fast becoming a viable option for many Nigerian households.
But what exactly are battery storage systems, and how do they work to power your home? This section covers all the basics you need to know.

2

HOW DO BATTERIES WORK?

Battery storage uses a chemical process to store electrical energy, which can then be used at a later time. For example, a solar powered torch stores electrochemical energy during the daylight hours that can be used to provide light at night.

In practice, battery storage systems can operate in a number of different ways. It is important to discuss your needs with an Professional Solar System Designer"

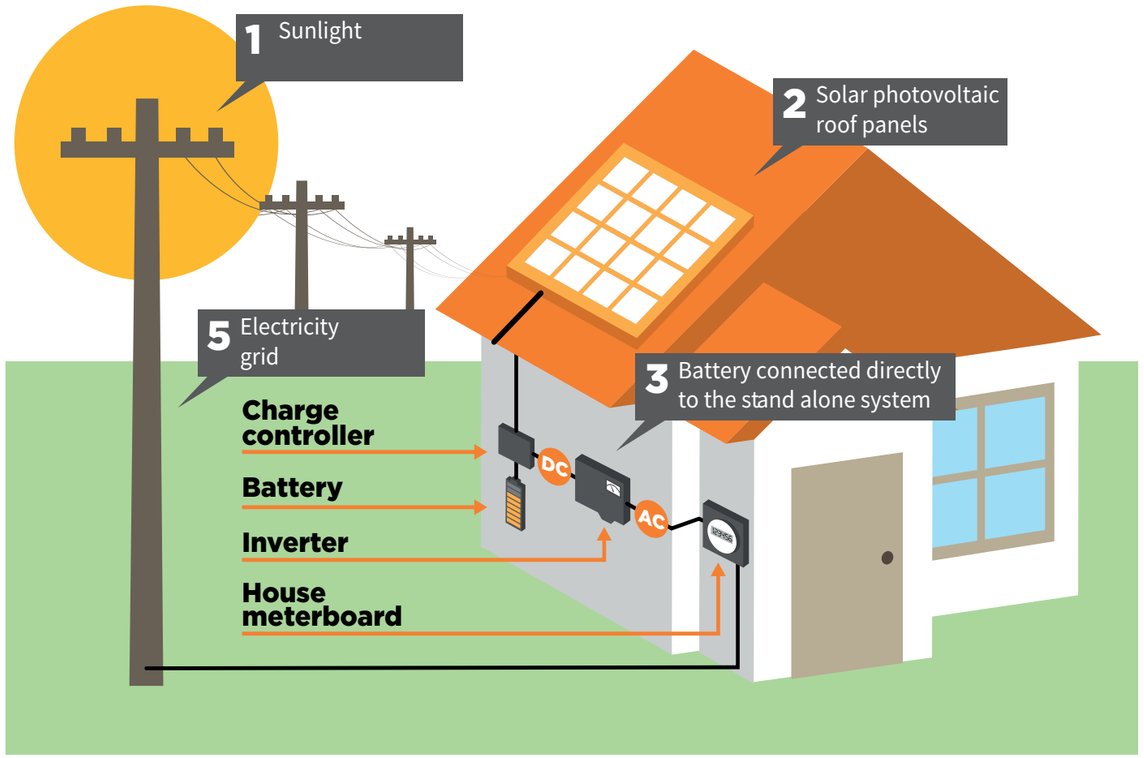
Please Call +234 802 356 7890 for free consultation.

A battery storage system connects to a house in two main ways – DC (direct current) coupled or AC (alternating current) coupled.

A DC-coupled battery storage system is integrated into your solar system. These systems generally have a single inverter that converts the DC electricity to AC to supply your house.

An AC-coupled system is separate to your solar system. It connects directly to your house wiring via its own dedicated bi-directional battery inverter, using local AC electricity to charge the battery and then discharge it directly to your house.

Each system has its own benefits. It is best to discuss the different options with your system designer.



THE THREE MOST COMMON WAYS TO PURCHASE A BATTERY STORAGE SYSTEM

When purchasing a battery storage system it is important to discuss your needs with a system designer. They will help you choose the best way to set up your system. The most common ways to purchase a system are shown as follows.

OFF-THE-SHELF SYSTEM	Advantages	Disadvantages
These systems are typically all-in-one systems that require little customisation to be installed.	One manufacturer One warranty	Predefined energy and power limits
SEMI-CUSTOMISED SYSTEM	**Advantages**	**Disadvantages**
Your designer may select various components (such as the inverter) and connects this to an off-the-shelf battery system to make your battery storage system.	Customisable Flexible energy and power limits can be set	Customisable More than one manufacturer More than one warranty
FULLY-CUSTOMISED SYSTEM	**Advantages**	**Disadvantages**
A system where the installer makes the battery system from individual battery cells or modules on site and connects it to an inverter to make the battery storage system.	Most designer flexibility of all solution Customisable energy and power limits	Multiple warranty considerations

OFF-THE-SHELF SYSTEM (Manufacturer BESS*)

"All-in-one" system - requires little customisation before installation.

Predefined energy and power limits

User has to deal with a single manufacturer and a single warranty

SEMI - CUSTOMISED SYSTEM (Manufacturer battery system)

More customisable. The designer selects components such as the inverter and connects them to an off-the-shelf battery

Flexible energy and power limits

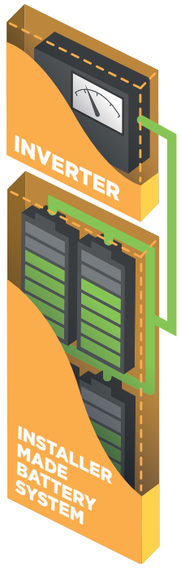
More complex. More than one manufacturer, more than one warranty

FULLY CUSTOMISED SYSTEM (Installer constructed BESS)

Most customisable. The designer makes the battery system and connects them to an inverter to make the storage system

Customisable energy and power limits

Most complex. Multiple warranty considerations



*BESS - battery energy storage system

WHAT DIFFERENT TYPES OF BATTERIES ARE AVAILABLE?

LITHIUM-ION BATTERIES	Advantages (compared to lead-acid batteries)	Disadvantages (compared to lead-acid batteries)
Lithium-ion batteries are becoming a popular choice for use with household solar panels, and may become the main technology used in the future. Lithium-ion technology has been used for many years in portable devices, including in laptops and mobile phones. Due to falling costs and increased production, they can now be manufactured in larger sizes and are well-suited to storing solar power.	Higher capacity and storage Lighter weight and higher voltage Smaller space and environmental footprint Reduced maintenance due to inbuilt battery management systems Longer cycle life and greater depth of discharge	Cost Possible limitation in operating temperature range Limited recycling programs in Nigeria Less well-known technology
LEAD-ACID BATTERIES	**Advantages** (compared to lead-acid batteries)	**Disadvantages** (compared to lead-acid batteries)
The technology behind lead-acid battery storage is similar to that of a car battery. Lead-acid batteries are commonly used with solar panels in remote rural homes, where connection to the grid is prohibitively expensive. Thanks to advances in technology, systems wellsuited to solar power storage are readily available in the form of low-maintenance sealed lead-acid batteries.	Well-understood technology Relatively cheap Easy to acquire Readily recyclable and have commercial value	Require regular (albeit simple) checks and maintenance Limited depth of discharge (i.e. a lower p roportion of the energy stored can be used) Requirement for external venting, which restricts installation locations

OTHER TECHNOLOGY TYPES

Other technology types include nickel-cadmium, nickel-metal hydride and flow batteries, but these are less common. Please contact Eneriv Trained Designers for further guidance. Helpline : **+234 802 356 7890**

HOW MUCH DO BATTERIES COST?

While the price of battery storage systems is falling rapidly, the cost to install a household system is still significant. The fully installed costs of a system are likely to be around ₦400,000 – ₦800,000 per kWh.

OTHER TECHNOLOGY TYPES

System size	Estimated price range
5 kWh	₦1,500,000 - ₦4,000,000
10 kWh	₦4,000,000 - ₦8,000,000

Some providers may offer leasing arrangements or payment plans, but make sure you check the details and ask for the total costs of any plan.

Once installed, the cost of running a battery storage system is minimal. It's important to have a maintenance plan in place to ensure your battery is running safely and efficiently, so speak to your retailer about any ongoing maintenance costs.

BATTERIES: FREQUENTLY ASKED QUESTIONS

WHAT DOES BATTERY CAPACITY MEAN?

Typically battery capacity is expressed in kilowatt hours (kWh), similar to the way your electricity is charged on your bill. Some battery manufacturers express their capacity in ampere hours (Ah). If this is the case, speak with your designer to get this converted to kWh.

The battery capacity quoted by the manufacturer is an 'ideal' number that is useful for comparing batteries. Some manufacturers promote their battery capacity based on the total capacity, for example 10 kWh. But all battery storage systems have what is called depth of discharge (DoD). This is how much of the total capacity can be used.

The majority of battery storage systems cannot have 100 per cent of the total energy drawn out of the battery. DoD is expressed as a percentage of the total capacity. If a 10 kWh battery has a DoD of 80 per cent, it will provide 8 kWh of usable energy. It is important to compare batteries based on their usable energy, not on the total capacity.

Lithium-ion battery systems typically have a depth of discharge of 80 per cent and above.

Lead-acid battery systems typically have a depth of discharge of 30–50 per cent.

HOW BIG ARE BATTERY STORAGE SYSTEMS?

A number of battery storage solutions are available. They come in a range of sizes (typically between the size of a split system air conditioner and a fridge) based on the technology that they use and the amount of energy they store. Lead-acid batteries tend to be physically larger than lithium batteries.

WHERE CAN I INSTALL A BATTERY STORAGE SYSTEM?

Some battery storage systems can be wall mounted, others are floor standing and some are best located inside, while others should be installed outside. You may also choose to install multiple batteries to increase your storage capacity, in which case you will need extra storage space.

Lead-acid batteries tend to be physically larger than lithium batteries and are usually installed outside or in a utility room (e.g. garage or basement) as they vent hydrogen when charged. Some batteries (usually lithium batteries) are designed to be wall mounted inside a utility room, which helps control their temperature.

If your battery is designed to be installed outside, it will come with a weatherproof enclosure, though you will still need to find a suitable place to install it. This will need to include access for electrical wiring, consider flooding/splashing of the enclosure, preferably be out of direct sunlight and not be adjacent to heat or ignition sources.

If your battery is installed inside, you may also need to consider ventilation. It is recommended that battery storage systems not be installed in a habitable room, like a living room or bedroom.

These are all factors to consider when you talk to a **Eneriv Trained Professional Designer**

BATTERIES: FREQUENTLY ASKED QUESTIONS

WHAT CONSIDERATIONS SHOULD I BE AWARE OF WHEN INSTALLING A BATTERY STORAGE SYSTEM?

The cabinet or housing of the battery should be built to comply with the standards and building codes applicable in the relevant jurisdiction. For example, in the Nigerian, the battery enclosure must comply with fire and building regulations. Your Eneriv Trained Professional Designer will be aware of these requirements.

WHAT HAPPENS IF I MOVE HOUSE?

It is possible for a storage system to be moved if you change residence, in the same way that solar panels can be moved. However, if the product standards change and your battery storage system no longer meets the new standard, you won't be able to reinstall it. Therefore, while it is technically possible to move your battery storage system to a new residence, you should check before you move that you will be able to reinstall the system. If the system is to be moved, it must be carefully uninstalled and reinstalled by an accredited installer.

DO BATTERIES MAKE NOISE?

Batteries themselves do not make much noise, but the systems attached to them – like the inverter – may make some noise. You may hear the cooling fans and an electronic 'buzz' from the circuits, but it should be fairly similar to a regular solar inverter.

HOW LONG DO BATTERIES LAST?

Product warranties on battery storage systems vary widely and are generally anywhere from 2 to 10 years. While a battery storage system will often last longer than its warranty, its ability to store energy will gradually reduce over time with use.

As well as the product warranty, the retailer you purchase the product through should offer a retailer warranty. Warranties offered by retailers vary, including how they define the life of the battery. Some retailers offer a warranty as an 'energy throughput' figure, which means that they guarantee their batteries will store and deliver a given amount of energy, no matter how quickly that limit is reached. Energy throughput for lithium-ion batteries ranges from 4000 to 6000 cycles (charges/ discharges of the battery) at 80 per cent discharge rate, meaning an expected life of more than 10 years for high-performing systems (if cycled once per day). Some battery retailers offer a warranty guaranteeing either an energy throughput or a lifetime in years, usually based on whichever limit is reached first.

WILL THE BATTERY CHANGE THE PERFORMANCE OF MY APPLIANCES?

Once your battery storage system is installed, your household electrical appliances will continue to operate as normal. If you are looking to go completely off the grid, you will need to consider how much power your appliances use and should speak to a Eneriv Trained stand-alone system Accredited Designer to design a system to meet your needs.

WILL MY BATTERY WORK IN A GRID OUTAGE?

Not all battery storage systems provide backup power. Some will work during a blackout, and some may operate following a brief power outage. If you need your battery storage system to operate during a blackout, make sure you discuss this with your system designer and choose an appropriate product. If you want an uninterrupted supply of electricity, you'll need to install an uninterruptible power supply (UPS) battery storage system. As UPS battery storage systems are typically larger and more complex to install, they will cost more than other systems.

If your battery is charged during a blackout, it may be able to supply power to your home. However, you might not be able to run as many appliances as normal, depending on the rating of your battery storage system. You may also want to conserve power for important appliances like your fridge.

Some battery storage systems can power your whole house in a blackout, or some may have a power point that you can plug appliances into. Alternatively, your installer may need to wire specific appliances so you can use them in a blackout. It's important to discuss your needs with your designer to make sure your system meets all of your needs.

Some systems may have a slight disruption in power (usually a couple of seconds) between the blackout occurring and the battery 'kicking in' to supply power. Appliances with clocks or on a timer (e.g. washing machines or dishwashers) may need resetting after a blackout.

If you are looking to go completely off the grid, make sure you speak to a Eneriv Trained Professional stand-alone system Accredited Designer. Stand-alone or off-grid systems are typically more complex than standard household systems and present some different considerations.

DO YOUR RESEARCH

Battery storage can be a great way to get the most out of your new or existing rooftop solar power system. Different battery storage systems suit different needs, so it's important to do your research and seek advice on what's best for you.

3

Your system designer will help you choose a system appropriate for your requirements. This will depend on your energy use and tariff, the size of your solar panel system and what you want from the system.

Some questions to think about and discuss with your designer when choosing a system include:

- What is the total installed cost of the battery storage system versus the expected output over its lifetime?
- What can you afford?
- What system best suits your tariff structure?
- Do you have an appropriate space to install the battery?
- Can the battery store and supply enough energy for your needs?
- Is the supplier a reputable company that can deliver on any potential warranty claims?
- Do you have any safety concerns?
- Can the battery be recycled?

In addition, questions to think about when choosing the right size battery include:

- What do you want to use the battery for (e.g. backup for grid outage, saving money)?
- How much energy do you use between battery charges (both now and in the future)?
- How much power do you need to run your appliances?
- How much excess energy do you generate from your solar panels each day?

As long as you stay connected to the electricity grid, you can continue to use your appliances to suit your lifestyle. Your energy needs will be met through the combination of grid electricity and your solar and battery storage system.

WHAT FEATURES SHOULD I LOOK FOR IN A BATTERY STORAGE SYSTEM?

The key features to look at when comparing battery storage systems are:

- How do I know what the system is doing (i.e. what is the user interface?)?
- How is it intended to be used (e.g. some systems are only intended for providing backup power while others can only charge from your solar panels and not from the electricity grid)?
- How much energy can it store?
- How fast can it store and supply energy?
- What are the maintenance and safety considerations of the system and technology?
- How big is it and where does it need to be installed?

Your designer will help you understand the differences between systems and choose a system that is appropriate for your requirement

Additional features you might want to discuss with your designer include:

What is the battery storage system's operating temperature range (some systems cannot charge in cold weather or may not operate on very hot days)?

- Can the battery storage system be recycled?
- How long will the battery storage system last, and what is the product warranty period?
- Would it be simple to add more batteries to the system down the track if your needs change?
- Is it an 'all-in-one' device or are there multiple components that must also be installed, including any programming to ensure compatibility?
- Does the battery storage system only work with a specific inverter or is it compatible with multiple brands?
- What is the efficiency of the system (how much of the stored energy can be used)?

HOW MUCH POWER DO YOU NEED FROM YOUR SYSTEM?

When thinking about what you need from your battery storage system, there are two key concepts to understand:

- power – how fast energy can be supplied (kilowatts, or kW)
- energy – how much energy is stored by the system (kilowatt hours, or kWh).

Check your electricity bill for information about your existing energy use. A 'typical' house may use around 18 kWh of energy per day with a maximum power consumption of 4.5–15 kW, although this can vary significantly.

As long as you stay connected to the grid, your battery storage system does not need to provide for all of your needs.

Most battery storage systems currently on the market have a power rating of 2–5 kW, and an energy rating of 2–10 kWh. Multiple systems can be used to scale this up if necessary.

Your peak power demand will depend on how many and which of your appliances are used at the same time. Typical maximum power requirements of some high power appliances are:

Air-conditioner	2 – 5+ kW
Water heater	3 kW
Clothes dryer	2.4 kW
Electric kettle	2.4 kW
Hair dryer	1 – 2 kW
Dishwasher	1.5 kW
Washing machine	1.5 kW
Microwave oven	1.5 kW
Plasma TV	0.8 kW
LED/LCD TV	0.2 kW

As a general rule of thumb, any appliance that cools or heats will need more power than other appliances.

EXAMPLE:

For a battery storage system to run a 2.4 kW clothes dryer for two hours, a battery storage system with a minimum power rating of 2.4 kW and energy rating of 4.8 kWh is required.

DO YOU WANT TO GO COMPLETELY 'OFF-GRID'?

If you would like to disconnect from the grid completely and supply your entire household with your own clean power, there are a number of very important factors to consider.

Your solar system will need to be large enough to meet your power needs and your battery will need to be able to cover your requirements at all times, including peak periods. In most cases, this means that you will need very large solar and battery storage systems.

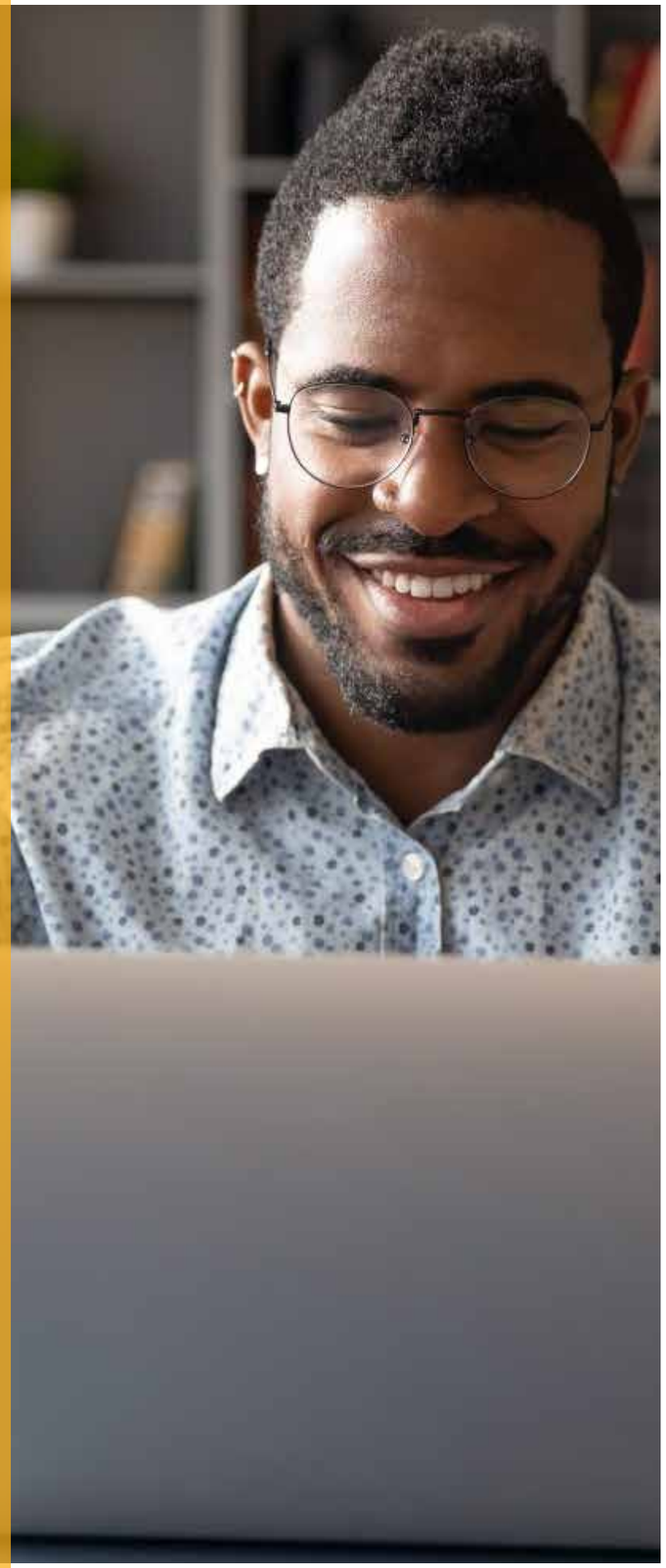
Large systems can present extra challenges, including their physical size, town planning regulations and grid connection requirements. Off-grid systems are more complex to design and install, so speak to a Eneriv Trained Professional Designer/Installer with experience working with these systems.

You should also plan for a back-up if something goes wrong.

Please contact Eneriv Advisory Team **+234 802 356 7890**

FIND A RETAILER

It's important to shop around before buying your battery storage system. Talk to different retailers of battery storage systems about options and obtain quotes, and if possible speak to people in your area who have had solar and storage installed. Unfortunately, if the offer sounds too good to be true, it probably is.



4

WHY CHOOSE ENERIV

eneriv
...Stable electricity

The main parties involved in the sale and installation of battery storage systems are the retailer, designer and installer. Sometimes these roles are filled by one individual, which may be the case with small retailer businesses run by a qualified designer/installer. However, two or thre e entities can be involved with medium to large companies that subcontract out their designs and/or installations.

CHOOSE ENERIV

Eneriv is the leading provider of high-quality solar systems for energy-smart homes and households in Nigeria. Our focus is on design integration, superior implementation and performance, extreme reliability and 24/7 support services with memorable esthetics. Eneriv is fast becoming the solar energy partner of choice of more homeowners, households and businesses around the world.

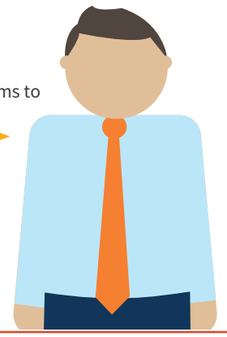
OUR COMMITMENT

We are dedicated to our commitment of affordable clean free energy. We provide your best solution based on your current electricity bills and energy budget.

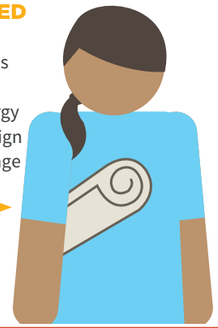
OUR TEAM

We stand apart from the crowd of moderately experienced solar installers and their subcontractors. Our consultants, designers and in-house engineers are passionate smart energy advocates in constant pursuit of innovation and best practices. Our installation teams are the best trained, the most accurate and the most thorough in the industry.

RETAILER
an entity that sells battery storage systems to customers



ACCREDITED DESIGNER
a person who is accredited by the Clean Energy Council to design a battery storage system



ACCREDITED INSTALLER
a person who is accredited by the Clean Energy Council to install battery storage systems

INSTALL YOUR SYSTEM

5

The first thing to do when having a battery storage system installed is to ask to see the installer's Eneriv installer Qualifications?

The installation process for a battery storage system is usually very straightforward and only takes around 1–2 days (unless you are having a large system installed, in which case it could take a few days longer).

If you are installing solar panels or upgrading your existing system, you could reduce overall equipment and labour costs by installing batteries and solar at the same time. However, if you're not sure whether you need a battery storage system now or in the near future, you can still add it down the track. Let your solar installer know that you may want to add storage in the future so that this can be planned for during installation.

Make sure that you receive all the necessary paperwork during installation. Documentation will be important if you ever need to make a warranty or insurance claim. You should also receive a system user manual when your system is installed, and make sure you ask any questions before your installer leaves.

The installation process shouldn't pose any risks to your other appliances, provided everything is done safely.

Your Eneriv installer will provide you with all required documentation and execution report. These are required for future upgrade and maintenance.

MAINTAINING AND ENJOYING YOUR SYSTEM

6

Your battery storage system installer will set up your system and should show you how it all works after installation, including different operating modes.

Your system may have settings that you can adjust. For example, you may wish to set your battery to only charge at certain times of the day and discharge at other times to coincide with how you use energy or to get the most out of your electricity tariffs. Not all battery storage systems have the same functions, so it's important to choose one upfront that suits your needs.

Some minor upkeep and maintenance is important to keep your battery running efficiently and safely. Different battery storage systems have different requirements, but most battery maintenance is not difficult or onerous. The maintenance should be performed by a Eneriv Installer. In addition, it is a good idea to carry out visual checks at least once a month to keep your system in top condition. If you notice something is not right, call your accredited installer or battery storage system retailer.

You will need to understand how to interpret critical system health information and recognise when your storage system needs attention. Your installer should also give you a logbook or table to record the system's critical measurements.

TIPS:

To get the most out of your solar and battery storage system, you may choose to reduce the amount of electricity you use in the evenings or overnight so you only use solar or solar-charged battery power. For example, you could run your washing machine or dishwasher during the day when your solar panels are generating power.

When doing maintenance on the system, the accredited installer can provide you with feedback on the system's performance and help you to understand your usage and the system's limitations. If there is an internal failure in an individual battery cell, that cell can begin to perform poorly long before the system as a whole has a problem. Again, this is something that the installer can identify during maintenance of the system.

The lifetime of a battery is strongly dependent on how the system is used. Poor or heavy usage may mean the product does not last as long as the manufacturer's specifications. The lifetime also depends on ambient temperatures. All battery types should be checked during extreme hot or cold weather to see whether they are still performing as required. Batteries can be discharged over a large temperature range (-20°C to 60°C), but the charge temperature should be limited for best results.

Your electricity consumption may also change over time, which can alter the long-term performance and life of the battery storage system. Check with your accredited installer when the maintenance is undertaken in case your consumption has changed significantly (e.g. if more people are living at your property or you have purchased new appliances). If you are unsure of anything about your battery storage system, please contact your accredited installer, who will be able to assist you.


FORTRESS

ENJOY ALL DAY ELECTRICITY

eneriv
...Stable electricity

WITH

3.5kVa Eneriv Solar System @

₦850,000

Package include:

- **Deye-Eneriv 4.5kVa Hybrid Solar Inverter**
- **390w by 290w Bifacial Solar Panel (x6)**
- ***5.12kWh Lithium-ion Battery****

*Terms & Conditions

WITH

5.5kVa Eneriv Solar System @

₦1,045,000

Package include:

- **Deye-Eneriv 6.5kVa Hybrid Solar Inverter**
- **390w by 290w Bifacial Solar Panel (x8)**
- ***5.12kWh Lithium-ion Battery****

*Terms & Conditions

- Works with Lithium-ion and Lead acid batteries.
- Free Wi-Fi enabled for online monitoring and fault detection
- Integrated with Automatic Change over
- Generator connection/Syncronization
- Smart Load and Energy Management
- Generates 30% more electricity
- LCD Touch Screen
- Web browser and mobile App monitoring supported
- IP65 protection degree, adapt to indoor and outdoor using
- Programmable charging and discharging times and schedule
- Parallable up Max. 16 units for higher system power
- Best fitted for Bifacial Solar panels
- Retrofitting of existing solar system to energy storage system

+234 805 743 5360, +234 803 660 1066, +234 813 027 0044

ce@eneriv.com | www.eneriv.com