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OFF-GRID PRODUCTIVE USE OF ENERGY 2020 CATALOG

Ghana

Browse

ACRONYMS AND ABBREVIATIONS

AC	alternating current
Ah	ampere hours
ALPS	aquaculture, livestock, and poultry solutions
AMMA	Modern and Handcrafted Carpentry Workshop *(Atelier de Menuiserie Moderne et Artisanal)*
ASG	African Solar Generation
C	Celsius
CAC	Crop Aggregation Center
CDA	controlled droplet application
CDARMA	Center for the Development of Rural Crafts and Agricultural Machinery *(Centre de Développement de l'Artisanat Rural et du Machinisme Agricole)*
CPF	Mbouo-Bandjoun Polyvalent Training Center *(Centre Polyvalent de Formation de Mbouo-Bandjoun)*
DC	direct current
DENG Ltd.	Danish Engineering Limited
DIN	Deutsches Institut für Normung
EBZ	Electro Education and Technology Center Dresden *(Elektro Bildungs- und Technologiezentrum Dresden)*
EDA	Energy of Africa *(Energie d'Afrique)*
EN	European Standard
ESP	Higher Polytechnic School of Dakar *(Ecole Supérieur Polytechnique de Dakar)*
F	Fahrenheit
FBO	farmer-based organizations
FES	Free Engineering Services
GAM	Group of Metal Artisans *(Groupement des Artisans du Métal)*
GIE	Global International Energy
GIMAFOR	Engineering, Management, Training, and Research Group *(Groupe d'Ingénierie, de Management, de Formation et de Recherche)*

ACRONYMS AND ABBREVIATIONS

GMACI	Business Marketing and International Brokerage Group *(Groupe Marketing des Affaires et Courtage International)*
GSM	global system for mobile communications
h	hours
HP	horsepower
IEC	International Electrotechnical Commission
IP	international protection
ISO	International Organization for Standardization
KCIC	Kenya Climate Innovation Center
kg	kilograms
kW	kilowatts
kWh	kilowatt hours
kWp	kilowatt peak *(kilowatt crête)*
L	liters
LCB	linear current booster
LV	low volume
m	meter
ml	milliliter
m^2	square meters
m^3	cubic meters
MFI	microfinance institution
min	minute
mm	millimeter
MPPT	maximum power-point tracking
MSBHD	mobile solar biomass hybrid dryer
PAYGO	pay-as-you-go
PV	photovoltaic
PUE	productive use of energy
RESEDA	Network for the Development of Crafts *(Réseau pour le Développement de l'Artisanat)*
SACCO	savings and credit cooperative

ACRONYMS AND ABBREVIATIONS

SARL	incorporated business *(Société A Responsabilité Limitée)*
SAS	Simplified Joint-Stock Company *(Société par Actions Simplifiée)*
SATECH	African Society of Technology *(Société Africaine de Téchnologies)*
SEV	Sun Water Life *(Soleil Eau Vie)*
SI2E ENR	Ivorian Society of Energy Efficiency and Renewable Energies *(Société Ivoirienne d'Efficacité Energétique et des Energies Renouvelables)*
SNV	Netherlands Development Organization
T / Tel	telephone number
ULV	ultra-low volume
V	volts
V DC	volts direct current
V AC	volts alternating current
W	watts
Wp	watt peak
ZECI	Zola EDF Côte d'Ivoire

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DISCLAIMER

BACKGROUND

Power Africa is a U.S. Government-led partnership that brings together the collective resources of over 170 public and private sector partners to double access to electricity in sub-Saharan Africa. Power Africa's goal is to add more than 30,000 megawatts of new electricity generation capacity and connect 60 million new homes and businesses to power by 2030. Read more: www.usaid.gov/powerafrica.

Reliable supply of energy is one of many important requirements for significant growth and increased productivity in African agriculture. For farmers in most African countries, access to fuel or electricity for farm operations, crop processing, and food storage is limited and costly. Rapid growth in agricultural production can stimulate rural and overall economic development.

Power Africa Off-grid Project provides technical assistance to private sector companies, agriculture cooperatives, agribusinesses, and government stakeholders to increase the uptake of off-grid energy solutions, such as solar home systems (SHS), mini-grids, and productive use of energy (PUE) technologies. Under its cross-cutting work stream, the Project plays a vital role in the adoption of PUE technologies by supporting off-grid companies to:

- Expand their product portfolios to include PUE
- Access finance to facilitate company growth, enter new markets, and pilot PUE business models across agricultural value chains
- Leverage innovation as the sector matures

INTRODUCTION

What is Productive Use of Energy (PUE)?

For the purposes of this catalog, PUE refers to any electrical and thermal equipment and technology that serves as a direct input for the production of goods or provision of services for income-generating activities.

Objectives

The main objective of this catalog is to increase awareness and uptake of the off-grid PUE appliances that are available in Ghana. The catalog provides stakeholders (including manufacturers, suppliers, nongovernment and community organizations, and government policymakers) with insight into PUE products and innovations.

This catalog is part of a collection aiming to:

- Increase the knowledge base of off-grid PUE equipment
- Address the PUE needs of the East and West Africa regions
- Identify sectors for which greater adoption of PUE products can stimulate economic development

Selected Countries

The collection of catalogs covers ten countries:

- **East Africa:** Ethiopia, Kenya, Rwanda, Tanzania, and Uganda
- **West Africa:** Cameroon, Côte d'Ivoire, Ghana, Niger, and Senegal

INTRODUCTION

Contents

The catalog includes technical and financial information for a range of PUE technologies with a focus on the economic activities of agriculture, fishing, livestock, and poultry.

The catalog presents the following information:

- The existing terms of sale for PUE products
- Pay-as-you-go (PAYGO) integration capabilities
- Manufacturer, distributor, and supplier channels

Target Audience

A wide range of participants in the off-grid energy sector can leverage insights from the catalog to inform their decisions, including government policymakers, private-sector practitioners, stakeholders from nongovernment and community organizations, investors, financial institutions, and end users.

CRITERIA FOR SELECTION OF PUE PRODUCTS

The catalog's scope is limited to off-grid PUE products for agriculture, fishing, livestock, and poultry and does not include other uses of energy, such as phone charging. Featured technologies include photovoltaic (PV) solar and those that combine electrical and thermal power, such as food dryers.

Applications and value chains include the following:

Category	Examples
Agriculture production	Water pumping solutions, solar spraying
Agriculture conservation	Fridges and freezers
Agriculture processing	Grain mills, threshing and husking machines, and food dryers
Livestock and poultry	Egg incubators, milk chillers, and fodder preparation (i.e. chaff cutters)
Fishing and aquaculture	Cold storage units (i.e. ice machines), fishing lights

HOW TO READ THE CATALOG

The catalog has two sections:

Section 1: Company Information

Provides an overview of local companies supplying PUE products in the targeted countries and outlines general information about the companies, such as contact information and current product offerings.

Classifies companies into four categories:

1. **Manufacturer** – a company that builds, design, and packages products for a market
2. **Distributor** – a company that buys products or product lines from a manufacturer and sells them directly to end users or supplies them to other retailing companies
3. **Brand Representative** – an international company's in-country subsidiary or partner company that fulfills sales and other services for end users
4. **Reseller/Retailer** – a company (or entity) that receives products from a distributor and sells them directly to end users

Classifies distribution channels into ten categories:

1. Direct retail
2. Online retail
3. On order
4. Large distributors
5. Retail through farmer cooperatives/producer groups and savings and credit cooperatives (SACCOs)
6. Retail through kiosks and similar outlets
7. Retail through microfinance institutions (MFIs)
8. Retail through outgrower schemes
9. Retail through sales agents
10. Retail through women's groups

Classifies payment models into six categories:

1. PAYGO
2. Flexible installments (hire purchase agreement, leasing, etc.)
3. Cooperation with local banks or MFIs
4. Cash payment or cash and carry
5. Product only sold as part of a package
6. Fee for service

HOW TO READ THE CATALOG

Section 2: Product Information

Provides detailed technical information on PUE products and further categorizes products into six sections by type of solutions:

1. **Agro-Processing** – mills, hullers, threshers, crushers, paste makers, and oil presses
2. **Cooling** – cold rooms, freezers, ice-making machines, milk tanks, and refrigerators
3. **Food Dryers** – thermal and ventilation-based solutions
4. **Aquaculture, Livestock, and Poultry** – fishing lights and egg incubators
5. **Pumping** – surface pumps and submersible pumps
6. **Sprayers** – animal medical treatments, disinfectants, fungicides, herbicides, insecticides, and pesticides

HOW TO READ THE DATASHEETS

The following reference table explains the product information and technical specifications for the product categories of pumps, fridges, mills, dryers, and ALPS (aquaculture, livestock, and poultry solutions) and country-specific data:

Datasheet Heading	Explanation	Unit of Measure	Product Category
Product Information			
Product Name	Product brand name and model	--	All
Manufacturer	The company that manufactures the product	--	All
Picture	Image of the product	--	All
Product Description	Characteristics of the product	--	All
Target Use	How the product is used and its target group	--	All
Technical Specifications			
Models	Specific model type, series, and number if applicable	--	Pumps, Mills
Product Type	Submersible or surface pump	--	All
Load	The power required to operate the solution	W	Pumps
Pump Type	Operational category of the pump, based on its mechanics: centrifugal, helical, and piston	--	Pumps

HOW TO READ THE DATASHEETS

Datasheet Heading	Explanation	Unit of Measure	Product Category
Automation	Process by which an equipment operates an action or a process operated automatically by an electronically controlled system and often without human assistance	--	ALPS
Electrical Output	Electrical energy produced by the product	kW	Dryers
Thermal Output	Thermal energy produced by the product	kW	Dryers
Mechanical Output	Mechanical energy produced by the product	kW	Dryers
AC/DC Coupled	Type of electric current	AC or DC or both	All
Electrical Efficiency	Measurement of the ratio between the energy input and the electrical-energy output	%	Dryers
Thermal Efficiency	Measurement of the ratio between the energy input and the thermal-energy output	%	Dryers
Voltage Range	Operating voltage range of the product	V DC or V AC	Pumps, Fridges, Mills, ALPS
Throughput	Processing-capacity output of the product	kg/h	Mills

HOW TO READ THE DATASHEETS

Datasheet Heading	Explanation	Unit of Measure	Product Category
Egg Capacity	Number of eggs the incubator can hold in one batch	eggs	ALPS
Power Rating	Highest approved power input of the product motor	W	Pumps, Fridges, Mills, ALPS
Required Solar Panel Size	Required PV-panel capacity required to power the product	W or Wp	Pumps
Storage Capacity	Volume of available storage	L	Fridges
Operating Temperature	Operating temperature of the product	°C (°F)	Fridges
Capacity of PV Modules Required	Required PV panel capacity that is required to power the product	Wp or W	Fridges, Mills, ALPS

HOW TO READ THE DATASHEETS

Datasheet Heading	Explanation	Unit of Measure	Product Category
Holdover Time	The time taken by the product to raise the inside cabinet's temperature from its cut-off temperature to the maximum temperature limit of its recommended range. For example, for a fridge with an operating temperature of 4 °C (39.2 °F) and a maximum operating temperature of 8 °C (46.4 °F), the holdover time is the time taken to reach 8 °C (46.4 °F) from 4 °C (39.2 °F) in case of a power loss	h or min	Fridges
Power (Energy Consumption)	Daily energy consumption of the product	W or Wh/day	Fridges
Product Dimensions	External measurements of the product (recorded as length × width × height, unless otherwise noted)	length x width x height	Fridges, ALPS
Total Dynamic Head	Maximum height at which a pump can raise water, inclusive of friction losses	m	Pumps
Max Discharge Rate	Maximum rated volume of water pumped per hour	m^3/h	Pumps
Controller Requirements	Requirement for an external pump controller	--	Pumps

HOW TO READ THE DATASHEETS

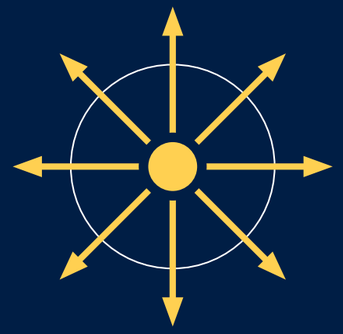
Datasheet Heading	Explanation	Unit of Measure	Product Category
Lamp Display/Output	Amount of light produced	lumens	ALPS
Lighting Duration	Length of time that the product produces light	hours	ALPS
Battery Size	Type, size, and specifications of the battery	Ah	ALPS
PAYGO Integration Capabilities	Compatibility with PAYGO	--	All
Product Link	Product website or datasheet link	--	All
Distribution Channels	Channels listed under the following categories: • Direct retail • Online retail • On order • Large distributors • Retail through farmer cooperatives/producer groups and savings and credit cooperatives (SACCOs) • Retail through kiosks and similar outlets • Retail through microfinance institutions (MFIs) • Retail through outgrower schemes • Retail through sales agents • Retail through women's groups	--	All

HOW TO READ THE DATASHEETS

Datasheet Heading	Explanation	Unit of Measure	Product Category
Payment Models / Terms of Sales	Models and terms listed under the following categories: • PAYGO • Flexible installments (hire purchase agreement, leasing, etc.) • Cooperation with local banks or MFIs • Cash payment or cash and carry • Product only sold as part of a package • Fee for service	--	All

SECTION 1

COMPANY INFORMATION



COMPANY LIST

Companies	Distributed Technologies	Category	Distribution Channels	Payment Models
AKO Engineering Ltd. +233 024 436 7071 www.akoengltd.com	**Pumps** • Grundfos CR Flex Pump Series • Grundfos SQ Flex Pump Series	Distributor	Direct retail	Cash & carry
Deep Solar Energy Ghana +233 055 812 6052	**Pumps** • Tornado Solar Water Pump	Distributor	Direct retail	Cash & carry
DENG Ltd., Accra (Danish Engineering Ltd., Accra) +233 024 431-3261 info@dengltd.com	**Pumps** • Lorentz Pump PS-CS-F • Lorentz Pump PS2 Series • Lorentz Pump PS2K Series	Distributor	Direct retail	Cash & carry

COMPANY LIST

Companies	Distributed Technologies	Category	Distribution Channels	Payment Models
G2Josh Evergreen Company +233 02 44 97 22 55 akowuahjoe@yahoo.co.uk	**Dryers** • Solar Tunnel Dryer • Mobile Solar Biomass Hybrid Dryer (MSBHD) • Solar Biomass Hybrid Dryer	Manufacturer	Direct retail	Cash & carry
Hatoum Trading Ltd. +233 05 44 44 42 90	**Pumps** • Future Pump SF2 • Shakti Pumps	Distributor	Direct retail	Cash & carry
PEG Ghana +233 30 255 0268 Off Aburi Road, after Dodowa Junction, Accra	**Pumps** • Dayliff Sunflo A Pump Series **Fridges** • Nilo 100 L DC Solar Fridge	Distributor	Direct retail	Cash & carry Flexible installments

COMPANY LIST

Companies	Distributed Technologies	Category	Distribution Channels	Payment Models
PumpTech Ltd. +233 050 545 8400 info@epicenterafrica.com http://epicenterafrica.com/	**Pumps** • Lorentz Pump PS-CS-F • Lorentz Pump PS2 Series • Lorentz Pump PS2K Series	Distributor	Direct retail	Cash & carry

SECTION 2

PRODUCT INFORMATION

QUALITY STANDARDS

Product	Quality Standards	VeraSol-tested / Certified
Pumping Solutions		
Futurepump SF2	International Organization for Standardization (ISO) 9001:2015-certified factory	VeraSol-tested
Grundfos CR Flex Series	International Electrotechnical Commission (IEC) and Deutsches Institut für Normung (DIN)	--
Grundfos SQ Flex Series, centrifugal	IEC, DIN, ISO	--
Grundfos SQ Flex Series, helical	IEC, DIN, ISO	VeraSol-tested (SQFlex 2.5-2)
Lorentz PS2 Series	IEC, EN, ISO	VeraSol-tested (PS2-600 HR-04H, PS2-600 C-SJ8-5)
Lorentz PS-CS-F	IEC, EN, ISO	--
Lorentz PSK2 Submersible Pumps	IEC, EN, ISO	--
Lorentz PSK2 Surface Pumps	IEC, EN, ISO	--
Shakti Pumps	ISO	VeraSol-tested (SOLAR 3 DCSSP 500, SOLAR 8 DCSSUP 500, SOLAR 6 DCSSP 500)

QUALITY STANDARDS

Product	Quality Standards	VeraSol-tested / Certified
Cooling Solutions		
Nilo Refrigerators	IEC	VeraSol-tested

AGRO-PROCESSING SOLUTIONS

Agro-Processing Solutions – List of Featured Products

Currently no listings for Ghana

QUALITY STANDARDS

READ MORE ABOUT AGRO-PROCESSING SOLUTIONS

AGRO-PROCESSING SOLUTIONS

Agro-Processing Solutions – Introduction

Solar-powered mills for agro-processing are available in different types, including rice mills, cassava graters, paste makers, crushers, flour mills, and more. This section details appropriate off-grid milling technologies that are financially viable PUE solutions for project developers as well as communities, smallholder farmers, agro-processing enterprises, and other end users. This section also includes technical information to help practitioners operationalize milling technologies and notes the complexities of doing so.

In sub-Saharan Africa, most agriculture-based economies produce grains as their top staple-food crops—especially corn/maize. Current non-solar off-grid milling solutions, such as diesel-powered mills, are not viable in small communities, because they are too large and expensive to run. For this reason, off-grid solar milling solutions have the potential to increase farming efficiency, increase farmers' revenues, and promote food security. PAYGO models of digital finance use embedded internet-connected hardware to give smallholder farmers and communities the ability to pay with greater ease and flexibility. Solar mills also give farmers the opportunity to generate income immediately after installation, have lower upkeep costs, and provide sound returns on investments.

COOLING SOLUTIONS

Cooling Solutions – List of Featured Products

Ⓥ 1. Nilo 100 L DC Solar Fridge

Ⓥ = VeraSol-tested/-certified

QUALITY STANDARDS

READ MORE ABOUT COOLING SOLUTIONS

COOLING SOLUTIONS

Cooling Solutions – Introduction

The cooling solutions vary from solar fridges and freezers to solar cold rooms, solar ice-cube makers, and solar milk tanks.

Solar Fridges and Freezers

Solar fridges and freezers provide various solutions and applications, including the preservation of juices, meat, fish, and milk, as well as cooling and ice production. The medical sector can use them for drug and vaccine storage. In this catalog, all solar fridges and freezers are solar products, powered by solar panels, with a voltage system of 12 and 24 V DC. Most solar fridges use batteries to ensure continuous energy service; however, some have very effective insulation capabilities, which allow them to function without battery power. If powered by PV panels, the equipment may not draw enough solar energy to maintain low refrigeration temperatures in severe cloud cover or at night; therefore, the equipment must preserve low temperatures with high-efficiency insulation, draw reserve power, or couple with another source of power (e.g., a battery).

The capacity of the fridges and freezers is expressed in volume capacity (liters), which manufacturers usually indicate. Freezers operate only at negative temperatures in Celsius (up to -18 °C [-0.4 °F]), while some fridges or refrigerators can operate dually.

In most cases, solar fridges and freezers are imported from Europe and the United States of America.

Solar Cold Rooms

Solar cold rooms have a variety of applications. Their cooling temperatures can be adjusted and monitored.

COOLING SOLUTIONS

The structure of their cooling chambers enables the preservation of fruits and vegetables (usually at positive temperatures) and the preservation of meat and fish (usually at negative temperatures) over long periods. In general, most cold rooms are large industrial units, but smaller sizes are also manufactured locally. In this catalog, all cold rooms are powered by solar panels with varying voltage systems (AC and DC).

Solar Ice-cube Makers

The solar ice-cube makers are machines that produce ice in large quantities. These machines are useful for people who need ice in large quantities daily, such as fishers or fish sellers who need to preserve and transport fish. Ice-cube makers are powered by solar panels but run with AC voltage.

Solar Milk Tanks

Solar milk tanks, which are generally in the shape of a tank or a cistern, allow the refrigeration of raw milk from animal milking to slow down the degradation of milk quality. Such tanks usually operate at a positive temperature of approximately 4 °C (39.2 °F). The capacity of these tanks (measured in liters) varies by model.

TERMS OF SALE

Cash & carry

Flexible installments

PRODUCT SPECS

PRODUCT LINK

NILO 100 L DC SOLAR FRIDGE

This fridge has an autonomy of 14 hours at full charge.

Target use: Preservation of juices, meat, fish, milk, and production of ice; cooling and storage of drugs and vaccines.

Manufacturer:
Youmma Solar
Rui Barbosa 1020
PO Box 91 ZIP Code 89219-901
Joinville-SC, Brazil
contact@yoummasolar.com

Distributor(s):
PEG Ghana

Distribution channels:
Direct retail

SPECS | Nilo 100 L, DC Solar Fridge

Product information	
Models	Nilo 100 L
Product type	Refrigerator/freezer
AC/DC	DC
Voltage range	9–16 V DC
Storage capacity	96 L
Operating temperature	6 °C (42.8 °F)
Power (energy consumption)	17.8 W
PAYGO integration capabilities	No

FOOD DRYERS

Food Dryers – List of Featured Products

1. Mobile Solar Biomass Hybrid Dryer (MSBHD)
2. Solar Biomass Hybrid Dryer (SBHD)
3. Solar Tunnel Dryer

QUALITY STANDARDS

READ MORE ABOUT FOOD DRYERS

FOOD DRYERS

Food Dryers – Introduction

Off-grid food dryers are generally used for the preservation and transformation of food (e.g., fruits and vegetables, meat, fish, and medicinal herbs) and can be operated on site immediately after a harvest. For the majority of the ten targeted countries in this catalog, off-grid communities face a particular challenge: Large quantities of agricultural products can spoil due to inadequate infrastructure and insufficient processing capacities, even during the traditional process of open-air drying. For such communities, solar food dryers have the potential to prevent food losses, generate income, and promote food security.

Food dryers are mostly produced locally and come in different sizes and shapes, often tailored to customer needs. Some are solely thermal, while others have ventilation systems powered by small PV panels.

In this catalog, solar food dryers fall into several categories:

Category	Examples
Direct drying	Solar box dryers
Indirect drying	Solar cabinet dryers
Mixed-mode drying	Solar tunnel dryers
Hybrid drying	Hybrid solar/biomass cabinet dryers
Natural air convection	Small-scale solar box dryers
Forced convection *(with air circulation fans)*	Solar tunnel dryers

Special Considerations

Some models are simple and inexpensive. More sophisticated types have temperature and humidity monitoring. For protection and hygiene, air filters and insect screens are useful. Manufacturers usually specify product-drying times in days or hours, which vary from food to food.

TERMS OF SALE

Cash & carry

PRODUCT SPECS

MOBILE SOLAR BIOMASS HYBRID DRYER

The mobile solar biomass hybrid dryer (MSBHD) is based on a greenhouse structure design that uses locally available technology, materials, and skills. In operation, the dryer can rely only on direct solar insolation during sunny days or the combined heat from the sun and biomass (hybrid mode) to provide hot air. The drying chamber is coupled to a biomass burner, which is constructed from mild steel pipes/plate and insulated with rockwool to prevent heat loss. The burner is enclosed with a cross flow-type heat exchanger, which raises the ambient air temperature before it is introduced into the drying chamber. It has a drying area/tray of 0.72 m². Its capacity is 500–1,000 kg per batch for grains and legumes.

Target use: Smallholder farmers, farmer-based organizations, women's cooperatives, warehouse operators, crop aggregation centers, poultry farmers, and feed manufacturers.

Manufacturer:
G2Josh Evergreen
+233 02 44 97 22 55
c/o J.O. Akowuah, Kofi Ankra Street,
Appiadu, Kumasi, Ghana
Akowuahjoe@Yahoo.co.uk

Distributor(s):
G2Josh Evergreen

Distribution channels:
Direct retail

SPECS | Mobile Solar Biomass Hybrid Dryer (MSBHD)

Product information	
Product type	Hybrid (solar/biomass) crop dryer
AC/DC coupled	DC/AC
Voltage range	220–240 V AC
Operating temperature	Solar mode only: 37 °C to 65 °C (98.6 °F to 149 °F) on clear weather; Hybrid mode: 45 °C to 85 °C (113 °F to 185 °F)
PAYGO integration capabilities	No

TERMS OF SALE
Cash & carry

PRODUCT SPECS

SOLAR BIOMASS HYBRID DRYER

The solar biomass hybrid dryer (SBHD) is a fixed structure that consists of a solar-drying unit and a biomass furnace section. The drying unit consists of a tent roof structure made from a transparent plastic material (Perspex) to collect solar radiation and retain trapped heat. The structure is mounted on a concrete base floor. The dryer is a direct solar dryer with a thin layer-batch drying system. The structure serves as both a solar radiation collector and a drying chamber. The biomass section comprises a biomass furnace for the combustion of any biomass material (e.g. maize cobs and coconut husks) and a heat exchanger with a chimney. The furnace is constructed with bricks that house the heat exchangers and a suction funnel connected into the dryer to supply hot air during cloudy and humid periods. The drying area/tray is 8.92 m² and the capacity is 3,000–5,000 kg/batch for grains and legumes.

Target use: Smallholder farmers, farmer-based organizations, women's cooperatives, warehouse operators, crop aggregation centers, poultry farmers, and feed manufacturers.

Manufacturer:
G2Josh Evergreen
+233 02 44 97 22 55
c/o J.O. Akowuah, Kofi Ankra Street,
Appiadu, Kumasi, Ghana
Akowuahjoe@Yahoo.co.uk

Distributor(s):
G2Josh Evergreen

Distribution channels:
Direct retail

SPECS | Solar Biomass Hybrid Dryer (SBHD)

Product information	
Product type	Hybrid (solar/biomass) crop dryer
AC/DC coupled	DC/AC
Voltage range	220–240 V AC
Operating temperature	Solar mode only: 37 °C to 65 °C (98.6 °F to 149 °F) on clear weather; Hybrid mode: 45 °C to 85 °C (113 °F to 185 °F)
PAYGO integration capabilities	No

TERMS OF SALE

Cash & carry

PRODUCT SPECS

SOLAR TUNNEL DRYER

This solar tunnel dryer (which is 7.5 m × 1.2 m × 1.2 m) is mainly built with angle irons and metal sheets to form the frame. The cable roof and doors are covered with a 3 mm acrylic sheet, while the base is made of wood and lined with black-coated metal sheets for maximum solar incidence radiation. Two DC fans are attached to provide the required airflow through the drying medium. A vent is attached at the opposite end to allow moist air to escape from the chamber. It is a batch-drying unit suitable to dry all types of crops. Its capacity is 100–200 kg/batch, and its drying area is 2.7 m².

Target use: Smallholder farmers, cottage-level agro-processors, and women's cooperatives.

Manufacturer:
G2Josh Evergreen
+233 02 44 97 22 55
c/o J.O. Akowuah, Kofi Ankra Street,
Appiadu, Kumasi, Ghana
Akowuahjoe@Yahoo.co.uk

Distributor(s):
G2Josh Evergreen

Distribution channels:
Direct retail

SPECS | Solar Tunnel Dryer

Product information	
Product type	Solar tunnel dryer
AC/DC coupled	DC/AC
Voltage range	220–240 V AC
Product dimensions	7.5 m × 1.2 m × 1.2 m
Operating temperature	37 °C to 65 °C (98.6 °F to 149 °F) on clear weather
PAYGO integration capabilities	No

AQUACULTURE, LIVESTOCK, AND POULTRY SOLUTIONS

Aquaculture, Livestock, and Poultry Solutions – List of Featured Products

Currently no listings for Ghana

Ⓥ = VeraSol-tested/-certified

QUALITY STANDARDS

READ MORE ABOUT AQUACULTURE, LIVESTOCK, AND POULTRY SOLUTIONS

AQUACULTURE, LIVESTOCK, AND POULTRY SOLUTIONS

This section consists of solar products for fishing lights, livestock, and poultry. Solar-powered egg incubators vary by size and capacity, depending on the needs of smallholder farmers to provide chick-hatching solutions to farmers, especially in rural areas without electricity. Incubators ensure that eggs hatch in bulk, which is an efficiency that many farmers prefer to the natural hatching process. Because incubators boost poultry production, they often result in greater income generation for communities and empower women and youth in rural communities. For example, through new poultry-raising opportunities facilitated by the NGO Tanager in Burkina Faso, local women improved their decision-making skills, gained market inclusion, and increased their societal status (Agrilinks 2019).

Special Considerations

In selecting an incubator, it is useful to consider a product's automation capabilities. For example, many incubators automate egg turning, temperature and humidity controls, and more.

PUMPING SOLUTIONS

Pumping Solutions – List of Featured Products

1. Dayliff SUNFLO-B Series
2. Ⓥ Futurepump SF2
3. Grundfos CR Flex Series
4. Grundfos SQ Flex Series Centrifugal
5. Ⓥ Grundfos SQ Flex Series Helical
6. Lorentz PS-CS-F
7. Ⓥ Lorentz PS2 Series
8. Lorentz PSK2 Submersible Pumps
9. Lorentz PSK2 Surface Pumps
10. Ⓥ Shakti Pumps
11. Tornado Solar Water Pump

Ⓥ = VeraSol-tested/-certified

QUALITY STANDARDS

READ MORE ABOUT PUMPING SOLUTIONS

PUMPING SOLUTIONS

While solar water pumps vary in size, this catalog focuses on solar pumps with a power rating between 150 watts (W) to 10 kilowatts (kW) (13 horsepower [HP]). Solar pumps are one part of the pumping system that involves three key components: the pumping mechanism itself, the pump controller, and the solar energy-generating technology (i.e., solar panels and inverters, when needed).

Pumps are classified either as surface pumps or submersible pumps depending on the depth of their submersion in a water source. **Surface pumps** are designed to pump water from surface sources, such as rivers, ponds, and shallow wells. They are placed above the surface of the water and should not be submerged. They are designed to draw water to a maximum depth of eight meters, beyond which submersible pumps are used. **Submersible pumps** are fully submerged in water and include a hermetically sealed motor which is close-coupled to the body of the pump.

Direct current (DC) pumps draw power directly from solar panels without inverting.

Alternating current (AC) pumps require an inverter to transform the DC power from the panels into AC power. Both types of solar pumps require an electronic-pump controller. One of the key features of the controller, the Linear Current Booster (LCB), boosts the current from the solar array by lowering the voltage, which translates the current and voltage available from the PV panels into a combination that better serves the pump's power requirements. The LCB enables pumping to operate even in the low-light conditions of early mornings, late evenings, and cloudy days. A pump's control box also protects it from current and voltage spikes and enables its sensors, such as the float switch, to activate and deactivate the pump. Some controllers also have remote monitoring capabilities.

PUMPING SOLUTIONS

DC pumps can operate without a controller while connected to a battery system. External power-storage systems, such as batteries, allow pumping to occur at night and in low-light conditions. Such storage systems allow pressure boosting to provide a continuous water supply at any time for optimal output. Most solar water-pumping systems, however, do not have energy storage and, therefore, can only operate within daylight hours.

Pump Sizing

The process of selecting the best pump system for a specific purpose involves several steps, the first of which is sizing. During the sizing process, a user must evaluate several parameters, such as flow rate and total dynamic head. Sizing is a technical process that requires the analysis of qualified personnel and technicians to get an accurate fit.

Various online resources are available to assist in determining the correct pump for a particular application, including pump-sizing resources on the websites of many manufacturers. Some manufacturers also sell complete plug-and-play solar systems, as featured in this catalog, which come equipped with solar panels, pump controllers, and solar pumps. In most cases, because companies sell pumps as singular units, users must complete the process of sizing.

Special Considerations

Because it is essential to seek the advice of qualified technical experts to achieve correct sizing, this catalog does not delve into the technical details of pump sizing.

PUMPING SOLUTIONS

However, in general, the sizing process involves the following steps:

	Objective	Considerations
Step 1	Determine if a surface or submersible pump is suitable for a particular application	What is the source of water, river, water pan, shallow well, borehole.
Step 2	Determine the daily water requirement	How many liters is the pump required to move during the day within prime daylight hours?
Step 3	Determine if the water source can produce enough water to supply the pump system	For example, the required water amount may be 100 liters per hour (L/h); however, the water source may only supply 50 liters per hour. For boreholes, wells, or streams, if flowrates are unknown, end users can conduct test-pumping
Step 4	Determine the total dynamic head	How high does the pump need to move the water? Measurements must account for the margin of friction loss
Step 5	Determine the correct pump make and model by referencing the pump flow chart, as provided by the manufacturer	--
Step 6	Estimate the balance of the system	This includes the wiring, piping, and necessary fittings

PUMPING SOLUTIONS

Pump Controllers

The primary function of the controller is to boost the current of solar modules in low-light conditions while holding the voltage of the solar modules at the maximum power point (i.e., the point of highest power output). This allows a pump to start earlier in the morning and stay running late into the evening.

A variety of controllers meet the specific needs of individual pumps, allowing them to maximize their output. DC pump controllers, also known as converters, maximize both the DC current and voltage. AC pump controllers invert the DC current to AC for use by the AC motors. It is also possible to use a solar-pump inverter to convert a grid-powered AC pump to use solar panels without changing the AC pump.

Related Resources

For calculation sheets, checklists and guidelines, see the Toolbox on Solar Powered Irrigation Systems by the Water and Energy for Food (WE4F) program.

TERMS OF SALE

Cash & carry

Flexible installments

PRODUCT SPECS

PRODUCT LINK

DAYLIFF SUNFLO-B SERIES

Dayliff SUNFLO-B pumps are specifically designed for PV solar-powered water supply from wells and boreholes. They are of centrifugal and rotary-screw design. The construction materials for the rotary-screw design are principally stainless steel with rubber stators. The centrifugal design features Noryl impellers and stainless steel chambers. Pumps are supplied complete with a controller, cable connectors, water level sensor, solar PV connecting cables, and spare rotor for helical type.

Manufacturer:

Davis & Shirtliff Head Office
Dundori Rd, Industrial Area
Nairobi, Kenya.
headoffice@dayliff.com
+254 20 69 68 000

Distributor(s):

PEG Ghana

Distribution channels:

Direct retail

SPECS | Dayliff Sunflo-B Series

Product models	Sunflo-B 1000 C	Sunflo-B 500CEF	Sunflo-B 1000CEF	Sunflo-B 2200 CEF
Product type	Submersible			
Pump type	Centrifugal			
Power rating	1,000 W	-	-	-
Required solar panel size	200 W	660 W (2 × 330 W)	1,350 W (5 × 270 W)	2,800 W (14 × 200 W)
AC/DC coupled	DC	DC	DC	DC
Voltage range	100 V DC	-	-	-
Total dynamic head	80 m	35 m	33 m	38 m
Max discharge rate	4.0 m^3/h	5.5 m^3/h	16.5 m^3/h	32 m^3/h
PAYGO integration capabilities	No			

FUTUREPUMP SF2

A portable reciprocating piston water pump suitable for smallholder irrigation farming.

Target use: Smallholder farmers.

TERMS OF SALE

Cash & carry

PRODUCT SPECS

PRODUCT LINK

Manufacturer:
Futurepump Ltd.

support@futurepump.com

Distributor(s):
Hatoum Trading Ltd.

Distribution channels:
Direct retail

SPECS | Futurepump SF2

Product information	
Product type	Surface mounted pump
Pump type	Piston
Power rating	80–120 W
Required solar panel size	120 W
AC/DC coupled	DC
Voltage range	60 V DC
Total dynamic head	15 m
Max discharge rate	3.6 m^3/h
PAYGO integration capabilities	No

TERMS OF SALE

Cash & carry

PRODUCT SPECS

PRODUCT LINK

GRUNDFOS CR FLEX SERIES

Grundfos CR Flex is a multi-stage centrifugal in-line non-self-priming surface pump, specifically designed for water transfer, irrigation, and pressure boosting in solar-powered applications. It is fitted with the advanced MG Flex permanent magnet variable frequency-driven motor.

Target use: Small-scale irrigation, livestock, fish farming, and water supply.

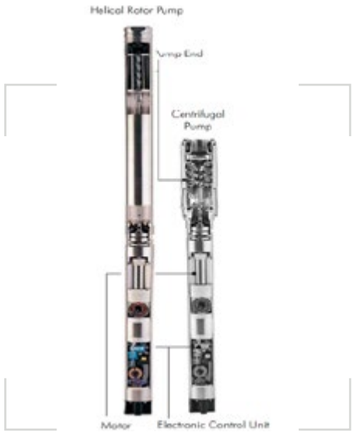
Manufacturer:
Grundfos
Poul Due Jensens Vej 7
Dk-8850 Bjerringbro,
Denmark

Distributor(s):
AKO Engineering Ltd.

Distribution channels:
Direct retail

SPECS | Grundfos CR Flex Series

Product information	
Product type	Surface pump
Pump type	Centrifugal
Load	1,730 W
AC/DC coupled	DC
Voltage range	30–300 V DC
Total dynamic head	150 m
Max discharge rate	13 m^3/h
Controller requirements	Required
PAYGO integration capabilities	No



TERMS OF SALE

Cash & carry

PRODUCT SPECS

PRODUCT LINK

GRUNDFOS SQ FLEX SERIES CENTRIFUGAL

The SQFlex system is a reliable water-supply system, based on renewable energy sources, such as solar and wind energy. Thanks to its flexible energy supply and performance, the SQFlex system can be combined and adapted to meet any need at an installation site. The SQFlex system has a wide voltage range, built-in maximum power-point tracking, as well as dry-running, voltage, and overload protection. The complete SQFlex pump range consists of 11 different pump sizes: five helical rotor pumps for medium to high heads and low to medium flows, and six centrifugal pumps for shallow heads and high flows.

Target use: Medium to high heads and low to medium flows, and 6 centrifugal pumps for shallow heads and high flows.

Manufacturer:
Grundfos
Poul Due Jensens Vej 7
Dk-8850 Bjerringbro,
Denmark

Distributor(s):
AKO Engineering Ltd.

Distribution channels:
Direct retail

SPECS | Grundfos SQ Flex Series Centrifugal

Product information	
Product type	Submersible
Pump type	Centrifugal
Power rating	1,400 W
AC/DC coupled	AC and DC
Voltage range	30–300 V DC and 90–240 V AC
Total dynamic head	200 m
Max discharge rate	1.79 m^3/h
Controller requirements	External controller
PAYGO integration capabilities	No

TERMS OF SALE

Cash & carry

PRODUCT SPECS

PRODUCT LINK

GRUNDFOS SQ FLEX SERIES HELICAL

The SQFlex system is a reliable water supply system based on renewable energy sources, such as solar and wind energy. Thanks to its flexible energy supply and performance, the SQFlex system can be combined and adapted to meet any need on the installation site. The SQFlex system has a wide voltage range, built-in maximum power-point tracking, as well as dry-running, voltage, and overload protection. The complete SQFlex pump range consists of 11 different pump sizes: five helical rotor pumps for medium to high heads and low to medium flows, and six centrifugal pumps for shallow heads and high flows.

Target use: Medium to high heads and low to medium flows.

Manufacturer:
Grundfos
Poul Due Jensens Vej 7
Dk-8850 Bjerringbro,
Denmark

Distributor(s):
AKO Engineering Ltd.

Distribution channels:
Direct retail

SPECS | Grundfos SQ Flex Series Helical

Product information	
Product type	Submersible
Pump type	Helical
Power rating	1,400 W
Required solar panel size	1,000–4,000 W
AC/DC coupled	AC and DC
Voltage range	30–300 V DC and 90–240 V AC
Total dynamic head	120 m
Max discharge rate	Max 2.8 m^3/h
Controller requirements	External controller
PAYGO integration capabilities	No

TERMS OF SALE

Cash & carry

PRODUCT SPECS

PRODUCT LINK

LORENTZ PS-CS-F

The Lorentz PS CS-F DC Surface Solar Pumps are high-specification solar-powered in-line centrifugal DC pumps, specifically designed for high-flow booster applications, including irrigation, water boosting, and industrial processes. They are also ideal diesel pump replacements.

Manufacturer:

Lorentz
Bernt Lorentz Gmbh & Co. Kg
Siebenstuecken 24
24558 Henstedt-Ulzburg, Germany
+49 (0)4193 8806-700

Distributor(s):

DENG Ltd.
Pumptech Ltd.

Distribution channels:

Direct retail

SPECS | Lorentz PS-CS-F

Product information	
Product type	Surface mounted pump
Pump type	Helical
Load	700 / 1,700 / 4,000 W
AC/DC coupled	DC
Voltage range	150 / 200 / 375 V DC
Total dynamic head	Max 90 m
Discharge volume	4 m^3/h
PAYGO integration capabilities	No

TERMS OF SALE

Cash & carry

PRODUCT SPECS

PRODUCT LINK

LORENTZ PS2-SERIES

Solar submersible pump system for 4-inch wells.

Target use: Farmers, water utility companies, manufacturing companies, NGOs, international organizations.

Manufacturer:

Lorentz
Bernt Lorentz Gmbh & Co. Kg
Siebenstuecken 24
24558 Henstedt-Ulzburg, Germany
+49 (0)4193 8806-700

Distributor(s):

DENG Ltd.
Pumptech Ltd.

Distribution channels:

Direct retail

SPECS | Lorentz PS2-Series

Product models	PS2-150 HR-07S	PS2-150 C-SJ5-8	PS2-200 HR -07	PS2-600 C-SJ8-5	PS2-4000 C-SJ8-15	PS2-4000 C-SJ8-15
Product type	Submersible pump					
Pump type	Helical					
Load	300 W	300 W	300 W	700 W	4,000 W	1,00 W
Required solar panel size	250 Wp	250 Wp	250 Wp	-	-	660 Wp
AC/DC coupled	DC	DC/AC	DC	DC	DC	DC
Voltage range	50 V DC	17–50 V DC and 220–240 V AC	34–100 V DC	238–375 V DC	102–200 V DC	102–200 V DC
Total dynamic head	60 m	20 m	40 m	15 m	80 m	70 m
Max discharge rate	1.4 m^3/h	4.6 m^3/h	1.3 m^3/h	15 m^3/h	13 m^3/h	7.6 m^3/h
Controller requirements	Controller required					
PAYGO integration capabilities	No					

TERMS OF SALE

Cash & carry

PRODUCT SPECS

PRODUCT LINK

LORENTZ PSK2-SUBMERSIBLE SERIES

Solar submersible pump system for 6-inch wells.

Target use: Farmers, water utility companies, manufacturing companies, NGOs, international organizations.

Manufacturer:

Lorentz
Bernt Lorentz Gmbh & Co. Kg
Siebenstuecken 24
24558 Henstedt-Ulzburg, Germany
+49 (0)4193 8806-700

Distributor(s):

DENG Ltd.
Pumptech Ltd.

Distribution channels:

Direct retail

SPECS | Lorentz PSK2-Submersible Series

Product models	PSK2-7 C-SJ42-3	PSK2-9-C-SJ8-44	PSK2-9-C-SJ17-11
Product type	Submersible pump		
Pump type	Centrifugal		
Load	8,000 W	10,000 W	10,000 W
AC/DC coupled	DC Coupled	DC Coupled	DC Coupled
Voltage range	575–850 V DC	575–850 V DC	575–850 V DC
Total dynamic head	30 m	180 m	90 m
Discharge volume	76 m^3/h	12 m^3/h	25 m^3/h
Controller requirements	Controller required		
PAYGO integration capabilities	No		

TERMS OF SALE

Cash & carry

PRODUCT SPECS

PRODUCT LINK

LORENTZ PSK2-SURFACE SERIES

A solar surface pump system.

Target use: Farmers, water utility companies, manufacturing companies, NGOs, international organizations.

Manufacturer:

Lorentz
Bernt Lorentz Gmbh & Co. Kg
Siebenstuecken 24
24558 Henstedt-Ulzburg, Germany
+49 (0)4193 8806-700

Distributor(s):

DENG Ltd.
Pumptech Ltd.

Distribution channels:

Direct retail

SPECS | Lorentz PSK2-Surface Series

Product models	PSK2-9 CS-F20-7	PSK2-9 CS-G100-22/2	PSK2-15-CS F32-60-2	PSK2-15-CS-G150-12.54
Product type	Surface mounted pump			
Pump type	Centrifugal			
Load	10,000 W	10,000 W	15,000 W	15,000 W
AC/DC coupled	DC	DC	DC	DC
Voltage range	575 V DC–850 V DC	575 V DC–850 V DC	575 V DC–850 V DC	575 V DC–850 V DC
Total dynamic head	80 m	120 m	80 m	135 m
Discharge volume	22 m^3/h	20 m^3/h	41 m^3/h	25 m^3/h
Controller requirements	Controller required			
PAYGO integration capabilities	No			

TERMS OF SALE

Cash & carry

PRODUCT SPECS

PRODUCT LINK

SHAKTI PUMPS SOLAR DCSSP SERIES

This is a solar submersible pump system for irrigation.

Target use: Farmers, rural water-supply agencies, and fountain operators.

Manufacturer:
Shakti Pumps Limited,
Plot No. 401, 402, & 413,
Industrial Area
Sector – 3, Pithampur,
Dist. Dhar – 454774 (M.P.) India

Distributor(s):
Hatoum Trading Ltd.

Distribution channels:
Direct retail

SPECS | Shakti Pumps Solar DCSSP Series

Product models	SOLAR 16.5 DCSSP	SOLAR 20.5 DCSSP	SOLAR 8 DCSSP	SOLAR 34.5 DCSSP	SOLAR 58 DCSSP	SOLAR 8.5 DCSSP	SOLAR 73.5 DCSSP	SOLAR 120 DCSSP
Product type	Submersible pump							
Pump type	Centrifugal							
Required solar panel size	900 Wp	1,200 Wp	1,200 Wp	1,800 Wp	3,000 Wp	3,000 Wp	4,800 Wp	6,750 Wp
AC/DC coupled	DC	DC	DC	DC	DC	DC	DC	DC
Total dynamic head	10 m	10 m	30 m	10 m	10 m	70 m	10 m	10 m
Max discharge rate	16.5 m^3/h	20.5 m^3/h	8 m^3/h	34.5 m^3/h	58 m^3/h	8.5 m^3/h	73.5 m^3/h	120 m^3/h
Controller requirements	Controller required							
PAYGO integration capabilities	No							

TERMS OF SALE

Cash & carry

PRODUCT SPECS

TORNADO SOLAR WATER PUMP

Solar submersible pump system for 6-inch wells.

Target use: Farmers and small irrigation services.

Manufacturer:
Tornado
Yuyao City
Win Electric Appliances Co., Ltd.
Zhejiang, China

Distributor(s):
Deep Solar Energy Ghana

Distribution channels:
Direct retail

SPECS | Tornado Solar Water Pump

Product model	**TB3IN-140/24/50/1.3/0.75**
Product type	Submersible pump
Pump type	Centrifugal
Load	280,000 W
AC/DC coupled	DC
Voltage range	24–36 V DC (For variable drive pumps)
Total dynamic head	50 m
Max discharge rate	1.3 m^3/h
Controller require-ments	Controller required
PAYGO integration capabilities	No

SOLAR SPRAYERS

Solar Sprayers – List of Featured Products

Currently no listings for Ghana

QUALITY STANDARDS

READ MORE ABOUT SOLAR SPRAYERS

SOLAR SPRAYERS

Solar Sprayers – Introduction

Sprayers diffuse liquid chemicals into mists through a process known as atomizing. Farmers and other users operate these products to spray a variety of chemicals, such as disinfectants, fungicides, herbicides, insecticides, and pesticides. Farmers often apply them to row crops (e.g., cotton, cowpeas, groundnuts, tobacco, vegetables, sugarcane, sisal, and maize) and for the control of migrant pests (e.g., locusts, grasshoppers, and armyworms). In some cases, farmers use sprayers as medical solutions to strengthen the immune systems of poultry and the treat mange in pigs and other animals.

Many varieties of sprayers are available in sub-Saharan Africa. This catalog presents solar-powered, handheld models of the spinning-disc type, which are designed for smallholder farmers and low volumes of liquid. Some sprayers come equipped with integrated light-emitting diode (LED) lights to allow spraying at night. Solar sprayers can replace other varieties of sprayers that use disposable batteries, thus reducing long-term environmental impacts and costs.

Special Considerations

In selecting the most appropriate sprayer for an activity, it is useful to compare data on run times and charging times as well as battery lifespans. Users may also consider the types of liquids (e.g., water-based products or CDA formulations) that the sprayer is designed to dispense. Other points of reference for decision-making include the volume capacity, flow rate range (measured in ml/min), and time needed to treat one hectare of land. It is essential to observe the precautions indicated by the manufacturer to minimize risks and promote the safety of operators.