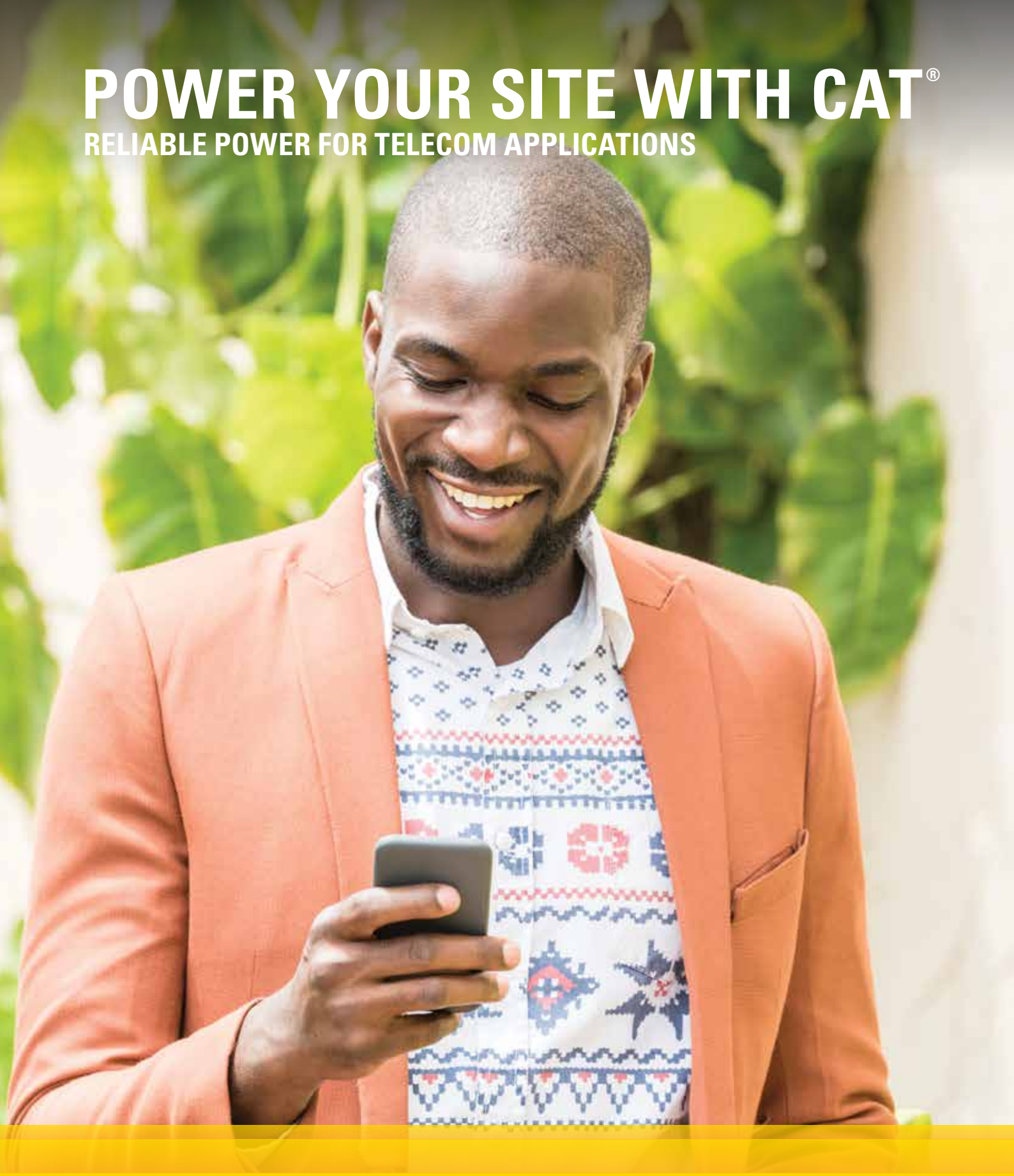
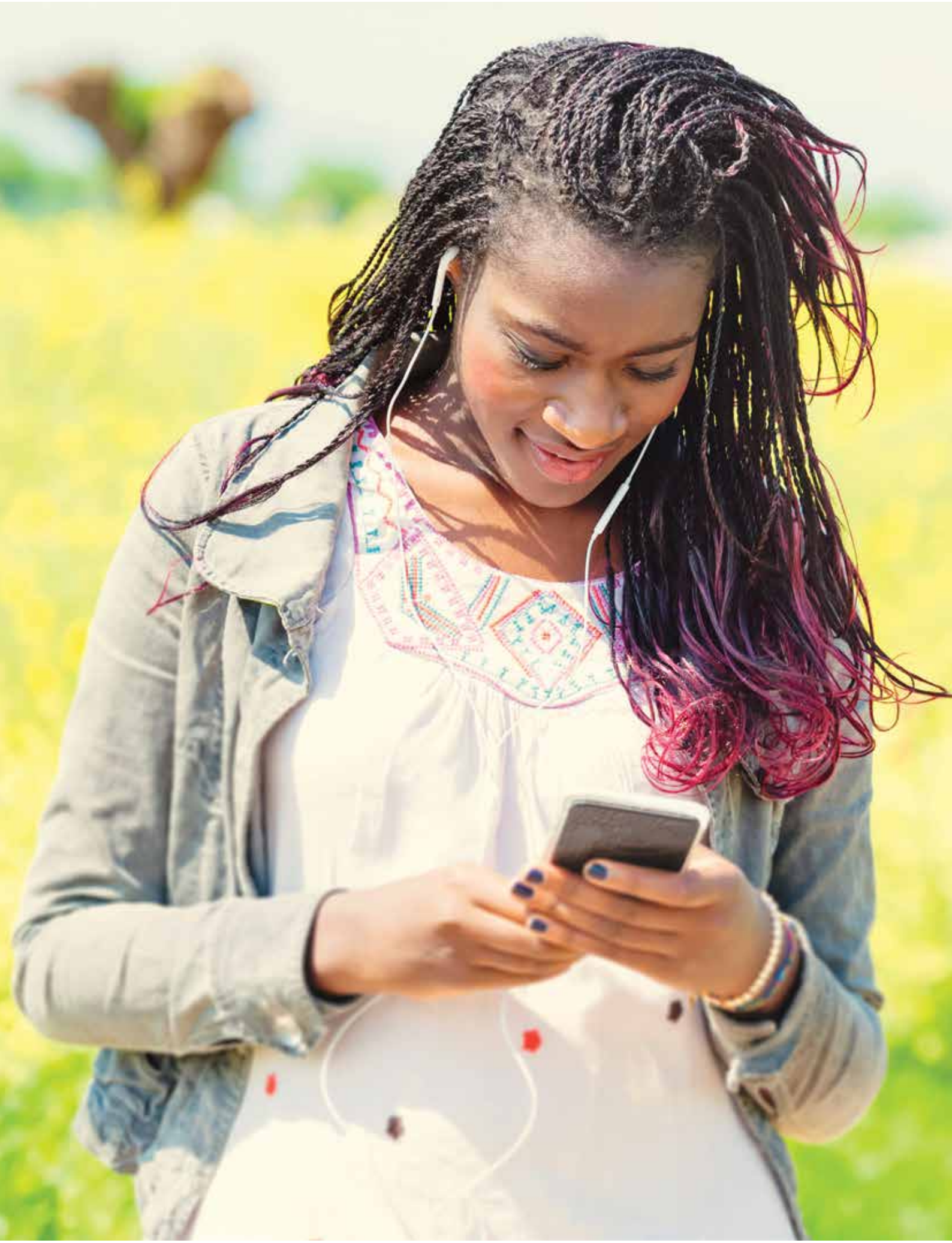
POWER YOUR SITE WITH CAT®

RELIABLE POWER FOR TELECOM APPLICATIONS





RELIABLE PARTNER. TRUSTED SUPPORT.

Reduce your operating costs, improve your network availability, and increase your site revenue. For more than 90 years, Caterpillar has delivered products and services that support the world's infrastructure. With our global Cat® dealer network, we have driven positive and sustainable change on every continent. We design, install, and service power systems, with hundreds of locations to serve and support you – from the Antarctic, to the desert, to the jungle.

POWER SOLUTIONS FOR TELECOM APPLICATIONS

We now offer a full range of energy storage products backed by technical expertise, customer support agreements and maintenance contracts, and the support of our global dealer network.

CAT POWER SYSTEM TECHNOLOGIES

A wide range of power system options incorporating traditional and renewable resources include:

- **Solar photovoltaics (PV)**
- **State-of-the-art storage**
- **Diesel or gas generator sets**
- **High efficiency power electronics**

CAT POWER SYSTEM TECHNOLOGIES

IMPROVED NETWORK AVAILABILITY

More uptime equals more revenue per tower. The Cat Energy Storage System (ESS) is designed to help improve your network availability with reliable, long-duration uninterruptible power to your BTS and microwave backhaul operations.

CONSTANT MONITORING

- 24/7 continuous monitoring provides full site performance transparency and reporting via cloud connectivity to a central network operating center (NOC). Reporting includes energy storage performance, utility availability, and overall site availability.

THEFT REDUCTION

- Cells contain no valuable metals and are inoperable if removed from the system.

EXTENDED RUN TIME

- The system can meet any telecom environment and power challenge with four- to 20-hour discharge capability.

VERTICALLY INTEGRATED

- Energy storage, electronics, and software on a single platform, developed and designed to work together in a complete packaged solution.

REDUCE OWNING & OPERATING EXPENSES

EASY TO INSTALL

- Designed for outdoor operation in 0°C to 50°C temperature range with no impact on cell life and no requirement for conditioned space.
- Suitable for outdoor installation in normal to dusty environment with an IP55 enclosure.

PREDICTABLE PERFORMANCE

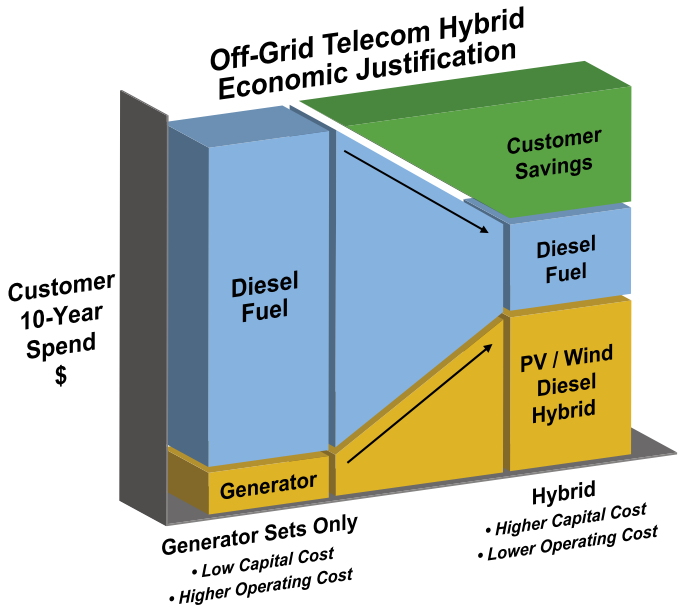
- No depth of discharge limitation. Energy cell can remain at 0% state of charge for extended periods of time with no long-term operating life impact.
- Energy modules have no cycle life limitation.

INTELLIGENT MONITORING

- The Cat ESS monitors individual cell performance and can issue alerts from the NOC if a cell is operating outside of expected operating parameters.
- Individual cells can be automatically removed from operation to ensure a single cell will not impact available power.

SCALABLE ARCHITECTURE

- Modular ESS architecture makes it possible to scale energy and power capabilities to meet expanding load requirements.



KEY FEATURES

1 ENERGY CELLS

- Proven technology.
- Long ride-through, long life, discharge capability.
- Inherently safe – no mechanism for thermal runaway.

2 POWER CELLS

- Available with heavy duty product.
- Short duration outages, fast discharge/recharge.

3 COMMUNICATIONS

- The monitoring system provides a high fidelity means of capturing real-time site data, such that an accurate operating cost savings (or lost revenue avoided) KPI can be derived on a monthly or quarterly basis.
- Automatic reporting provides insight to all key parameters necessary to assess the actual site power consumption, reliability, and grid outage profile at each site.

4 ELECTRONICS (ON ENERGY CELL)

- Intelligent monitoring at the individual cell level.
- Can remove cells from operation and not impact peak power capability.

5 ELECTRONICS (CONTROLLER)

- Dedicated central electronics panel supports the intelligent circuit boards.
- These boards not only control each module but also handle all amp-hour balancing and charging protocol functions for each board.

ESS ENERGY STORAGE TECHNOLOGY

CAT ESS IS A SAFE, LONG-LIFE, HIGH TEMPERATURE TOLERANT, RELIABLE, AND COST EFFECTIVE WAY TO BACK UP MISSION CRITICAL DC LOADS.

At the core are rechargeable metal-air energy cells. These modules have integrated intelligence and are self-governing to autonomously balance the Ah discharge of the contributing cells. Since each individual module behaves just like a large capacity 50V battery, they are essentially sub-systems that can be arranged in parallel and added to or removed from the system based on the power and capacity needs of your equipment.

Primary applications are peak shaving, load shifting, and backup power in locations where reliability, long calendar life, long runtime capability, and scalability are needed. The system is designed to interface directly with the existing -48 VDC bus and is compatible with all -48 VDC rectifier equipment for charging needs.

GENERAL DUTY ESS

Cat general duty ESS is designed for poor grid areas. Its modular architecture can meet any load or backup duration demands. With high peak power capabilities, ultra-long discharge capabilities, and fast recharge, the general duty ESS is an excellent solution whether the grid has very frequent short outages, very long outages, or a combination of both.

GENERAL DUTY ESS		
Model	Design Power (kW)	Runtime at Design Power (Hrs)
ES6H0.75 DC	0.75	7.25
ES12H1.5 DC	1.50	7.25
ES18H2.25 DC	2.25	7.25
ES24H3.0 DC	3.00	7.25
ES30H3.75 DC	3.75	7.25
ES36H4.5 DC	4.5	7.25

HEAVY DUTY ESS

Cat heavy duty ESS is designed for applications that experience daily utility load shedding. It adds a power module to the existing energy modules for short duration peaking power or smaller increments of nominal power. It can operate either in a peak power mode where both the energy modules and power module discharge together, providing short duration, high power output or in a front end mode where the power modules discharge before the energy cells, for optimized performance in short duration load shed.

HEAVY DUTY ESS				
Model	Peak Power (kW)	Runtime at Peak Power (Hrs)	Nominal (Design) Power (kW)	Runtime at Design Power (kW)
ES14H3.5 DC HD	3.50	1.0	1.50	8.56
ES20H4.25 DC HD	4.25	1.0	2.25	8.11
ES27H6.0 DC HD	6.00	1.0	3.00	8.22
ES34H7.75 DC HD	7.75	1.0	3.75	8.29
ES40H8.5 DC HD	8.50	1.0	4.5	8.11

EVERYTHING YOU NEED FOR YOUR OPERATION

Your solution comes with the full support of the global Cat dealer network, always available for service and support. They have options to help get you up and running and to make sure you stay that way.

CUSTOMER VALUE AGREEMENT (CVA)

A CVA is the most effective way to operate your power systems at peak performance, reducing risk, disruption, and loss of revenue caused by unscheduled downtime. It ensures that your service, maintenance, and repairs are performed by highly skilled professionals, giving you more time to concentrate on your business.

MAINTENANCE CONTRACTS

From analysis and assessment to service agreements that take maintenance worries off your mind, your Cat dealer gives you total support for maximum efficiency and peak performance.

FINANCING

Our experienced industry finance representatives understand Cat products and will help you get the most from your investment. This includes the capability to finance the entire power infrastructure, rather than generating equipment only, and to offer flexible programs to suit specific needs. We're built to power your world.

www.cat.com/microgrid

LET'S DO THE WORK.™

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CAT®