

# Microgrid

## Energy Time Shift & Energy Capacity Expansion



Image shown may not reflect actual configuration.

## Cat® Energy Time Shift (ETS) & Energy Capacity Expansion (ECE)

570 kW | 1000 kW  
1518 kWh - 9108 kWh  
60 Hz 480 Volt & 600 Volt  
50 Hz 400 Volt

The Cat® ETS and ECE modules are scalable and rapidly deployable energy storage system. The energy storage system integrates with the utility, generator sets and renewable sources to store energy for use at a later time. The system may provide temporary backup power to facilities in the event of a power outage.

### FEATURES

#### Reliable, Modular and Scalable

The Cat ETS and ECE modules are robust and consist of pre-engineered containers that are easily installed on site. Multiple energy storage modules may be operated in parallel to provide increased power output and/or increase the battery energy capacity. Installed modules allow optimized genset operation.

#### Renewable Integration

The energy storage modules are designed to work with an array of renewable systems, including solar and wind. Seamless integration with the Cat® Microgrid Master Controller (MMC) allows for maximum renewable penetration and full asset control. The onboard multi-mode Cat® Bi-Directional energy storage inverter is capable of grid forming allowing generator set(s) to be completely switched off, further reducing fuel consumption and operating costs.

#### Grid Stabilization

The ETS module also protects against many typical power problems, voltage sags/surges, and under/over frequency conditions.

#### Cat Bi-Directional Energy Storage Inverter

The Cat BDP1000 inverter is the core to the energy storage system. Based on technology developed for Cat electric drive machines, the Cat BDP provides exceptional reliability, durability and features that include:

- Controls for the charging and discharging of the energy storage equipment.
- 2 per unit fault current capability
- Static VAR compensator
- Four-quadrant output power factor control

- Patented nonlinear droop for tight control of voltage and frequency
- Seamless mode transfer
- Automatic anti-islanding
- Grid forming, grid firming, and grid following modes
- Autonomous mode or Remote-Control mode
- Parallel ready – multiple modules may be used in parallel to increase total output up to 100+MW

#### Energy Storage

- Advanced lithium-ion batteries provide energy density, high discharge/recharge efficiency, and long cycle life

#### Standard Equipment

- Cat BDP1000 bi-directional energy storage inverter
- Energy storage batteries
- Color HMI touchscreen
- CSC certified ISO High Cube container
- Remote communications via Modbus TCP
- HVAC system to maintain optimal interior temperatures
- Convenience receptacles
- Fire suppression system

#### Applications

- Time shifting of energy from renewables, genset or utility
- Renewable smoothing
- Peak shaving
- Grid firming/grid stabilization
- Generator set transient assist
- Facility backup
- Reserve power capacity


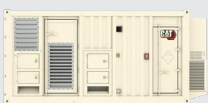

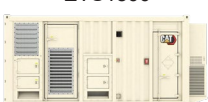


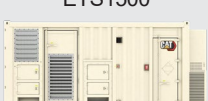



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## Product Scalability

The ETS1500 contains the Cat BDP1000 bi-directional energy storage inverter with a fixed number of batteries and support equipment. The ETS1500 may be installed

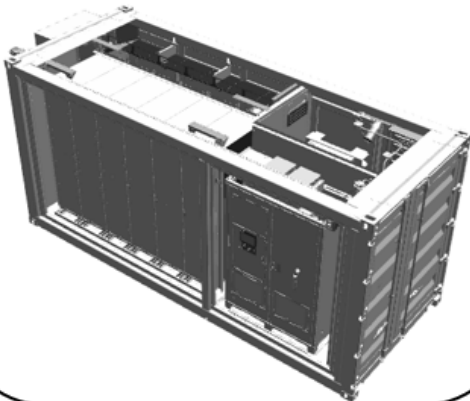
and operated alone or in combination with up to three (3) ECE1500, ECE2000 or ECE2500 modules for increased energy capacity and discharge duration.

| Total Energy Capacity | Nameplate Power | Energy Time Shift (ETS)   | Energy Capacity Expansion (ECE)   |   |   |
|-----------------------|-----------------|---|---|---|---|
| 1.5 MWh               | 570 kW          | ETS1500<br>  |   |   |   |
| 3.0-4.0 MWh           | 1 MW            | ETS1500<br>  | ECE1500/2000/2500<br>  |   |   |
| 4.5-6.5 MWh           | 1 MW            | ETS1500<br>  | ECE1500/2000/2500<br>  | ECE1500/2000/2500<br>  |   |
| 6.0-9.1 MWh           | 1 MW            | ETS1500<br> | ECE1500/2000/2500<br> | ECE1500/2000/2500<br> | ECE1500/2000/2500<br> |

## Modular Configuration

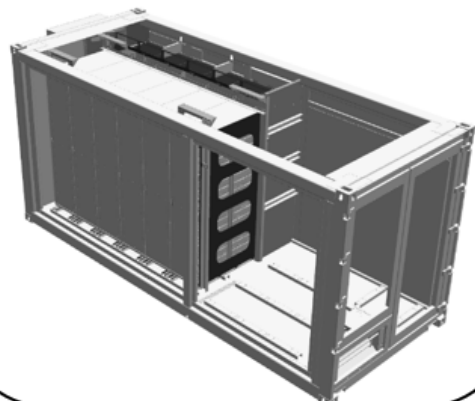
### Energy Time Shift (ETS)

- BDP Inverter with liquid cooling
- 6 Racks of batteries
- HVAC for batteries
- Fire suppression
- Transformer



### Energy Capacity Expansion (ECE)

- 6, 8 or 10 Racks of Batteries
- HVAC for batteries
- Fire suppression



# Microgrid Energy Time Shift & Energy Capacity Expansion



## Technical Specifications <sup>(1)</sup>

| Model   |                        | ETS1500   |                     | ECE1500   | ECE2000 | ECE2500 |
|---|------------------------|---|---------------------|---|---------|---------|
| Module Output                                       |                        | ETS Only  | ETS with ECE        |   |         |         |
| <b>Nameplate Power at 1.0 PF</b>                    | <b>kW</b>              | <b>570 <sup>(2)</sup></b>   | <b>1000</b>         | –   | –       | –       |
| Overload Power (Only in Island Mode) <sup>(3)</sup> |                        |   |                     |   |         |         |
| 15 min Overload at 1.0 PF                           | kW                     | 570   | 1170 <sup>(4)</sup> | –   | –       | –       |
| 10 min Overload at 1.0 PF                           | kW                     | 570   | 1220 <sup>(4)</sup> | –   | –       | –       |
| 5 min Overload at 1.0 PF                            | kW                     | 570   | 1260 <sup>(4)</sup> | –   | –       | –       |
| 1 min Overload at 1.0 PF                            | kW                     | 570   | 1260 <sup>(4)</sup> | –   | –       | –       |
| 10 s Overload at 1.0 PF                             | kW                     | 570   | 1260 <sup>(4)</sup> | –   | –       | –       |
| <b>Nameplate Energy Capacity <sup>(5)</sup></b>     | DC kWh                 | 1518  |                     | 1518  | 2024    | 2530    |
| Number of Battery Racks                             | qty                    | 6   |                     | 6   | 8       | 10      |
| Battery Type  |                        | Lithium Ion   |                     | Lithium Ion   |         |         |
| Battery Chemistry                                   |                        | NMC   |                     | NMC   |         |         |
| <b>Inverter Model</b>                               |                        | BDP1000   |                     | –   |         |         |
| <b>Number of Inverters</b>                          |                        | 1   |                     | –   |         |         |
| <b>Isolation Transformer</b>                        | Pri/Sec                | Delta/Wye   |                     | –   |         |         |
| <b>Number of Transformers</b>                       |                        | 1   |                     | –   |         |         |
| Output Voltage                                      | 50 Hz<br>60 Hz         | 400 VAC<br>480 & 600 VAC  |                     | –<br>–  |         |         |
| Output Voltage THD                                  |                        | <3%   |                     | –   |         |         |
| <b>Ambient Temperature Capability</b>               | °C                     | -25 to +40<br>(+50 with power de-rate/rest period) <sup>(6)</sup> |                     | -25 to +40<br>(+50 with power de-rate/rest period) <sup>(6)</sup> |         |         |
| <b>Altitude</b>                                     | mASL                   | 2000 <sup>(6)</sup>   |                     | 2000 <sup>(6)</sup>   |         |         |
| <b>Average Parasitic Load</b>                       |                        |   |                     |   |         |         |
| At 20°C in Standby Operation (0% Load)              | kW                     | 7.2   |                     | 3.2   |         |         |
| At 40°C in Continuous Operation (100% Load)         | kW                     | 40.3  |                     | 35.0  | 36.4    | 36.4    |
| Shore Power Connection                              | V (50 Hz)<br>V (60 Hz) | 400V 50 Hz 3 ph 4 wire<br>480V 60 Hz 3 ph 4 wire                  |                     | 400V 50 Hz 3 ph 4 wire<br>480V 60 Hz 3 ph 4 wire                  |         |         |
| <b>Features</b>                                     |                        |   |                     |   |         |         |
| Microgrid Stabilization                             |                        | Yes   |                     | –   |         |         |
| Patented Non-Linear Droop Control                   |                        | Yes   |                     | –   |         |         |
| Seamless Mode Transfer                              |                        | Yes   |                     | –   |         |         |
| Islanding Detection                                 |                        | Yes   |                     | –   |         |         |
| Grid Forming  |                        | Yes   |                     | –   |         |         |
| Four Quadrant Power Factor Control                  |                        | Yes   |                     | –   |         |         |
| Static VAR Compensator                              |                        | Yes   |                     | –   |         |         |
| 2 Per Unit Fault Current Capability                 |                        | Yes   |                     | –   |         |         |
| Reserve Power Capacity                              |                        | Yes   |                     | –   |         |         |
| Plug-and-Play Parallel Ready                        |                        | Yes   |                     | –   |         |         |
| Energy Storage Management                           |                        | Yes   |                     | –   |         |         |
| Human-Machine Interface                             |                        | Yes   |                     | –   |         |         |
| Fire Suppression System                             |                        | Yes   |                     | Yes   |         |         |
| Communications Protocols                            |                        | Modbus TCP/IP   |                     | Modbus TCP/IP   |         |         |

<sup>(1)</sup> Ensure compatibility of all microgrid equipment by referring to A&I guides (or equivalent) for generator sets, BDP inverters, PV inverters, switchgear, and controls. Contact your local Cat dealer for assistance selecting compatible equipment.

Consult factory for additional options such as additional voltages and cold weather operation.

<sup>(2)</sup> Power is limited due to available energy content.

<sup>(3)</sup> For discharge events starting at 95% State of Charge (SoC).

<sup>(4)</sup> 1140 kW when ETS is connected to a single ECE1500.

<sup>(5)</sup> Beginning of Life (BoL) nameplate energy.

<sup>(6)</sup> Consult factory for power de-rate and rest period recommendation.

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## Applicable Codes and Standards

- UL 1973
- UL 9540 Ed1
- UL 9540 Ed2 (pending)
- CSC Certified
- 2014/35/EU LVD
- 2014/30/EU EMCD
- 2011/65/EU RohS
- UN38.3
- IEC60204-1
- Marking: cULus, CE

**Note:** Reference component spec sheets for additional codes. Codes may not be available in all model configurations. Please consult your local Cat Dealer for availability.

## Registration

- California Energy Commission ([CEC Solar Equipment List](#))

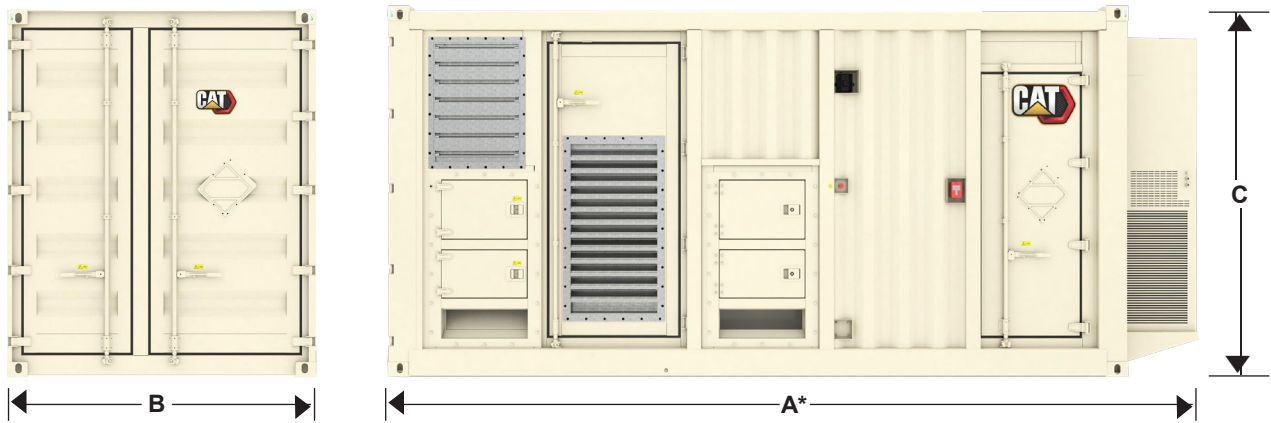
## Remote Monitoring (Sold Separately)

The Cat® Connect telematic device and an active subscription to Cat Connect are available. The internet connection provides real time monitoring of the performance and health of the battery and installation. If an issue is detected, local technicians can be dispatched to resolve the problem.

## Worldwide Product Support

- Cat dealers provide extensive post-sale support including maintenance and repair agreements.
- Cat dealers have over 1,800 dealer branch stores operating in 200 countries.

## Weights and Dimensions



|                                | ETS 1500        | ECE1500         | ECE2000         | ECE2500         |
|--------------------------------|-----------------|-----------------|-----------------|-----------------|
| A – Length, m (ft)             | 6.75 (22.13)    | 6.75 (22.13)    | 6.75 (22.13)    | 6.75 (22.13)    |
| B – Width, m (ft)              | 2.4 (8)         | 2.4 (8)         | 2.4 (8)         | 2.4 (8)         |
| C – Height, m (ft)             | 2.8 (9.5)       | 2.8 (9.5)       | 2.8 (9.5)       | 2.8 (9.5)       |
| Weight (Approximate), kg (lbs) | 18,725 (41,282) | 16,325 (35,990) | 19,693 (43,416) | 23,061 (50,841) |

**Note:** Do not use for installation design. See general dimension drawings for detail. Dimensions are dependent on selected options.  
\* Without A/C module length 6.06 (19.87), m (ft).

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