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Storing Infinite Energy
Energy Storage System Solutions and Products
About CATL

CATL is a global leader of new energy innovative technologies, committed to providing premier solutions and services for new energy applications worldwide.

Main Business

Provide EV battery systems and services for green transportation

- Cell
- Module
- Pack

Provide solutions and services for clean energy storage

- Rack
- Container
- Power Station

Development in Three Directions

- Utilizing renewable energy generation + energy storage to replace stationary fossil energy
- Utilizing EV batteries to replace mobile fossil energy
- Utilizing electrification + intelligence to real-ize integrated innovation of market applications

Innovation in Four Dimensions

- Innovation in Material and Electrochemistry System
- Structure System Innovation
- Extreme Manufacturing Innovation
- Business Model Innovation

About CATL

- World Economic Forum: The Member of Lighthouse Network
- TIME: TIME100 Most Influential Companies of 2022
- NAATBatt: Dr. Zeng was awarded the Lifetime Achievement Award
- Automotive INNOVATIONS Awards: The Most Innovative Automotive Supplier (2021)
- Financial Times: Prospering in the pandemic: 2020’s top 100 companies
- Fortune: Future 50 (2019 - 2021)
- MIT Technology Review: 50 Smartest Companies in China (2019)

Annual revenue of 2022 H1: 16.84 billion USD
R&D investment to revenue ratio of 2022 H1: 5.10%
The founding team established ATL, which is the world’s leading company in the field of lithium-ion batteries for consumer electronics (CE).

1999

- The founding team established ATL, a new endeavor started by the founding team.
- Participated in the construction of Zhangbei energy storage project - the largest wind and solar energy storage and transmission project in the world at the time.

2010

- Established CATL, a new endeavor started by the founding team.
- Started strategic partnership with BMW.

2011

- Participated in the construction of Zhangbei energy storage project.
- Developed EV batteries for the world’s largest commercial vehicle manufacturer, Yutong.
- Established Xining production base.

2012

- Started strategic partnership with BMW.
- Developed EV batteries for the world’s largest commercial vehicle manufacturer, Yutong.

2013

- Established Xining production base.
- Developed EV batteries for the world’s largest commercial vehicle manufacturer, Yutong.
- Established CATG in Germany, the company’s wholly-owned subsidiary.

2014

- Established CATG in Germany, the company’s wholly-owned subsidiary.
- Participated in the construction of Zhangbei energy storage project.
- Established CATG in Germany, the company’s wholly-owned subsidiary.
- Acquired Brunp Recycling to start the development in battery recycling and regenerating.

2015

- Acquired Brunp Recycling to start the development in battery recycling and regenerating.
- Developed EV batteries for the world’s largest commercial vehicle manufacturer, Yutong.

2016

- Established the CATL Academician and Specialist Workstation.
- Established the CATL Academician and Specialist Workstation.
- Successfully delivered phase I of Jinjiang 100 MW Energy Storage Power Station Project - the largest indoor stationary energy storage system in China.

2017

- Established wholly-owned subsidiaries in France, USA, Canada and Japan.
- Established joint ventures with SAIC Motor.
- Participated in Europe’s largest grid-side battery energy storage power station - Minety Battery Energy Storage System in the UK.

2018

- Listed on the Shenzhen Stock Exchange.
- Established joint ventures with Dongfeng Motor and GAC Group respectively.
- Led the establishment of the National Engineering Research Center for Electrochemical Energy Storage Technology.

2019

- Established joint ventures with Geely Auto Group and FAW Group respectively.
- Successfully delivered phase I of Jinjiang 100 MW Energy Storage Power Station Project - the largest indoor stationary energy storage system in China.
- Established joint ventures with Geely Auto Group and SAIC Motor respectively.

2020

- Established joint ventures with Dongfeng Motor and GAC Group respectively.
- Put Liyang production base into operation.
- Established two energy storage joint ventures with the State Grid Integrated Energy Service Group under the State Grid.

2021

- Ningde Plant was selected as a member of the Global Lighthouse Network.
- Put Yibin and Lingang production bases into operation.
- Established strategic cooperation with China Huadian Corporation, State Power Investment Corporation, China Three Gorges Corporation, China Energy, Energy China and other companies.

2022

- Yibin Plant was selected as a member of the Global Lighthouse Network.
- Rolled out its battery swap solution EVOGO featuring modular battery swapping.
- Participated in Europe’s largest grid-side battery energy storage power station - Minety Battery Energy Storage System in the UK.
- Established two energy storage joint ventures with the State Grid Integrated Energy Service Group under the State Grid.
- Successfully delivered phase I of Jinjiang 100 MW Energy Storage Power Station Project - the largest indoor stationary energy storage system in China.

Ningde Plant was selected as a member of the Global Lighthouse Network.

Put Yibin and Lingang production bases into operation.

Established strategic cooperation with China Huadian Corporation, State Power Investment Corporation, China Three Gorges Corporation, China Energy, Energy China and other companies.

Participated in Europe’s largest grid-side battery energy storage power station - Minety Battery Energy Storage System in the UK.

The 220MWh liquid-cooling energy storage project in Texas is connected to the grid, marking the world’s first large-scale application of its kind.

Released its first-generation sodium-ion battery with the world’s leading energy density of its kind.

Established a joint lab with the Institute of Physics, Chinese Academy of Sciences.

Co-founded the CATL Xiamen Institute of New Energy with Xiamen University.

Deployed the Innovation Center and the Future Energy Research Institute in Shanghai.

SNE Research:
- Ranked No.1 globally in EV battery consumption volume for six consecutive years.
- Ranked No.1 globally in BESS battery shipment for two consecutive years.

Launched CTP 3.0 battery “Qilin”...
Global Locations

5 R&D Centers
China | Ningde, Fujian / Liyang, Jiangsu / Shanghai
Xiamen, Fujian
Germany | Munich

13 Production Bases
China | Ningde, Fujian / Xining, Qinghai / Liyang, Jiangsu / Yibin, Sichuan / Zhaoqing, Guangdong
Shanghai / Yichun, Jiangxi / Xiamen, Fujian / Guiyang, Guizhou / Jining, Shandong / Luoyang, Henan

Germany | Erfurt

Hungary | Debrecen
R&D Strength

- R&D Scope

R&D Investment and Talents

- Annual R&D investment (M USD)
  - 2018: 294.2
  - 2019: 442.1
  - 2020: 551.9
  - 2021: 1,206.1
  - 2022 H1: 864.2

- R&D Talent
  - 12,132

- Doctors
  - 193

- Masters
  - 2,233

Rapidly Increasing Number of Patents

- Pending Patents
  - 2018: 2,110
  - 2019: 2,913
  - 2020: 3,454
  - 2021: 4,445
  - 2022 H1: 5,480

- Issued Patents
  - 2018: 1,656
  - 2019: 2,484
  - 2020: 3,317
  - 2021: 4,777
  - 2022 H1: 7,444

*Data: CATL’s 2022 semi-annual report

- Led or participated in the formulation or revision of national and international standards
  - 70+

- 21C Innovation Lab
- National Engineering Research Center for Electrochemical Energy Storage Technology
- Key Laboratory of Lithium-ion Battery Enterprise of Fujian Province
Technology Highlights

Substantial Safety
Aircraft-grade safety and reliability
CATL ensures safety and reliability in real scenarios with well selected and designed raw materials, multi-level protective structures, automated manufacturing processes, comprehensive testing and verification, 24-h monitoring, and big data-based early warning.

Long Service Life
Life up to 12,000 cycles
CATL has upgraded key components such as the cathodes, anodes, electrolytes, and pole pieces of the battery to slow down the battery capacity loss, extend the battery life, and reduce LCOS throughout the battery life cycle.

High Energy Density
Volumetric energy density higher than 350 Wh/L
Advanced high-energy density materials and original CTP high-efficiency group technology enable the container system to achieve a floor space energy density of over 250 kWh/m².

Intelligent Temperature Control
Automatic temperature adjustment to cope with cold and heat
The intelligent thermal management system effectively avoids the bucket effect caused by the series connection of cells, guarantees the attenuation of life consistent of each cell to the greatest extent, ensures a temperature difference of cells in the container within 5°C, and improves the discharge capacity of the battery system. The integrated liquid-cooled units selected are featured in adaptive adjustment of the operating state, reducing the auxiliary loss by 30%.

Intelligent Management
24/7 protection
The BMS monitors the battery health status and identifies unhealthy batteries in advance. Intelligent internal short-circuit detection with early warning of battery fire hazards can reduce the probability of relevant fires by more than 90%. The online early warning system ensures the safe operation of battery throughout the life cycle.
Quality Assurance

### Extreme manufacturing

- Extreme strict processes
  - Strict shape and performance control
  - Strong coupling of multiple fields
  - Size control from nanometer level to kilometer level

- Extremely fast production speed
  - Produce a cell in 1.7 s on average
  - Produce a module in 20 s

- Extremely high quality requirements
  - 4,800+ quality control points
  - More than 10,000 items of traceability data for a battery on average
  - 100+ tests on each cell before delivery to warehouse

- Produce a cell in 1.7 s on average
- Produce a module in 20 s
- 4,800+ quality control points
- More than 10,000 items of traceability data for a battery on average
- 100+ tests on each cell before delivery to warehouse

### Comprehensive testing and verification

- 100 items of material testing and analysis capabilities
- Comprehensive system of standards, covering R&D, production and manufacturing fields, with CATL's leading and involvement in developing a number of national, industrial and company-level standards

- World-leading characterization technology
  - Characterization and analysis of single-particle microelectrodes
  - High-precision in-situ expansion analysis
  - UHPC analysis
  - Electrochemical simulation and material simulation analysis

- Laboratory testing capabilities
  - Material atoms, molecules, battery cells and devices, including crystal structure, element composition, chromatography, mass spectrometry, micro-area surface structure, thermal analysis, electrochemical analysis and many other fields

- 400+ product tests
  - Multi-level: materials, cells, modules, BMS, packs
  - Multi-dimensional: mechanism, electrical performance, safety and reliability, etc.
  - Standards: GB/T, ISO, IEC, UN, ECE, etc., with complete company-level standards developed

- High-pressure water spray test
- Rain test
- Crush test
- Fire test
- Water immersion test
- Vibration test

### Quality management system

- Providing clients with the perfect quality beyond expectations is our unremitting pursuit.

#### Quality policy

- IATF16949
- ISO9001

#### Client requirements

- Design & development
- Manufacturing
- Client complaint management
- Client satisfaction

#### Multi-level:
- Materials, cells, modules, BMS, packs

#### Multi-dimensional:
- Mechanism, electrical performance, safety and reliability, etc.

#### Standards:
- GB/T, ISO, IEC, UN, ECE, etc., with complete company-level standards developed
Since energy storage is a key part of energy transition and power transformation, CATL has always been committed to providing first-class energy storage solutions to the world. CATL has developed a safe, efficient, and economical electrochemical energy storage system that is widely adaptive to the fields of power generation, power transmission and distribution, and power consumption, helping to optimize the energy structure, enhance the safety of the power system, and reduce the cost of energy use.
Liquid Cooling Solution

- LFP batteries with high thermal stability
- Protection level of IP55 to meet the requirements of outdoor applications
- Resistance up to CS corrosion level, with 20-year reliability
- Prevention-oriented fire protection strategy, with a separate fire protection system

Available for integration with CATL’s advanced technologies (e.g. optional cell with super-long cycling up to 12,000 cycles)
- Integrated high-efficiency liquid-cooling system, with the temperature difference in the container limited to 5°C

- Modular design for the 1,500V system
- Separate arrangement of electrical room and battery room for convenient maintenance
- Non-walk-in/modular design with high integration, saving the floor space by 35%
- Prefabricated installation, reducing on-site installation costs and commissioning time

- Integrated high-efficiency liquid-cooling system, with the temperature difference in the container limited to 5°C

Available for integration with CATL’s advanced technologies (e.g. optional cell with super-long cycling up to 12,000 cycles)
- Integrated frequency conversion liquid-cooling system, with cell temperature difference limited to 3°C, and a 33% increase of life-expectancy

- Modular design, compatible with 600-1,500V system
- Separate water cooling system for worry-free cooling
- Modular design with a high energy density, saving the floor space by 50%
- Transportation after assembly, reducing on-site installation costs and commissioning time

Basic Parameters

<table>
<thead>
<tr>
<th>Configuration</th>
<th>10P4165</th>
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</thead>
<tbody>
<tr>
<td>Cell capacity [Ah]</td>
<td>280</td>
</tr>
<tr>
<td>Rated voltage [V]</td>
<td>1331.2</td>
</tr>
<tr>
<td>Rated energy [MWh]</td>
<td>3.72</td>
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<tr>
<td>IP Rating</td>
<td>IP55</td>
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<tr>
<td>Product weight [T]</td>
<td>35</td>
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<tr>
<td>Dimensions [L<em>W</em>H] [mm]</td>
<td>6058<em>2462</em>2896</td>
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</table>

Testing and certification

IEC 62619, UL 1973, UL 9540A, IEC 62477-1

Basic Parameters

<table>
<thead>
<tr>
<th>Configuration</th>
<th>1P416S</th>
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<tbody>
<tr>
<td>Cell capacity [Ah]</td>
<td>280</td>
</tr>
<tr>
<td>Rated voltage [V]</td>
<td>1331.2</td>
</tr>
<tr>
<td>Rated energy [kWh]</td>
<td>372.7</td>
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<tr>
<td>IP Rating</td>
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<tr>
<td>Product weight [kg]</td>
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<tr>
<td>Dimensions [L<em>W</em>H] [mm]</td>
<td>1300<em>1300</em>2280</td>
</tr>
</tbody>
</table>

Testing and certification

IEC 62619, UL 1973, UL 9540A, IEC 62477-1


### UPS Backup Battery Solution

- **Cell safety**
  - LFP batteries with high thermal stability
- **System Safety**
  - Dual redundancy for BMS control and protection; shunt trip by contactor control and molded case circuit breakers
  - Dual redundancy for short circuit protection; magnetic trip by fuse protection and molded case circuit breakers

- **Self-powered DC/DC auxiliary power supply**
  - Dual redundancy of auxiliary power to reduce the risk in case of AC power interruption
  - Black start in case of power outage

- **System Safety**
  - Dual redundancy for BMS control and protection: shunt trip by contactor control and molded case circuit breakers
  - Dual redundancy for short circuit protection: magnetic trip by fuse protection and molded case circuit breakers

- **High level of safety**
  - Exit of the faulty cabinet only to improve system availability
  - Low temperature rise

- **System Safety**
  - Temperature rise of about 20°C at the highest discharging rate, with only natural cooling needed to meet the use requirements
  - Simple and reliable system

- **High reliability**
  - Self-powered DC/DC auxiliary power supply
  - Dual redundancy of auxiliary power to reduce the risk in case of AC power interruption

- **High reliability**
  - Black start in case of power outage in the grid

- **Individual rack exit**
  - Exit of the faulty cabinet only to improve system availability

- **Low temperature rise**
  - A temperature rise of about 20°C at the highest discharging rate, with only natural cooling needed to meet the use requirements
  - Simple and reliable system

- **Super flexibility**
  - Flexible wiring system
  - Available for three-wire and two-wire UPS systems

- **Super flexibility**
  - Flexible configuration
  - Available for a wide voltage range configuration of 320~691V, compatible with UPS of high and low voltage platforms

- **Flexible configuration**
  - Available for a wide energy range configuration of 32.768~49.152 kWh for individual rack, reducing excessive configuration

- **Flexible transportation mode**
  - Available for whole rack transportation, reducing packaging materials, transportation costs, and on-site installation and commissioning costs and time

- **Flexible transportation mode**
  - Available for bulk transportation, with flexible shipment of the rack body and spare parts

### Telecom Backup Battery Solution

- **Small size/ light weight**
  - 48100 LFP product: 3U modular design, lightweight and small size to maximize space utilization

- **High level of safety/ long service life**
  - A system composed of LFP batteries, with high safety and long service life. 0.5C charge and discharge at 25°C, 100% DOD, and number of cycles > 3,500

- **Flexible system configuration**
  - Configuration of multiple packs in parallel based on the power backup time of the system, with 16 packs in parallel at most, facilitating multiple application scenarios

- **Basic Parameters**

<table>
<thead>
<tr>
<th>Item</th>
<th>Cell Capacity [Ah]</th>
<th>Rated voltage [V]</th>
<th>Dimensions [W<em>H</em>D][mm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Configuration</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cell</td>
<td>100</td>
<td></td>
<td>438<em>130</em>450</td>
</tr>
<tr>
<td>Module</td>
<td></td>
<td>51.2</td>
<td></td>
</tr>
<tr>
<td>Rack (8/10/12 Modules)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight [kg]</td>
<td>5.3</td>
<td>50</td>
<td>600</td>
</tr>
<tr>
<td>Routed voltage [V]</td>
<td>3.2</td>
<td>60</td>
<td>700</td>
</tr>
<tr>
<td>Voltage range [V]</td>
<td>2.5~3.6</td>
<td>40~57.6</td>
<td>400~631</td>
</tr>
<tr>
<td>Routed capacity [Ah]</td>
<td>20</td>
<td>80</td>
<td></td>
</tr>
<tr>
<td>Routed energy [kWh]</td>
<td>0.064</td>
<td>4.096</td>
<td>32.768</td>
</tr>
</tbody>
</table>

**Advantages:** Integrated design, small size, light weight, unattended mode, easy-to-use cabinet with standardized installation method, energy saving and environmentally friendly design, etc.

**Applications:** Widely used as a backup power supply in communication fields such as network access devices, remote switching offices, mobile communication equipment, transmission equipment, satellite ground stations and microwave communication equipment.
## Energy Storage on Power Generation

The energy storage system can realize storage and output management on the power generation. It is a system combining the electrochemical energy storage technology and the renewable energy power generation technology. With the good consistency of cells and the strong computing ability of the battery management system (BMS), CATL’s solution helps, on the power generation, restore the stability of the power grid, optimize the energy output curves of power generation and reduce waste of wind and photovoltaic energy, and provides functions such as system inertia, frequency and peak regulation, thus increasing the proportion of renewable energy power generation and optimizing the energy structure.

## Energy Storage on Power Transmission and Distribution

The energy storage system enables intelligent load management on the power transmission and distribution, and makes timely peak and frequency regulation based on grid loads. Featuring capacity expansion and backup power supply, CATL’s electrochemical energy storage system can help utilize more renewable energy on the power transmission and distribution to ensure safe, stable, efficient and low-cost operation of the power grid.

### Benefits for clients

- Improve the utilization proportion of new energy power generation channels and improve access capacity for power generation
- Reduce waste of wind and photovoltaic energy, and effectively handle the energy utilization
- Improve the power quality of PV power stations
- Enhance output characteristics of PV power stations

### Features

- High-power batteries in modular design, with safe and fast charge and discharge
- Cells with square aluminum shells, with excellent thermal performance, long life and high level of safety
- Operating automatically based on the state of the wind-solar plant EMS and according to the dispatching plans to improve grid-connection convenience
- Quick response of the battery system to frequency regulation command

### CATL’s Advantages

- Industry-leading LFP battery manufacturing technology, with high level of safety
- Availability of high rate charge and discharge, with multiple large projects constructed under stable operation
- Long cycle life and long project period of benefits
- Fully automated production lines, with high level of safety and reliability
The energy storage system enables power users to carry out peak shifting & valley filling and stable power quality management. CATL’s electrochemical energy storage products have been successfully applied in large-scale industrial and commercial projects and residential fields, with the applications extended to emerging fields such as backup power supply for communication base stations, UPS, micro grids for islands, and intelligent BESS charging stations, which has enabled and secured the power supply, reduced social cost of power consumption, thus maximizing energy efficiency to achieve social and economic benefits.

### Applications of Electrochemical Energy Storage Solutions

#### Benefits for clients

- Provide sufficient backup power for peak shifting and valley filling, ensure power supply, and reduce costs and increase efficiency
- Explore the peak-to-valley price arbitrage model
- Address issues of power grid capacity expansion and new energy vehicle charging

#### Features

- Peak shifting and valley filling to reduce electricity expenses
- UPS to guarantee power supply
- Real-time dispatching for intelligent life
- Diversified energy storage applications, covering all aspects of power consumption

#### CATL’s Advantages

- Self-developed high-performance LPi batteries that are safe, reliable, and long-life
- Unattended operation, with the operation of the energy storage and charging station automatically controlled by the EMS in the power station
- Fast charging technology & leading BMS technology
CATL Energy Storage Application Cases

- **Minety Battery Storage Project in the U.K.**
  - Scale: 99.8MW/99.8MWh
  - Functions: peak and frequency regulation in the power grid, black start, and capacity market

- **New energy storage power station in Southern California, the U.S.**
  - Scale: 50MW/100MWh
  - Functions: virtual synchronization-based control, tracking of power generation plan, and support of second frequency regulation

- **Luneng National Energy Storage Power Station Demonstration Project in the U.S.**
  - Scale: 70MW/70MWh
  - Functions: energy integration, frequency regulation in the system, peak-to-valley price arbitrage

- **National wind and solar energy storage and transmission demonstration project in the U.S.**
  - Scale: 4MW/16MWh
  - Functions: smoothening of wind and solar power generation, tracking of planned power generation, peak load shifting, frequency regulation in the grid system

- **Minety Battery Storage Project in the U.K.**
  - Scale: 99.8MW/99.8MWh
  - Functions: peak and frequency regulation in the grid system, black start, and capacity market
CATL Energy Storage Application Cases

**Jinjiang 100MWh Energy Storage Power Station**
- Scale: 50MW/100MWh
- Functions: new energy utilization, peak loading shifting, and frequency regulation

**Guantang Energy Storage Project, Huai’An**
- Scale: 15MW/26MWh
- Functions: peak load regulation and frequency regulation of 110KV transformer substations on the power distribution

**Zhenjiang Xinbo Power Station, Jiangsu**
- Scale: 10MW/20MWh
- Functions: peak load regulation of 110KV transformer substations on the power distribution
CATL Energy Storage Application Cases

ADN Comprehensive Demonstration Project of Smart Grid Application Demonstration Area in Suzhou Industrial Park

Scale: 1.5MW/3MWh
Functions: peak load shifting and backup power supply

Energy Storage Power Station in Zhangjiagang Cement Plant

Scale: 8MW/32MWh
Function: peak-to-valley price arbitrage

Energy Storage for Emergency Power Supply

Mobile energy storage vehicle

Scale: 250kW/500kWh
Functions: emergency power supply and uninterrupted power supply for critical loads; flexible applications for multiple scenarios, with access available anytime and anywhere

Smart Micro-Grid Energy Storage

Intelligent BESS Charging Station

Scale: 250kW/500kWh
Functions: fast charging of new energy vehicles; online battery inspection; energy storage, cost reduction and efficiency increase; V2G, income increase; integration of renewable energy
CATL’s energy storage system solutions and products have been used in major energy storage markets such as the United States, China, the United Kingdom, Germany, Australia, rendering energy storage services such as clean energy utilization, auxiliary services for grids, peak-load shifting and valley filling.

Since its establishment, CATL has delivered 200+ large-scale energy storage projects worldwide. CATL hopes to provide safe and innovative energy storage solutions to improve the stability and reliability of renewable energy generation, increase the proportion of renewable energy utilization, optimize the energy structure, and help achieve the goal of carbon neutrality.