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**CATL**

# Storing Infinite Energy

Energy Storage System Solutions and Products

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Contemporary Amperex Technology Co., Limited

# About CATL

**2011**  
Establishment

**5.10%**  
R&D investment to revenue ratio of 2022 H1

**16.84 billion USD**  
Annual revenue of 2022 H1

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

## 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 + intelligentization to realize integrated innovation of market applications

## Main Business

Provide EV battery systems and services for green transportation



Provide solutions and services for clean energy storage



Innovation in Material and Electrochemistry System

Extreme Manufacturing Innovation

Innovation in Four Dimensions

Structure System Innovation

Business Model Innovation



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)



Forbes  
Global 2000: The World's Best Employers (2019)

# Company Milestones

**1999**

The founding team established ATL, which is the world's leading company in the field of lithium-ion batteries for consumer electronics (CE).

**2011**

Establishment of CATL, 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.

**2012**

Started strategic partnership with BMW.

**2013**

Established Xining production base.

Developed EV batteries for the world's largest commercial vehicle manufacturer, Yutong.

**2014**

Established CATG in Germany, the company's wholly-owned subsidiary.

**2015**

Acquired Brup Recycling to start the development in battery recycling and regenerating.

**2020**

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 MWh Energy Storage Power Station Project - the largest indoor stationary energy storage system in China.

Established 21C Lab.

**2019**

Established joint ventures with Geely Auto Group and FAW Group respectively.

Led the establishment of the National Engineering Research Center for Electrochemical Energy Storage Technology.

**2018**

**Listed on the Shenzhen Stock Exchange.**

Established joint ventures with Dongfeng Motor and GAC Group respectively.

Put Liyang production base into operation.

**2017**

Established wholly-owned subsidiaries in France, USA, Canada and Japan.

Established joint ventures with SAIC Motor.

**2016**

Established the CATL Academician and Specialist Workstation.

**2021**

**Ranked No.1 globally in EV battery consumption volume for five consecutive years.**

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.

**2022**

Yibin production base was certified as the world's first zero-carbon battery factory.

Rolled out its battery swap solution EVOGO featuring modular battery swapping.

Launched CTP 3.0 battery "Qilin"

# Global Locations

## Headquarters

Ningde, Fujian

## 5 R&D Centers

China | Ningde, Fujian / Liyang, Jiangsu / Shanghai

Xiamen, Fujian

Germany | Munich

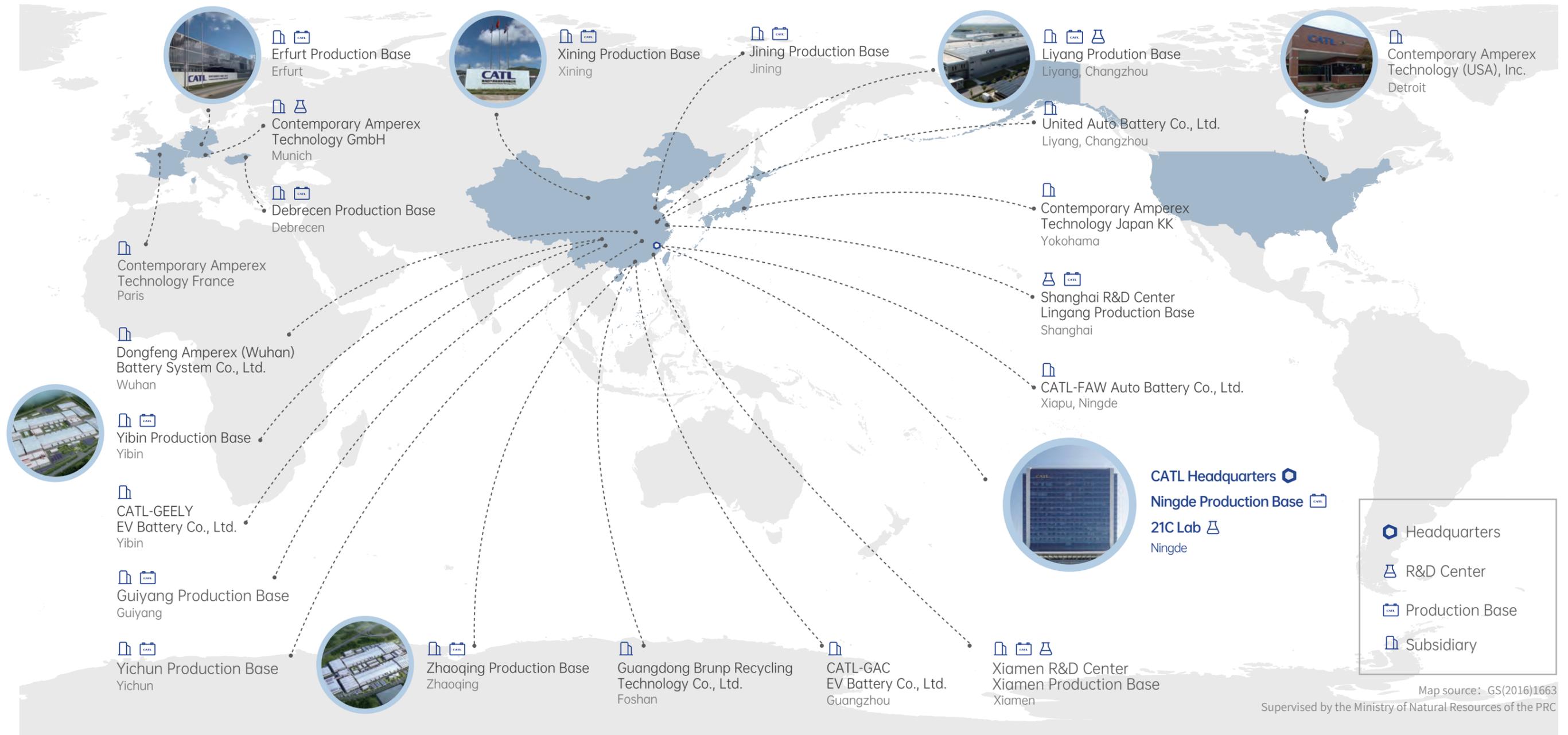
## 12 Production Bases

China | Ningde, Fujian / Xining, Qinghai / Liyang, Jiangsu / Yibin, Sichuan / Zhaoqing, Guangdong

Shanghai / Yichun, Jiangxi / Xiamen, Fujian / Guiyang, Guizhou / Jining, Shandong

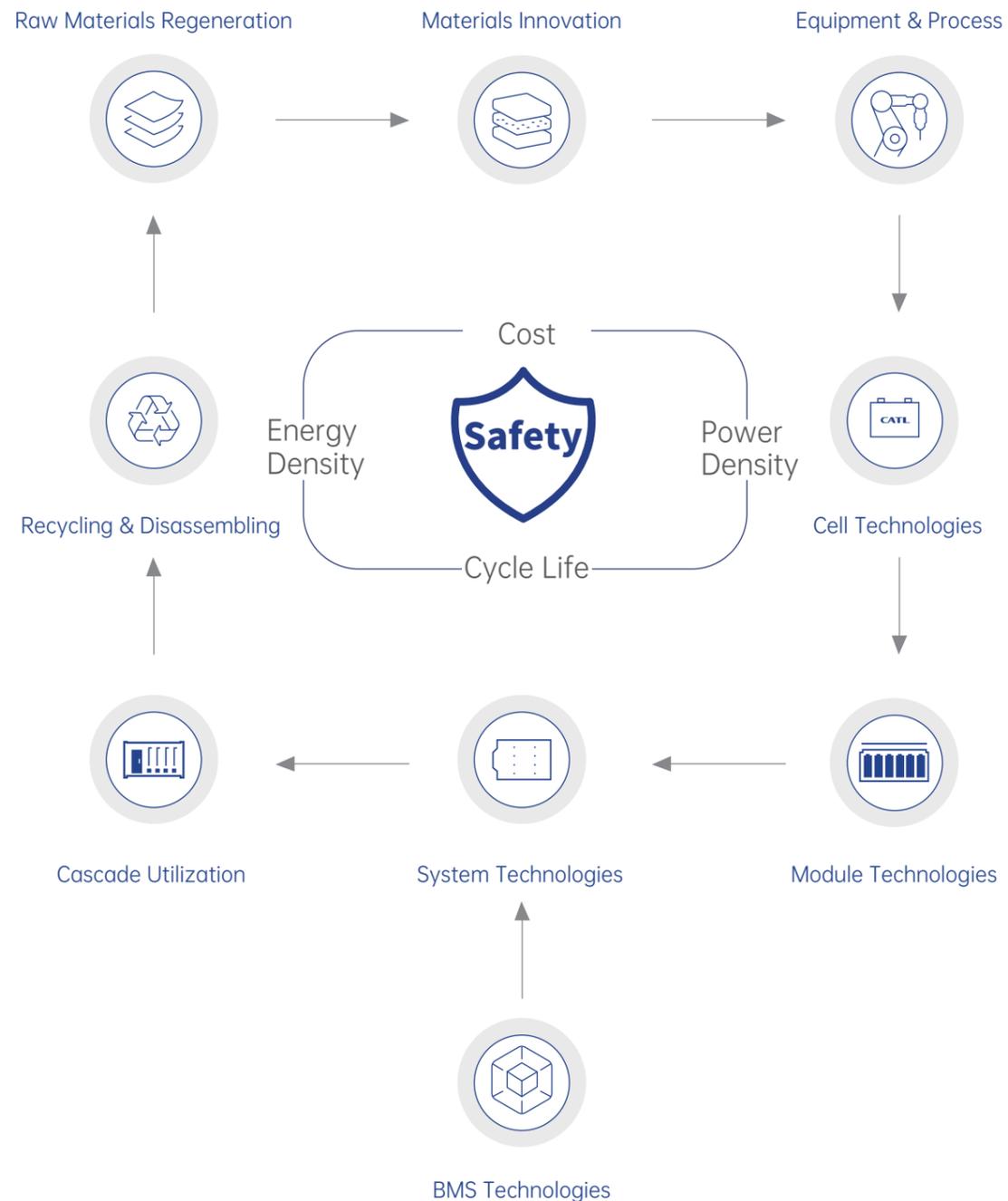
Germany | Erfurt

Hungary | Debrecen

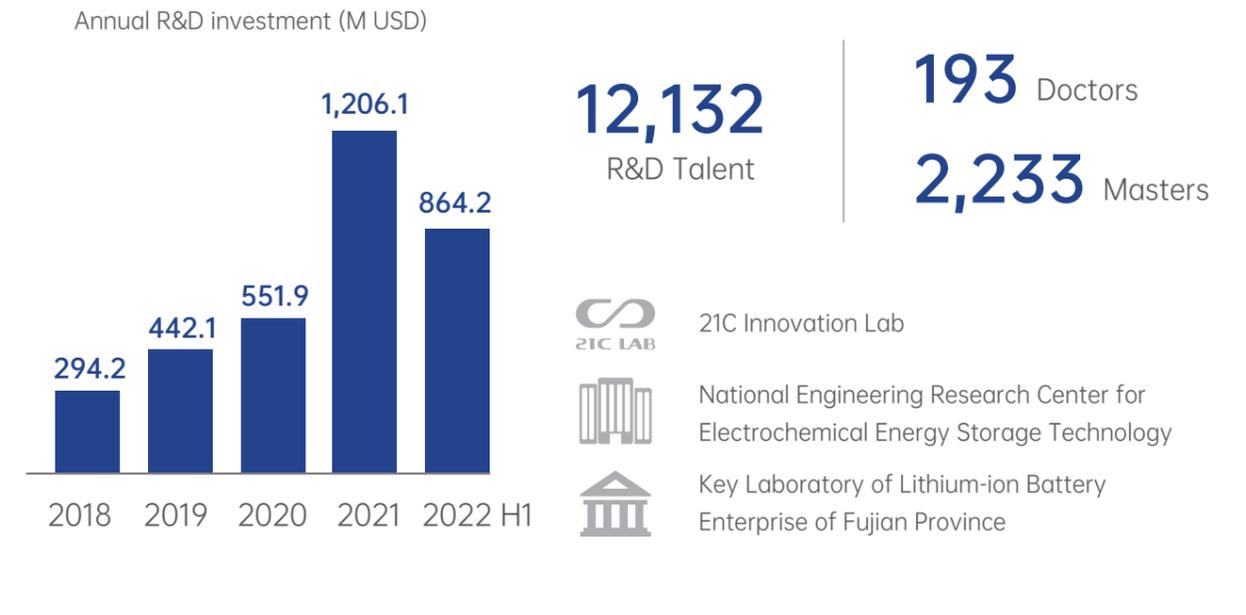


# R&D Strength

## R&D Scope



## R&D Investment and Talents



## Rapidly Increasing Number of Patents



\*Data : CATL's 2022 semi-annual report

# Technology Highlights



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/m<sup>2</sup>.



## 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

Defect rate of a single cell reduced to 1/1,000,000,000

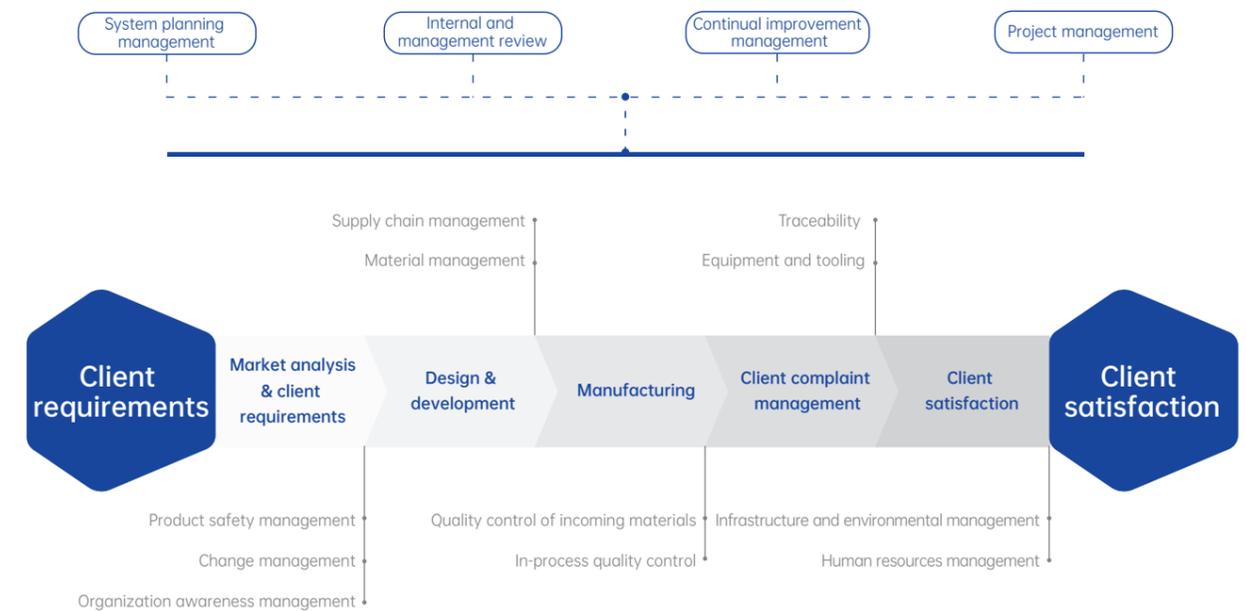
Extremely strict processes	Extremely fast production speed	Extremely high quality requirements
<ul style="list-style-type: none"> <li>Strict shape and performance control</li> <li>Strong coupling of multiple fields</li> <li>Size control from nanometer level to kilometer level</li> </ul>	<ul style="list-style-type: none"> <li>Produce a cell in <b>1.7 s</b> on average</li> <li>Produce a module in <b>20 s</b></li> </ul>	<ul style="list-style-type: none"> <li>6,800+ quality control points</li> <li>More than <b>10,000 items</b> of traceability data for a battery on average</li> <li><b>100+ tests</b> on each cell before delivery to warehouse</li> </ul>

## Comprehensive testing and verification

6,800+

<p><b>100 items</b> of material testing and analysis capabilities</p> <p><b>Comprehensive system of standards,</b> covering R&amp;D, production and manufacturing fields, with CATL's leading and involvement in developing a number of national, industrial and company-level standards</p>	<p><b>World-leading characterization technology</b></p> <ul style="list-style-type: none"> <li>Characterization and analysis of single-particle microelectrodes</li> <li>High-precision in-situ expansion analysis</li> <li>UHPC analysis</li> <li>Electrochemical simulation and material simulation analysis</li> </ul>	<p><b>Laboratory testing capabilities</b></p> <p>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</p>	
<p><b>400+ product tests</b></p> <p>Multi-level: materials, cells, modules, BMS, packs</p> <p>Multi-dimensional: mechanism, electrical performance, safety and reliability, etc.</p> <p>Standards: GB/T, ISO, IEC, UN, ECE, etc., with complete company-level standards developed</p>	 <p>High-pressure water spray test</p>	 <p>Impact test</p>	 <p>Crush test</p>
	 <p>Fire test</p>	 <p>Water immersion test</p>	 <p>Vibration test</p>

## Quality management system



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

**Quality policy**

**IATF16949** **ISO ISO9001**





Energy Storage Station of the Luneng Haixi Complementary Multi-energy Demonstration Project (50MW/100MWh)

# Energy Storage Solutions

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.

## ● CATL Cell Solutions



Basic Parameters	
Capacity [Ah]	280
Charge/discharge rate [P]	0.5 1
Cycle life [25°C, @60%SOH]	8,000 8,000
Dimensions [L*W*H] [mm]	173.9*71.7*207.2

### | Testing and certification



Basic Parameters	
Capacity [Ah]	100
Charge/discharge rate [P]	1
Cycle life [25°C, 0.5C/0.5C @70%SOH]	6,000
Dimensions [L*W*H] [mm]	160.0*49.9*116.0

### | Testing and certification



Basic Parameters	
Capacity [Ah]	26
Charge/discharge rate [P]	0.5
Cycle life [25°C@65%SOH]	8,000
Dimensions [D*H] [mm]	46.7*152

### | Certification



Basic Parameters	
Capacity [Ah]	20
Charge/discharge rate [P]	1
Cycle life [25°C@65%SOH]	10,000
Dimensions [D*H] [mm]	46.7*152

### | Certification



## ● Liquid Cooling Solution



### EnerC

Containerized Liquid Cooling Battery System

 **High level of safety**

- LFP batteries with high thermal stability
- Protection level of IP55 to meet the requirements of outdoor applications
- Resistance up to C5 corrosion level, with 20-year reliability
- Prevention-oriented fire protection strategy, with a separate fire protection system

 **Long service life**

- 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

 **High integration**

- 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



### EnerOne

Outdoor Liquid Cooling Battery System

 **High level of safety**

- LFP batteries with high thermal stability
- Protection level of IP66 to meet the requirements of outdoor applications
- Resistance up to C5 corrosion level, with 20-year reliability
- Separate fire protection system

 **Long service life**

- 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

 **High integration**

- 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

Configuration	10P416S
Cell capacity [Ah]	280
Rated voltage [V]	1331.2
Rated energy [MWh]	3.72
IP Rating	IP55
Product weight [T]	35
Dimensions [L*W*H] [mm]	6058*2462*2896

#### | Testing and certification



IEC 62619



UL 1973



UL 9540A



IEC 62477-1

#### Basic Parameters

Configuration	1P416S
Cell capacity [Ah]	280
Rated voltage [V]	1331.2
Rated energy [kWh]	372.7
IP Rating	IP66
Product weight [kg]	3500
Dimensions [L*W*H] [mm]	1300*1300*2280

#### | Testing and certification



IEC 62619



UL 1973



UL 9540A



IEC 62477-1

## UPS Backup Battery Solution



UPS Lithium-ion Battery Rack

  
High level of safety

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

  
High reliability

- 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 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
- Flexible configuration**  
· Available for a wide voltage range configuration of 320 - 691V, compatible with UPS of high and low voltage platforms  
· Available for a wide energy range configuration of 32.768-49.152kWh 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  
· Available for bulk transportation, with flexible shipment of the rack body and spare parts

### Basic Parameters

Item	Cell	Module			
		4P16S	4P128S	4P160S	4P192S
Configuration	/				
Dimensions [mm]	46*145[D*L]	480*750*130[W*D*H]		600*900*2000[W*D*H]	
Weight [kg]	0.53	50	600	700	800
Rated voltage [V]	3.2	51.2	410	512	614
Voltage range [V]	2.5~3.6	40~57.6	320~461	400~576	480~691
Rated capacity [Ah]	20	80		80	
Rated energy [kWh]	0.064	4.096	32.768	40.960	49.152

## Telecom Backup Battery Solution



48100 Battery Module for Telecom

  
Small size/ light weight

- 48100 LFP product: 3U modular design, light weight 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

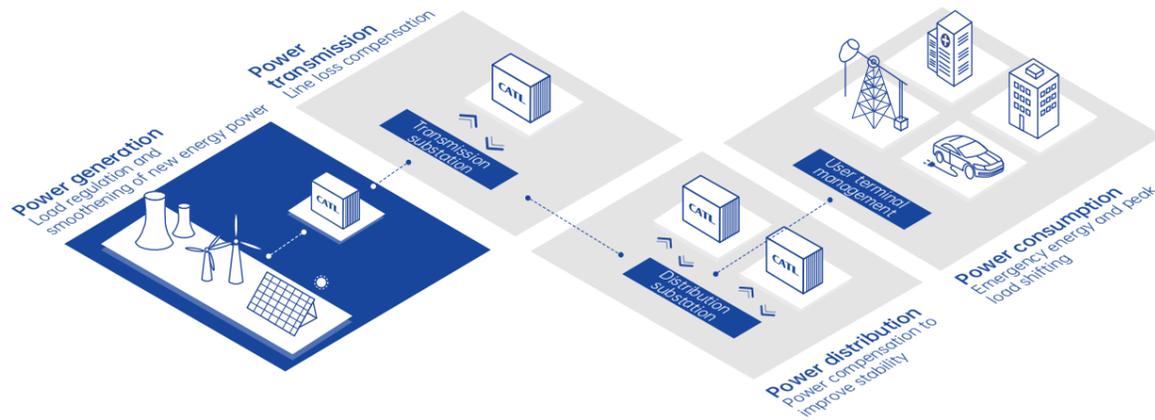
Cell chemistry	LFP
Capacity [Ah]	100
Rated voltage [V]	51.2
Dimensions [W*H*D][mm]	438*130*450

**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

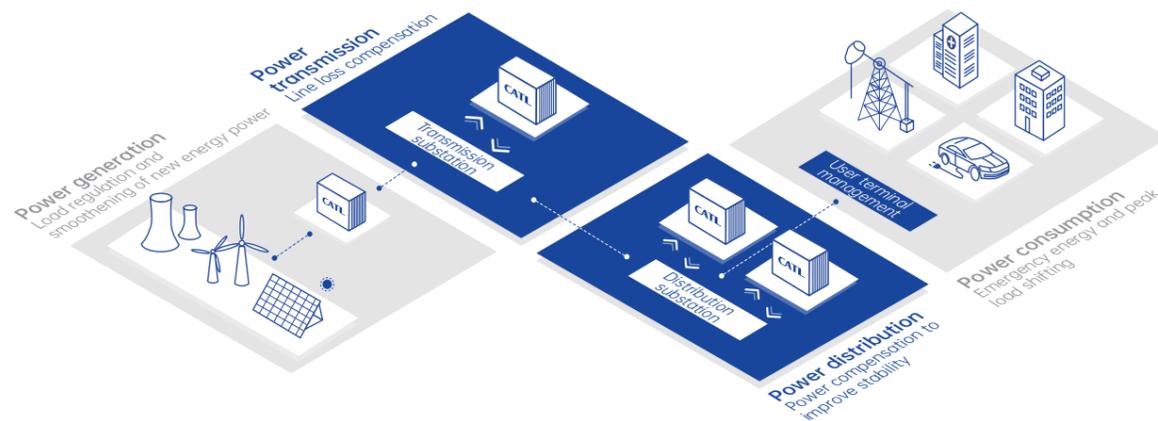
## ● Energy Storage on Power Generation

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

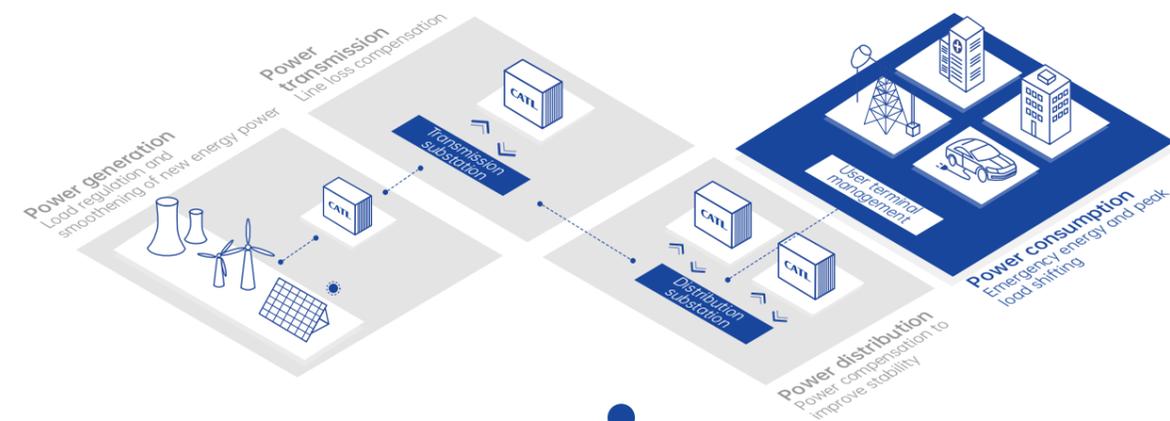


### Benefits for clients

- Undertake the government's deep frequency regulation instructions for the power grid to obtain benefits
- Abide by regulatory requirements for electricity to avoid fines and receive rewards
- Extend the life of thermal power units, reduce the fault rate, and reduce the labor intensity of workers
- Assist in the stable operation of the power grid and reduce line losses

## ● Energy Storage on Power Consumption

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.



**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 LFP 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



Applications of Electrochemical Energy Storage Solutions

# CATL Energy Storage Application Cases



 **Power Generation**

Luneng National Energy Storage Power Station Demonstration Project

Scale: 50MW/100MWh

Functions: virtual synchronization-based control, tracking of power generation plan, and support of second frequency regulation



 **Power Generation**

New energy storage power station in Southern California, the U.S.

Scale: 70MW/70MWh

Functions: energy integration, frequency regulation in the system, peak-to-valley price arbitrage



 **Power Generation**

National wind and solar energy storage and transmission demonstration project

Scale: 4MW/16MWh

Functions: smoothing of wind and solar power generation, tracking of planned power generation, peak load shifting, frequency regulation in the grid system



 **Power Generation**

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

# CATL Energy Storage Application Cases



 **Power Transmission & Distribution**  
Jinjiang 100MWh Energy Storage Power Station

Scale: 30MW/108MWh  
Functions: new energy utilization, peak loading shifting, and frequency regulation



 **Power Transmission & Distribution**  
Guantang Energy Storage Project, Huai'an

Scale: 15MW/26MWh  
Functions: peak load regulation and frequency regulation of 110KV transformer substations on the power distribution



 **Power Transmission & Distribution**  
Zhenjiang Xinba Power Station, Jiangsu

Scale: 10MW/20MWh  
Functions: peak load regulation of 110KV transformer substations on the power distribution

# CATL Energy Storage Application Cases



## Industrial & Commercial Energy Storage

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

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



## Energy Storage for Emergency Power Supply

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

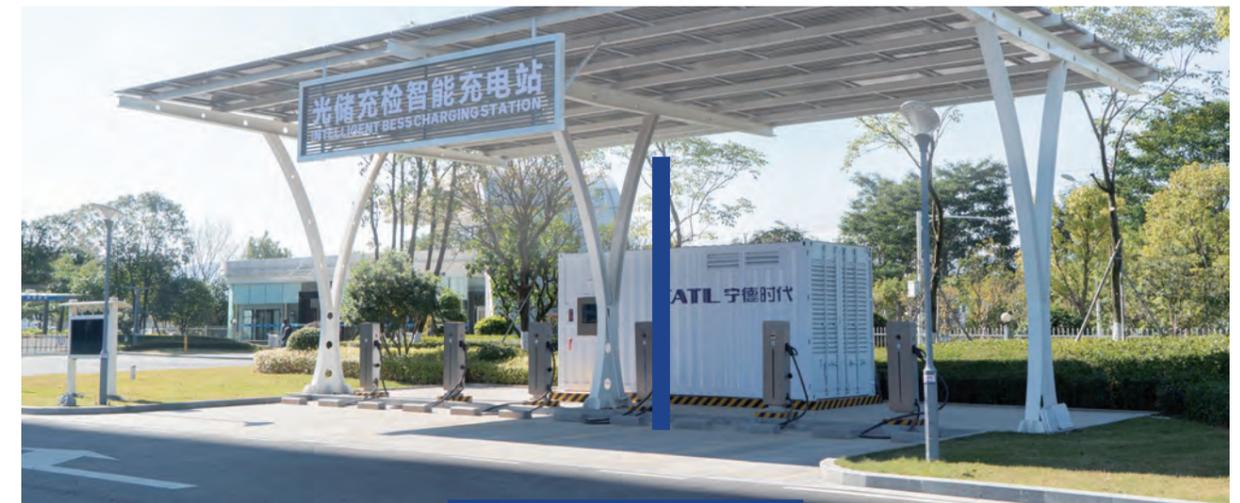
Mobile energy storage vehicle



## Industrial & Commercial Energy Storage

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

Energy Storage Power Station in Zhangjiagang Cement Plant



## Smart Micro-Grid Energy Storage

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

Intelligent BESS Charging Station

# Market Performance



CATL ranked first in the market share of global energy storage battery production in 2021

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 100+ 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.



\*Data source: ICC Sino

# After-sales Service for Energy Storage

七星级  
售后服务  
Seven-star After-sales Service

服务宗旨  
Service Principle

用心服务 E路领先  
Leading e-mobility with attentive service

售后服务体系  
After-sales service system



Seven-star after-sales service to guarantee various energy storage applications worldwide

Specialized | Comprehensive

## China



200+  
Cities with service outlets



350+  
Service outlets

\*Data as of September 2021

## Overseas



Key outlets

Europe (Iceland, United Kingdom, France, Netherlands, Bulgaria and Germany), Americas (United States, Mexico, Colombia, Chile, Uruguay and Brazil), Asia (Singapore, Kazakhstan, Indonesia, Israel, Pakistan and Nepal), Oceania (Australia and New Zealand)



System improvement

Service outlets + logistics network + central warehouses for spare parts (China, Europe and North America) + recycling of used parts



System services

On-site maintenance + empowered self-maintenance + client training + remote diagnosis consultation + spare parts/tool support + free regular inspection during the warranty period