

ITECH TEST SOLUTION - Battery Recycling



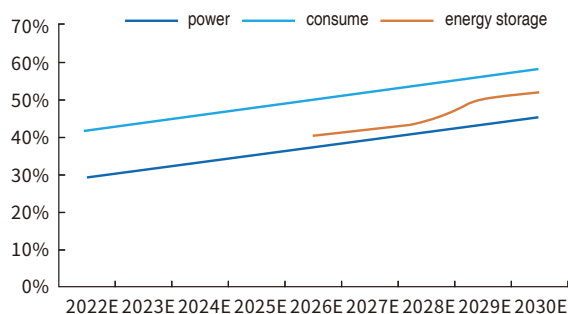
YOUR POWER
TESTING
SOLUTION

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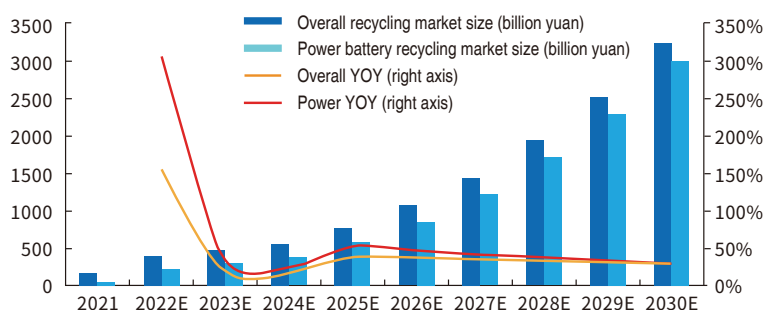
ITECH TEST SOLUTION - Battery Recycling



In the context of carbon neutrality, the electric vehicle market is growing rapidly. Along with the decay of power battery life to less than 80%, the electro-chemical performance of the battery will decline significantly, making it difficult to fully meet the normal power needs of the car, and the battery will enter the end-of-life stage. Comprehensive environmental factors and economic factors, recycling of used power batteries is a necessary task.

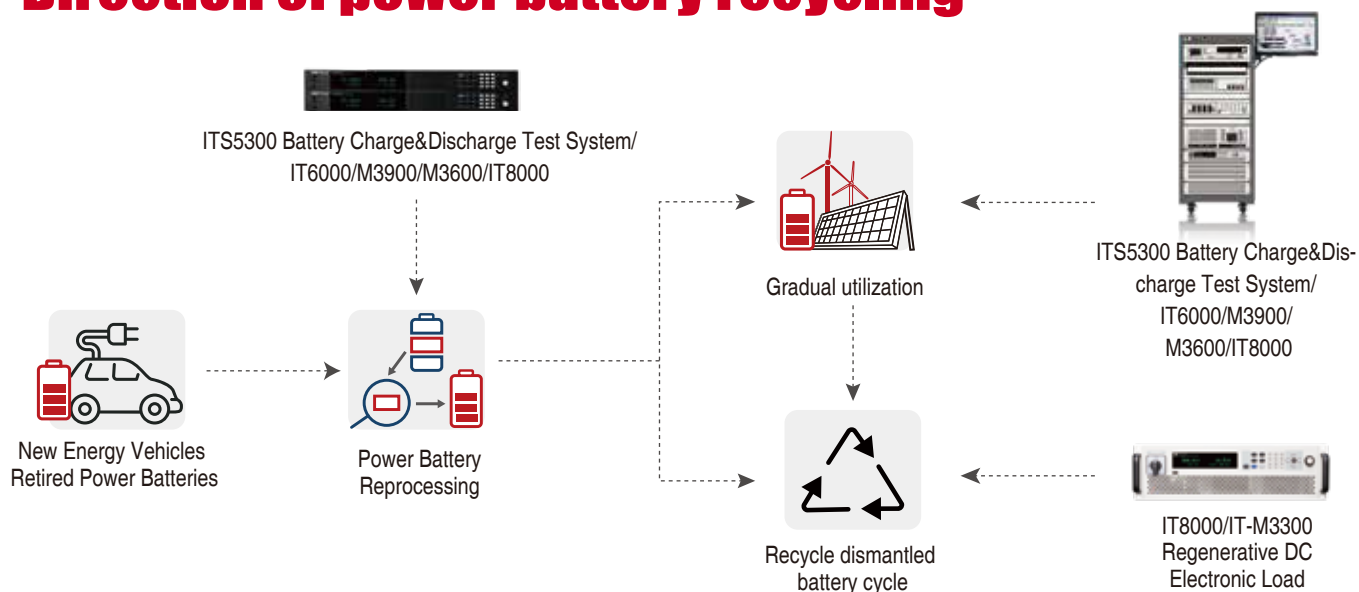


The proportion of retired batteries of each type that can be recycled in the current year



Global recycling market size estimation

Direction of power battery recycling



ITECH Testing solutions for retired power batteries

Reprocessing of retired power batteries

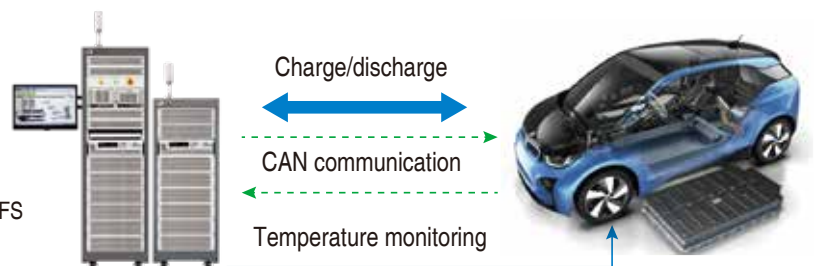
The process of re-processing retired power batteries is mainly to test the battery pack capacity, internal resistance and other performance parameters, and then to carry out the process of battery pack sorting according to the tested data.

ITECH Phase testing program for power battery reprocessing

The ITS5300 battery test system provides a wealth of test worksteps and statistical analysis functions during the charge/discharge cycle testing of power packs. Users can quickly master test program editing and running without any language programming background.

Applicable battery pack testing range

- Voltage range: up to 2250V
- Current range: 2040A for single machine
- Power range: up to 2MW
- Maximum voltage measurement accuracy: $\leq 0.02\% + 0.02\%FS$
- Maximum power measurement accuracy: $\leq 0.1\% + 0.1\%FS$



Battery pack system key functional features

- Bi-directional energy-feeding module, single module 3U could up to 18kW
- Energy feed-back efficiency up to 95%
- Fiber optic master-slave parallel technology to extend the test power
- Different temperature charge/discharge characteristics test (normal/high/low temperature)
- Different multiplier charge/discharge capacity test
- Charge retention capacity test
- Multiple safety protection functions (over-voltage, over-current, over-temperature, anti-islanding protection)
- High Extensible ability, integrated third party equipment (temperature chamber or water cooling system)



Energy feedback solution

IT6600C Bidirectional Programmable DC Power Supply

- Bidirectional, integrating power supply and e-load in one
- High power density, up to 42kW in 3U
- Independent dual-channel design in 3U unit, and channels can be connected in series or parallel
- High efficient power regeneration
- Master-slave current equalizing, output max. 10MW in parallel, no performance lost
- 5-inch touch screen with intuitive GUI
- Dynamic response $\leq 200\mu s$
- Rise time $\leq 1ms$
- High precision $\leq 0.03\% + 30mA$

IT6000C Bidirectional Programmable DC Power Supply

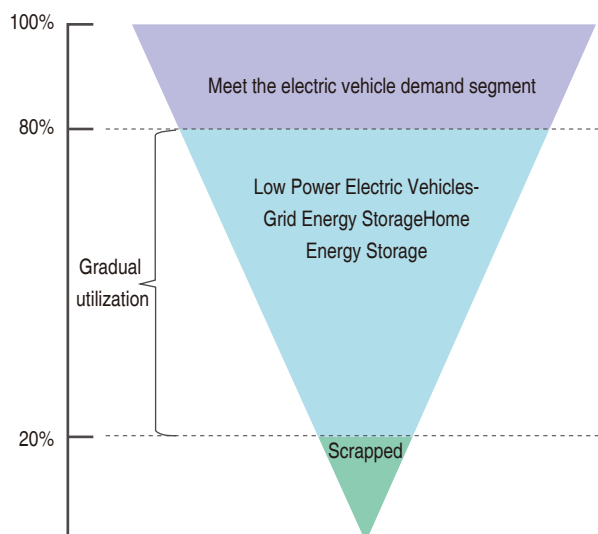
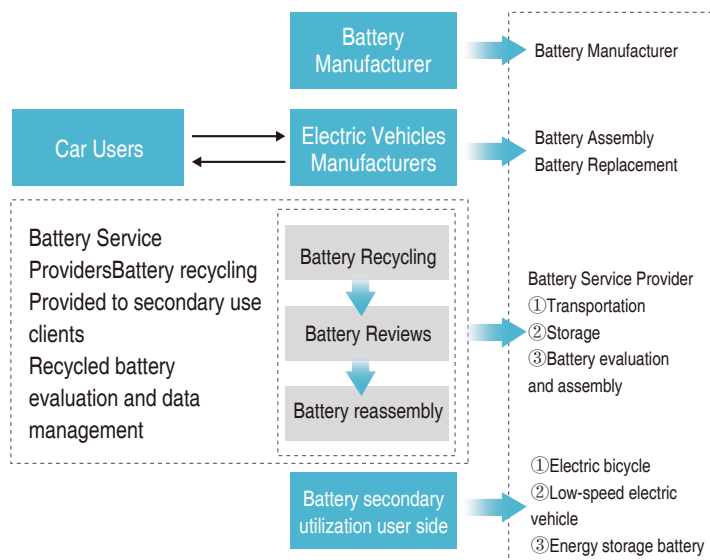
- Bi-directional power supply combined with regenerative electronic load function, regenerative efficiency up to 95%
- Stand-alone max. output power 144kW, expandable up to 2MW by paralleling
- High power density up to 18kW in compact 3U rack space

IT-M3900C Bidirectional Programmable DC Power Supply

- Voltage range: 10-1500V
- Current range: -720A~1020A
- Power range: +/-12kW
- Compact design, power up to 6kW in 1U space, power up to 12kW in 2U
- space Bidirectional energy flow between the DUT and grid, seamless switching across quadrants

Gradual utilization

Gradual utilization is mainly for the battery capacity reduced to less than 80%, can not be used in new energy vehicles, but the battery itself is not end-of-life battery, can be retired batteries, recycling, screening, reuse in other areas, the typical applications are energy storage, such as Wind & Solar Energy Storage, peak shaving, backup power, household power regulation, etc. As the performance parameters of retired power battery cells vary greatly, how to determine simple, suitable, reliable and certain universal sorting conditions is a technical problem that needs to be solved urgently.

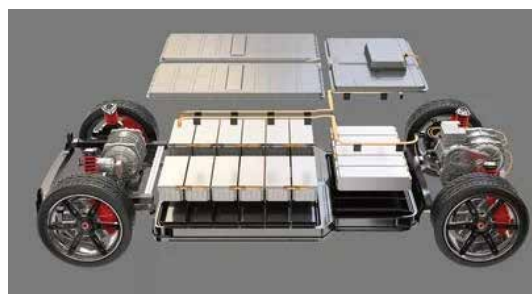


ITECH Testing solution for power batteries entering the gradual use phase

ITS5300 battery test system can simultaneously test the performance of hundreds of individual battery modules/cells, simultaneous monitoring of the voltage and temperature of each cell in the module, providing a wealth of test steps, curve plotting and statistical functions. The ITS5300 provides a regenerative solution with a 95% regenerative efficiency, solving the problem of high power costs associated with high-volume battery module/cell testing.

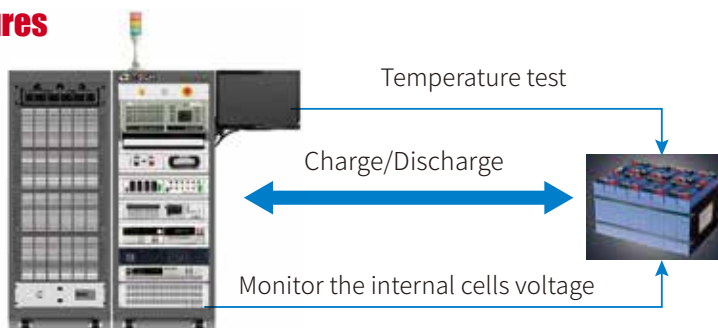
Applicable battery pack test range

- Applicable battery module test range
- Voltage range: 0~1000V
- Current range: 1200A for single machine
- Maximum voltage measurement accuracy: $\leq 0.025\% + 0.025\%FS$
- Maximum current measurement accuracy: $\leq 0.05\% + 0.1\%FS$
- Sampling rate up to: 1ms



Battery module system main functional features

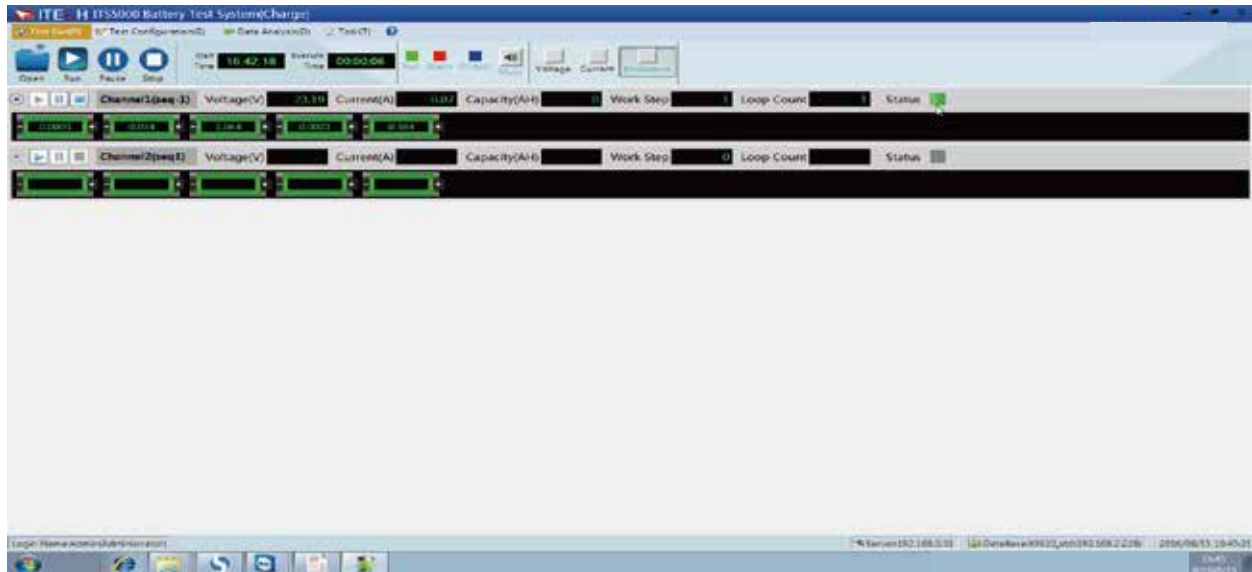
- AC impedance (ACIR) and DC impedance (DCIR) testing
- Cycle life test
- Different temperature charge/discharge characteristics test (room temperature/high temperature/low temperature)
- Different multiplier charge/discharge capacity test
- Charge retention capability test
- Temperature/voltage monitoring function of single unit in module



Real-time online monitoring on single module resistance, voltage and temperature.

Multi-channel online operation/parallel power expansion

ITS5300 battery pack test system not only provides the internal resistance measurement function of the pack, but also combines with temperature collector and internal resistance tester or DVM meter, etc. It can monitor the voltage and temperature changes of the single cell in the pack online and stop the test if the pressure difference of the single cell exceeds the allowable range. ITS5300 supports various types of thermocouples, T, K, B, E, J, N, S, R, C, with measurement accuracy up to $\pm(0.01\% \text{ of reading} + 0.5)^\circ\text{C}$.



Internal resistance test solution

IT5100 Battery Tester

IT5100 series is a series of battery internal resistance testers with high precision, high resolution and high speed. IT5100 adopts AC 4-terminal sensing, that means the tester can test internal resistance and voltage simultaneously with high precision. Resistance resolution is down to $0.1\ \mu\Omega$, voltage resolution is $10\ \mu\text{V}$. Combined with external USB disk, IT5100 is available for long-term statistics calculation. Built-in comparator function, IT5100 can automatically determine whether the battery parameters meet the standards and count pass rate, which is suitable for a variety of battery's test and pick. Built-in USB / LAN communication interface to support SCPI communication protocol. Single unit of IT5102 support 16 channels batteries measurement, master-slave connection up to max. 17 sets and extension channels quantity up to 272, that greatly improves testing efficiency. Built-in LAN / RS232 communication interface, IT5100 series can be widely applied in cellphone lithium batteries, electric vehicle batteries and other batteries inspection and sorting.

Battery internal resistance tester main functional features

- Support resistance & voltage simultaneously test and display, 4.3 inch LCD screen
- Voltage ranges: $10\ \mu\text{V} \sim 300\ \text{V}$ *2
- Resistance ranges: $150\ \mu\Omega \sim 3000\ \Omega$ *1
- voltage ranges, 7 resistance ranges, optional automatic or manual measuring *3
- Support resistance & voltage simultaneously test, speed up to 125 times / S *4
- Built-in USB, LAN interfaces, supports SCPI protocol.
- IT5102 single unit supports 16 channels testing, max. 17 sets master and slave extension connection *5
- Comparator function: sorting result HI/IN/LOW display
- Available for supporting ITS5300 battery charging & discharging test system automatic measurement.
- 4-terminal AC measurement

*1: IT5101E is $15\text{m}\Omega \sim 3\Omega$, IT5102/5102E is $0.01\text{m}\Omega \sim 2\Omega$

*2: IT5102/5102E is $0 \sim 60\text{V}$

*3: IT5101E、IT5102/5102E resistance is the two range

*4: IT5101/5101E under Ex_Fast mode

*5: IT5102E is 8 channels



Recovery and dismantling, recycling

Recycling and dismantling is mainly for the batteries that cannot enter the gradient use or after the end of the gradient use, need to enter the process of recycling and dismantling, resource optimization process, this process in order to recover as many parts of the battery as possible, used as raw materials for new batteries, will be completely discharged before the battery decomposition process. The main purpose of this is to avoid dangerous voltages or the risk of fire.

ITECH Testing solution for power batteries entering the recovery and disassembly and recycling stage

IT8000/IT-M3300 series Regenerative DC electronic load can simulate various load characteristics and return electrical energy to the grid, which not only saves electricity and heat dissipation cost for users, but also meets the demand of energy saving and environmental protection.

Regenerative and energy saving solutions

IT8000 Series Regenerative DC Electronic Load

- Recover DC energy to local grid with efficiency up to 95%
- Stand-alone power up to 144kW, expandable by master-slave paralleling up to 1152kW
- High power density design provides 18kW in 3U space



IT-M3300 Regenerative DC Electronic Load

- 1U half rack, high power density
- High efficient power regeneration
- Independent control of multi-channels, implement synchronization or proportional tracking



The main advantages of ITECH over traditional battery recycling solutions



Regenerative and energy saving solutions

- IT6600/IT6000 Platform
- IT-M3600
- IT-M3900 Platform
- Common-IT8000
- Regenerative efficiency up to 95%
- ITS5300 Battery Charge&Discharge Test System

Reliability and safety

- Emergency stop warning device
- Anti-reverse connection and anti-ignition
- Power failure prevention
- Power supply over-voltage

Report analysis and statistics

- Statistical analysis is designed to help users quickly obtain key information from a large amount of data and improve the efficiency of battery analysis

Flexible system editing and comprehensive functionality

- Integrated temperature box, water cooling system, etc.
- The channels can be used in parallel or split
- Flexible and simple operation and editing
- Supports real-time communication between the customer's PC and the IT5300 test system, enabling remote start, pause, and real-time status inquiry

Customized testing requirements accepted

- Customized security alarms
- Scan gun function to identify different brands of batteries to complete customized testing process
- Test report uploading to user specified path
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Applications of EIS Testing for Power Battery Reuse and Remanufacturing

Electrochemical Impedance Spectroscopy (EIS) is an analytical technique that probes the dynamic behavior and interfacial phenomena of electrochemical systems by measuring their impedance response to AC signals over a range of frequencies. In practice, it's like giving a battery both a "fingerprint" and a "health check." In second-life/re-manufacturing operations, EIS is widely used to identify capacity-fade mechanisms from frequency-domain features, rapidly estimate state of health (SOH), screen out risky cells/modules, and recommend suitable reuse scenarios (e.g., stationary storage, low-speed EVs, UPS). ITECH IT2705 mainframe paired with multi-channel SMU module IT27814 integrates EIS testing and automatically generates Nyquist and Bode plots. Under multi-frequency excitation (0.1 Hz–20 kHz), it captures subtle responses and reveals potential issues that conventional methods may miss. Results are presented intuitively via Bode and Nyquist plots and fit seamlessly into second-life workflows—e.g., incoming pre-screening, standard scans, cell/module matching, and final outgoing inspection.



Nyquist Plot

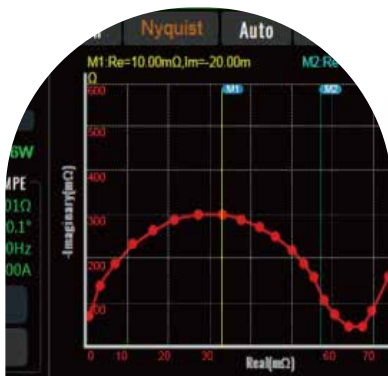


Bode Plot

IT2705 + IT27814 SMU Module — Testing Advantages

- Up to 8 slots per IT2705 mainframe, freely mixed with SMU (IT27814) / DC power / regenerative load modules to deliver a one-stop workflow for EIS + ACIR (AC internal resistance) + capacity / durability tests.
- Integrated charge/discharge with EIS in one setup, avoiding the synchronization and wiring errors common with multi-instrument "patchwork" benches.
- Sweep bandwidth: 0.1 Hz–20 kHz.
- nA-level measurement accuracy and μ s-level dynamic response.
- Minute-scale EIS with multi-channel parallelism enables high-throughput prescreening and shorter test cycles.
- Direct Nyquist/Bode readout, making it easy to classify by $R\Omega$, R_{ct} , and low-frequency diffusion features.
- Multi-channel EIS in one mainframe with unified triggering/power-up sequencing—ideal for incoming inspection and batch grading.
- Four-wire Kelvin, remote sense, and channel isolation supported.
- Built-in high-sampling oscilloscope monitoring (up to 200 kHz) on the IT2705 helps correlate transients (cold start/voltage dips) with EIS operating conditions.

IT2705 Power Analyzer with SMU module



Built-in EIS+EIS waveform analysis—generate Nyquist Plot & Bode Plot directly

✗ Waveform generator ✗ DAQ data acquisition card ✗ Shunt current sensor ✗ PC



IT2705 with IT27814 SMU module



YOUR POWER TESTING SOLUTION



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