

# CS ENERTECH

CREATIVE ENERGY SOLUTION PARTNER

Global Player providing optimum Battery Pack Technology



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## Creative Energy Solution Partner!

CS ENERTECH specializes in rechargeable battery packs. We have been a major battery pack supplier with over ten years' experience and research.

We offer state-of-the-art energy solutions for electric vehicles (EV) including rail vehicles, buses, and golf carts, and energy storage systems (ESS).

The solutions include battery management system (BMS) configurable to different customers' needs and battery pack design for safety and reliability.

We are the first domestic battery packer to be certified by Korea Apparel Testing and Research Institute (KATRI) in 2011.

Since then we have been diversifying our product ecosystem, which extends to battery packs for rail vehicles. As the sole battery vendor of Hyundai Rotem, we developed many types of rail vehicle battery packs for domestic and international sites including Australia and Turkey.

In 2017, we began developing battery packs for Club Car, the largest golf cart maker, with LG Chem Li-Ion Cells. Mass-production and shipping of these battery packs started in late 2018. We developed ESS Module and Rack into our own technology in 2017 and installed total 22.6MWh in past years.

We pursue our goal to be the best energy solution provider for domestic and international customers through solid partnership with global cell makers and pack makers, and active R&D.

CS ENERTECH, 10년 이상의 축적된 Know-how와 지속적인 기술 혁신을 통해 국내 및 해외 대용량 Battery Pack의 선두적인 공급자 역할을 하여 왔습니다.

우리는 고객의 다양한 요구사항에 부합되는 S/W 개발을 통한 BMS Solution과, 안정성을 최우선으로 하는 Pack 설계 역량 확보를 통해, Rail Vehicle, Bus, Golf Cart 등 다양한 EV와 ESS System에 대응하는 최적화 된 Energy Solution과 Service를 제공하고 있습니다.

2011년 한국 Packer로는 처음으로 차량 안전 규격 인증 (KATRI)을 획득함으로써, 기술 신뢰성과 제품 안정성을 인정받아 다양한 고객 제품을 위한 Battery Pack을 개발 공급하게 되었고, Rail Vehicle용 Battery Pack은 현대 Rotem의 Sole Vendor 지위를 확보하며 국내는 물론, 호주, 터키를 비롯한 해외 고객에게까지 다양한 신규 제품을 공급해 오고 있습니다.

2017년 ESS시장 성장과 더불어 독자적인 Module 설계와 Rack 구성으로 단기간에 고효율 ESS를 개발하여, 총 22.6MWh ESS를 제작 설치하여 정상 가동 중이며 LG화학 Li-Ion Cell을 적용하여 세계 No. 1 Golf Cart Maker인 미국의 'Club Car'에 Battery Pack 개발을 성공적으로 완료하여 2018년 11월부터 양산 공급하고 있습니다.

당사는 세계 Global Cell Maker 또는 Pack Maker들과의 전략적 Partnership 및 끊임 없는 연구 개발을 통한 최적의 제품을 만들어 국내, 해외 고객들의 다양한 요구에 만족하는 Energy Solution Partner 가 되도록 노력할 것입니다.

CS ENERTECH specializes in rechargeable battery packs. We have been a major battery pack supplier with over ten years' experience and research.



## Company History

2009~2014	2015~2016	2017~2019
<p><b>2009</b> Separated the business unit from 'CS' (Parent Company) into the battery business unit. 'CS(모회사)에서 배터리 부서 분리</p> <p><b>2011</b> For the first time in Korea, KATRI certification for Plug-in Bus battery (LiFePO4, 98kWh) was obtained. 국내 최초 플러그인 버스 배터리 (LiFePO4, 98kWh)에 대한 KATRI 인증을 획득</p> <p><b>2013</b> Developed wireless charging bus battery pack. 무선 충전 버스 배터리 팩 개발 Separated from CS Co., Ltd., established CS Enertech. 'CS(주)와 분리하여 CS Enertech 설립</p> <p><b>2014</b> ESS supply official dealer, packer registration, cell supply contract with LG Chem. 'LG화학'과 ESS 공급 업체, 패커 등록, 셀 공급 계약</p>	<p><b>2015</b> KATRI certification of replaceable battery system. 교체형 배터리 시스템의 KATRI 인증 획득 Started mass production of batteries for Hyundai Rotem iron cars. '현대Rotem' 철차용 배터리 양산 시작</p> <p><b>2016</b> Acquired KATRI certification for Plug-in type bus battery system. Plug-in 타입 버스 배터리 시스템의 KATRI 인증 획득 Signed a battery supply contract with 'Club Car', the No. 1 golf cart in the US (LG Chemical) '18/11 ~ mass production supply through self designed). 미국 골프 카트 1위 'Club Car'와 배터리 공급 계약 체결(LG화학) (자체 개발 통해 '18/11~ 양산 공급)</p>	<p><b>2017</b> Mass production as a sole vendor of Hyundai Rotem. '현대로템' sole vendor로 양산 (철차 부문)</p> <p><b>2018</b> Developed the own ESS model of CS Enertech Co., Ltd. and delivered ESS 12 MW (Wooljin, CJ Hello). CS Enertech Co., Ltd.의 자체 ESS 모델을 개발하고 ESS 12 MW (우진, CJ헬로)를 납품</p> <p><b>2019</b> Renewal &amp; Obtaining Certificate as ISO 9001, ISO14001, IATF16949 ISO 9001, ISO14001, IATF16949 갱신 및 취득 Developed LEV Module, contracted and delivered Daepoong EV LEV Module 개발, 대풍EV 계약 및 납품</p>

## Clients



## The Most Valuable Energy Partner!

CSE has secured new market creation and leading position through participating in various national project and new battery technology development.

Currently, CSE shares partnership sales strategy with battery manufacturers.

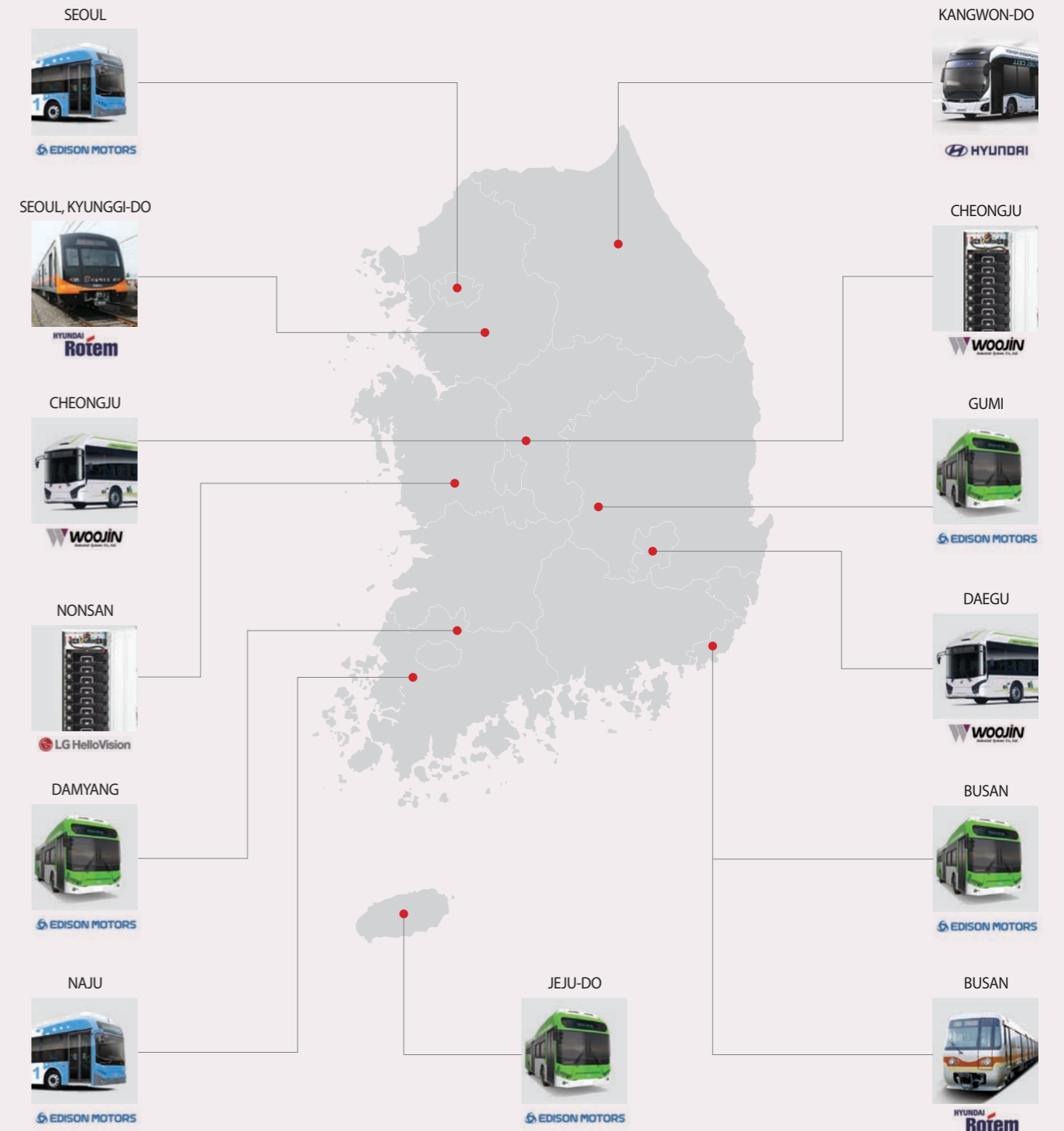
Especially, CSE is striving to enter to not only local market but also America, Japan, Europe and China market through strong partnership with global cell suppliers including LG Chem which possesses globally competitive technology in electric lithium secondary battery sphere.



### Overseas (Golfcart, Railway, Tram)



### Domestic (e-Bus, Railway, ESS)

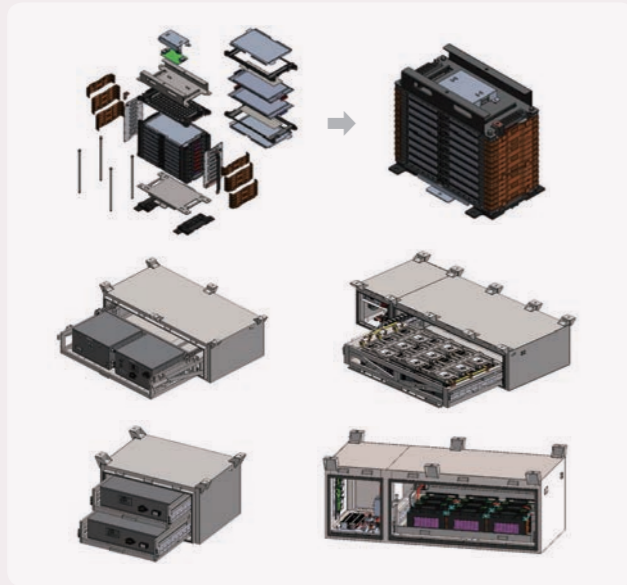


## Applications – Train

### Supply for main railway battery pack

- Being the first domestic supplier of Li-Ion battery packs for Hyundai Rotem's trains
- CSE expands its train battery business to many countries including Indonesia, Philippines, Turkey and Australia
- The business also covers battery maintenance

#### PACK TYPE



#### PACK SPECIFICATION

Configuration	4P 27S
Voltage	98.6V
Capacity	212 Ah
Energy	29.0 kWh
Weight	Max. 150 kg
Dimension	1,060(L) × 540(W) × 270(H)
IP rating	IP65
Cooling	Air cooling with thermal pads and fans

#### TRAIN TYPE



KOREA  
HYUNDAI  
**Rotem**



AUSTRALIA  
HYUNDAI  
**Rotem**



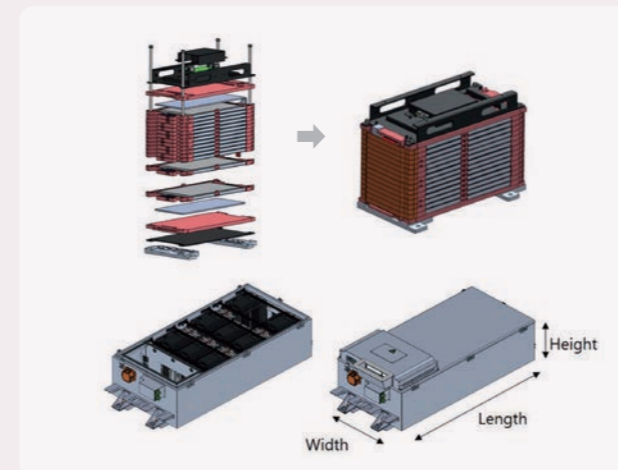
TURKEY  
HYUNDAI  
**Rotem**

EMU260 (Main)	114 car	29 kWh
Gyeongwon Line (KORAIL)	18 car	9.7 kWh
Gyeongin Line (KORAIL)	40 car	9.7 kWh
Gwacheon Ansan (KOREAIL)	70 car	9.7 kWh
Donghae Line Communication	28 car	1.4 kWh
Turkey Antalya	90 car	5.5 kWh
Turkey Yenikapi	68 car	13.9 kWh
Turkey Istanbul	80 car	15.7 kWh
Turkey Izmir	190 car	5.5 kWh
Phillippines Manila	108 car	20.9 kWh
Australia Sydney	512 car	20.8 kWh
SEOUL 2, 3 LINE	210 car	9.7 kWh

## Applications – Bus

- Supply Battery (Li-ion polymer) Pack to major domestic electric bus manufacturers such as Hyundai, Edison Motors, and Woojin Industrial Systems
- Based on the experience of bus installation in Seoul, Busan, Jeju, and Cheongju, the optimal space utilization pack design
- Providing a BMS solution with an efficient charge / discharge algorithm based on actual system operation

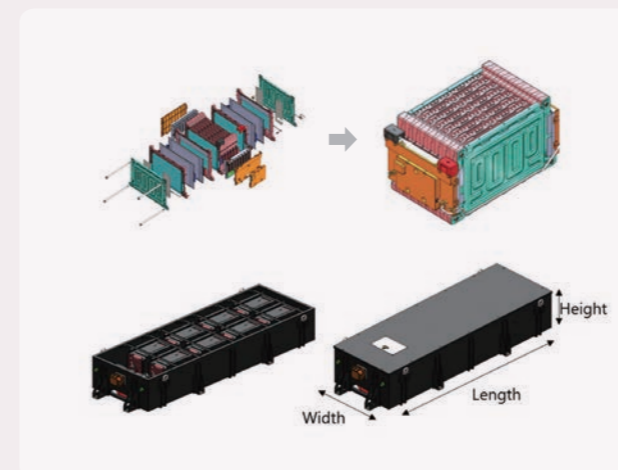
#### PACK TYPE 1



#### PACK SPECIFICATION

Configuration	1P 168S
Voltage	613.4V
Capacity	53 Ah
Energy	32.5 kWh
Weight	Max. 330 kg
Dimension	1,400(L) × 670(W) × 496(H)
IP rating	IP43
Cooling	Air cooling with thermal pads and fans

#### PACK TYPE 2



#### PACK SPECIFICATION

Configuration	1P 176S
Voltage	642.4V
Capacity	53 Ah
Energy	34.0 kWh
Weight	Max. 360 kg
Dimension	1,880(L) × 660(W) × 390(H)
IP rating	IP43
Cooling	Air cooling with thermal pads and fans

#### BUSTYPE



**woojin**  
Woojin Industrial Systems Co., Ltd.



**EDISON MOTORS**



**HYUNDAI**  
HYUNDAI MOTOR GROUP  
(Hyundai Hydrogen Bus)

## Applications – Golf Cart



- Providing top golf cart maker Club Car in USA with the battery (Li-Ion) pack that designs to the tight and standards of commercial vehicles
- Applied Li-Ion Battery Cell (Pouch Type) manufactured by one of the best battery makers, LG Chem
- Excellent safety and reliability achieved through over three years' research and development, supported by numerous certificates (Vibration, shock, temperature, etc)
- Simple design allowing flexible pack configuration (1P/2P)

### ➤ OPTIMIZATION SYSTEM



### ➤ PACK TYPE



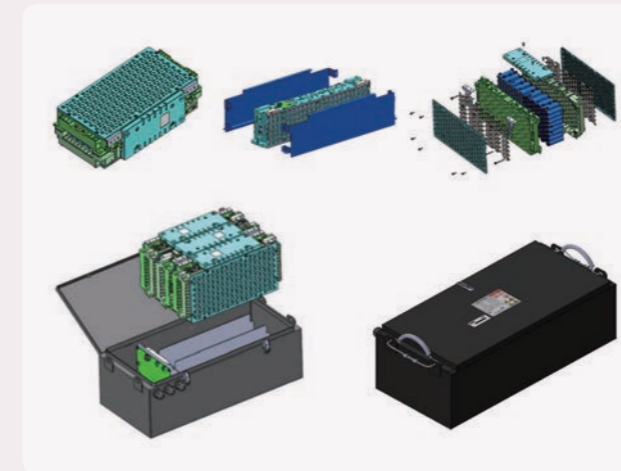
### ➤ 1P/2P PACK SPECIFICATION

Golf-Cart and Utility-Cart	Configuration	1P 16S / 2P 16S
	Voltage	58.4V
	Energy	3.1 / 6.2 kWh
	Weight	53 / 73 kg
	Cooling	Air cooling with thermal pads

## Applications – LEV Light Electric Vehicle

- Providing top golf cart maker Club Car in USA with the battery (Li-Ion) pack that designs to the tight and standards of commercial vehicles
- Applied Li-Ion Battery Cell (Pouch Type) manufactured by one of the best battery makers, LG Chem
- Excellent safety and reliability achieved through over three years' research and development, supported by numerous certificates (Vibration, shock, temperature, etc)
- Simple design allowing flexible pack configuration (1P/2P)

### ➤ PACK TYPE



### ➤ PACK SPECIFICATION

Configuration	24P 18S
Voltage	65.7V
Capacity	68.4 Ah
Power	4.4 kWh
Cell	Li-Ion Cylindrical
IP rating	IP43
Cooling	Air cooling with thermal pads and fans

### ➤ Applied Model : Dae-Poong LEV

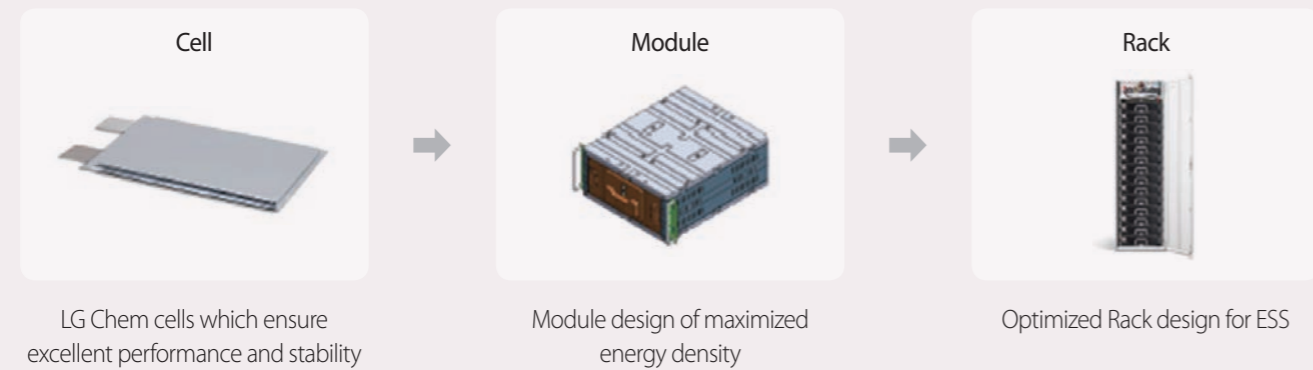
- Independently designed BMS application
- The highest performance SDI 18650 cylindrical cell is applied
- Passed international standards for vibration and thermal shock (KS R & IEC 60068)



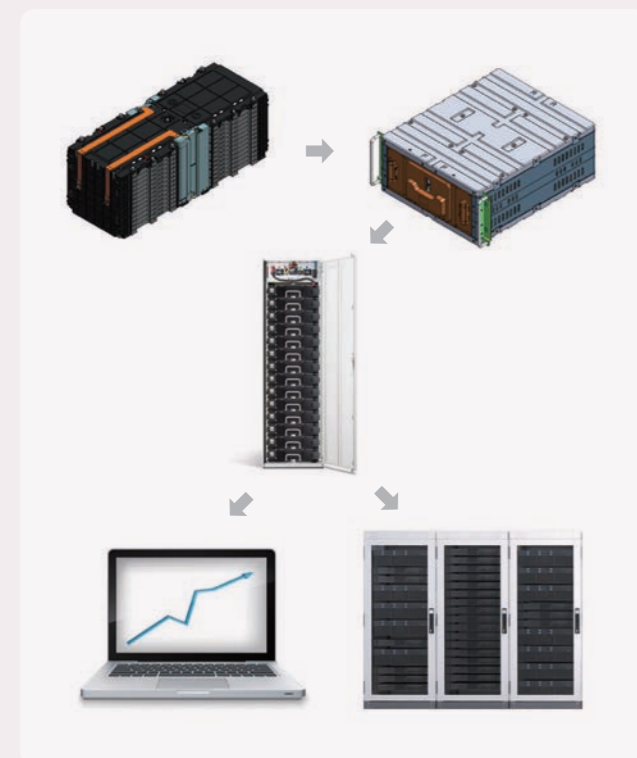
## Applications – ESS Energy Storage System

- CS EnerTech developed its own ESS battery module
- Our ESS adopted by CJ Hello and Woojin Industrial System size up to 22.6MWh

### OPTIMIZATION SYSTEM



### RACKTYPE



### ESS (Energy Storage System)

As a subsystem of smart-grid, it enables efficient integration of local renewable energy sources such as PV systems into the main power grid. It can also work as stand-alone system for balancing electricity production and consumption.

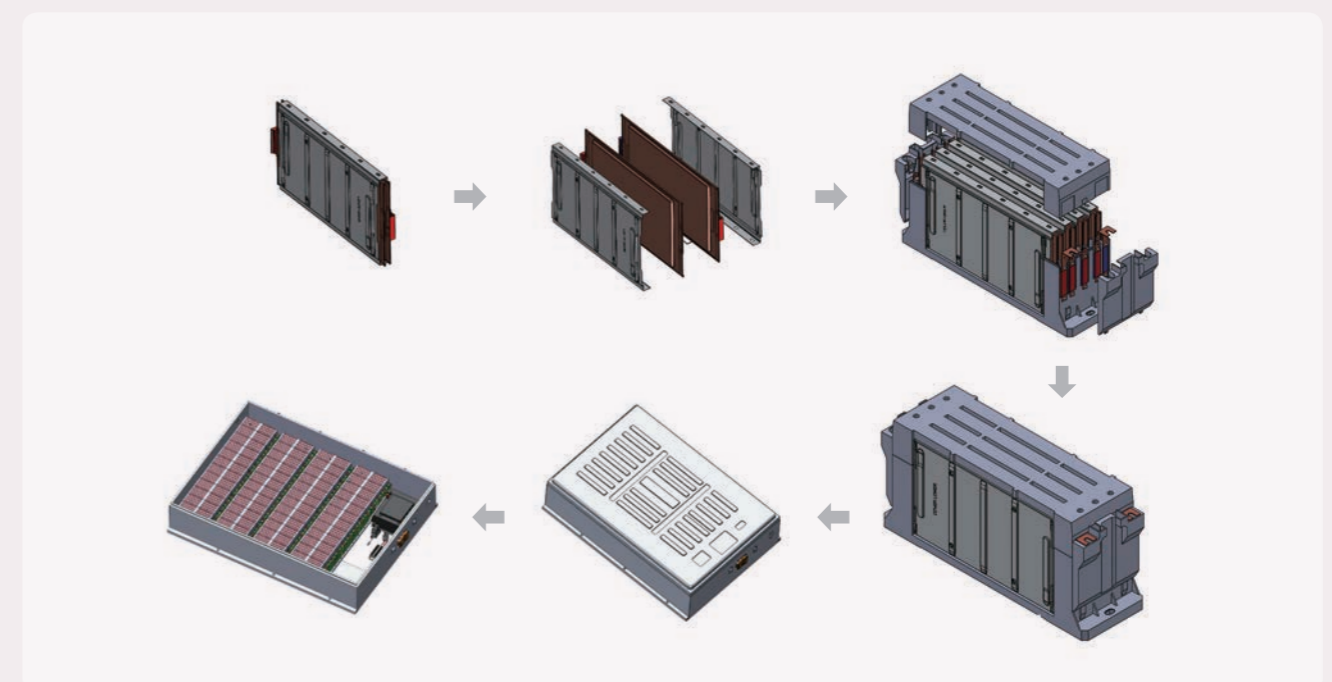
ESS	Configuration	4P 238S
	Voltage	880.6V
	Energy	116.5 kWh
	Weight	1,250 kg

## Applications – Construction Equipment



- Developed battery charging method for 3.5 ton excavator.
- LG Chem lithium ion pouch cell applied.
- Independent development of BMS for high power control.
- Battery pack system suitable for customer requirements.

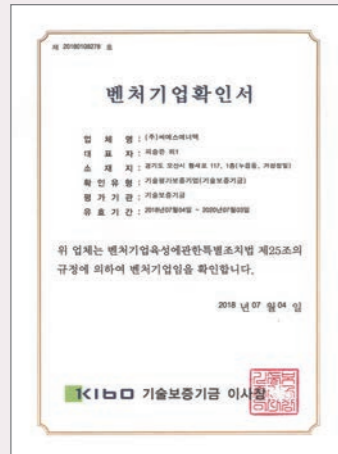
CONFIGURATION	
Cell	LGC E65, 3.65V / 65Ah
Module	1.90kWh_ 4S2P, 14.6V / 130Ah
Pack	45.55kWh_ 96S2P, 350.4V / 130Ah



# CS EnerTech Features

- Providing H/W(Hardware) & S/W(Software) of accumulated BMS (Battery Management System) design technology over 10 years
- Providing optimal BMS algorithm according to user's environment analysis
- Safety and performance-proven module design based on vibration / thermal analysis
- Remote automatic management of battery status by applying IoT (Internet of Things)
- Satisfaction of customers through prompt response in case of quality problems
- Various functional tests and quality equipment
- Design for extensibility to additions or adaptation models
- High reliability due to use of parts considering external environmental conditions
- 10년 이상의 축적된 BMS(Battery Management System) 설계 기술이 반영된 H/W(Hardware) & S/W(Software) 제공
- 사용자 환경 분석에 따른 최적의 BMS 알고리즘 제공
- 진동/열 분석을 기반으로 안전하고 성능이 입증된 모듈 설계
- IoT(Internet of Things)를 적용하여 배터리 상태를 원격으로 자동 관리
- 품질 문제 발생시 신속한 대응을 통한 고객 만족도 향상
- 다양한 기능 Test 및 신뢰성 장비 보유
- 적응 모델의 추가 또는 확장성을 위한 설계
- 외부 환경 조건을 고려한 부품 사용으로 인한 높은 신뢰성

# Main Production Line



## Certifications of Quality Management



IATF 16949



ISO 9001



ISO 14001



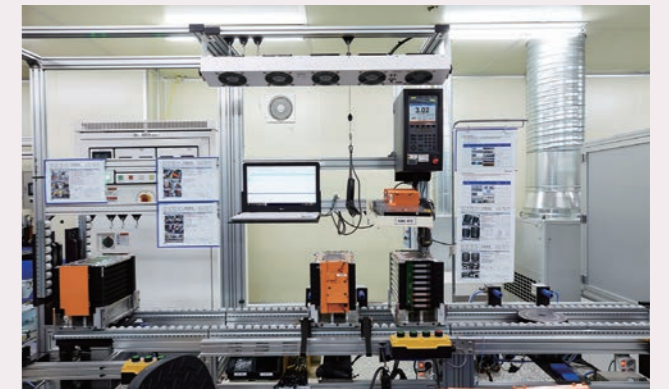
Auto Spot Welding Machine



Charging/Discharging Equipment



Charging/Discharging Equipment



Torque Recorder



Air Robot



Auto Laser Welding Machine



Voltage Tester



Voltage Tester

## Reliability Test Instruments



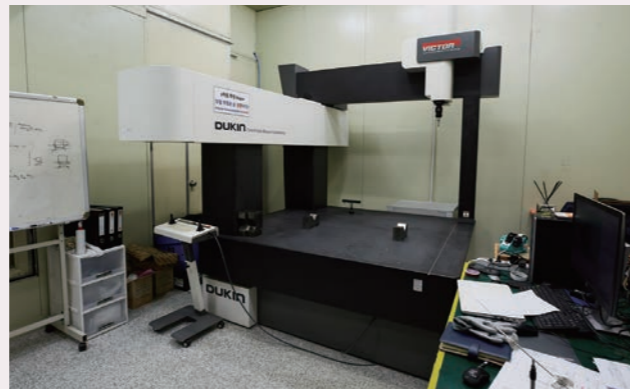
Charging/Discharging Equipment



Thermal Chamber



Thermal Room Chamber



3D Measuring Machine



Pack Function Tester



Pack Function Tester



Pack Function Tester



Pack Function Tester

***Creative Energy Solution Partner!***

**The Most Valuable Energy Partner!  
Optimized Battery Pack Solution Provider!**

