

Innovation  
for a Better Life



# CHANGE YOUR ENERGY CHARGE YOUR LIFE

ADVANCED BATTERIES  
FOR ENERGY STORAGE

# Introducing LG Chem

## LG Chem at a Glance

### Energy Solutions



### Basic Materials & Chemicals



### IT & Electronics Materials

Foundation	1947
Headquarters	Seoul, Korea
Employees	26,000
Sales Revenue	USD 18B (2015)

## Energy Solutions

With 22 years of experience in successfully delivering products and solutions to customers in the global energy sector, LG Chem is recognized as the industry leader in Lithium-ion battery manufacturing.

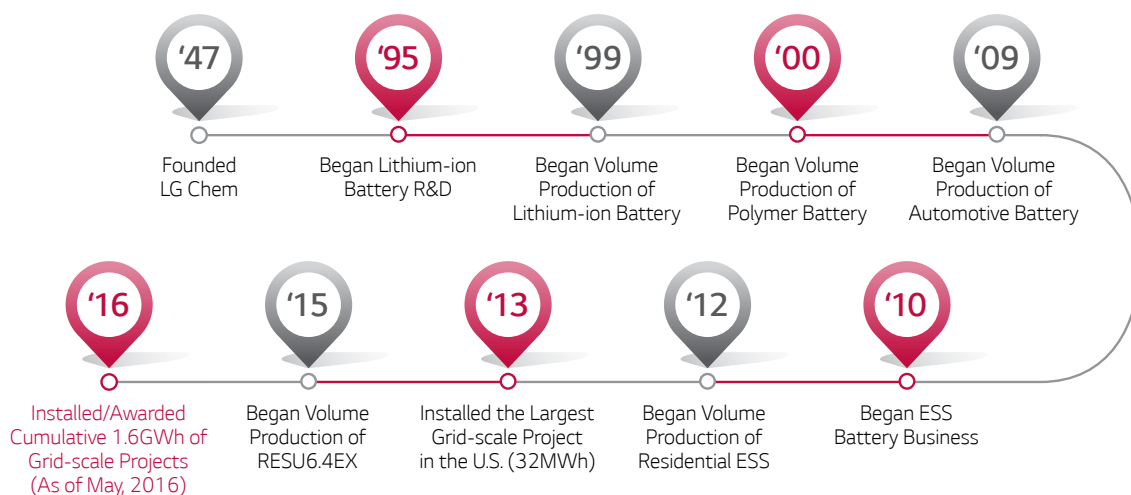


## Global Operation of Energy Solutions

LG Chem is successfully implementing rapid go-to-market strategies across its wide range of global networks. By locating manufacturing plants in the three strategic locations of Korea, China, and the U.S., LG Chem can supply batteries to meet the needs of local customers in the most efficient and timely manner.



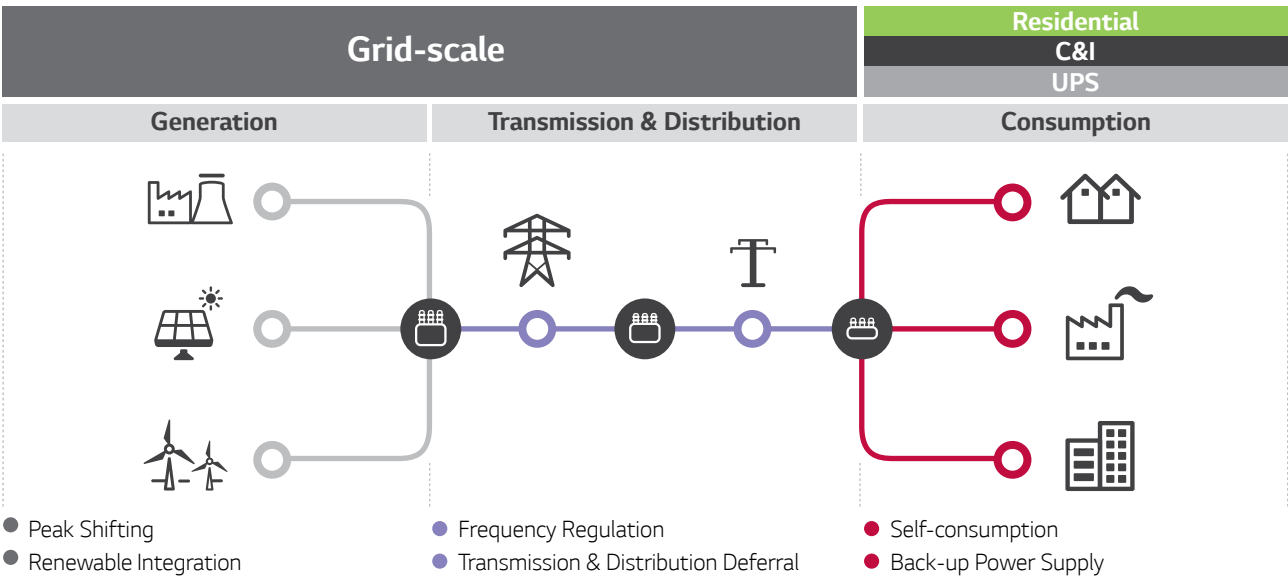
## Business History of Energy Solutions



# Total Solutions for ESS (Energy Storage System)

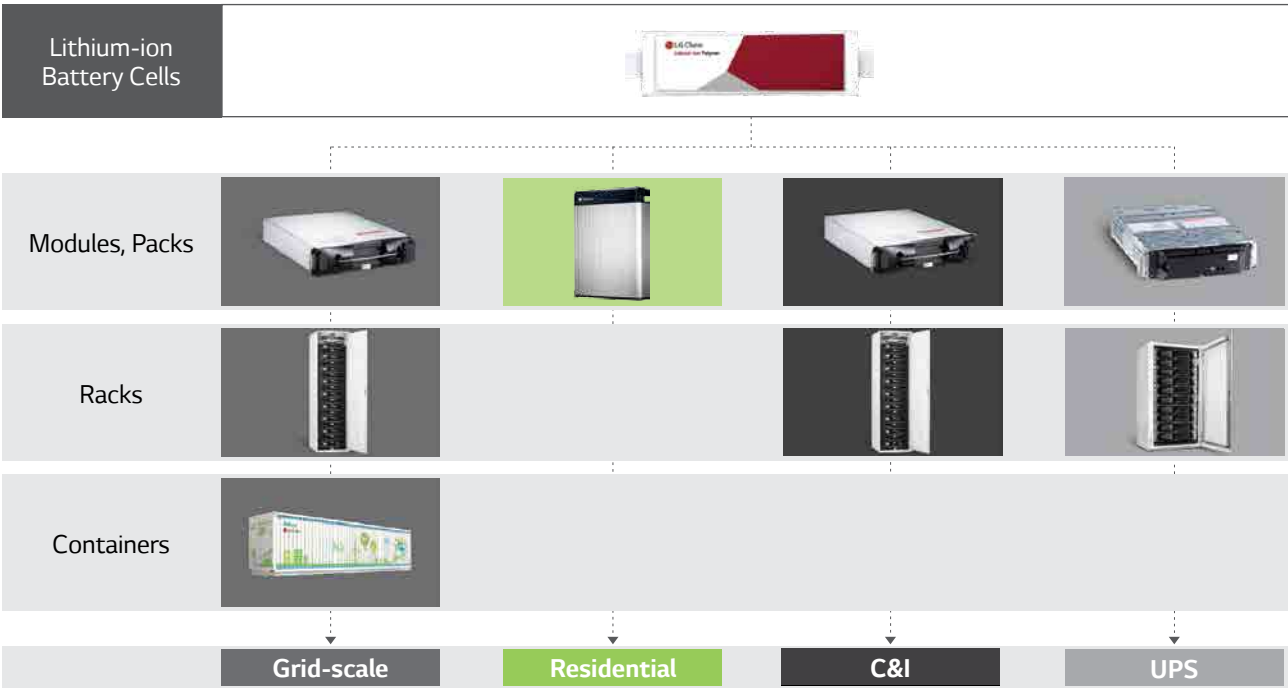
## Applications of ESS

ESS (Energy Storage System) provides solutions for applications throughout power supply systems including Grid-scale, Residential, C&I (Commercial and Industrial), and UPS (Uninterruptible Power Supply).



## Product Portfolio

LG Chem offers a wide variety of products, such as Battery Cells, Modules, Packs, Racks, and Containers that allow our customers to source total solutions.

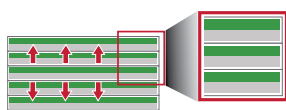


# Technical Strengths

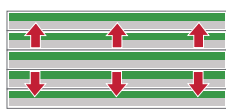
## Lithium-ion Battery Cell

### Compactness & Long Lifespan

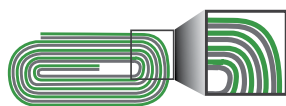
LG Chem's L&S (Lamination & Stacking) process minimizes dead space, enables higher energy density, and enhances the sustainability of cell structures.



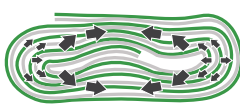
LG Chem : L&S  
Less dead space



LG Chem : L&S  
Stable cell structure after cycles



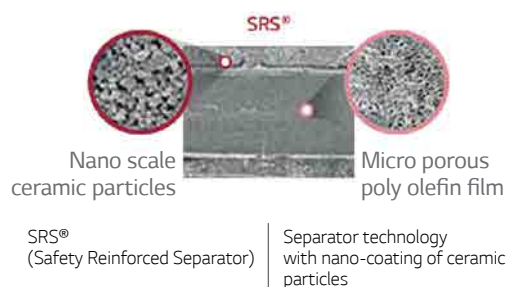
Others : Winding



Others : Winding

### Safety

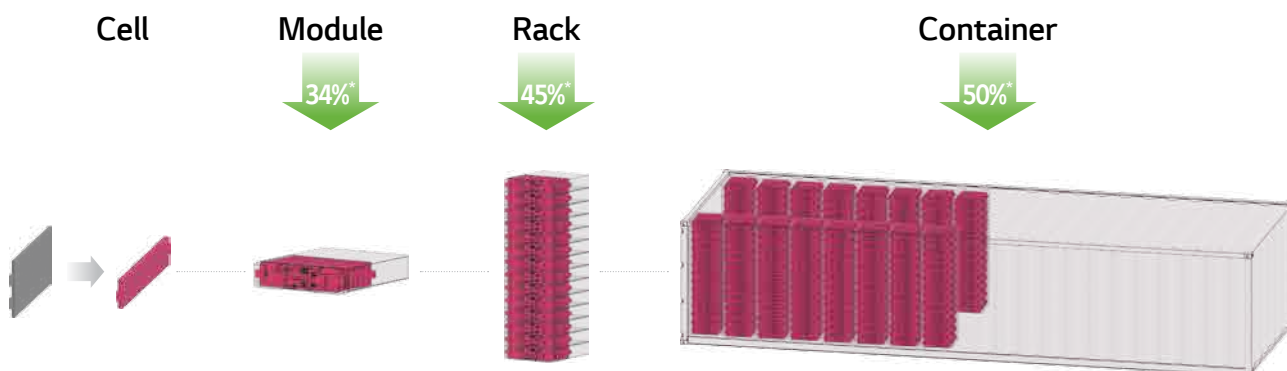
LG Chem's SRS® (Safety Reinforced Separator) increases the mechanical and thermal stability of battery cells.



## Battery System

### System Optimization

The high energy density and optimal dimensions of our new generation of Energy Cell (JH3) and Power Cell (JP3) have allowed us to radically improve the efficiency of pack design. In 2016, LG Chem is introducing this enhanced space efficiency in its Modules, Racks, and Containers.



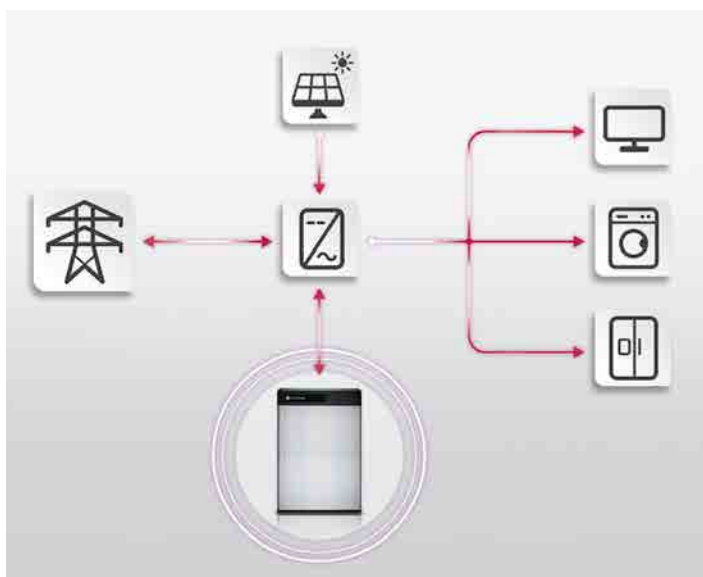
- High Energy Density 355Wh/ℓ → 410Wh/ℓ (15% ↑)
- Optimized Dimension for 19-inch Standard Racks

\* % of Space Reduction  
(Comparison with former models)

# LG Chem ESS Solutions

## Residential ESS

An ESS can store surplus energy generated from rooftop photovoltaic panels for use when needed. When the sun has set, energy demand is high, or there is a black-out, you can use the energy stored in your ESS to meet your energy needs at no extra cost. In addition, an ESS helps you pursue the goal of energy self-consumption and ultimately energy-independence.



### Electricity Bill Saving

- Charge during off-peak times
- Discharge during peak times

### Self-consumption

- Store solar energy generated from photovoltaic panels for the future use.

### Emergency Power Back-up

- Discharge during a black-out, functioning as back-up power



RESU6.4EX (Former model)

*Slimmer & Lighter*

**RESU**



RESU6.5



## Key Features of New RESU Series



### Compact Size & Easy Installation

The compact and lightweight nature of the RESU is world-class. It is designed to allow easy wall-mounted or floor-standing installation for both indoor and outdoor applications. The inverter connections have also been simplified, reducing installation time and costs.



### Powerful Performance

The new RESU series features industry-leading continuous power (4.2kW for RESU6.5) and DC round-trip efficiency (95%). LG Chem's L&S (Lamination & Stacking) technology provides durability ensuring 80% of capacity retention after 10 years.



### Proven Safety

LG Chem places the highest priority on safety and utilizes the same technology for its ESS products that has a proven safety record in its automotive battery. All products are fully certified in relevant global standards.



### Diversity in Product & Capacity Options

A total of five different models are available to meet customers varying needs with respect to voltage and capacity. With the RESU Plus, all 48V models can be "cross-connected" with one other 48V unit of any capacity. This allows the RESU range to offer energy storage capacities from 3.3kWh to 19.6 kWh.

48V

3.3kWh

6.5kWh

9.8kWh

400V

7.0kWh

9.8kWh

**RESU PLUS**

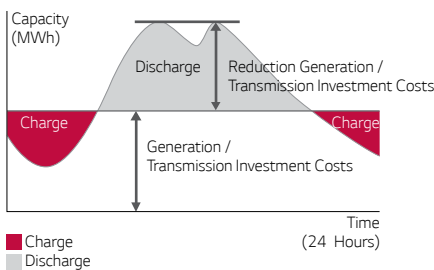
RESU Plus is an expansion kit specially designed for 48V models of new RESU series.  
Number of expandable battery units: Up to 2EA



# LG Chem ESS Solutions

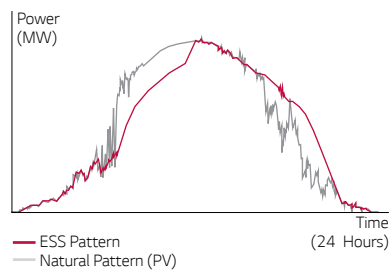
## Grid-scale ESS

For stabilizing the grid, an ESS provides capabilities such as peak shifting, renewable integration, and frequency regulation. With our world-leading Lithium-ion battery technology, LG Chem can offer an entire battery system for grid-scale ESS applications.



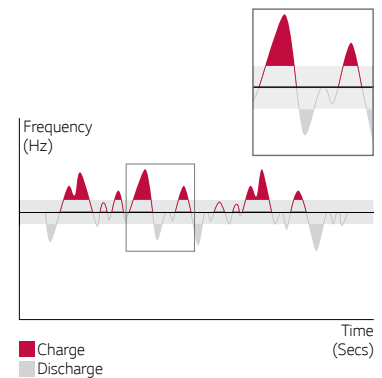
### Peak Shifting

- Charge during off-peak times
- Discharge during peak times



### Renewable Integration

- Stabilize the intermittent renewable power by alternately charging and discharging

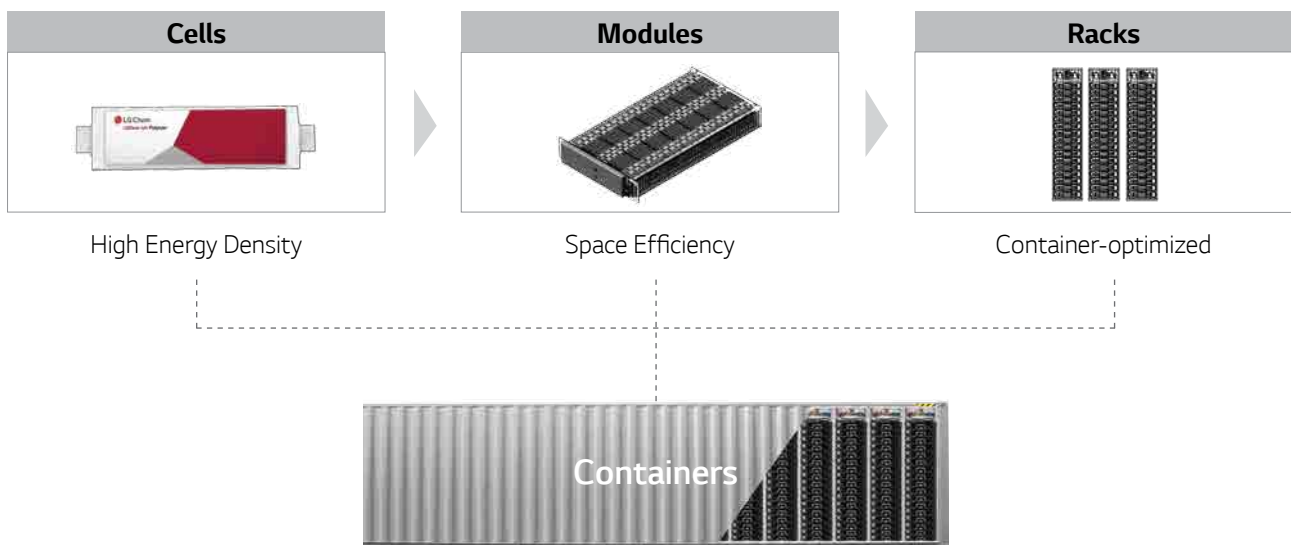


### Frequency Regulation

- Charge when grid frequency increases
- Discharge when grid frequency decreases

## Advanced Battery System of LG Chem

LG Chem focuses on supplying advanced battery systems, including Cells, Modules, Racks, and Containers.



- World's Biggest Loading Capacity (4.8MWh, 40ft HC ISO Container)
- Optimized System Configuration



## Global Reference

LG Chem has installed or been awarded approximately 1.6GWh of grid-scale projects since the launch of our ESS business.

**1.6GWh**  
(As of May, 2016)

**World-leading Grid-scale ESS supplier with extensive experience and proven reference projects**

\* Cumulative amount of installed/awarded projects



\* Consisting of two or more grid-scale applications

# Specifications

## Grid-scale ESS



### Energy

Long-duration applications with continuous power supply (> 1 hour)

#### Energy Module



Models	M4863P3B	M48126P3B	M48189P3B
Energy [kWh]	3.3	6.5	9.8
Capacity [Ah]	63	126	189
Nominal Voltage [V]	51.8	51.8	51.8
Voltage Range [V]	42.0~58.8	42.0~58.8	42.0~58.8
Dimension [W x H x D, mm]	445 x 110 x 339	445 x 110 x 587	445 x 110 x 846
Weight [kg]	25	44	68

#### Energy Rack



Models	R800 (14 Modules)		
	M4863P3B	M48126P3B	M48189P3B
Energy [kWh]	45.7	91.3	137.0
Capacity [Ah]	63	126	189
Nominal Voltage [V]	725	725	725
Voltage Range [V]	588~823	588~823	588~823
Dimension [W x H x D, mm]	520 x 1,880 x 425	520 x 1,880 x 670	520 x 1,880 x 930
Weight [kg]	435	707	1,075



Models	R1000 (17 Modules)		
	M4863P3B	M48126P3B	M48189P3B
Energy [kWh]	55.5	110.9	166.4
Capacity [Ah]	63	126	189
Nominal Voltage [V]	881	881	881
Voltage Range [V]	714~1,000	714~1,000	714~1,000
Dimension [W x H x D, mm]	520 x 2,200 x 425	520 x 2,200 x 670	520 x 2,200 x 930
Weight [kg]	517	848	1,292

#### Energy Container



Models	40ft HC ISO Container
	M48126P3B
Energy [MWh]	4.8
System Voltage [V dc]	714~1,000
Dimension [W x H x D, m]	12.2 x 2.9 x 2.5
Weight [ton] (with battery)	50
Ambient Temperature [°C]	-20~50
Communication	CAN 2.0 B, Modbus TCP/IP

(System design can be changed according to customer requirements)



## Power

Short-duration applications with fast response, high power supply (< 1 hour)

### Power Module



Models	M4864P6B	M48128P6B
Energy [kWh]	3.3	6.6
Capacity [Ah]	64	128
Nominal Voltage [V]	51.5	51.5
Voltage Range [V]	42.0~58.8	42.0~58.8
Dimension [W x H x D, mm]	445 x 110 x 344	445 x 110 x 592
Weight [kg]	28	47

### Power Rack



Models	R800 (14 Modules)	
	M4864P6B	M48128P6B
Energy [kWh]	46.2	92.3
Capacity [Ah]	64	128
Nominal Voltage [V]	721	721
Voltage Range [V]	588~823	588~823
Dimension [W x H x D, mm]	520 x 1,880 x 425	520 x 1,880 x 670
Weight [kg]	472	758
Models	R1000 (17 Modules)	
	M4864P6B	M48128P6B
Energy [kWh]	56.0	112.1
Capacity [Ah]	64	128
Nominal Voltage [V]	876	876
Voltage Range [V]	714~1,000	714~1,000
Dimension [W x H x D, mm]	520 x 2,200 x 425	520 x 2,200 x 670
Weight [kg]	562	909

### Power Container



Models	40ft HC ISO Container
	M48128P6B
Energy [MWh]	4.0
System Voltage [V dc]	714~1,000
Dimension [W x H x D, m]	12.2 x 2.9 x 2.5
Weight [ton] (with battery)	50
Ambient Temperature [°C]	-20~50
Communication	CAN 2.0 B, Modbus TCP/IP

(System design can be changed according to customer requirements)

## Residential ESS

**RESU**


### 48V



Models		RESU3.3	RESU6.5	RESU10
Total Energy [kWh]		3.3	6.5	9.8
Usable Energy [kWh]		2.9	5.9	8.8
Capacity [Ah]		63	126	189
Nominal Voltage [V]		51.8	51.8	51.8
Voltage Range [V]		42.0~58.8	42.0~58.8	42.0~58.8
Dimension [W x H x D, mm]		452 x 401 x 120	452 x 654 x 120	452 x 483 x 227
Weight [kg]		31	52	75
Enclosure Protection Rating		IP55		
Communication		CAN 2.0 B		
Certificates	Cell	UL1642		
	Product	CE / RCM / TUV (IEC 62619) / UL1973		

Compatible Inverter Brands : SMA, SolaX, Sungrow, Schneider, Ingeteam, GoodWe, Redback, Victron Energy  
(As of 3Q. 2016, More brands to be added)

### 400V



Models		RESU7H	RESU10H	
Total Energy [kWh]		7.0	9.8	
Usable Energy [kWh]		6.6	9.3	
Capacity [Ah]		63	63	
Voltage Range [V]		350~450	350~450	385~550
Dimension [W x H x D, mm]		744 x 692 x 206	744 x 907 x 206	
Weight [kg]		76	97	99.8
Enclosure Protection Rating		IP55		
Communication		RS485	RS485	CAN 2.0 B
Certificates	Cell	UL 1642		
	Product	TUV (IEC 62619) / CE	TUV (IEC 62619) / UL1973 / CE	

Compatible Inverter Brands : SMA, SolarEdge, Delta (As of 3Q. 2016, More brands to be added)

## C&I ESS

Models	R400	R600	R800 Bi Polar	R800		R1000	
Energy [kWh]	45.7	65.2	91.3	91.3	131.0	110.9	166.4
Capacity [Ah]	126	126	126	126	189	126	189
Nominal Voltage [V]	363	518	±363	725	725	880	880
Voltage Range [V]	294~412	420~588	294~412 -294~-412	588~823	588~823	714~1,000	714~1,000
Dimension [W x H x D, mm]	520 x 1,200 x 670	520 x 1,880 x 670	520 x 2,200 x 670	520 x 1,880 x 670	520 x 1,880 x 930	520 x 2,200 x 670	520 x 2,200 x 930
Weight [kg]	400	570	760	740	1,160	890	1,350
Certificates	UL 1973 (Listed), IEC 61000-6-2 / 61000-6-3, FCC Part 15 Class A						

## IDC UPS

Models	UPS Rack (10 Modules, 600V)	
	M4850P1B	M4860P2B
Energy [kWh]	27.4	32.1
Continuous Power [kW]	123	96
Capacity [Ah]	54	63
Nominal Voltage [V]	511	518
Voltage Range [V]	420~588	420~588
Dimension [W x H x D, mm]	600 x 600 x 2,000	600 x 600 x 1,800
Weight [kg]	440	435

## Telecom. UPS



Models	M4860P2S	M4863P3S	M48126P3S	M4830P2S1
Energy [kWh]	3.2	3.3	6.5	1.6
Capacity [Ah]	63	63	126	31.5
Nominal Voltage [V]	51.8	51.8	51.8	51.8
Voltage Range [V]	42.0~58.8	42.0~58.8	42.0~58.8	42.0~58.8
Dimension [W x H x D, mm]	445 x 122 x 600	455 x 110 x 339	455 x 110 x 587	182 x 212 x 278
Weight [kg]	35	26	44	14



## Energy Solutions Company ESS Battery Division

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### LG Chem ESS Partner Portal

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<http://www.lgesspartner.com>

