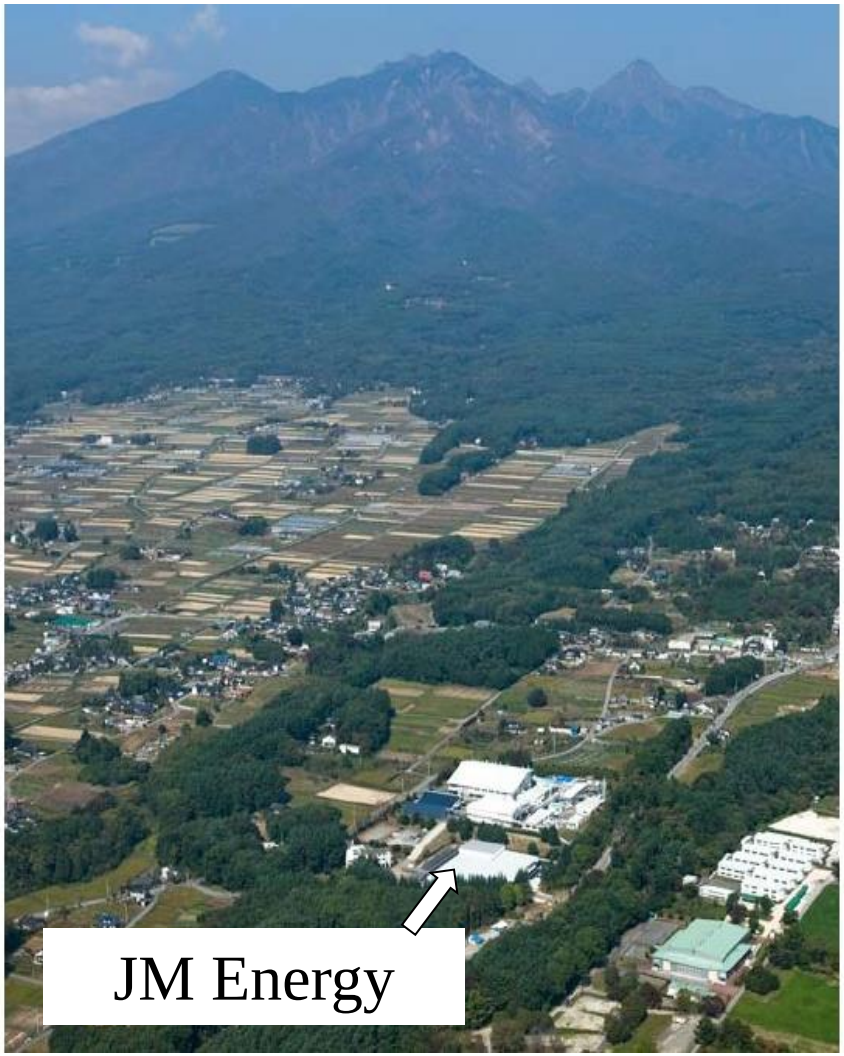
JM Energy and LIC Introduction

September 2015

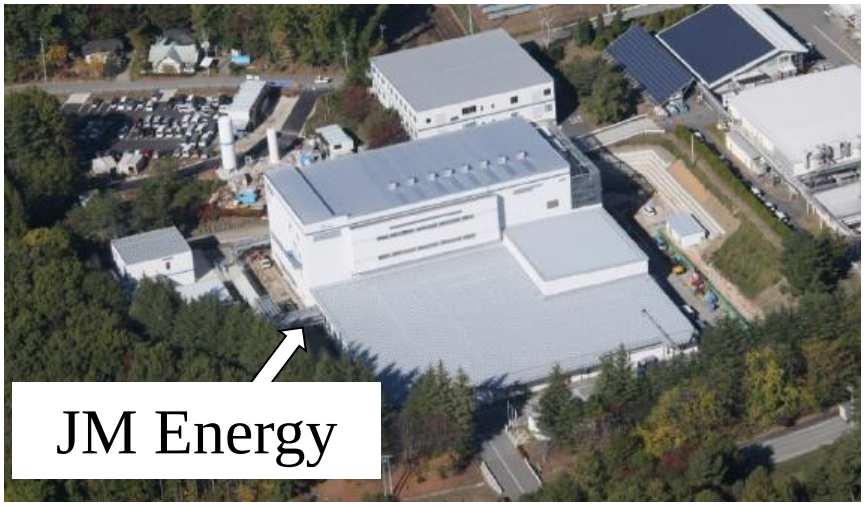
Confidential

JM Energy Corporation (Yamanashi HQ Plant)



JM Energy:
Established August 1st, 2007
HQ Plant:
Launched November 11th, 2008

ISO 9001: 2008
ISO 14001: 2004
certified



ULTIMO

JSR CORPORATION AND JM ENERGY

Japan Synthetic Rubber was created by the Japanese government to produce synthetic rubber for making car tires

Since 1957 JSR has developed a unique expertise in the field of polymer chemistry

JSR is a $4 billion supplier of advanced polymer materials with more than 5,000 employees

JSR is the parent company of JM Energy Corporation

ULTIMO

JM ENERGY CORPORATION AND MANUFACTURING PLANT

JM Energy was founded on Aug. 1st 2007 as a subsidiary of JSR Corporation to develop, to produce and to supply lithium ion capacitor (LIC) cells.

The world first LIC commercial plant operates in Hokuto-city, 150 miles west of Tokyo, since Nov. 11th 2008.

We develop and manufacture 2 types of LIC cells, Laminate cell and Prismatic cell, for various application. With production capacity more than 3million cells/year.

ISO 9001: 2008
ISO 14001: 2004
certified

JSR's Global Network

JSR Micro N.V.
(Leuven, Belgium

JM Energy Co.
(Hokuto, Yamanashi)

JSR Micro Korea Co., Ltd.

JM Energy Tokyo Office
JSR Corporation
(Tokyo)

JSR Micro, Inc.
(Sunnyvale, CA)

Wallisellen Branch
(Switzerland)

JSR
Yokkaichi Research Center
（Yokkaichi, Mie）
Yokkaichi Plant
Tsukuba Research Center
Kashima Plant
Chiba Plant

JSR Trading, Inc.
(Cincinnati, OH)

JSR Shanghai

JSR Micro
Taiwan Co., Ltd.

Singapore Office

JSR Micro Kyushu Co., Ltd.
JSR Optech Tsukuba Co., Ltd.
JSR MICROTECH Inc.
JSR Life Science Co.

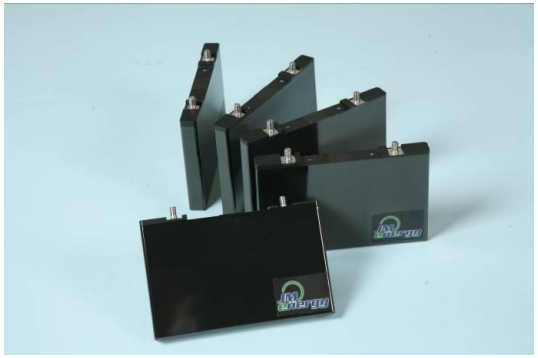
New Commercial Plant for Prismatic LIC Cells

Commercial production at the new plant shall start in June, 2015

Production Capacity:

Laminate cell: 300K cells/year

Prismatic cell: 120K cells/year => 3,000k / year !



Introduction of “ULTIMO”

JM Energy’s Lithium Ion Capacitor

JM Energy's Product Line-Ups

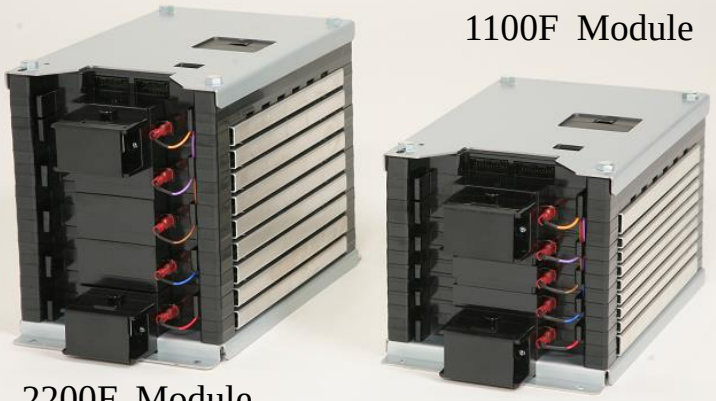
- Ultra Low Resistance（ULR）laminate cells & modules
- Ultra Low Resistance（ULR）prismatic cells & modules

LAMINATE CELL
1100F, 2200F

ON SALE

LAMINATE CELL MODULE

1100F Module



2200F Module

ON SALE

PRISMATIC CELL
2300F, 3300F

ON SALE

PRISMATIC CELL MODULE

ON SALE

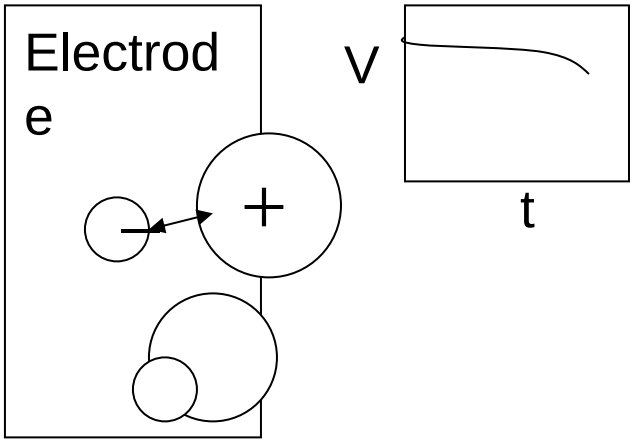
Difference between Battery and Capacitor

Battery

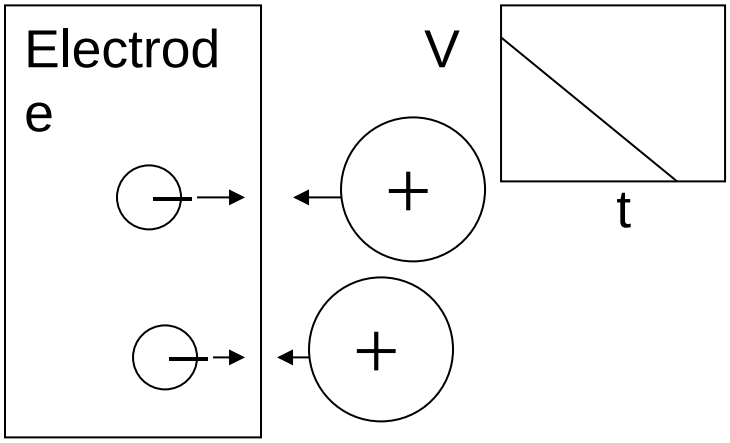
Based on electrochemical reactions.
→Slow charge/discharge rate.

Capacitor

Based on electrostatic induction.
→Rapid charge/discharge rate.



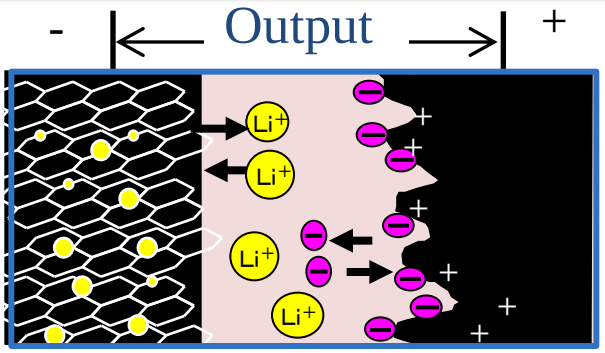
redox reaction (constant voltage)



electrostatic reaction (voltage is proportional to quantity of electricity)

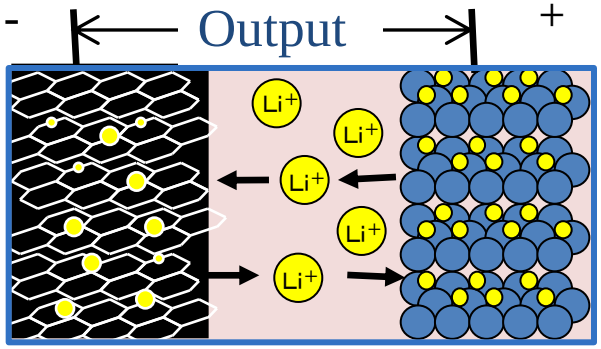
Design concept of ULTIMO

ULTIMO



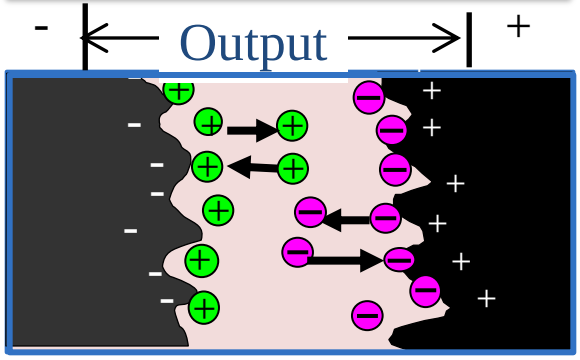
Li-doped Carbon | Electrolyte | Activated Carbon

Lithium-ion Battery



Graphite | Electrolyte | LiMOx

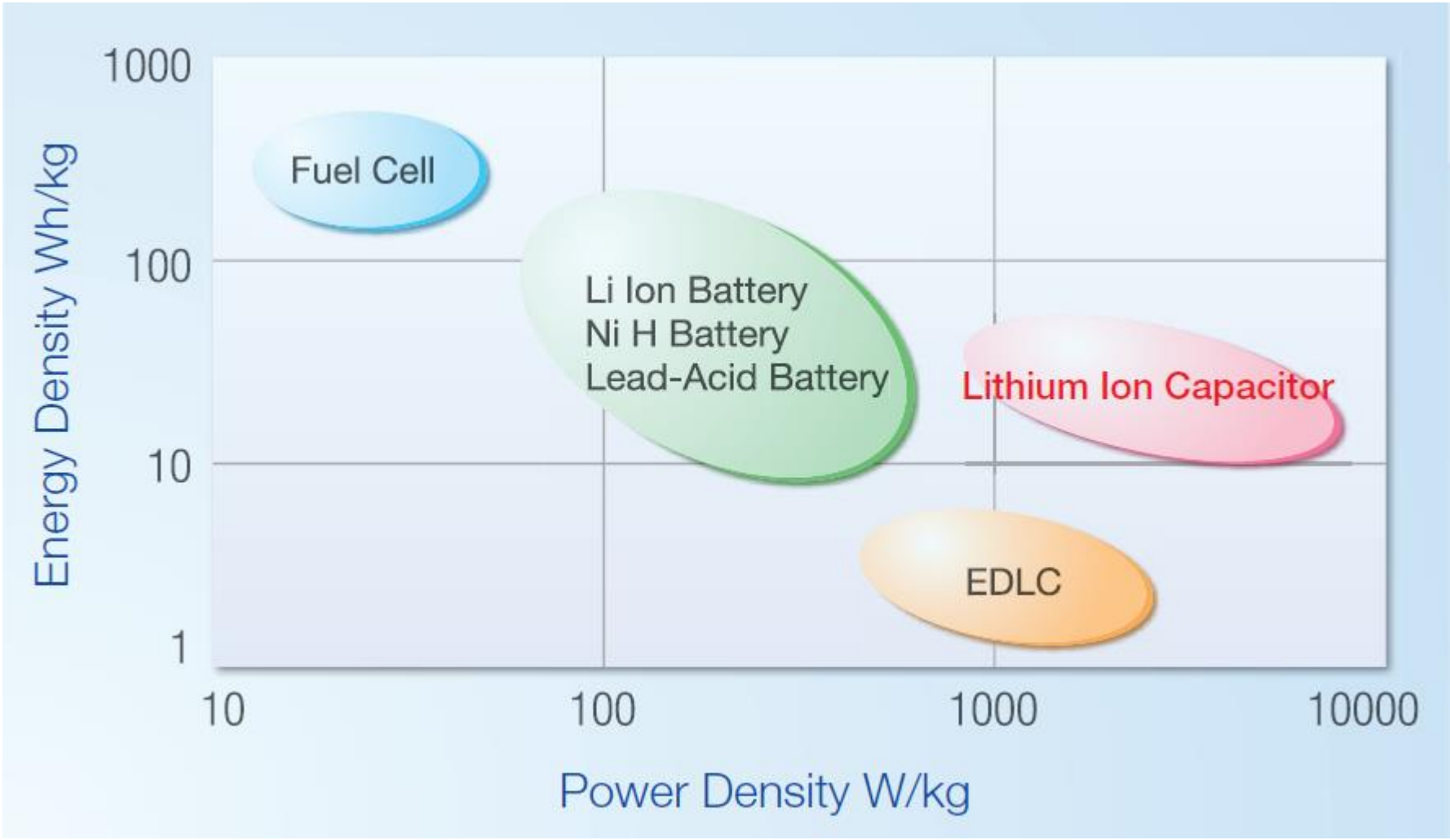
EDLC



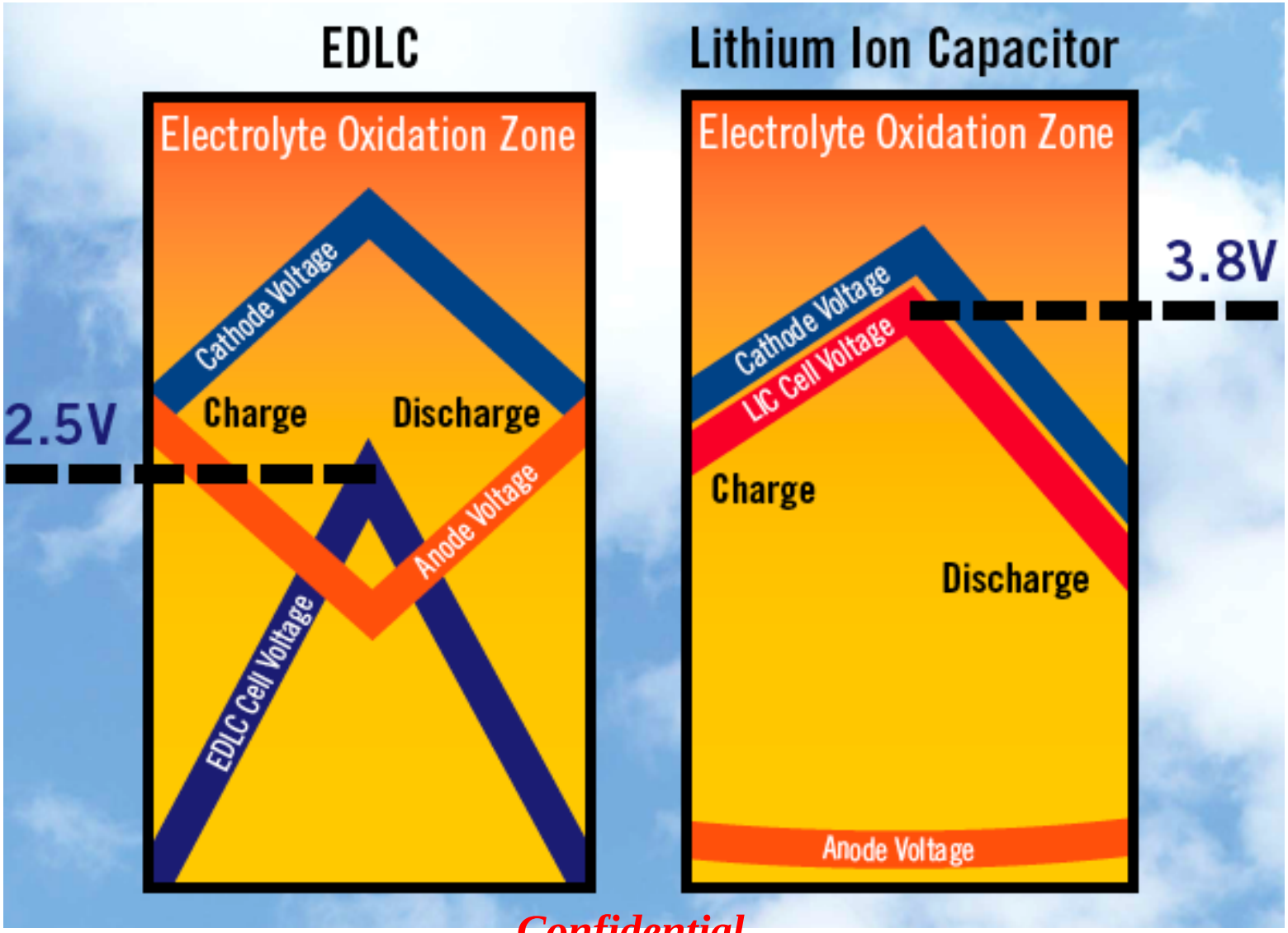
Activated Carbon | Electrolyte | Activated Carbon

Position of Lithium Ion Capacitor

High power, and high energy density capacitor



Higher Operating Voltage



Characteristics of ULTIMO

★Higher Operating Voltage(3.8V-2.2V)

★Higher Energy Density

→Enables downsizing & weight saving

★Low Self-discharge

★High Working Temperature

★Excellent Durability/Reliability

★Quick Charge/Discharge

★Safe in use

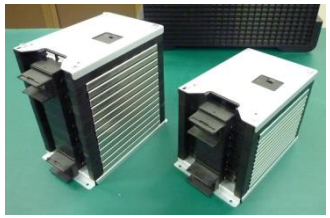
ULTIMO Cell product line

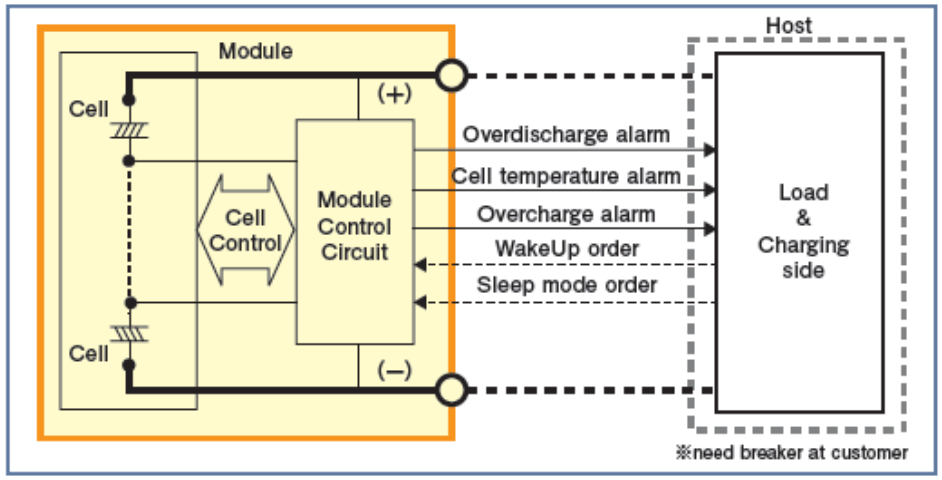
- ◆Various product line (laminate & prismatic)
- ◆Top level in low internal resistance & power within LIC industries

Item	Laminate	Prismatic			Remark
	CLQ1100S1A	CPP1500S	CPQ2300S	CPP3300S	
Working temp range	-30～70℃	-30～70℃	-30～70℃	-30～70℃	
Rated Voltage [V]	2.2 ~ 3.8	2.2 ~ 3.8	2.2 ~ 3.8	2.2 ~ 3.8	
Capacitance [F]	1100	1500	2300	3300	
DC-IR[mΩ]	1.2	1.2	0.7	1.0	Constant current discharge, @25℃
Energy density by weight [Wh/kg]	10	11	8	13	Constant current discharge, @25℃
Energy density by volume [Wh/L]	19	18	15	20	Constant current discharge, @25℃
Self discharge performance	Less than 5%	Less than 5%	Less than 5%	Less than 5%	3 months, @25℃
Size [mm]	180 x 126x5.5	120.2x71.8x12.8	150x91.5x15.5	150x91.5x15.5	Without terminal

ULTIMO Module Products

- ◆Using high capacitance/power cells
- ◆Excellent durability/reliability
- ◆Inter-cell/module balance control
- ◆Low power consumption
- ◆High safeness

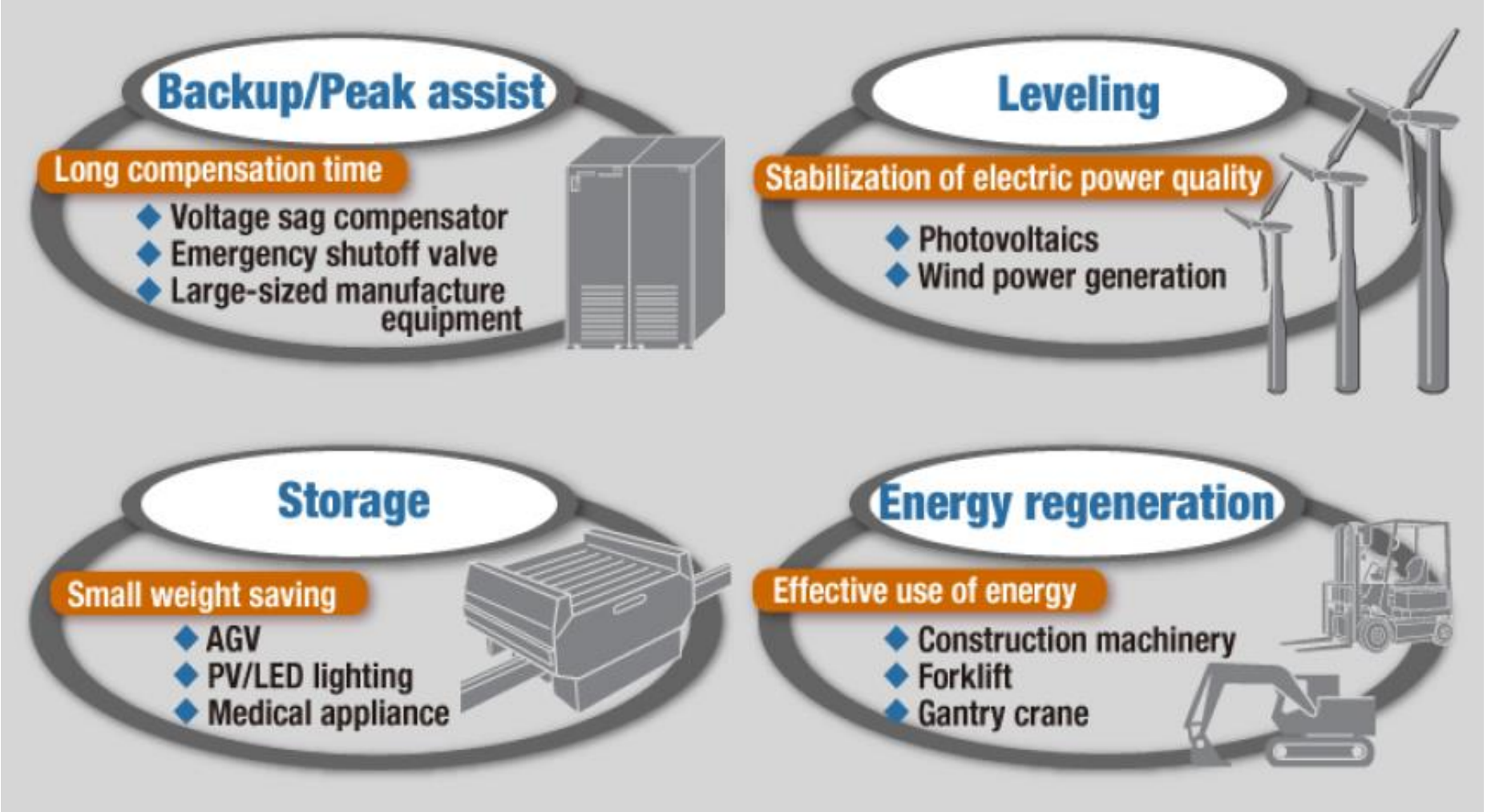




Grade	Cell Type	Rated Voltage		Capacitance (F)	DC-IR (mΩ)	Cell Component	Size(W x D x H mm)
		Max	Min				
MLB15G275D	Laminate	15.2V	8.8V	275	5.1	CLQ1100S1A,4cells	152.0×267.2×105.1
MLB30G138D		30.4V	17.6V	138	10	CLQ1100S1A,8cells	152.0×267.2×142.3
MLB45G92D		45.6V	26.4V	92	14.9	CLQ1100S1A,12cells	152.0×267.2×179.5
MPA15G575G	Prismatic	15.2V	8.8V	575	3.6	CPQ2300S,4cells	168.8×127.1×112.5
MPA15G825H				825	4.8	CPP3300S,4cells	168.8×127.1×112.5
MPA30G288G		30.4V	17.6V	288	7	CPQ2300S,8cells	168.8×127.1×186.5
MPA30G413H				413	9.4	CPP3300S,8cells	168.8×127.1×186.5
MPA45G192G		45.6V	26.4V	192	10.4	CPQ2300S,12cells	168.8×127.1×260.5
MPA45G275H				275	14	CPP3300S,12cells	168.8×127.1×260.5

Application Examples
Commercially in Use

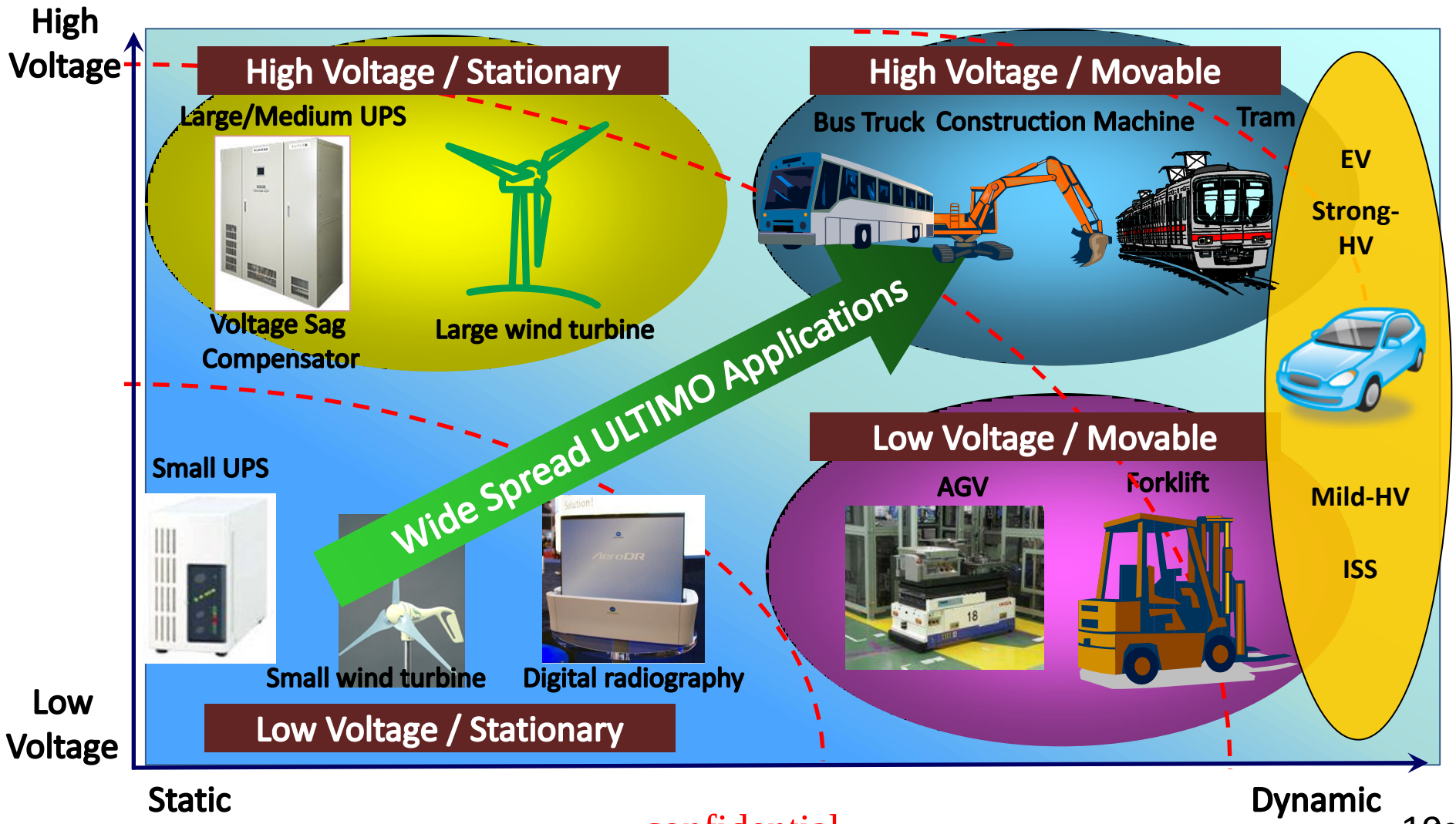
Target Applications



JM Energy is supporting its customers globally in wide range of applications.

Marketing Status

Low voltage to high voltage applications, Static to dynamic applications



Voltage Sag Compensation/Short Time UPS

VSC/Short-time UPS

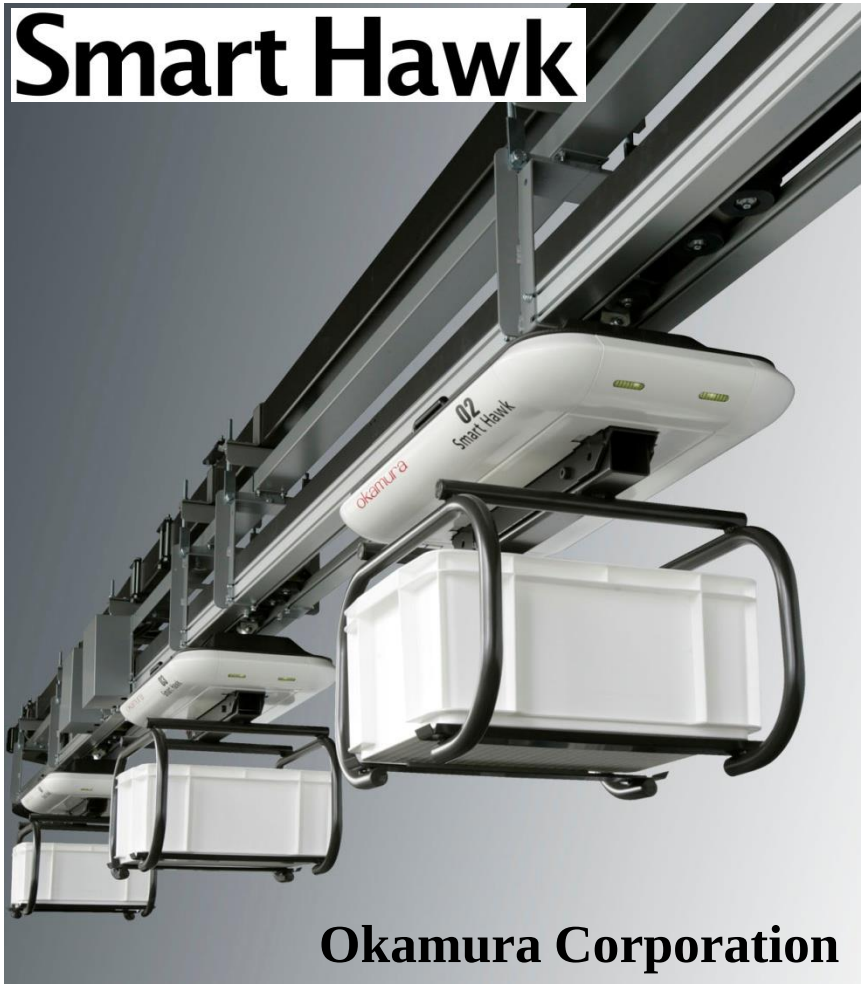
200V/120kVA

WHY ULTIMO? - Customer Voice

1) High Energy Density:
   Can compensate the energy long enough until the emergency backup generator starts.
2) High Voltage:
   Makes small, light, and economical storage system.

600kW/115s/6600V/1000kVA

AGV

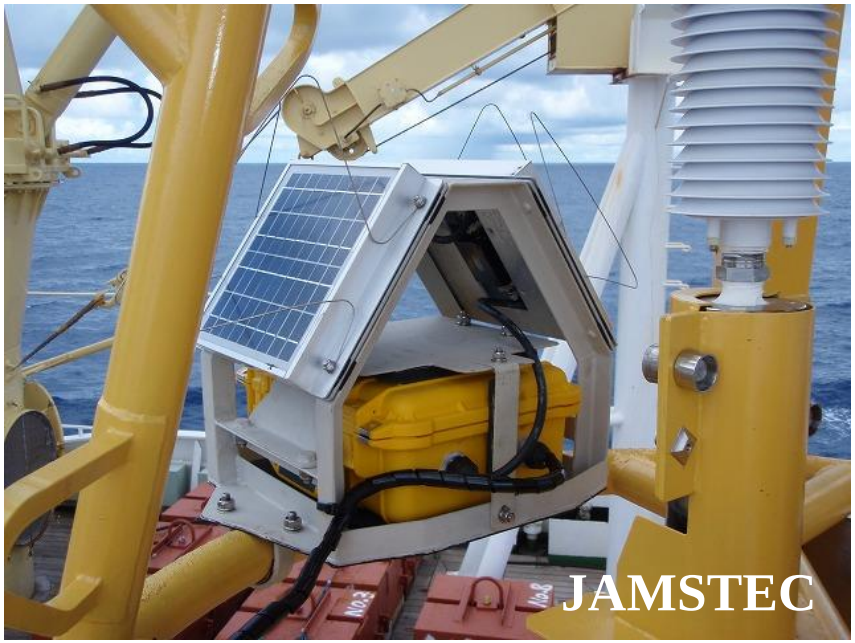


Smart Hawk:
New transportation system that charges power automatically as needed.

WHY ULTIMO? - Customer Voice

1) Enables Rapid Charge.
2) High Energy Density:
   Enabled lighter weight than EDLC.
3) Long Durability:
   Maintenance free for long.

Mooring Buoy with CO2 Monitoring Sensor



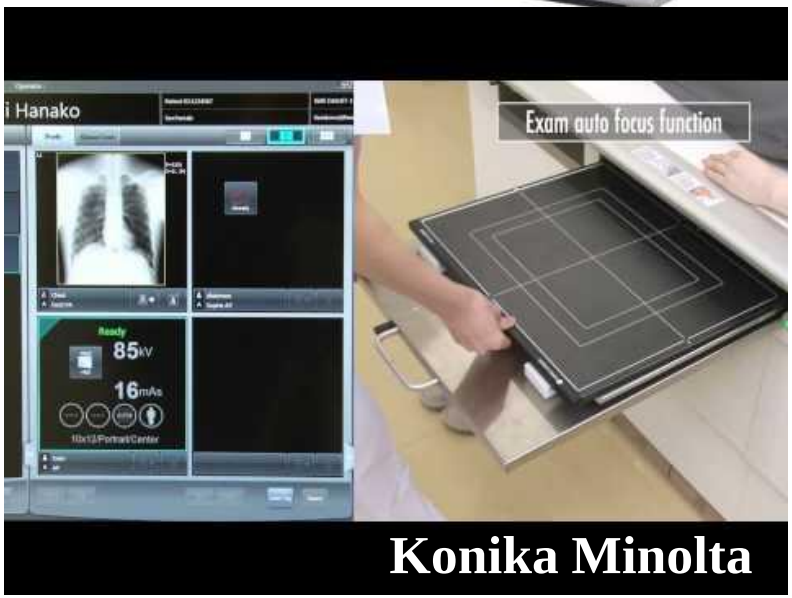
WHY ULTIMO? - Customer Voice

1) Rapid Charging:
2) Low DC-IR:
   Chargeable under cloudy sky
3) Low Self Discharge Rate:
   Store enough energy to sustain frequent data communication via satellite.
4) Longer Life:

Mooring Buoy:
CO2 monitoring sensor in Pacific Ocean. PV electricity supply. Satellite data transmission.

* JAMSTEC:
  Japan Agency for Marine-Earth Science and Technology

Wireless Digital Radiography System



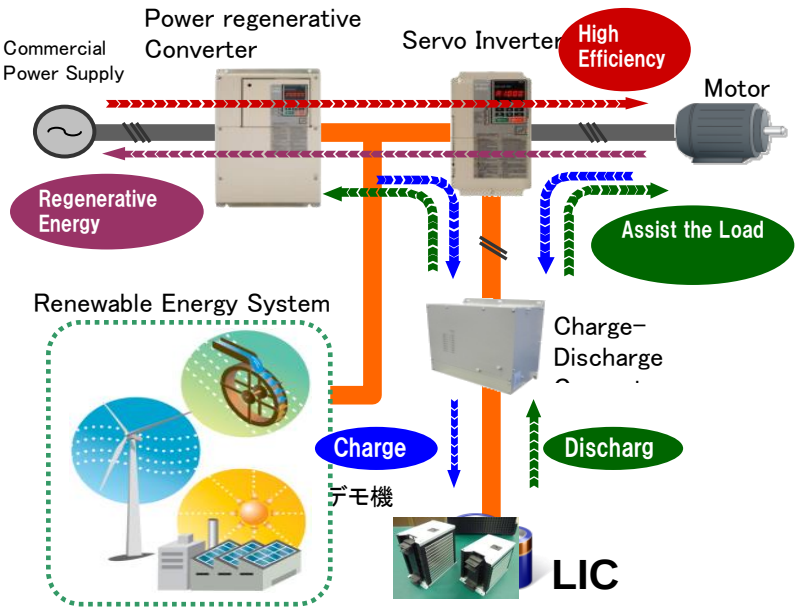
WHY ULTIMO? - Customer Voice

1) Safety:
   Unlike LIB, LIC won't cause thermal runaway. It is a key for our medical system that touches human body.
2) Rapid Charge:
3) High Energy Density:
   Increases the number of photos that can be taken in one charge.
4) Longer Life:
   No need to replace.
   Can design robust one shell housing.

Energy Recovery/Assist/Peak-Cut System

DC Multi Link Drive

Links motor drive systems using inverters and servos, and energy storage system and converter by direct current. Enables pico-smart grid at every motor by utilizing energy effectively and efficiently.
<Yasukawa Electric Corp.>



WHY ULTIMO? - Customer Voice

1) Compact/Low DC-IR/High Power:
Ultimo enables smaller power source and use of regenerative energy. The low DC-IR makes it efficient.

2) High Energy Density:
Enables small and light storage system compared against EDLC.

3) Low Self-Discharge:
Unlike EDLC, Ultimo shows low self- discharge rate. No need for initial charge.

Vertical Transportation System

HOKUSHO Corp.

In use at warehouses and distribution centers.
Reducing the energy consumption by
applying regenerative energy system.

WHY ULTIMO? - Customer Voice

1) Lower DC-IR:
Efficient use of regenerative energy.

2) High Energy Density:
Small and light storage system.

3) Long Durability:
Maintenance free for long period.

Hybrid Excavator

Active Hybrid Excavator SH200HB-6

Thanks to SUMITOMO（S.H.I.）
CONSTRUCTION MACHINERY CO.,LTD.

〈Product Introduction〉

High Fuel Economy based on Hybrid Excavator

By controling accurately and timely the power of the electric motor which is directly connected the shaft of the engine in accordance with the load of the engine, in addition to reusing the energy, which is stored in the capacitor when the upper structure decelerates, when it accelerates, the reduction of fuel consumption has been greatly achieved.

Powerful and Smooth Operation surpassing hydraulic excavator

By utilizing the power of the engine left for the attachment, the performance of operation has been greatly improved, because the energy stored in the capacitor is supplied to the electric motor which rotates the upper structure.
Furthermore, by matching the power of the electric motor with the operation of the attachment, the smooth performance have been realized.

WHY ULTIMO? - Customer Voice

1)High Voltage, High power
have made the module of the capacitor smaller and lighter.
And, the wide voltage range being able to make full use of the capacitance
have enabled also the higher level energy management to contribute greatly to the reduction of fuel consumption.

2) High Heat resistance
has enabled the cooling structure in the module to be smaller and lighter.

3) Long Life

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