

Hitachi's Battery Business

Combining Hitachi's strengths
with a focus on industrial applications

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Hitachi's Battery Business

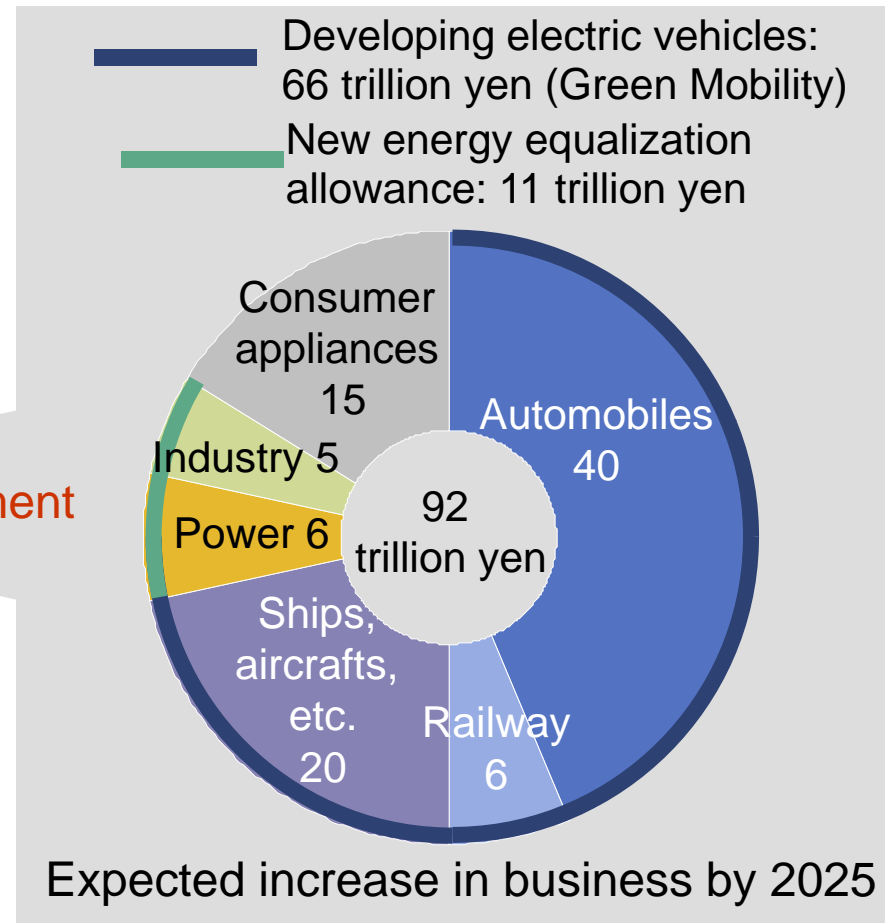
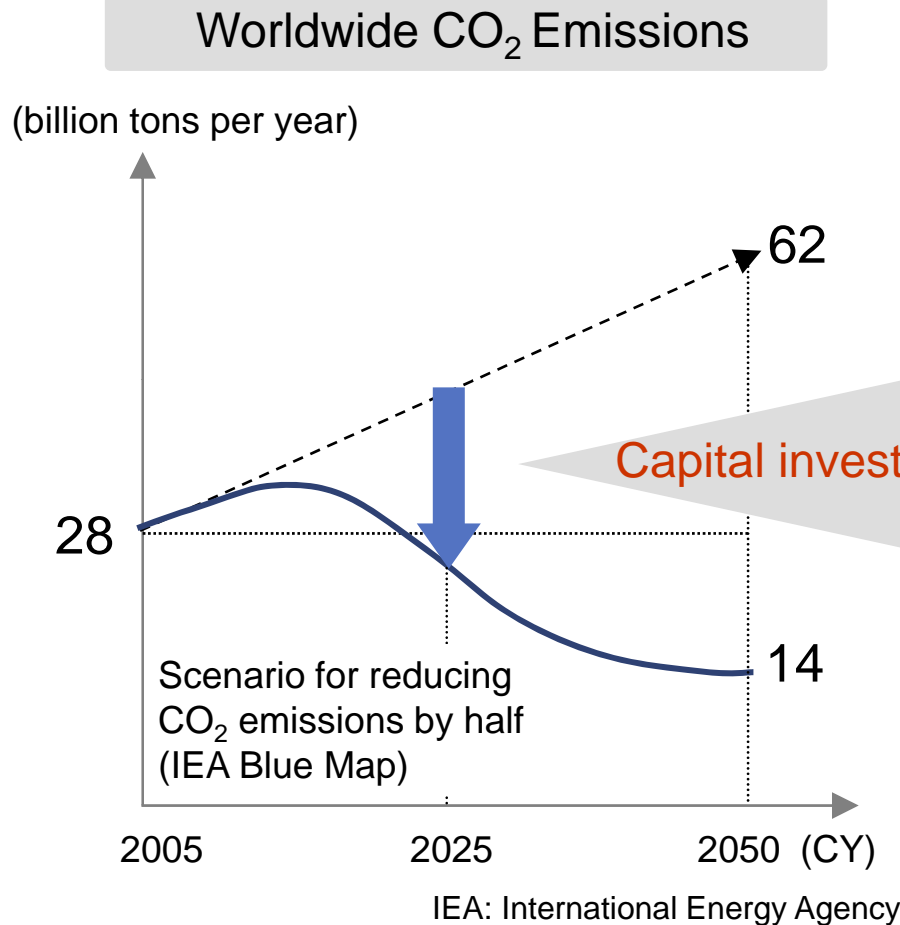
Combining Hitachi's strengths
with a focus on industrial applications

Contents

1. Market Environment
2. Activities at the Battery Systems Company
3. Business Strategies

1-1. Market Environments

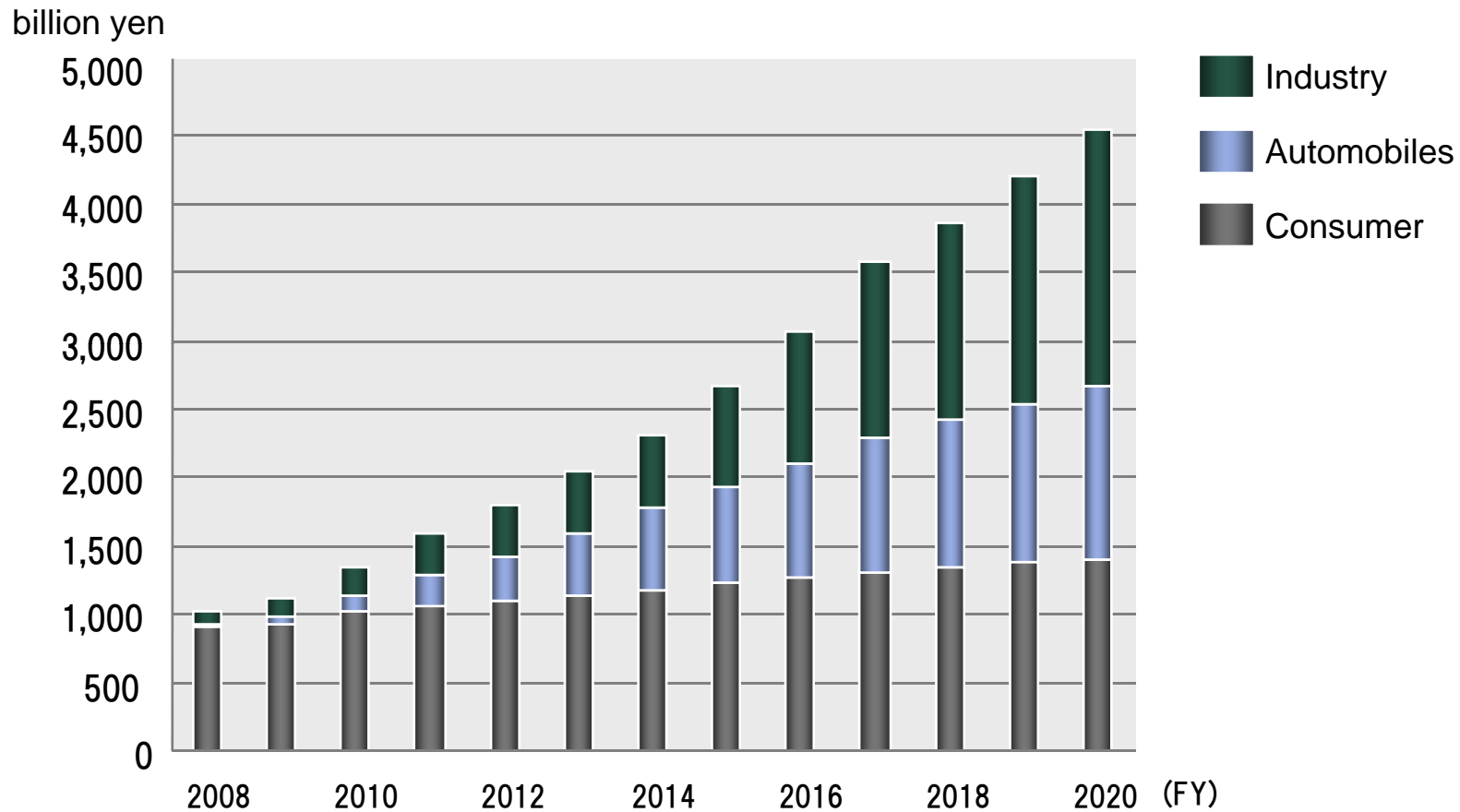
- High expectations for batteries in the areas of green mobility and new energy
- Batteries are key devices in the formation of Smart Communities and other new industrial fields



Source: Hitachi Research Institute

1-2. Lithium-ion Battery Market Trends

- Lithium-ion batteries have global growth potential on a scale of 4 trillion yen
- There is an increasing demand for power storage as a means of reducing CO₂ emissions, and growth is expected in industrial and automotive applications, with government measures (e.g., the Green New Deal) spurring this growth



Source: Hitachi Survey

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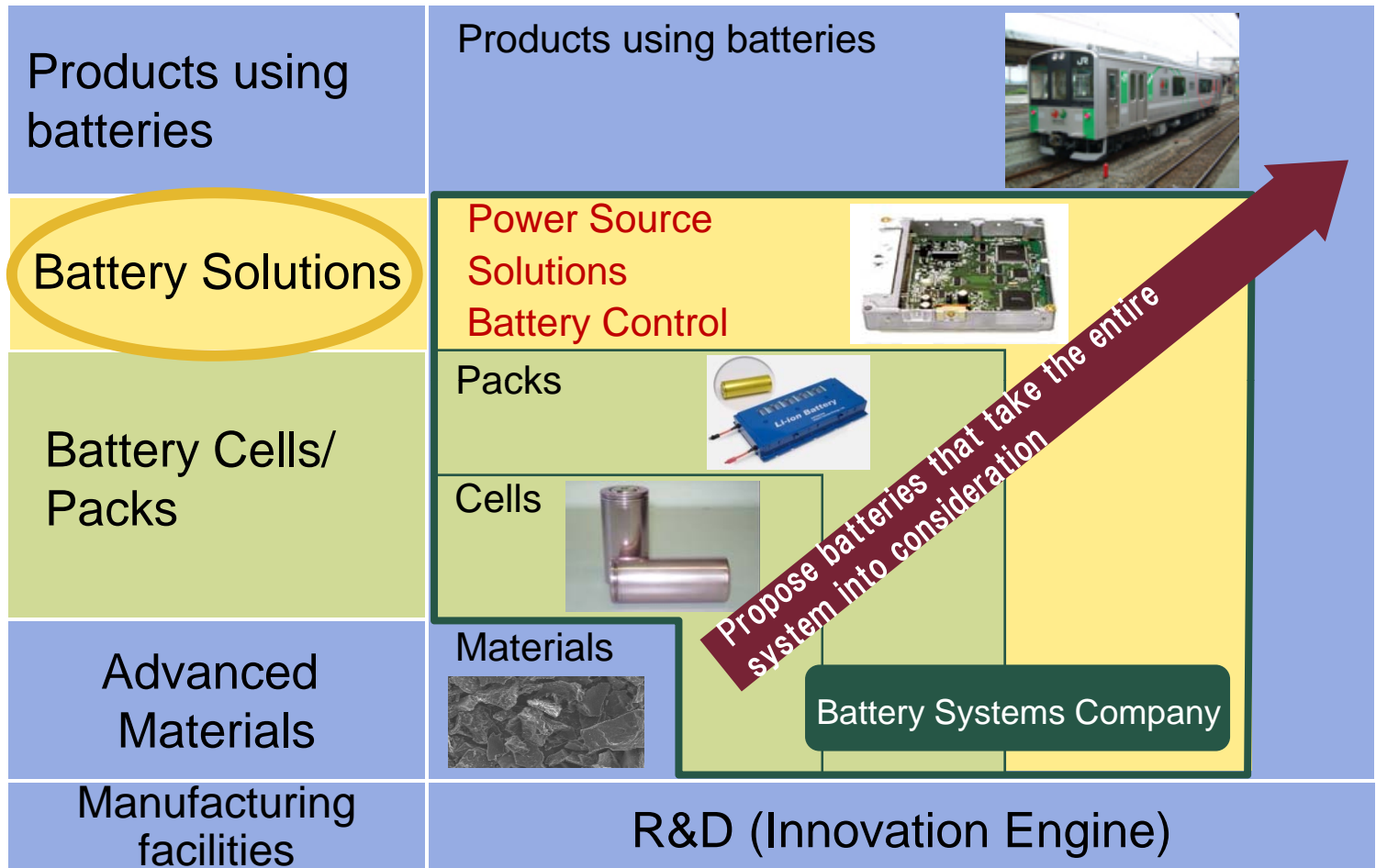
Contents

1. Market Environment
2. Activities at the Battery Systems Company
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2-1. Targets of Hitachi's Battery Business

Strengthen the expansion of battery business from devices to battery solutions for power sources, with a focus on industrial applications, and create new business based on collaborations throughout the Hitachi Group

Direction targeted by Hitachi's battery business



2-2. Platform Technologies that Support Hitachi's Battery Business

The Battery Systems Company combines:

- (1) "Monozukuri" capabilities in consumer and automotive batteries;
- (2) Advanced material technologies from Research Divisions; and
- (3) System applications based on Hitachi Group collaborations

Battery Systems Company

Combining Hitachi's strengths with a focus on industrial applications



Dispersion coating / electrode production
(Hitachi Maxell)



Automotive Production Lines
(Hitachi Vehicle Energy)



Long-lasting electrode materials*
(Advanced Battery Research Center,
Hitachi Research Laboratory)



Hitachi Group's Materials Products



Control technologies and
products using batteries

Monozukuri Capabilities

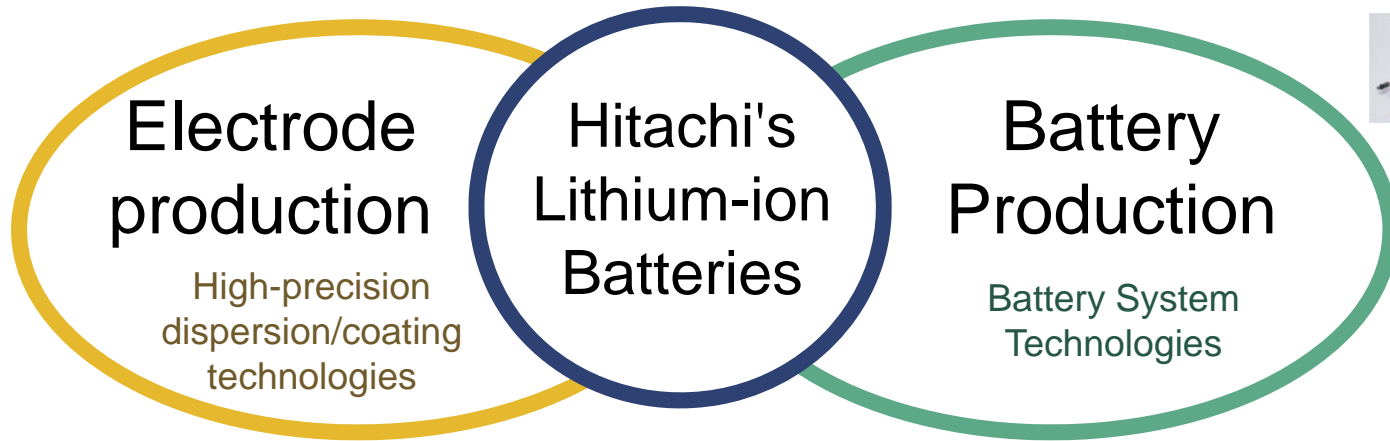
Advanced materials
technologies

System
Applications

*Results of research contracted by NEDO

2-3. “Monozukuri” Capabilities

- Hitachi’s “Monozukuri” pursues outstanding safety, power, and capacity
- Electrode manufacturing is at the core of batteries, and Hitachi’s battery manufacturing achieves high reliability



High power and high capacity

Computer tape manufacturing technologies

Dispersion technologies

Coating technologies

Slit technologies

1965: Production of Maxell's magnetic tape begins

High reliability

Micro-battery manufacturing technologies
Volume production of automotive batteries for commercial vehicles

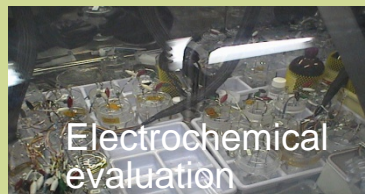
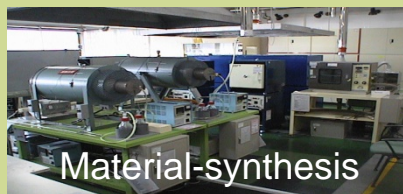
Welding technologies

Sealing technologies

1961: Production of Maxell's battery (cell) begins
“Maximum Capacity Dry Cell”

Develop technologies in a comprehensive process, from material-synthesis to battery prototype evaluations

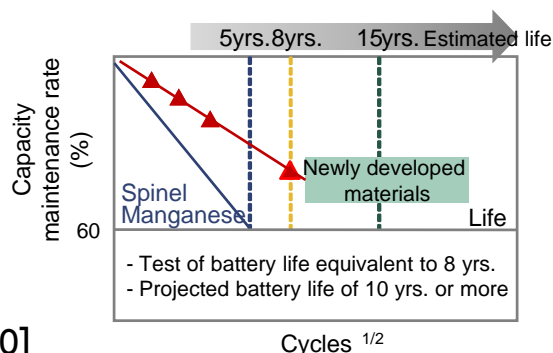
Challenges towards advances materials technologies



Platform for integrated analysis of electrode surface response and internal degradation

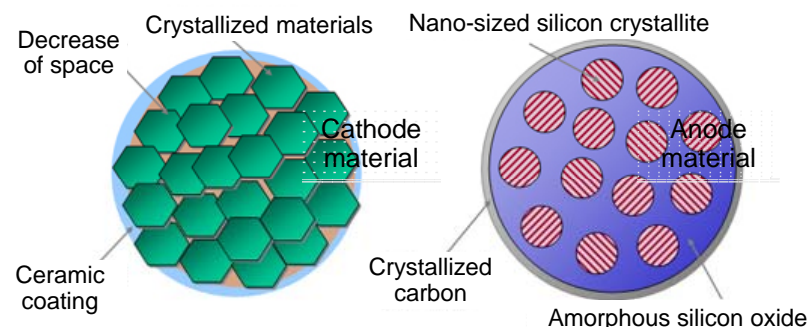


■ Technology for doubling the life of industrial lithium-ion batteries with manganese cathodes



■ Compound cathode material (reduced cobalt content)

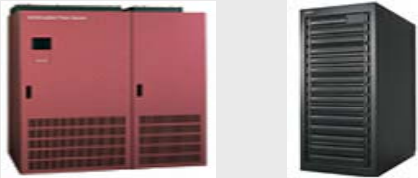
■ Silicon anode material (increased capacity)



[Research contracted by NEDO]

- Control technologies to maximize battery cell performance
- The Hitachi Group's product capabilities enable comprehensive

Information and Telecommunications



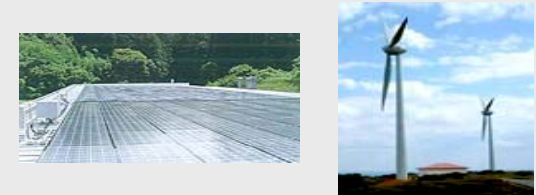
UPS: Uninterruptible Power Supply

Industrial machinery



Railway / Construction machinery

Power systems



Wind power / Solar power / Smart grids



Cell controllers



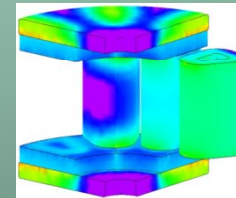
Battery controllers



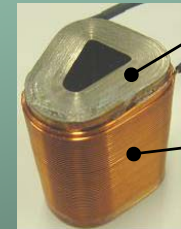
"HiGT" chip



Power module



Electromagnetic field analysis



Amorphous Metal core

Coil

Battery Control

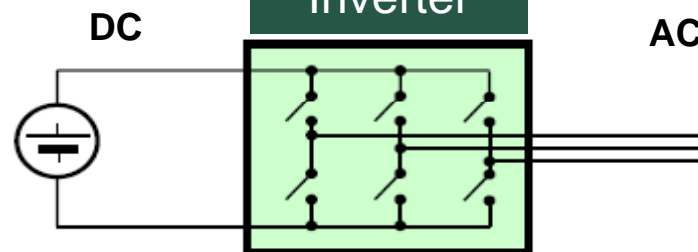
Low loss / high voltage resistance inverters

High efficiency motors

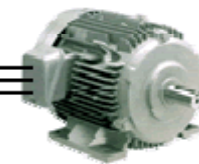
Battery



Inverter



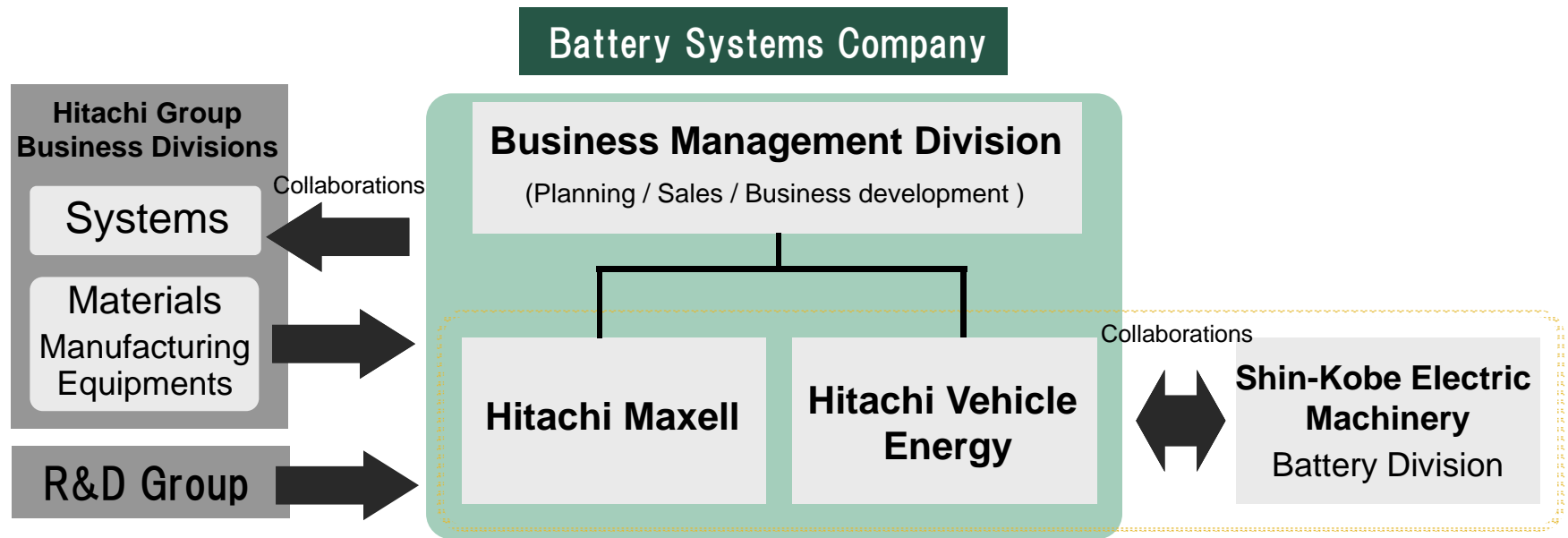
Motors



* HiGT: High Conductivity IGBT, IGBT: Insulated Gate Bipolar Transistor

Battery Systems Company

1. Business Management Division:
Overall supervision of operations; Creation of large-scale industrial solutions business
2. Hitachi Maxell:
Consumer battery and small- to medium-sized industrial lithium-ion battery business
3. Hitachi Vehicle Energy:
Automotive lithium-ion battery business



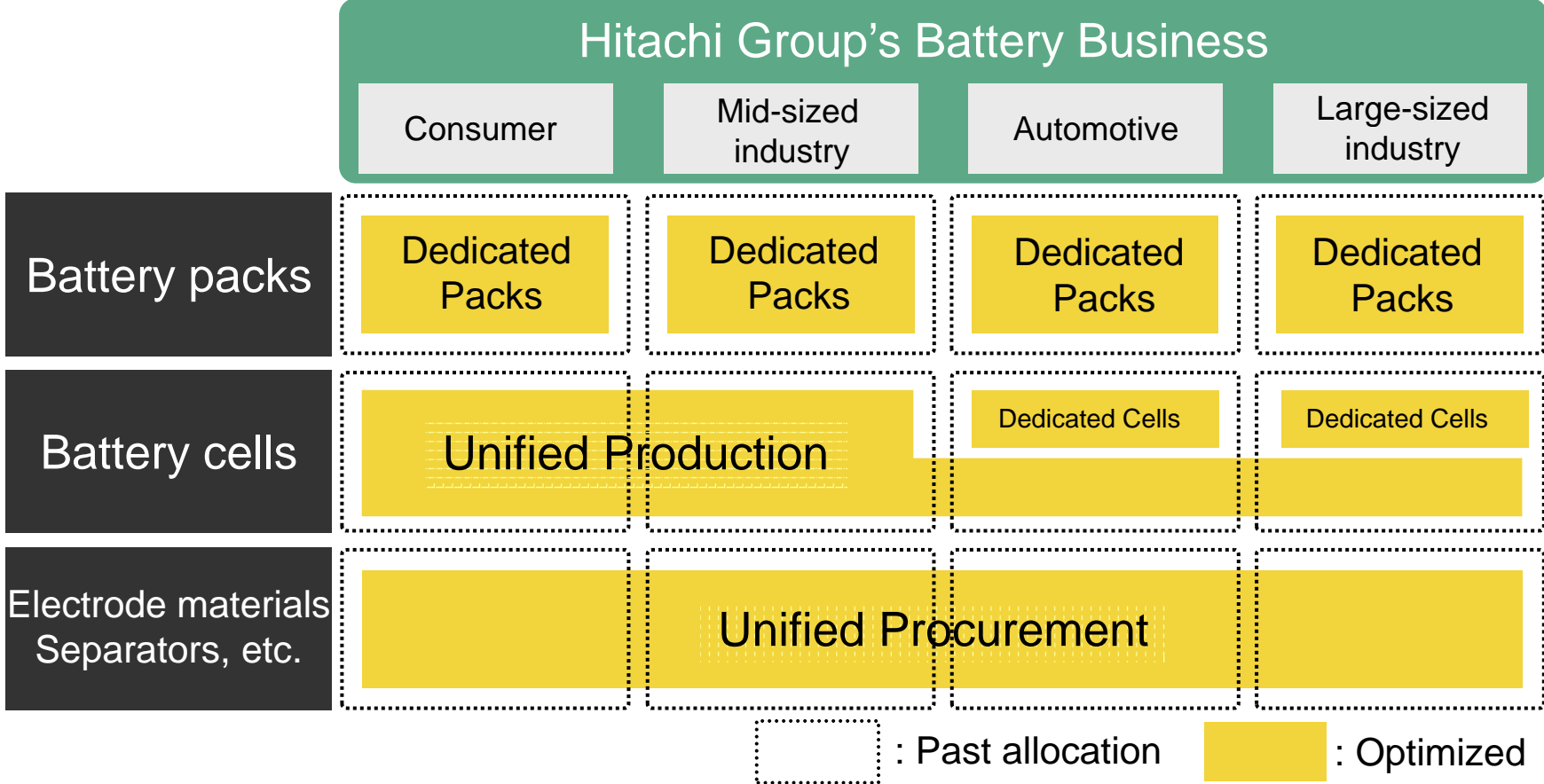
Revenues

FY2009 :142.1 billion yen (Including non-battery business at Hitachi Maxell)

2-7. Promoting Optimization of Battery Business

Promote overall optimization of a broad range of battery business fields, from small consumer products to large-scale industrial applications, and improve investment efficiency by breaking away from the “separate vertically integrated” model

Configuration of the Battery Business



Unique Features of Hitachi's Battery Business

- Battery business base covers a wide range of applications, from consumer products to industrial applications
- Proposes solutions based on collaborations between Business Divisions and other Hitachi Group companies
- Adopts advanced technologies through R&D (Innovation Engine)

| | Consumer applications | Automotive applications | Industrial applications | | |
|----------------|-----------------------|-------------------------|---|--|---|
| | | | Small to medium-sized packs <small>Power tools / electric scooters</small> | Large packs <small>Railway / Stationary equipment, etc.</small> | Battery solution <small>New energy / Smart communities</small> |
| Co. A (Korea) | ● | ● | — | — | — |
| Co. B (Japan) | ● | ● | ○ | ○ | — |
| Co. C (U.S.) | — | ● | ● | ○ | — |
| Hitachi | ● | ● | ● | ● | ○ System collaboration proposals |

● Currently rolling out business ○ Planning on rolling out Business in the future

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3-1. Hitachi Maxell's Strategy and Products

- Increase business in consumer product aiming for high-end smart phones
- Expand business in growth fields with cylindrical, laminated, and micro batteries
- Develop new industrial market with high-power cylindrical and laminated batteries

Product lineup

Micro batteries



Coin-type rechargeable batteries
About 20mm in diameter;
capable of high rate
discharge at 140mA

Medical sensor nets,
multi-function watches,
Bluetooth modules, etc.

Mobile batteries



High capacity batteries by
using Si anode

Mobile phones, smart
phones, digital cameras,
portable game devices,
electronic dictionaries, etc.

Cylindrical batteries



Expanding applications
(power tools, etc.) with
high-power type, and
developing a high
capacity type

Power tools,
gardening tools,
pedelecs, wireless radios,
etc.

Laminated batteries



Thin, high-capacity batteries
Sample size variation

Electric scooters, UPS,
floor cleaners, portable
power supply, etc.

Total investment: 2 billion yen Production of laminated batteries to begin in fiscal 2011

- Selected as recipient of METI subsidy for the program
- Assembly facilities installed in the Toyama Works and electrode production facilities installed at the Kyoto Works
- Achieves both small-lot production and high-efficiency production
- Laminated batteries contribute to the expansion of the Battery Solution Business at the Battery Systems Company as a core device in industrial applications (electric scooters, etc.)



Toyama Works



Kyoto Works
New electrode plant



- Strengthen marketing targeting commercial buses and trucks
(in March 2010, achieved cumulative shipments of one million cells)
- Fiscal 2010: Began operation of a new production line, and began delivery in passenger vehicles
- Develop large, high-capacity batteries for PHEVs and strengthen rollout to industrial fields

Product lineup

Cylindrical batteries/packs for HEVs



Battery cell

High-quality, high-reliability battery cells and packs based on extensive track record in the automotive market



Battery pack

Hybrid commercial vehicles (buses, trucks), hybrid electric vehicles (HEV), rolling stocks, cargo-handling machinery systems, stationary energy storage systems for regenerative power absorption, etc.

Prismatic batteries for HEVs



4,500W/kg high output type; 1.7x the output of former Hitachi models

Prismatic batteries for PHEVs



25Ah high capacity type; motor running distance: approx. 20 km

Plug-in hybrid electric vehicles (PHEVs), stationary industrial applications, etc.

3-4. Battery Solution Business

- Seek out new applications, mainly in the industrial application (e.g., Smart communities)
- Target for orders in related fields: 1 billion yen (FY2012); 10 billion yen (FY2014)



- Design rechargeable battery controls/interfaces for system power sources
 - Integrate peripheral hardware (PCS, etc.)
 - Maintenance, service
- PCS: Power Conditioning System

Lithium-ion battery cells/packs



- Shin-Kobe Electric Machinery promotes lead acid battery business, and Battery Systems Company supports expansion of the long-life lead acid battery business targeting new energy applications
- Shin-Kobe and Battery Systems Company collaborate in seeking out new applications for large-scale industrial lithium-ion batteries

Product lineup

Long-life lead acid rechargeable batteries

Prismatic lithium-ion batteries

Cylindrical lithium-ion batteries

Lithium-ion capacitors



For wind power generators; expected life: 17 yrs. (LL-W type); For storage: 10-15 yrs.

Wind power generator output variance control, power storage, etc.



200Ah high-capacity batteries*¹ (Float life: 10 yrs.)

Backup applications (UPS, etc.)



Industrial cycle applications based on EV batteries (50Ah, 90Ah)

Construction equipment, electric forklifts, wind/solar power generators, etc.



Greater output than EDLC *², and more than 3x the energy density

Energy regeneration, compensation power sources, etc.

*¹ Joint development with NTT Facilities, Inc.

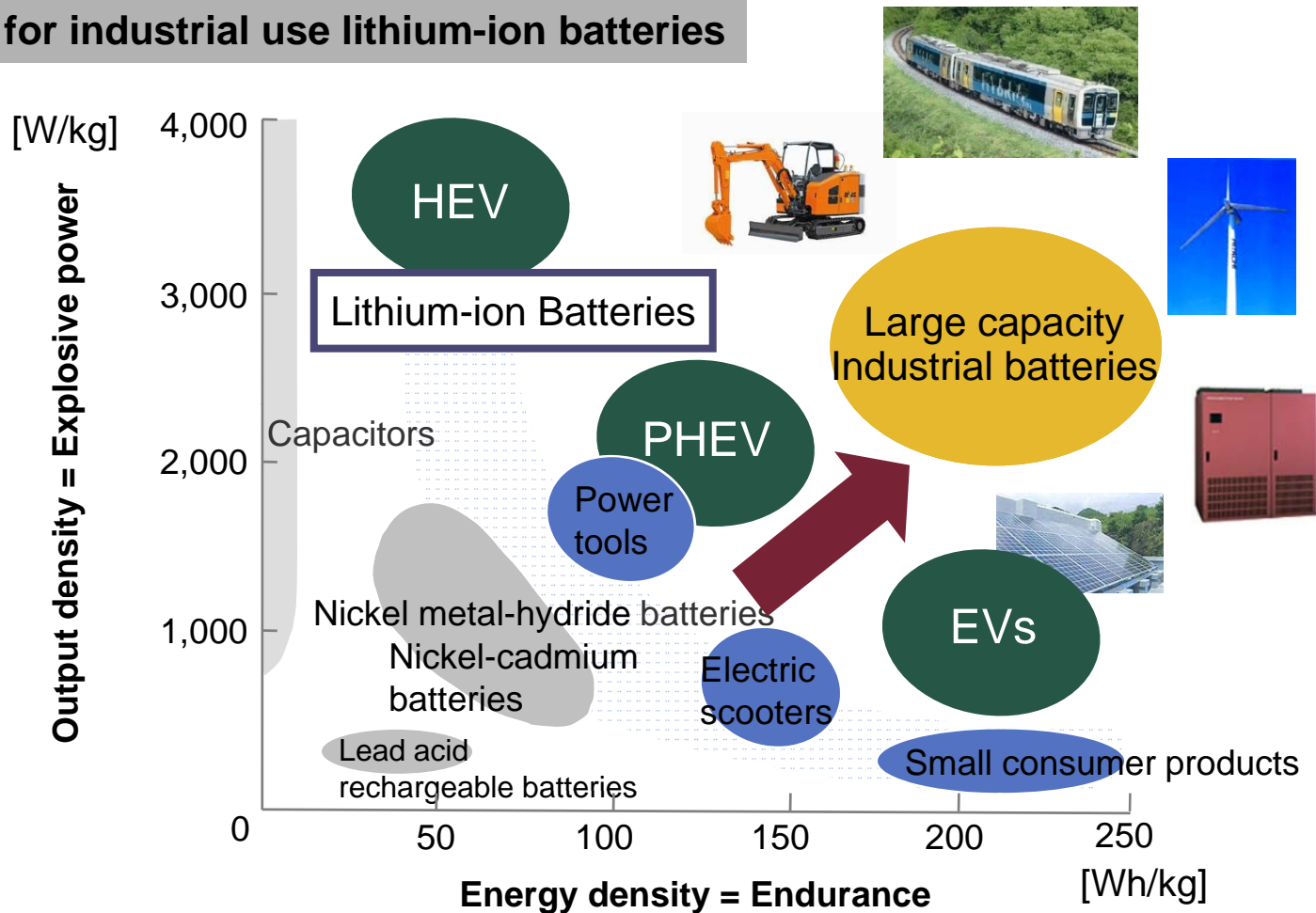
*² Electric Double Layer Capacitor

3-6. Development of Innovative Battery Technologies

- Started up Group-wide development project targeting large-scale industrial applications (May 2010)
- Developing “standard cells” and “battery control platforms”

3 year plan; 5 billion yen

Targets for industrial use lithium-ion batteries



Product Strategies

- Combine the comprehensive strengths of the Hitachi Group, and expand into the Battery Solution Business

Development Strategies

- Continually strengthen innovative battery technologies, in collaboration with R&D Group

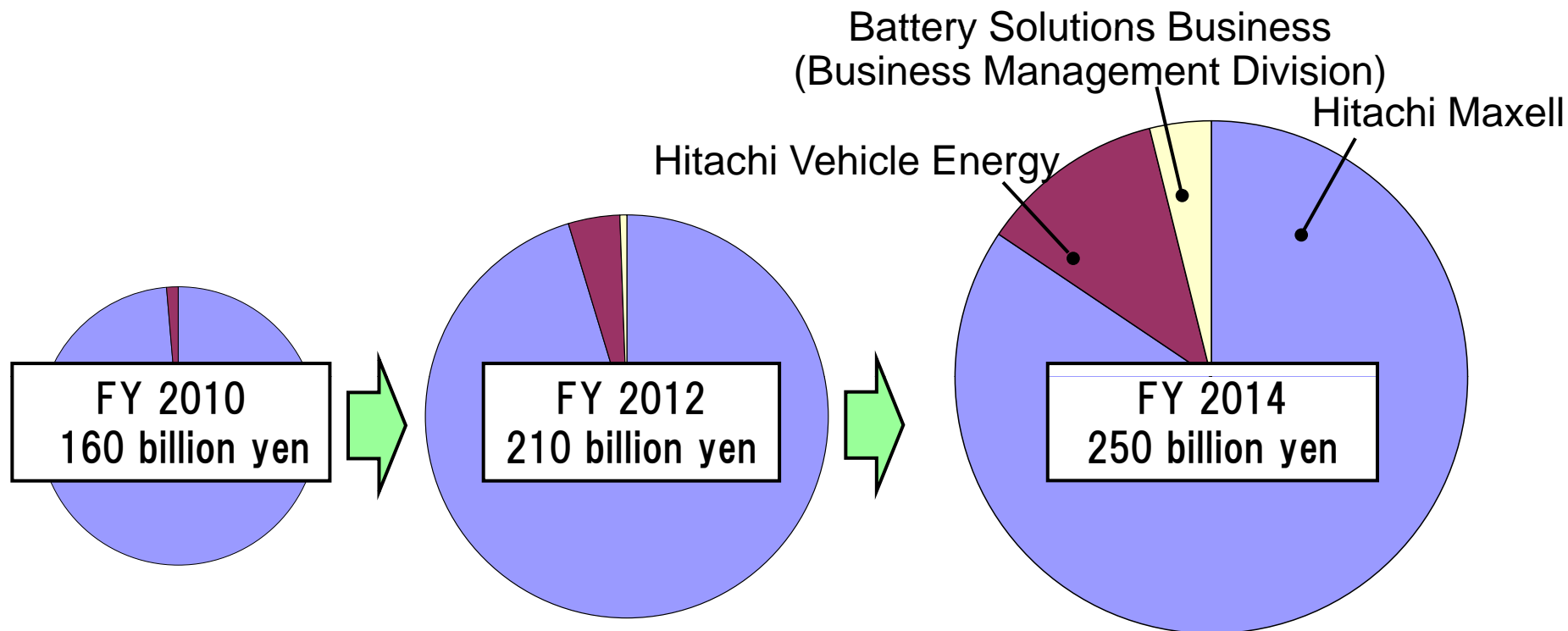
Cost Strategies

- Increase investment efficiency by promoting overall optimization (unification of production and procurement activities)
- Increase cost competitiveness through the Group-wide development project

Finance/Alliance Strategies

- Secure global intellectual property rights for innovative battery technologies
- Actively build partnerships (alliances) with outside companies

Battery Systems Company's Revenue (FY2014 Target) 250 billion yen



The Battery Systems Company will support the new Social Innovation Business in various fields, including Green Mobility and New Energy Applications.

HITACHI
Inspire the Next 