

R&D strategy to restore a growth trajectory

- For a giant leap in the centennial year of Hitachi's foundation -

April 22, 2009

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General Manager of Research & Development Group,
Environmental Strategy Office

Hitachi, Ltd.

Basic policy

Focus on social innovation business

Initiatives

1. Fusion of information & telecommunication systems and power & industrial systems
2. Transformation into a truly global company
3. Expansion of environmental business

Emphasis on R&D to expand social innovation business

1 Fortify R&D organization

2 Fortify environmental & power conservation technologies

3 Fortify energy technologies

4 Initiatives in global "market-in"

5 Fusion of information & telecommunication systems and power & industrial systems

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1 Environmental strategy

2 R&D strategy

2.1 Fortify R&D organization

2.2 Initiatives in global “market-in”

2.3 Fusion of information & telecommunication systems and power & industrial systems

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1 Environmental strategy

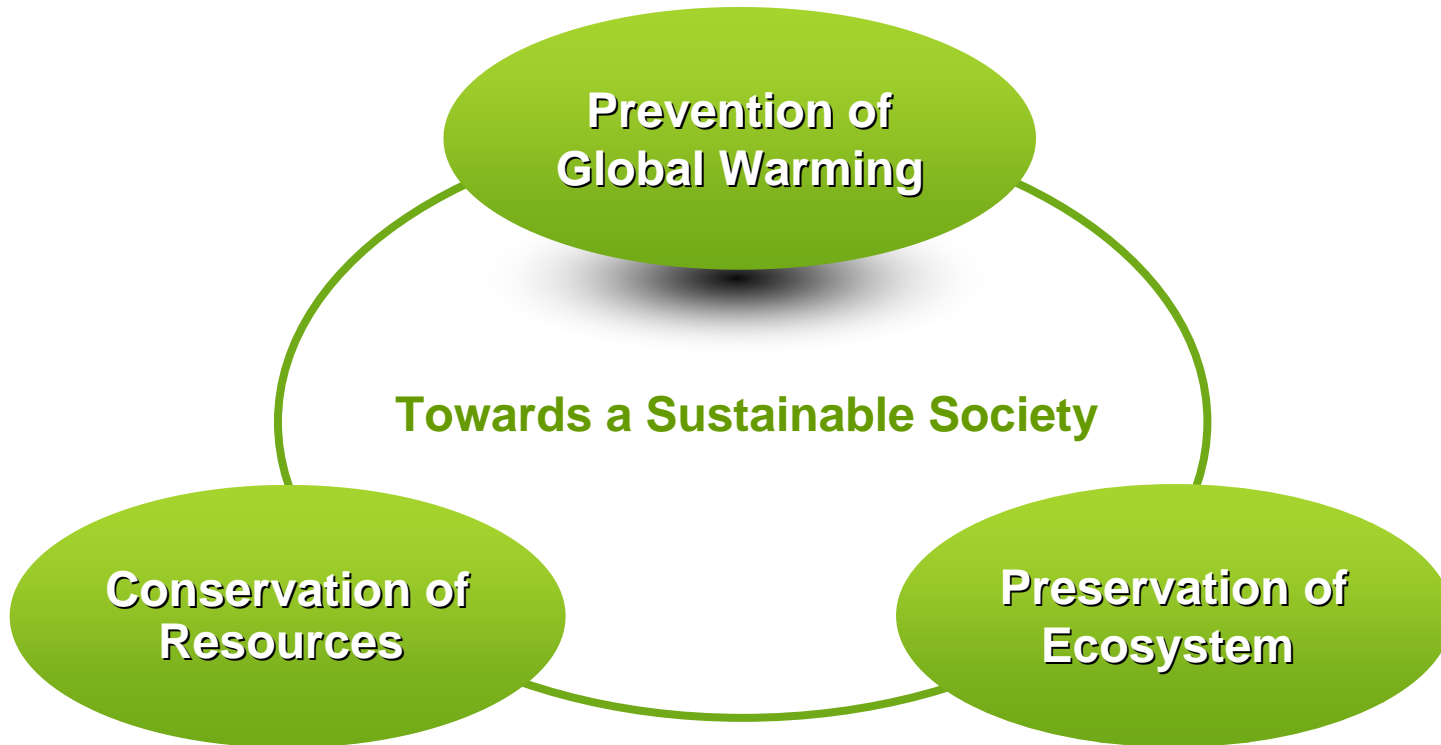
2 R&D strategy

2.1 Fortify R&D organization

2.2 Initiatives in global “market-in”

2.3 Fusion of information & telecommunication systems and power & industrial systems

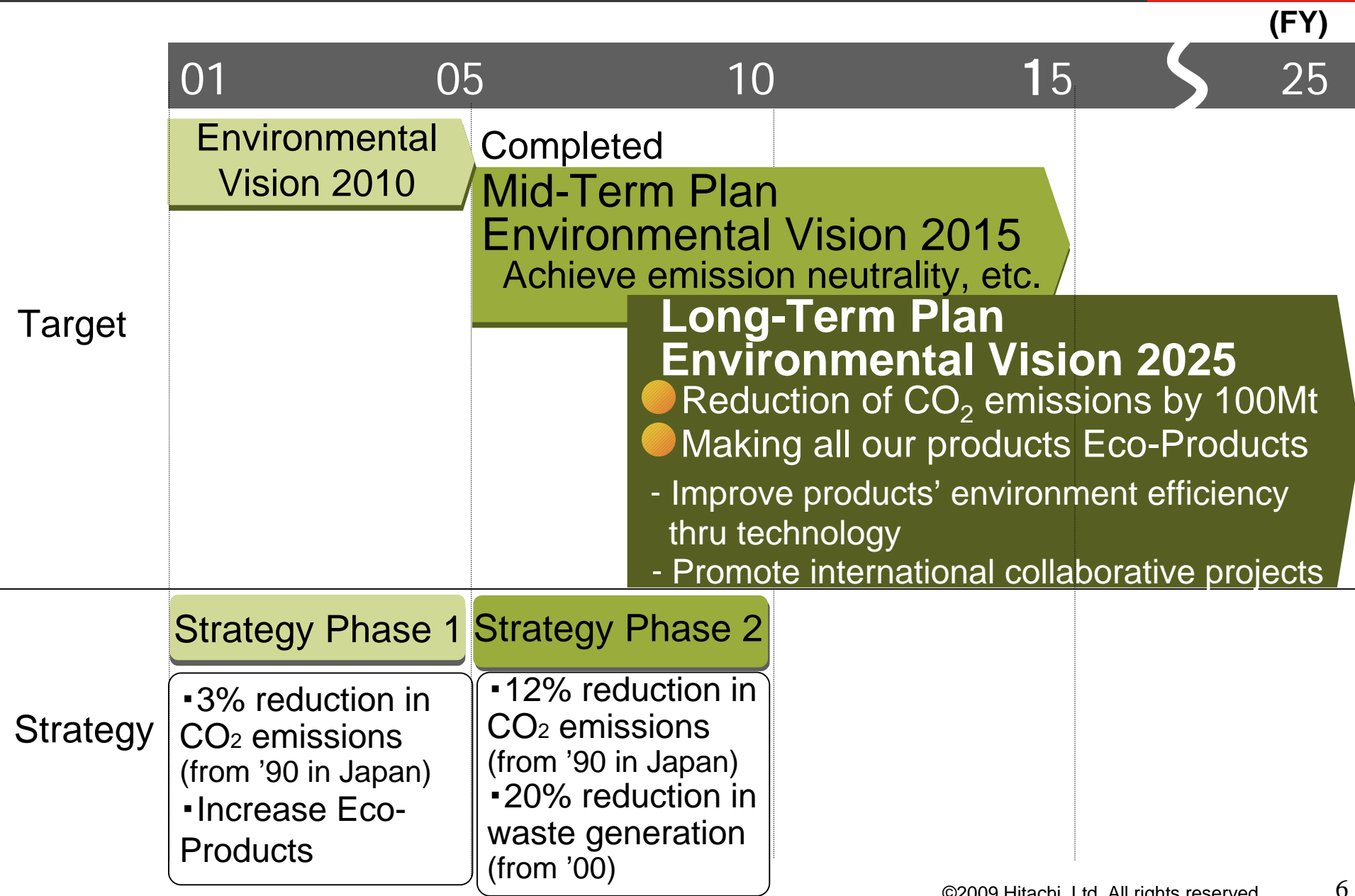
- Reduce CO₂ emissions in energy production
- Enhance energy efficiency of our products



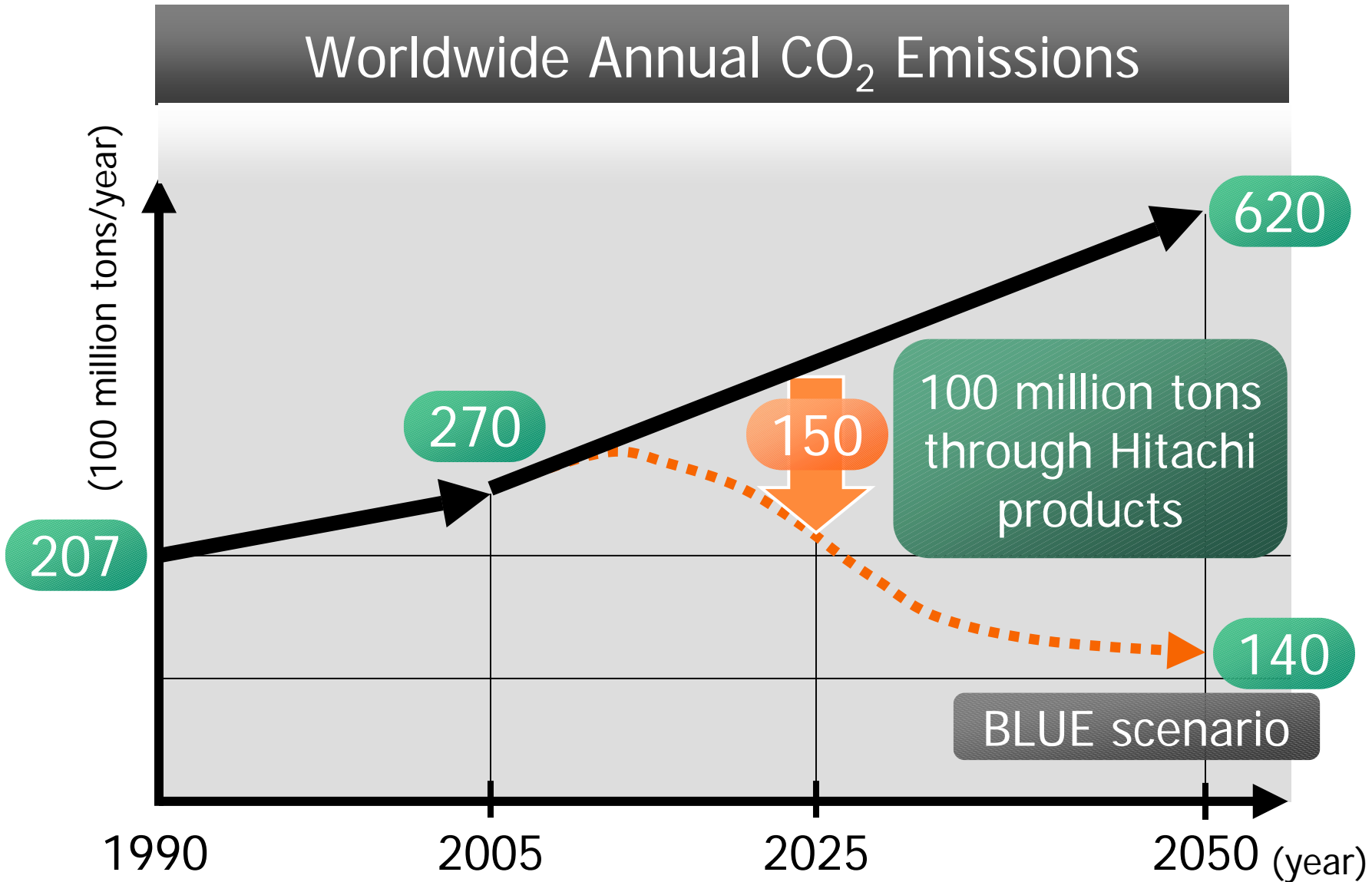
- Collect products for reuse or recycling

- Reduce negative effect on air, water and soil

1-2. Framework of Hitachi's Environmental Vision

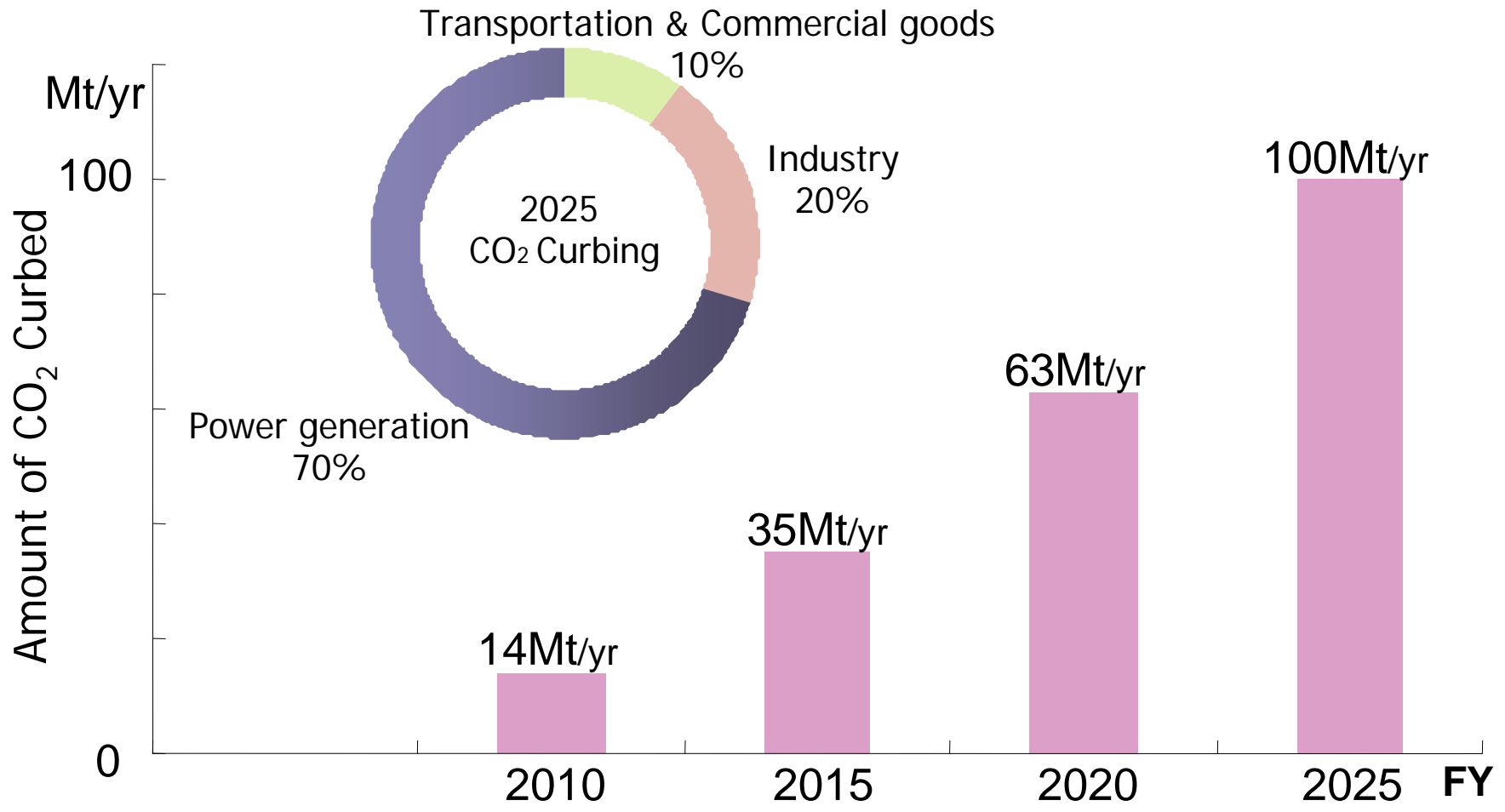


1-3. Contribute to curb CO₂ emission by 100M tons/year



Source: Hitachi, Ltd. based on IEA *Energy Technology Perspective 2008*

1-4. Plan to curb CO₂ emission by 1M tons/yr



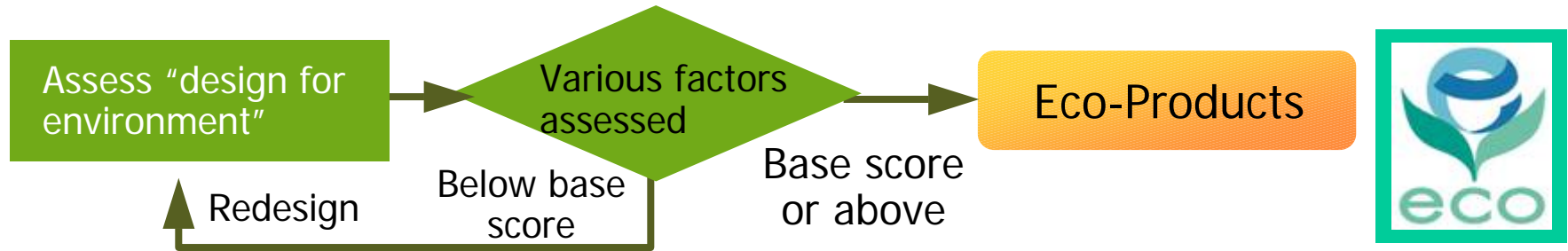
Plan for CO₂ Curbing

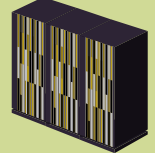









[base year: 2005]

1-5. To Curb Environmental Burden to Society: Hitachi Eco-Products

● Product development according to assessment on design for environment

Assessment factors	1) reduction 4) ease of disassembly/processing 6) energy efficiency	2) extension of product life 7) packaging	3) recyclability 5) environment preservation 8) information availability
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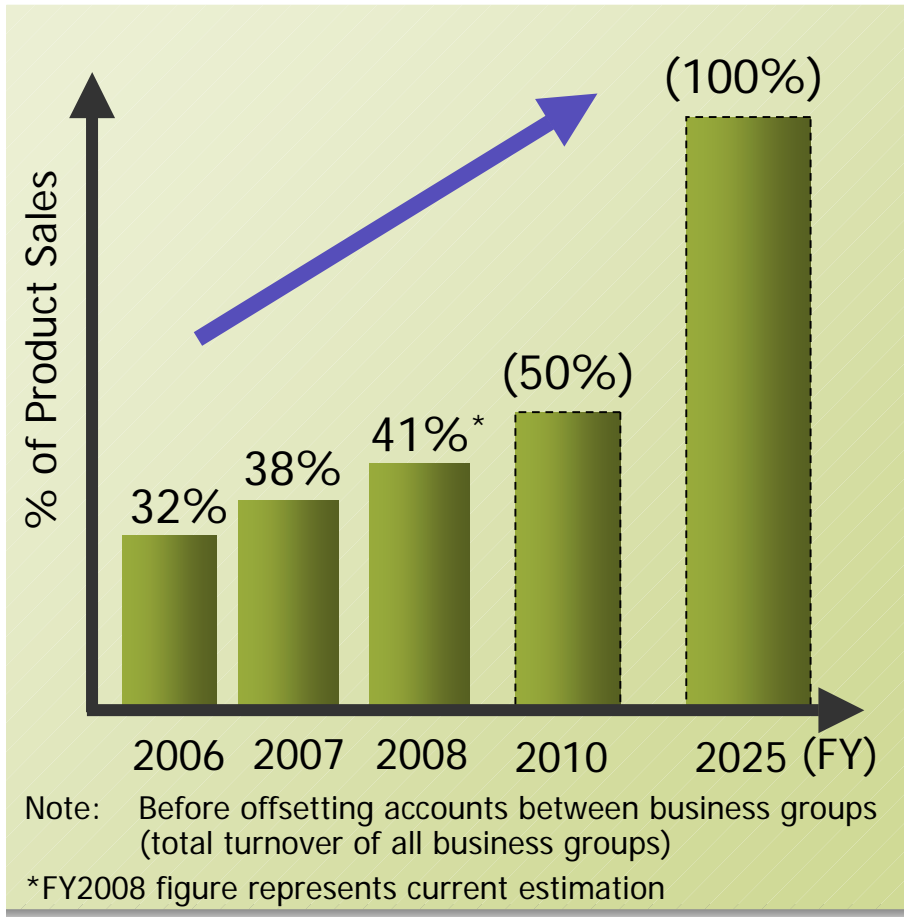


Information & Telecommunication Systems	Electronic Devices	Power & Industrial Systems	Digital Media & Consumer Products	Highly Functional Materials & Components
 Server  Hard disk drive	 Clinical analysis  CD-SEM	 H25 Gas turbine  Amorphous transformer	 Plasma display TV  Washing machine	 Anisotropic conductive film ANISOLM  Eco-cables

1-6. Consistency of strategies between core businesses and environment

● Make all our products & services Hitachi Eco-Products by 2025

Increase in Eco-Products



Strategies to expand business

- Increase in Eco-Products
 - Pursuit of environmental efficiency
- Active investment in environmental business

- Power generation
- Green mobility
- Green ICT
- Urban infrastructure, etc.

↓
Core business

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1 Environmental strategy

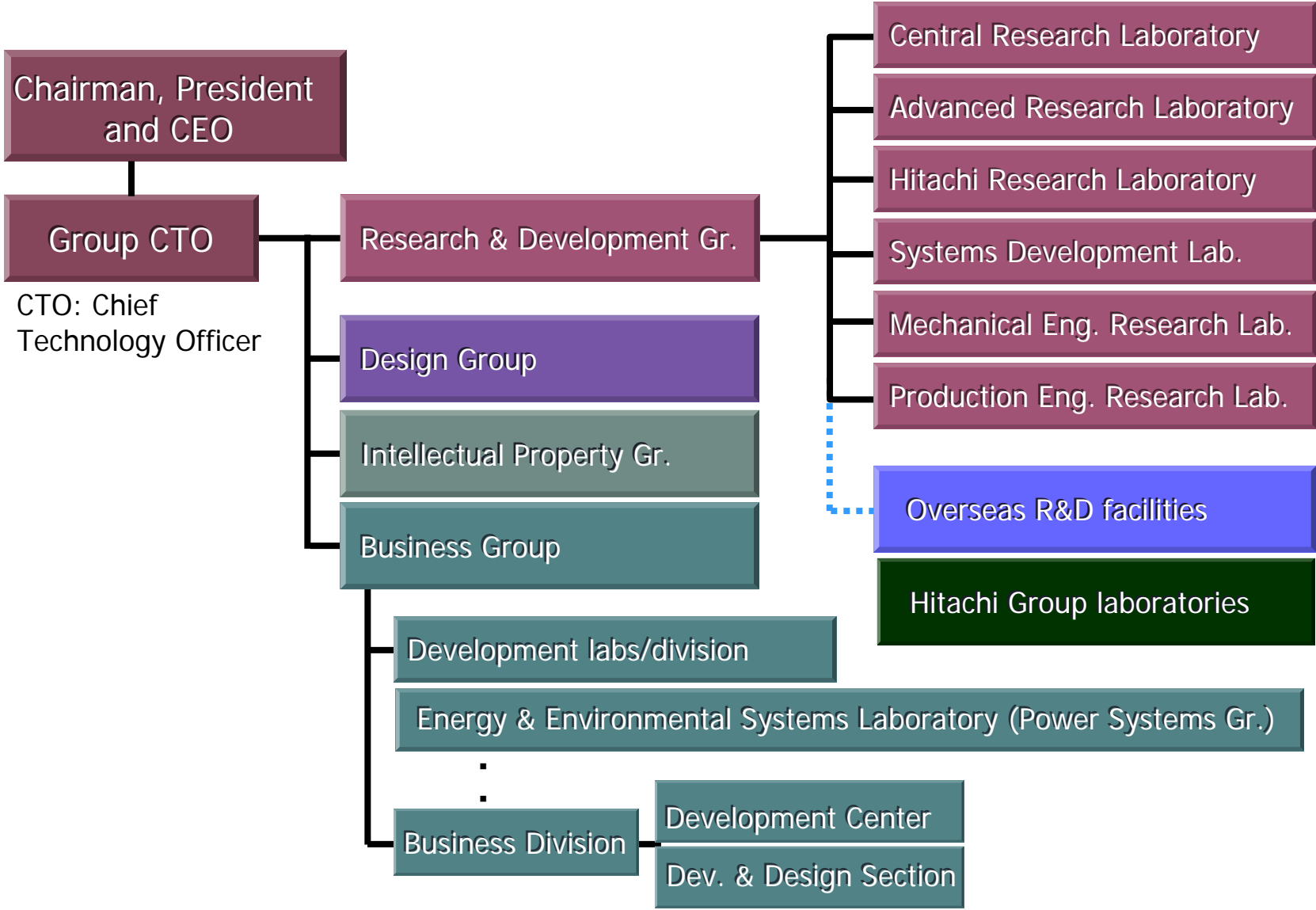
2 R&D strategy

2.1 Fortify R&D organization

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2-1. Group R&D organization



Technology Platforms across the Hitachi Group

1 Expand current business

2 Generate new business

3 Create innovative technology

6 Corporate Laboratories

Central Research Lab.
<950>



Kokubunji-shi, Tokyo

Info. & Comm., Embedded Systems,
Solution LSI, Storage, Life Science

Mechanical Engineering
Research Lab. <380>



Hitachinaka-shi, Ibaraki

Mechatronics Application Systems

Production Engineering
Research Lab. <340>



Yokohama-shi, Kanagawa

Management & Production Systems
and Process, Facilities

Hitachi Research Lab.
<680>



Hitachi-shi, Ibaraki

Public Systems, Devices,
Components & Materials

Systems Development Lab.
<500>



Kawasaki-shi, Kanagawa

Info. Systems, Security, Ubiquitous,
Storage, Service Solutions

Adv. Research Lab. <100>



Hatoyama-machi, Saitama

Human & Information, Health &
Measurement, Environment & Energy,
Nano-Materials & Devices

<No. of Employees as at 2009/4/1>

2-3. Technology Platforms across the Hitachi Gr.

Group wide enhancement & fusion of common key technology and personnel development

	Mechanical & Electrical				Electronics			Information				
Details	Materials		Digital Engineering		Embedded Systems			Service Science				
	Electronics Environment & Energy New materials Medical & Biotechnology Nanotechnology		Electron beam-based measurement Non-destructive measurement Product design support Optimal motor development		Solution LSI Efficient systems development Platforming Project management Optimal inverter development			Outsourcing EA*/SoA**/Initial stage consulting Application of advantage technology & devices New Service Methodologies *EA: Enterprise Architecture **SoA: Service Oriented Architecture				
Technology Platform	Materials Research Laboratory		Mechanical Innovation Center		Advanced Simulation Center		Motor Innovation Center	Adv. Measurement & Analysis Center	Inverter Innovation Center	Embedded System Platform Research Laboratory	uVALUE Innovation Center	Cooperative Creation with Customers (Lab. Open Days)
	'04.04		'05.03		'04.04		'05.10	'04.04	'06.04	'05.04	'05.10	'02 ~

Allocation of research resources

Expansion of priority business
(70%)

Priority Themes: monthly follow-up

Innovation research
(10%)

Strategic research
for growth

Platform research (20%)

Measures

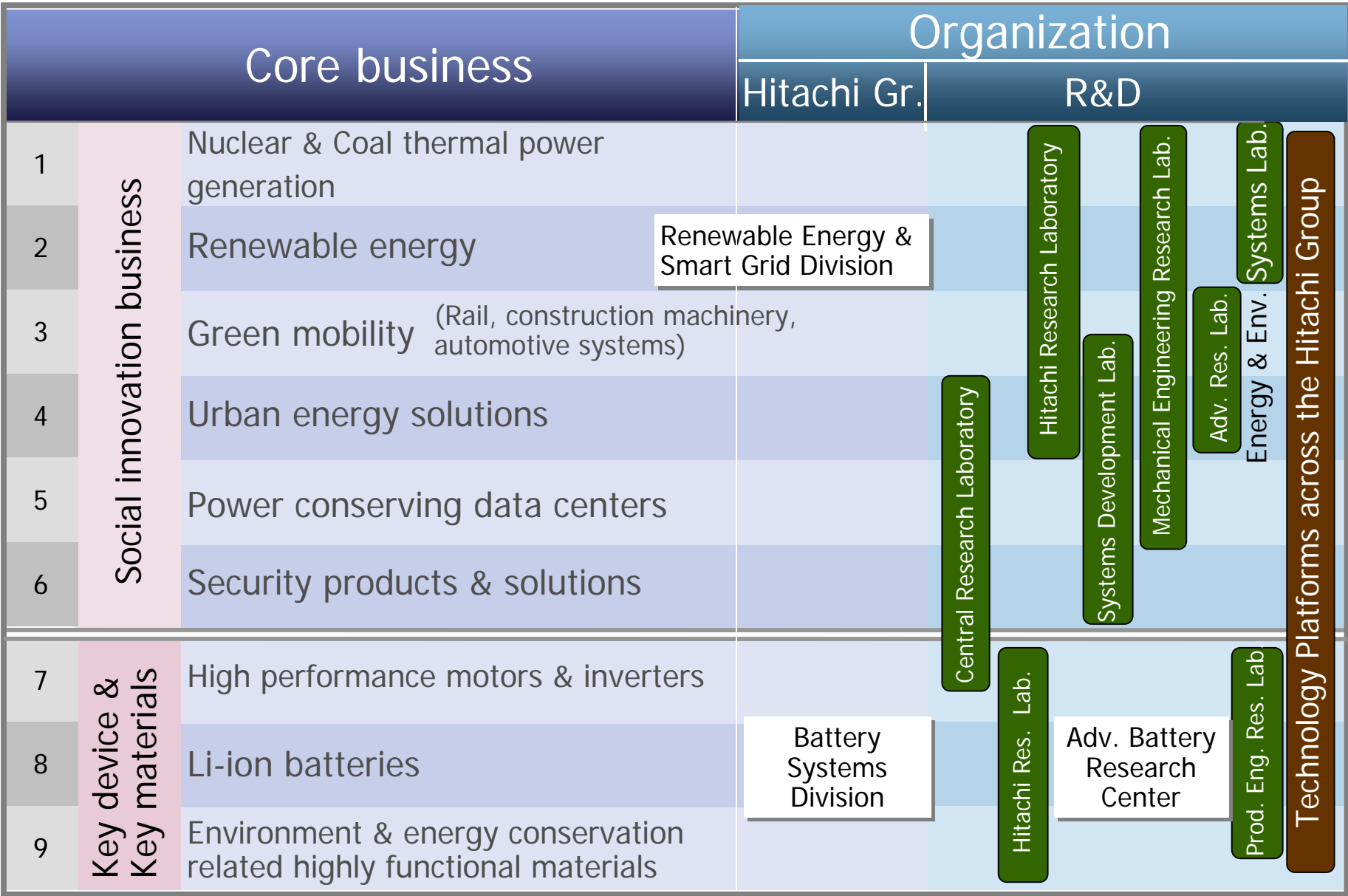
1. Exercise Group synergy

Use of Token (Special R&D scheme)

2. Alignment of business & technology roadmaps

Group CTO meeting

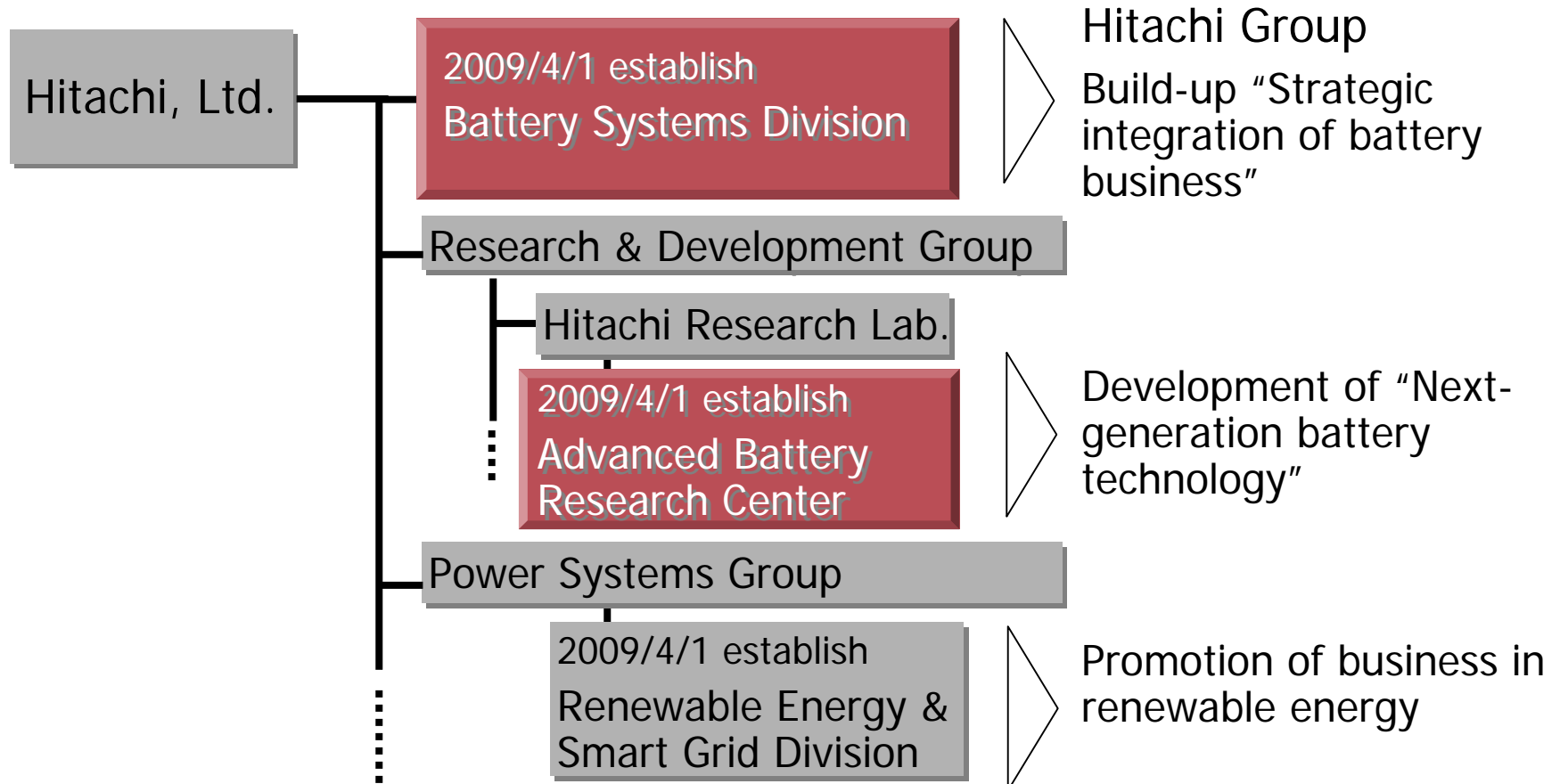
2-5. Initiatives in social innovation business



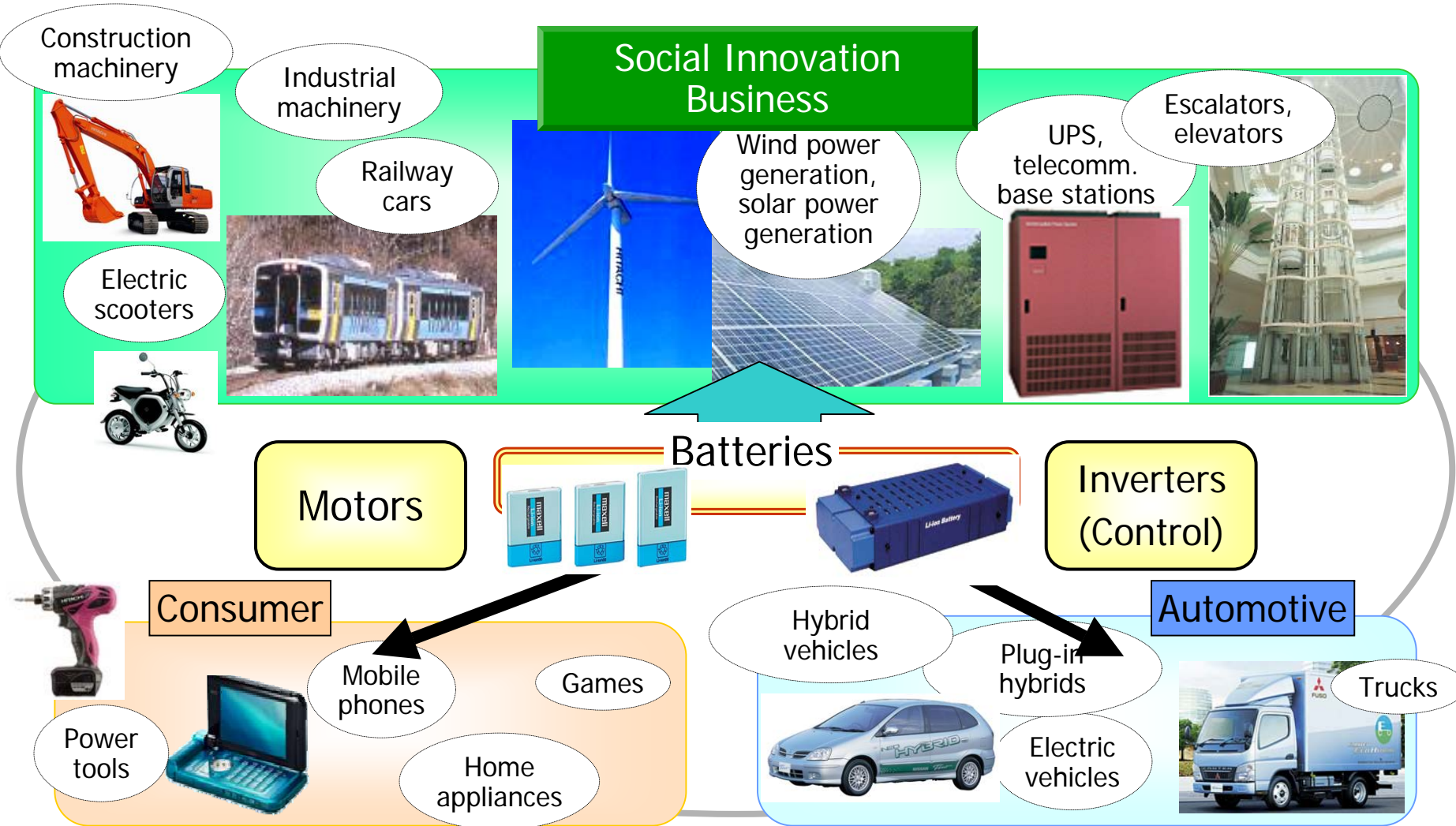
2-6. Establishment of an integrated strategic organization for battery business

Mission

1. Strengthening Hitachi Group synergy in the battery business
2. Pioneering new applications for Li-ion batteries



Batteries: 3rd Core Device in Addition to Motors & Inverters



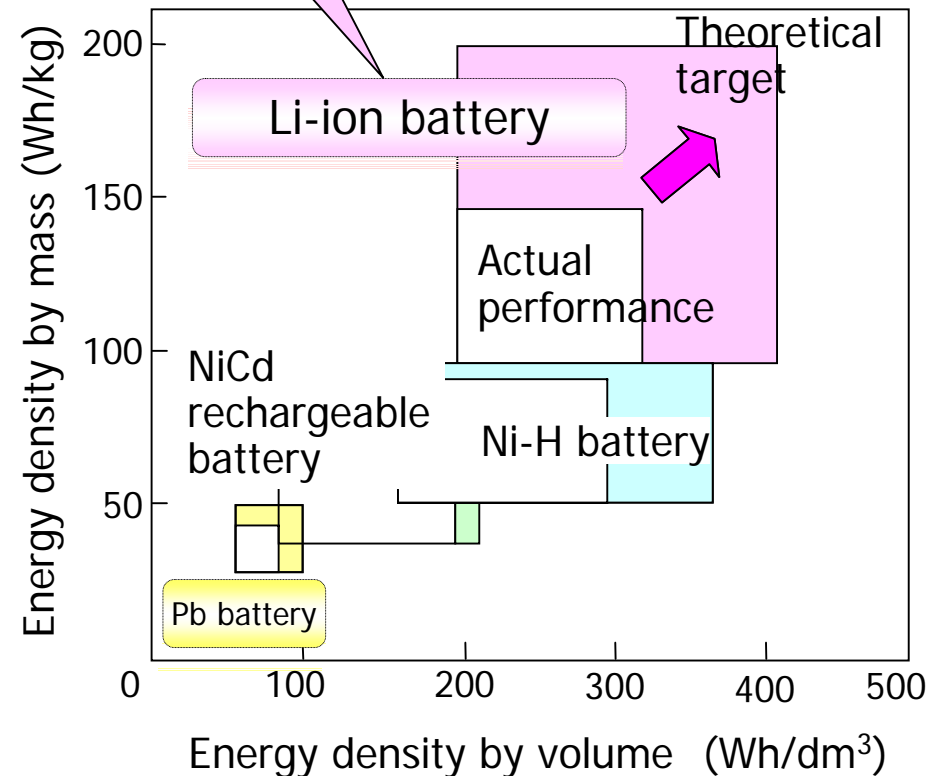
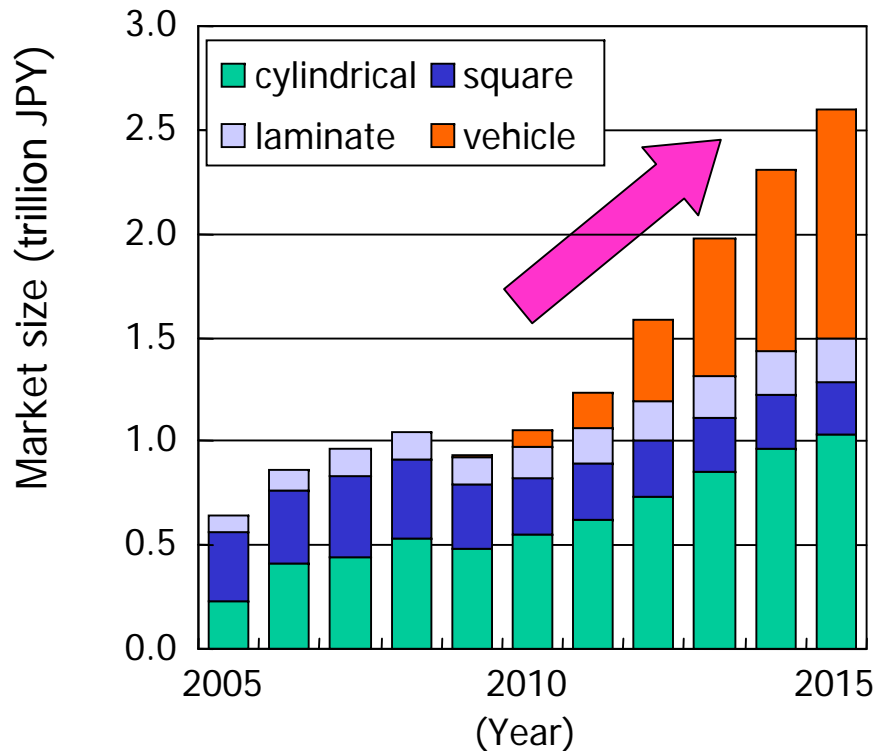
2-8. Aims & issues for Li-ion batteries

- Light & high-energy density are characteristics, suitable for a wide range of applications from consumer products to medium-large equip.
- Issues in mass distribution: safety & cost

Volume & weight of Li-ion battery

→ 1/2 NiH battery

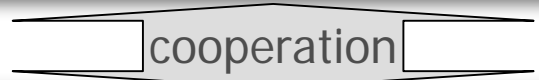
→ 1/3 Pb battery



【Mission】 Development of high capacity, high safety Li-ion batteries for industrial applications & automotive vehicles

Organization

Battery Systems Division (est. April 2009)



Hitachi Research Laboratory
 Adv. Battery Research Center
 • Est. April 2009

Mechanical Engineering Research Lab.
 & Production Eng. Research Laboratory

Group synergy

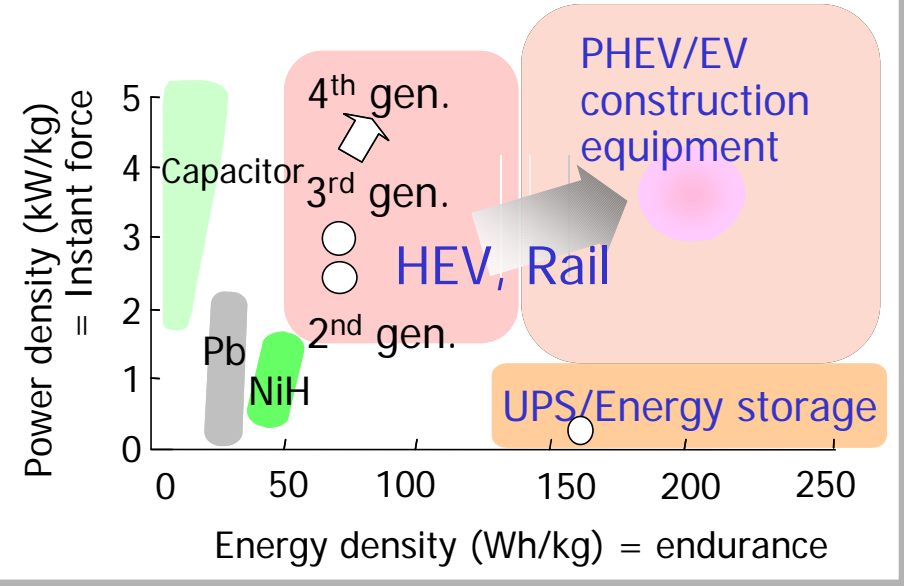
Manufacturing facility	Materials	Electrode, etc.	Battery cell
Hitachi Plant Technologies Ltd.	Hitachi Cable, Ltd.	Hitachi Maxell Ltd.	
Hitachi Setubi Engineering Co., Ltd.	Hitachi Metals Ltd.	Hitachi Vehicle Energy Ltd.	
Hitachi Engineering & Services Co., Ltd.	Hitachi Chemical Co., Ltd.	Shin-Kobe Electric Machinery Co., Ltd.	
	Hitachi Powdered Metals Co., Ltd.		

Technology development

- Increased power
- Increased safety
- Higher quality

Target

Achieve both endurance & instantaneous force



PHEV: Plug-in Hybrid Vehicle EV: Electric Vehicle
 HEV: Hybrid Electric Vehicle UPS: Uninterruptible Power System

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2-10. Global R&D network

Mission of overseas R&D centers

1. Contribute to local business operations
2. Cooperate with world leading research centers
3. Deployment of global staff (% local staff: 75%)

Hitachi Europe Ltd. - European R&D Centre



Staff: 35

- Fundamental device physics
- Organic electronics
- Mobile communications
- Security
- Automotive systems

- Fundamental physics research at the Univ. of Cambridge

- Hitachi Cambridge Lab.

- Technology support for European automobile manufacturers

- Automotive Research & Development Lab.

Manager: David Williams

Hitachi America, Ltd. - R&D Division



Staff: 40

- Automotive components
- Advanced wireless systems
- Storage area network solutions

- Close cooperation in development with US automobile manufacturers

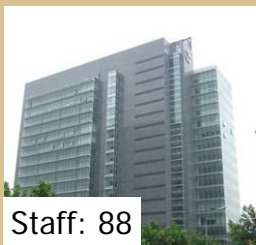
- Automotive Products Research Lab.

- R&D for the next-generation U.S. storage business

- Storage Area Network Laboratory

Manager: George Saikalis

Hitachi (China) R&D Corporation



Staff: 88

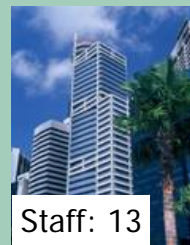
Vice President: CHEN Yang-Qiu

- IP network
- Digital TV
- Innovative software
- Materials, etc.

- Info. & Communications, Software, Environmental tech.

- Industry-academia cooperation with Tsinghua Univ., Fudan Univ., etc.

Hitachi Asia Ltd. (Singapore) - R&D Center



Staff: 13

- Storage mechanics
- Network storage
- Water treatment

- Establishment of India Office(2008)

- R&D in line with national strategy to fortify storage technology

- Regional R&D hub in ASEAN region and south Asia

Europe	<ul style="list-style-type: none">• Joint global research for low CO₂ coal-fired thermal power• Technology development for UK rail business
North America	<ul style="list-style-type: none">• Joint research with IBM for beyond 32nm node semiconductor manufg. techn.• Cooperative creation with local R&D and North American customers in the storage business
China	<ul style="list-style-type: none">• Energy conserving electric system project in Yunnan Province• Order received for rail wireless communication system in Chongqing
Asia	<ul style="list-style-type: none">• Establishment of India Office, Hitachi lecture series at the Indian Institute of Technology

Energy conserving electric system project in Yunnan Province

Delivery of industrial high voltage inverter



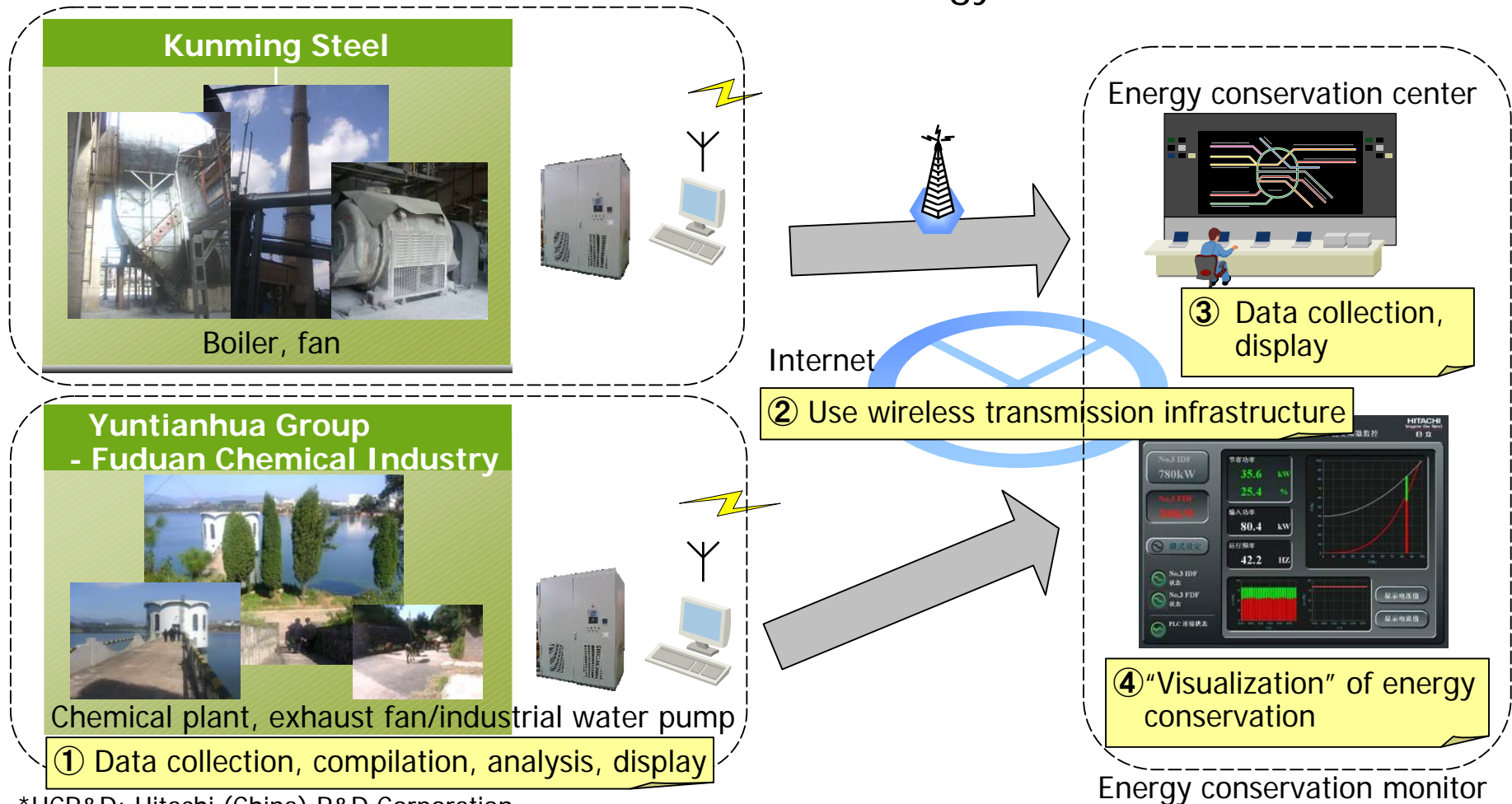
(For fan in iron/steel production)



(For intake pump)

2-12. Technology development in the Yunnan energy conservation model project

Development of an energy conservation monitoring system applying HCR&D* information & communication technology



*HCR&D: Hitachi (China) R&D Corporation

CERNET: China Education & Research Network; ITS: Intelligent Transportation System; CDM: Clean Development Mechanism

First major European order: British CTRL*

*Channel Tunnel Rail Link



Appointed preferred bidder status*
(Feb. 2009): British IEP**

- * British-led Agility Trains consortium; comprising of Barclays Private Equity, Hitachi, Ltd. and John Laing
- ** Intercity Express Programme

- ◇ 200km/h high-speed rail cars
- Project to replace a max. of 1,400 cars
- ◇ 2013: Plan to commence operation

Environment-conscious hybrid technology

World's first commercial run

(2007/7)



(East Japan Railway Company: Kōumi Line)

High-speed hybrid test train "HAYABUSA"

(2007/9~2008/3)



Test run in England

Li-ion battery module for high speed diesel hybrid rail cars



Battery system



Embedded battery module



2-14. Global R&D activity

Hitachi contributions recognized in Cambridge Univ. 800th anniversary celebrations



2008/5

Commence collaborative lectures at Tsinghua University



2008/6

Indian Institute of Technology:
Hitachi lectures



2008/10 ~ 2009/4

Global cooperative creation in coal thermal power generation:
Pilot tests in CO₂ recovery (2009)

<p>RWTH Aachen Uni.</p> <p>Oxygen CO₂ combustion</p>	<p>Stanford Univ.</p> <p>Elementary reaction model</p>	<p>Energy & Environmental Systems Lab.</p> <p>LES analysis</p> <p>Low NOx combustion</p> <p>Virtual Boiler analysis</p>
<p>Babcock-Hitachi K.K. Kure Laboratory</p> <p>5MW test combustion</p>	<p>Coal O₂ combustion boiler</p>	
<p>Ruhr-Uni. of Bochum</p> <p>Ash radiation model</p>	<p>Hitachi Research Lab.</p> <p>High temp. materials</p>	

Joint research with IBM

- IBM Thomas J. Watson Research Center
- State Univ. of New York (Albany Nanotech Complex)



2008/2 ~

Basic research on beyond 32nm node semiconductors

Elucidate semiconductor physics at the atomic level

New manufacturing equip.
New analytical equip.



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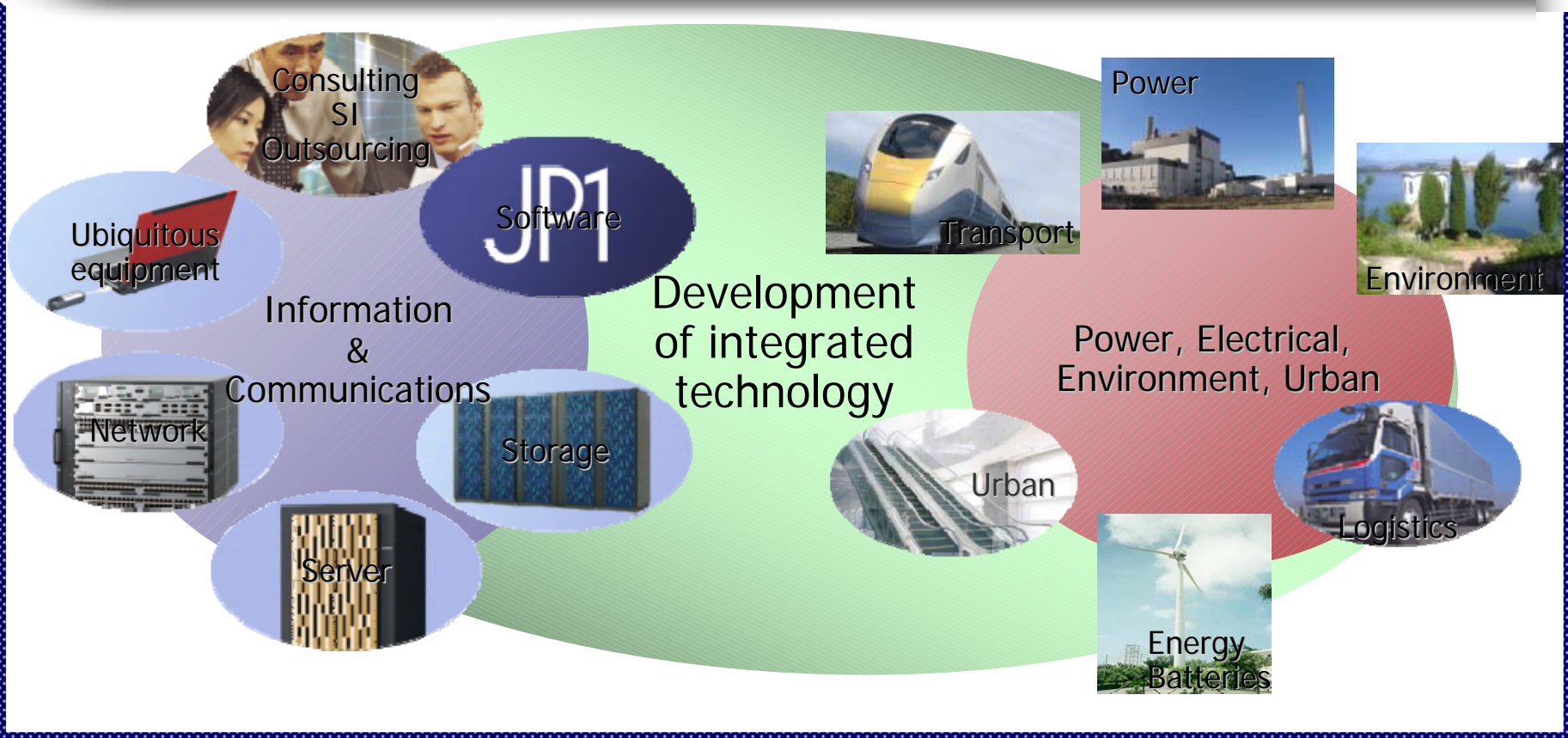
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Social innovation business that only Hitachi can provide



Establish Supervisory Office for Business Coordination (2009/4~)

2-16. Eco-Conscious data center

Fortify development of environment-conscious IT equip.

Harmonious Green Plan

Reduce 5-year CO₂ emission by 330,000 tons
(Corresponding to a forest area of 746km²)



Main equipment

- Server
- Storage
- Router
- Switch

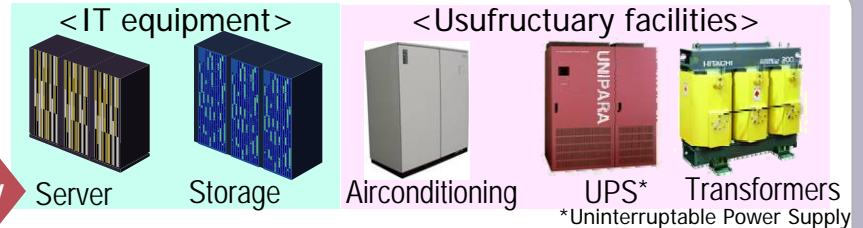
Developments to reduce power consumption in IT equipment

- Operational level (virtualization, etc.)
- Equipment level (Cooling, power, etc.)
- Component level (LSI, HDD, etc.)

Data center total energy conservation

CoolCenter50 Project

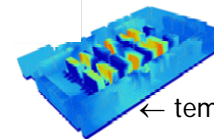
Reduce Data Center power by a max. of 50%



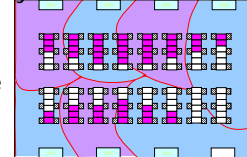
Apply

System management/monitoring

【IT- Air conditioning coordinated management technology】

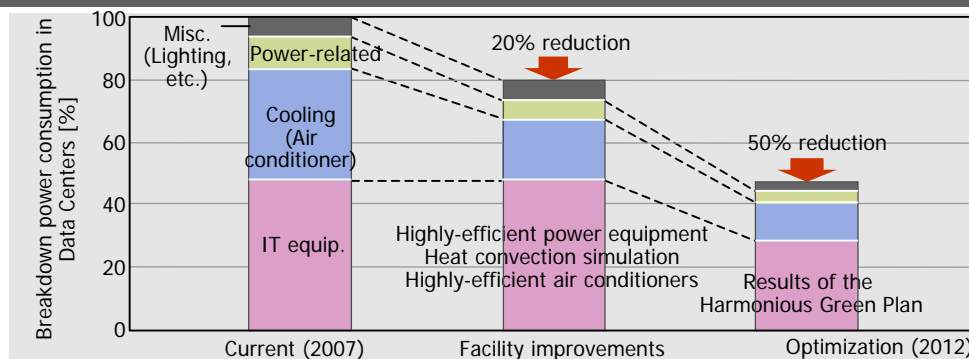


Analysis of load on air conditioners



Optimal control of air conditioning

Info. & Telecommunication
Systems Gr.
Hitachi Plant Technologies Ltd.
Central Research Laboratory
Hitachi Research Laboratory
Mechanical Engineering
Research Lab.
Systems Development
Laboratory

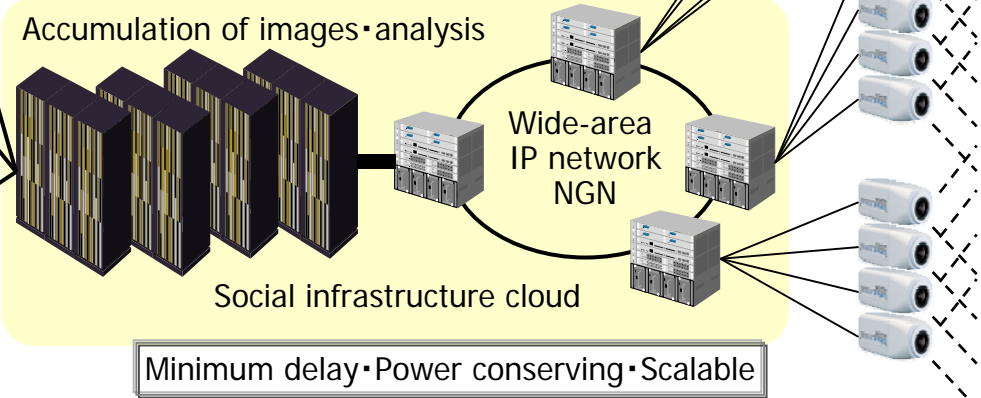
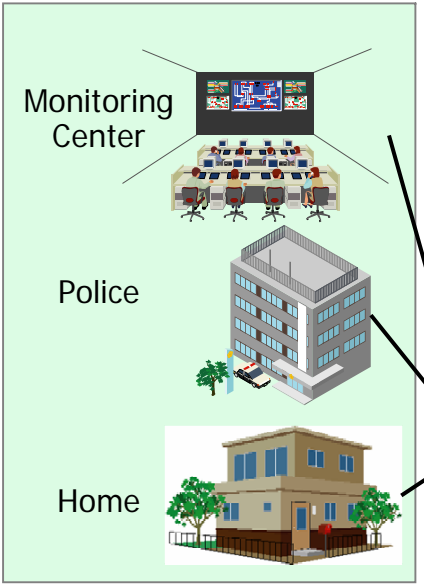
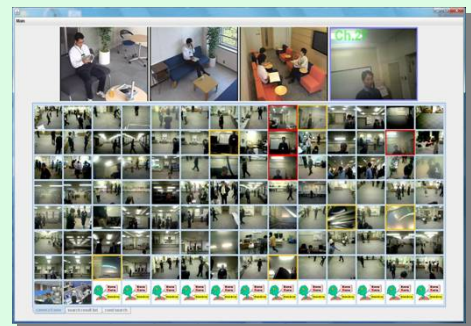


Urban & facility maintenance based on large-scale monitoring system using net cameras

- Urban Planning & Development Systems Gr.
- Hitachi Kokusai Electric Inc.
- Central Research Laboratory
- Hitachi Research Laboratory
- Mechanical Engineering Research Lab.

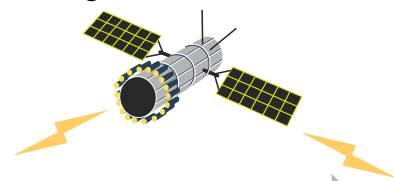
<Large-scale monitoring system>

- High-speed high precision facial recognition
- Seamless search of similar images from the monitor screen
- Display tracking of specific persons



- Monitor the operation status of over 500,000 construction machinery worldwide to improve productivity & reliability

Hitachi Construction Machinery
Hitachi Research Laboratory



On-site

- Current location
- Operational status
- Breakdown info.
- ...

Optimal production,
stock management

Increasing
productivity
& reliability

Increasing operational efficiency
Construction machinery administrator

- Real-time operation status
- Maintenance guidance

Hitachi Construction Machinery

Accumulate

- Transfer, operation history
- Maintenance history
- Trouble history
- Technical information

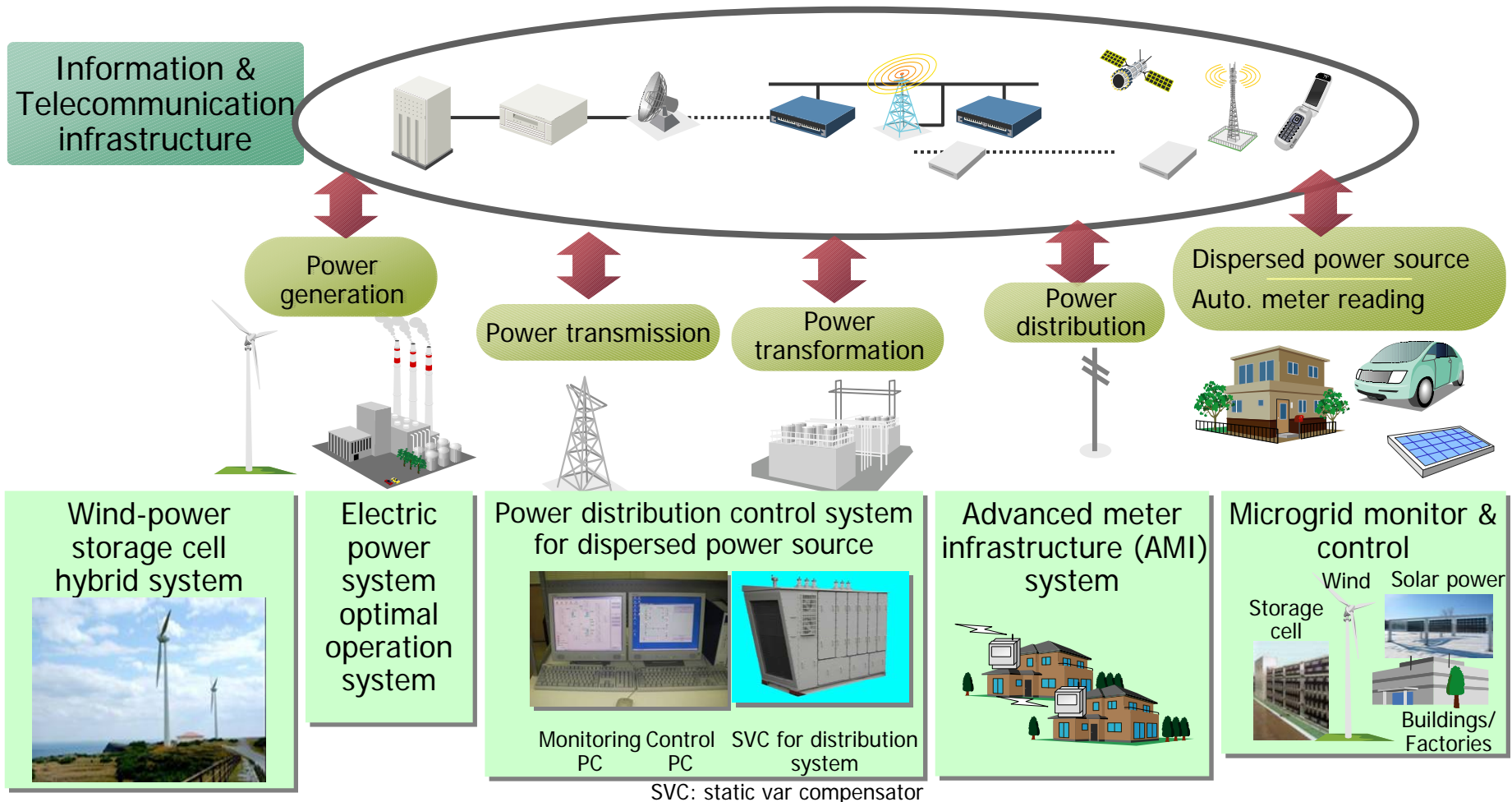
Transform into knowledge

Forecast of market trends and trouble/breakdown for each region, parts and equipment

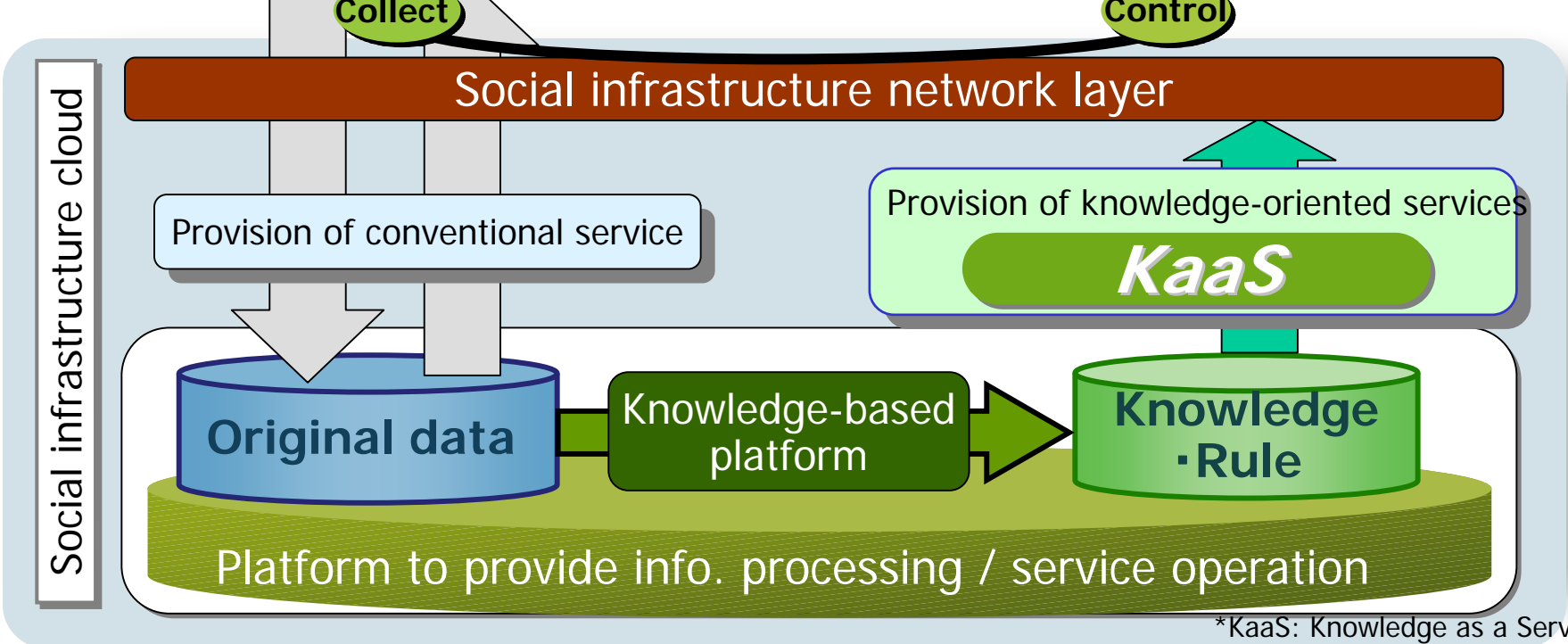
Assessment

2-19. Next-generation smart grid

- Achieve high efficiency & high reliability in power & energy infrastructure through the fusion of information & communication technologies and power & industrial systems technologies based on real-world businesses

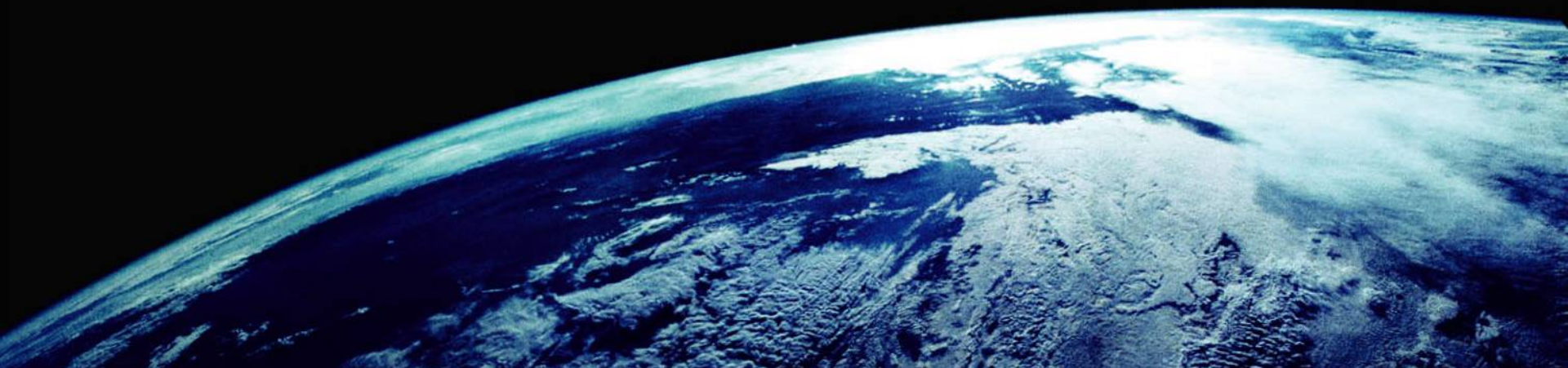


Promotion of social innovation business providing knowledge-oriented services



*KaaS: Knowledge as a Service

- For a “giant leap” in the centennial year of Hitachi's foundation -



HITACHI
Inspire the Next 