Japan’s New Science and Innovation Policy
-Beyond the Boundaries for Innovation -

March 9, 2011

at ISPlasma 2011, in Nagoya

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Japan Science & Technology Agency (JST)

Contents

Since 1989

End of the Cold-War
ICT revolution

Globalization ⇒
The World is
Changing Rapidly …

- **Sustainable development**
- **Climate change, disasters**
- **Energy, water & resources shortage**
- **Aging society, Smarter cities**
- **Infectious diseases, Disparity**
- **Knowledge-based society**

Now

Climate change

Economic crisis &
New Emerging market

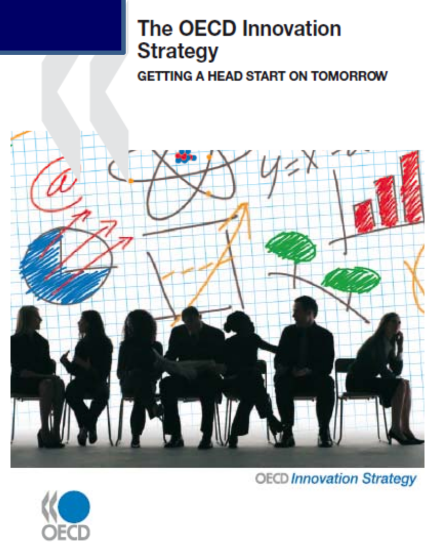

Since 1989
The Rules of games are Changing !!
Innovation & Entrepreneurship
Globalization and Localization
Shaping the Post-Crisis World
Shaping the Values and Leadership
Principles for a Post –Crisis World
Catalising the Next Wave of Growth
through Science & Innovation
Rethink, Redesign and Rebuild
Green New Deal & Smart Ageing Society
Global Management & Governance of
Enterprises and S& I
e change
The Economist
masters of
gement
Economic crisis &
New Emerging market
society

Innovation for what in the 21st century ?

- ○Innovation for profit
- ○Innovation for competitiveness
- ○Innovation for growth
- ○Innovation for employment
- ○Innovation for wellbeing & quality of life
- ○Innovation for safety, security & social cohesion
- ○Innovation for sustainable development

Innovation horizon is expanding,
Science and technology policy is changing.

" OECD New Innovation Strategy " , May 2010
- Getting a head start on tomorrow -



The broad concept of innovation embraced by the OECD Innovation Strategy emphasises the need for a better match between supply-side inputs and the demand side, including the role of markets. Moreover, policy actions need to reflect the changing nature of innovation.

* Broadening policies to foster innovation beyond science and technology in recognition of the fact that innovation involves a wide range of investments in intangible assets and of actors.

* Education and training policies adapted to the needs of society today to empower people throughout society to be creative, engage in innovation and benefit from its outcomes.

* Greater policy attention to the creation and growth of new firms and their role in creating breakthrough innovations and new jobs.

* Sufficient attention for the fundamental role of scientific research in enabling radical innovation and providing the foundation for future innovation.

* Improved mechanisms to foster the diffusion and application of knowledge through well-functioning networks and markets.

* Attention for the role of government in creating new platforms for innovation.

* New approaches and governance mechanisms for international cooperation in science and technology to help address global challenges and share costs and risks.

* Frameworks for measuring the broader, more networked concept of innovation and its impacts to guide policy making.

Contents

Legal framework : S&T Basic Law and Basic Plan

Science and Technology Basic Law（enacted unanimously in 1995）

1st Basic Plan（FY 1996-2000）

●Increase in government R&D expenditure

The total budget for governmental R&D expenditure exceeded **170 B$.＜176 B$＞**

●Construction of new R&D system

- Increase in competitive research funds
- Support plan for 10,000 post-doctoral fellows
- Promotion of industry-academia-government collaboration
- Implementation of evaluation systems

2nd Basic Plan（FY 2001-2005）

●Three basic ideas

(i) Creation of wisdom
(ii) Vitality from wisdom
(iii) Sophisticated society by wisdom

●Key policies

- Strategic priority setting in S&T
  - Promotion of basic researches
  - **Prioritization of R&D**
- S&T system reforms
  - Doubling of competitive research funds
  - Enhancement of industry-academia-government collaboration
- Total budget :**240 B$ ＜211 B$＞**

3rd Basic Plan（FY 2006-2010）

●Three basic ideas

Create Human Wisdom, Maxim… and Protect Nation's Hea…

●Key Polici…

Promo…

- Quantum… based … creation … researchers
- Basic rese… in diversified areas
- Strategic basic research

Prioritization of R&D

Prioritized 4 Areas	Promoted 4 Areas
*Life Science	･Energy
*ICT	･Manufacturing technology
*Environment	･Social Infrastructure
*Nanotech/Materias	･Frontier

Key Technologies of National Importance

S&T System Reform

- **Developing, securing and activating human resources**
- **Creating scientific development and persistent innovation**
- Total budget :**250 B$ ＜215 B$＞**

4th Basic Plan（FY 2011-2015）

1

New Growth Strategy, June 2010

- Strong Economy, Robust Public Finances & Strong Social Security System -

- Achieve nominal & real growth in excess of 3% and 2% by 2020
- Return consumer prices to positive increase in FY2011
- Lower unemployment rate to 3% - 4% at an early time

【Growth areas】

Green Innovation

【Targets by 2020】

・Create over ¥50 trillion in new markets and 1.4 million new jo

・Reduce worldwide greenhous gas emissions by 1.3 billion to using Japanese technology

Life Innovation

【Targets by 2020】

Foster industries that meet demand and create jobs:

-Roughly ¥45 trillion in new markets and 2.8 million new jobs

Opening new frontiers

- Asia
- local Revitalization

Platforms to support growth

- Science & Technology
- Employ-ment & human resources

S&T as an engine for New Growth Strategy

The 4th S&T Basic Plan（FY 2011-2015）

Comprehensive promotion of science, technology and innovation policy

3

4th Science and Technology Basic Plan (1)

Basic concept

Positioning of the Basic Plan in National Strategy

○A five-year-plan with the foresight of 10 years ahead, based on **"New Growth Strategy".**
Comprehensive promotion of science, technology and innovation policy

○Perspective for 2020

- Nation which realizes sustainable growth
- " takes the lead in solving global issues
- " create the world's highest knowledge
- Nation which takes pride in high quality of life
- Nation where the youths hold a dream

Two major innovation as the national strategic pillar

Green Innovation

To realize low carbon society with sustainability

- Renewable energy, Low carbon of energy supply and demand, Saving energy, Green infrastructure
-Accelerate innovation by affirmative legal framework
-Establish "National Lab" with proper regulation easing
-Develop strategies for the international standardization

Life Innovation

To realize high quality of life in an aging society

- Promotion of preventive medicine, Development of innovative diagnostic and treatment method, Development of life-supporting technology for elderly and disability people
-Promote translational research
-Promote regulatory science
-Accelerate innovation by affirmative legal framework

The new system which stimulates innovation

To construct the system which promote issue-driven innovation

−Establish Innovation Strategy Platform
−Establish Open Innovation Centers
−Create a new market by the new affirmative legal framework

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4^{th} S&T Basic Plan (2)

Promotion of R&D which sustains the nation and produces new advantage

Bases for the high quality of life
- Maintain necessities: food/resources/energy
- Maintain safe society

Bases for the industries
- Extend advantage of Japan
- Create new advantage for the future

Bases for the nation
- Maintain a technology bases for security
- Develop a new frontier

Common Base for R&D
- Maintain cross-sectional key technologies
- Establish hubs of advanced R&D

Drastic Reinforcement of S&T Potential

Drastic reinforcement of basic research
- Reinforce basic research based on originality/variety
- Reinforce the world top-level basic research
- Form the group of "Research Universities"
- R&D Hub for International research network

human capital for S&T
- Drastic reinforcement of the graduate school education

Formation of research environment of international standard
- Domestic/international maintenance and utilization of large research facilities

International openness Integrated with world vitality
- "East-Asia Science and Innovation Area" Initiative

Implementing the new policy

Reforming S&T System : Construction of PDCA (Plan-Do-Check-Action) cycle

Bridging Science and Society : New development of S&T communication

Increasing R&D investment : Increase public and private R&D investment to **4%**(3.6), and government investment at **1%** (0.7) of GDP **<250 B$>**

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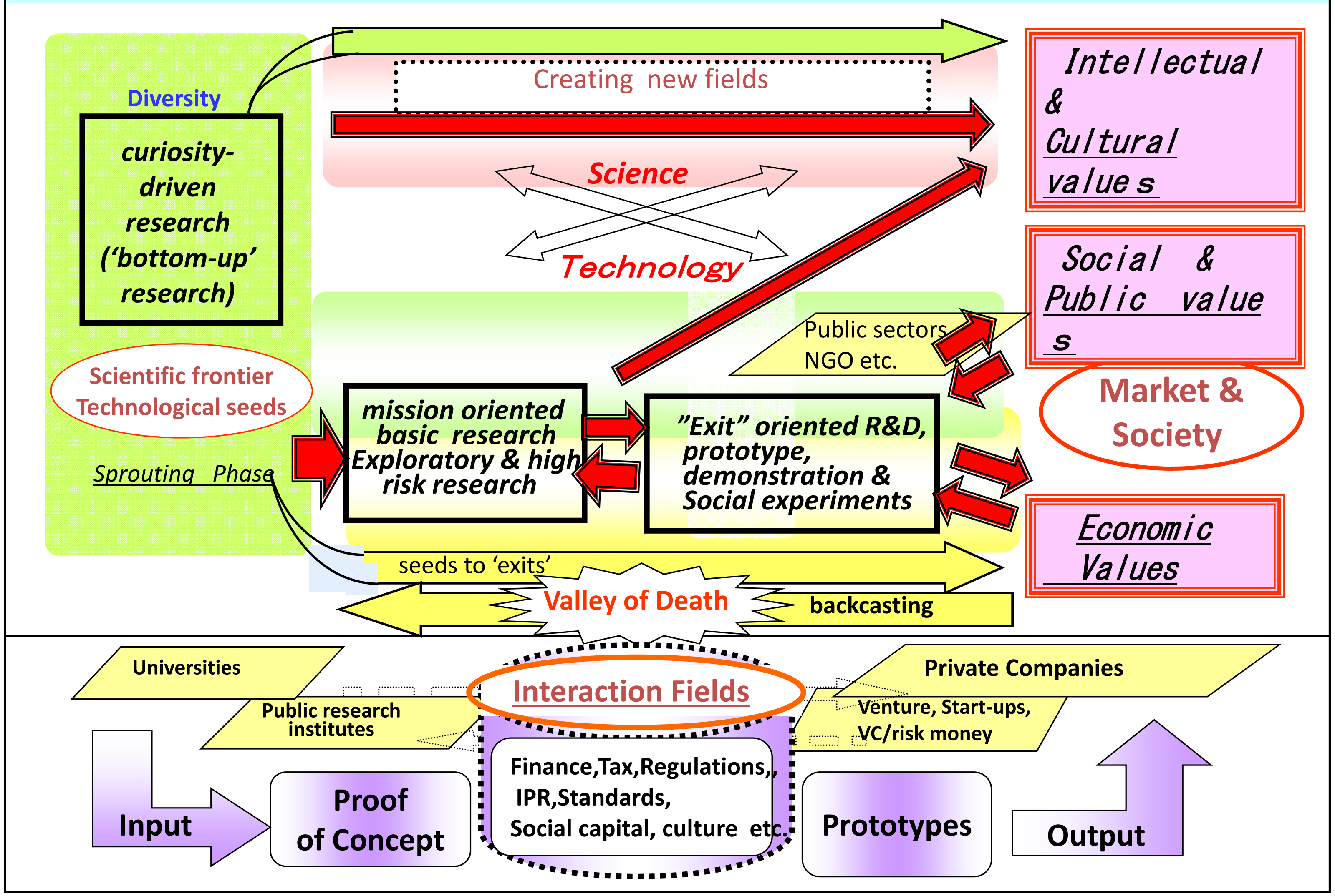
Contents

Funding system for science-based national innovation system in Japan



Grand challenges we should meet

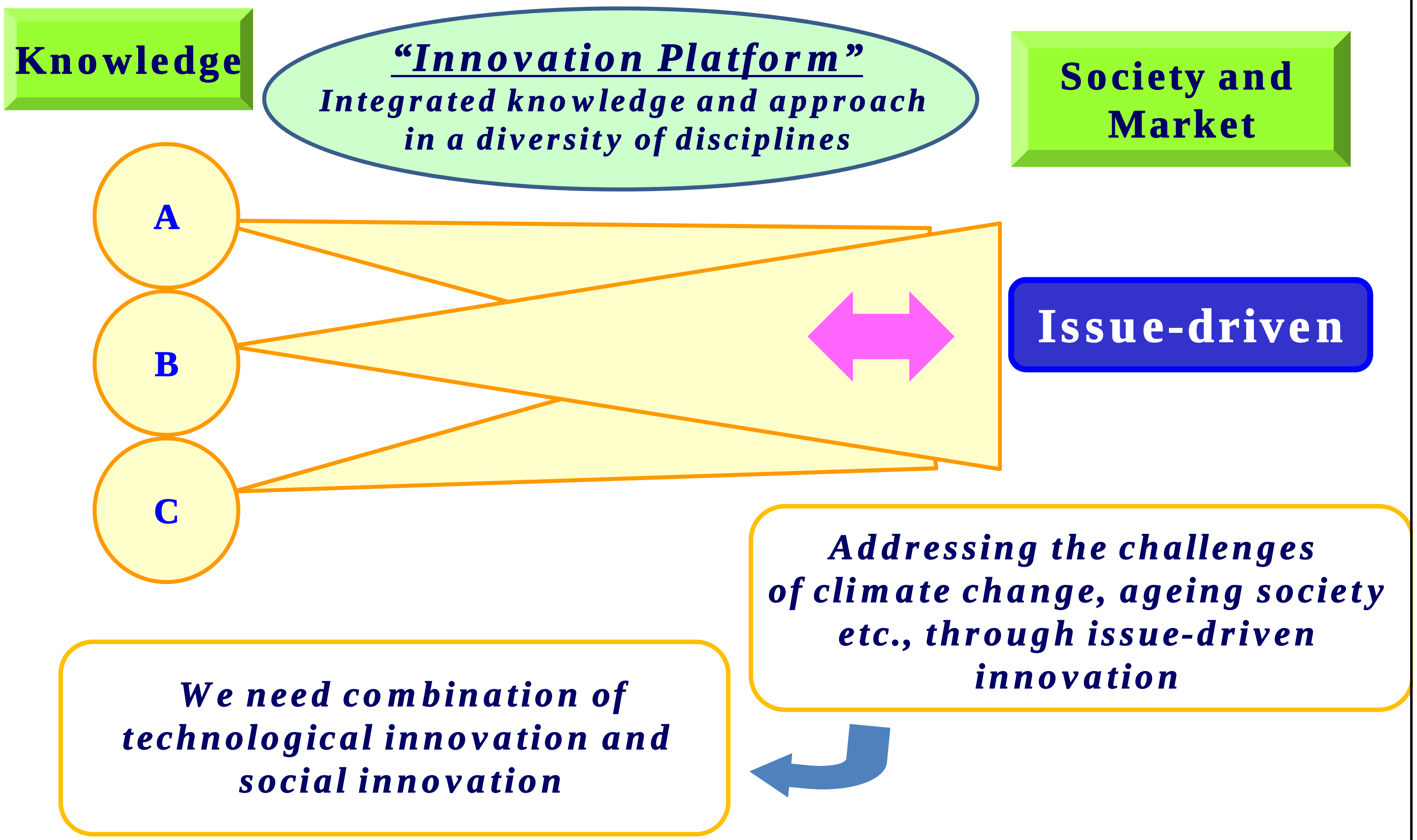
○The world is confronted with the global challenges of climate change, food and energy security, and infectious deceases which threaten sustainability.

○The New Growth Strategy should be empowered by S&T and innovation to transform the grand challenges to opportunities for thriving in the fiercer global competition.

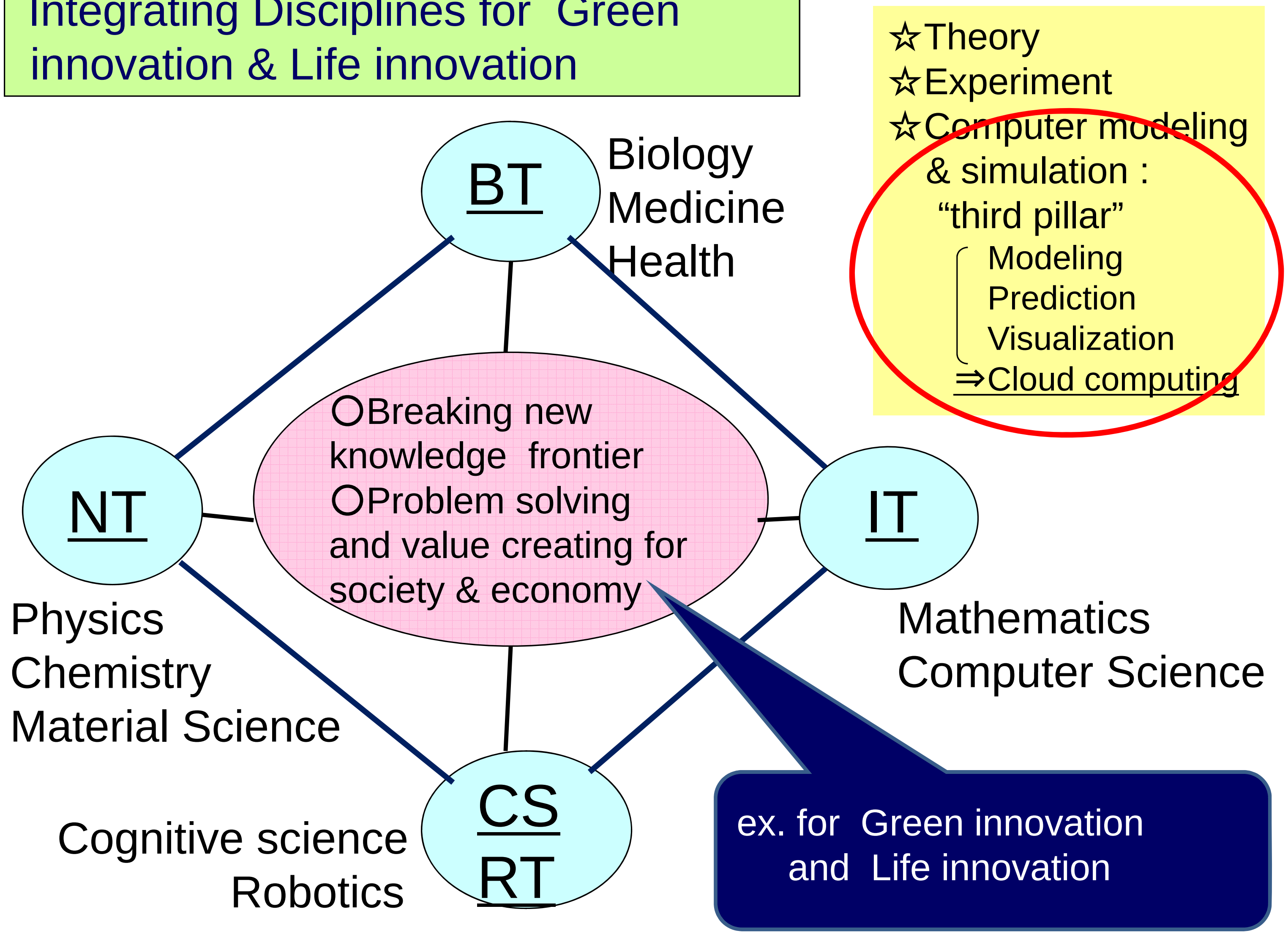
○Due to complexity of the challenges, it is getting more difficult to find a solution by single discipline of S&T.

○A diversity of knowledge derived in different disciplines of S&T along with social science and humanities should be integrated to address the challenges, which is characterized by Issue-driven Innovation beyond Discipline-oriented Innovation.

Grand challenge we should meet; New Policy : Issue driven innovation beyond discipline-oriented Innovation

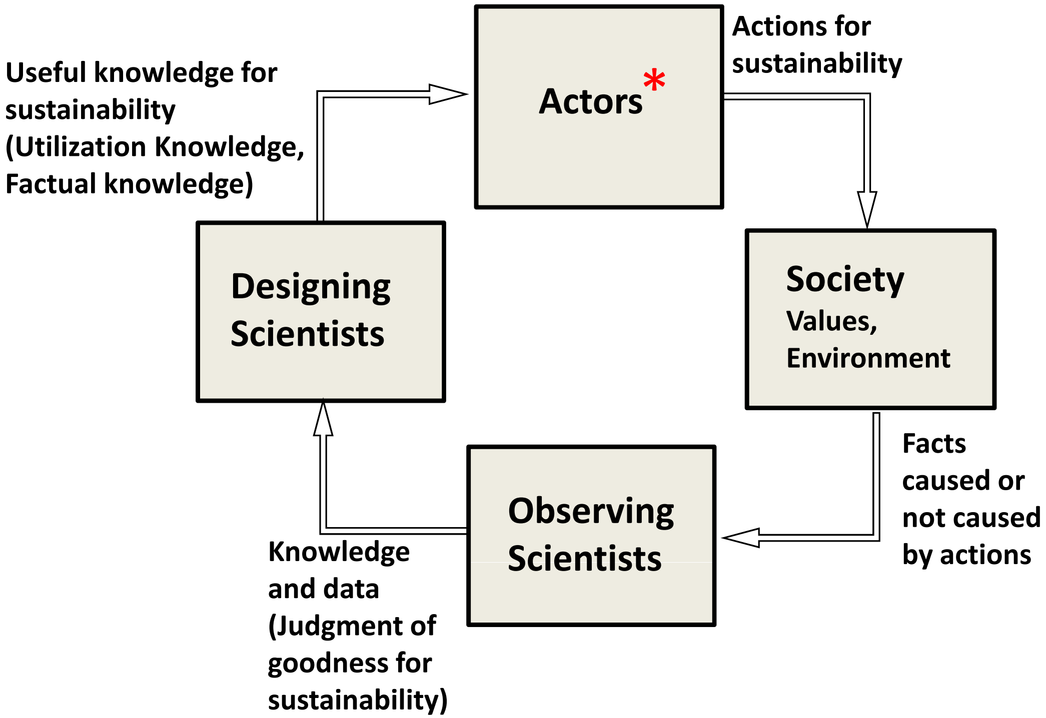


Integrating Disciplines for Green innovation & Life innovation



Basic Loop for Sustainable Evolution

by H.Yoshikawa, CRDS/JST

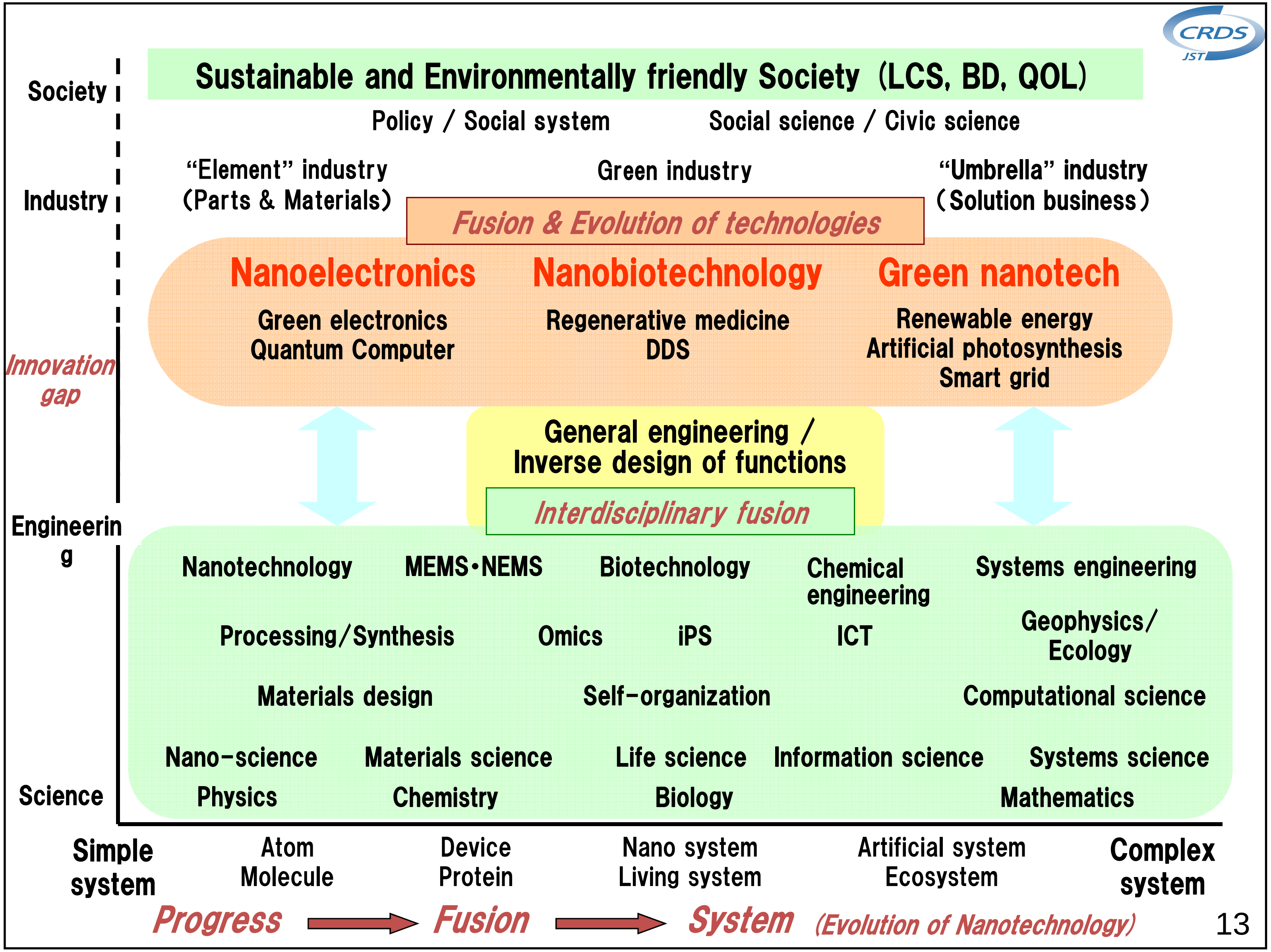


*Actors in Society are:

statesmen,
policymakers,
business humans,
administrators,
engineers,
educators,
writers,
artists,
journalists,
etc...

who move society.

C. S. Peirce: Abduction, F. Saussure: Evolutionary Loop, K. Popper: Piecemeal Technology


Sustainable and Environmentally friendly Society (LCS, BD, QOL)
Society
Policy / Social system
Social science / Civic science
Industry
"Element" industry (Parts & Materials)
Green industry
"Umbrella" industry (Solution business)
Fusion & Evolution of technologies
Innovation gap
Nanoelectronics
Green electronics
Quantum Computer
Nanobiotechnology
Regenerative medicine
DDS
Green nanotech
Renewable energy
Artificial photosynthesis
Smart grid
General engineering / Inverse design of functions
Interdisciplinary fusion
Engineering
Nanotechnology
MEMS・NEMS
Biotechnology
Chemical engineering
Systems engineering
Processing/Synthesis
Omics
iPS
ICT
Geophysics/ Ecology
Materials design
Self-organization
Computational science
Nano-science
Materials science
Life science
Information science
Systems science
Science
Physics
Chemistry
Biology
Mathematics
Simple system
Atom Molecule
Device Protein
Nano system Living system
Artificial system Ecosystem
Complex system
Progress
Fusion
System
(Evolution of Nanotechnology)
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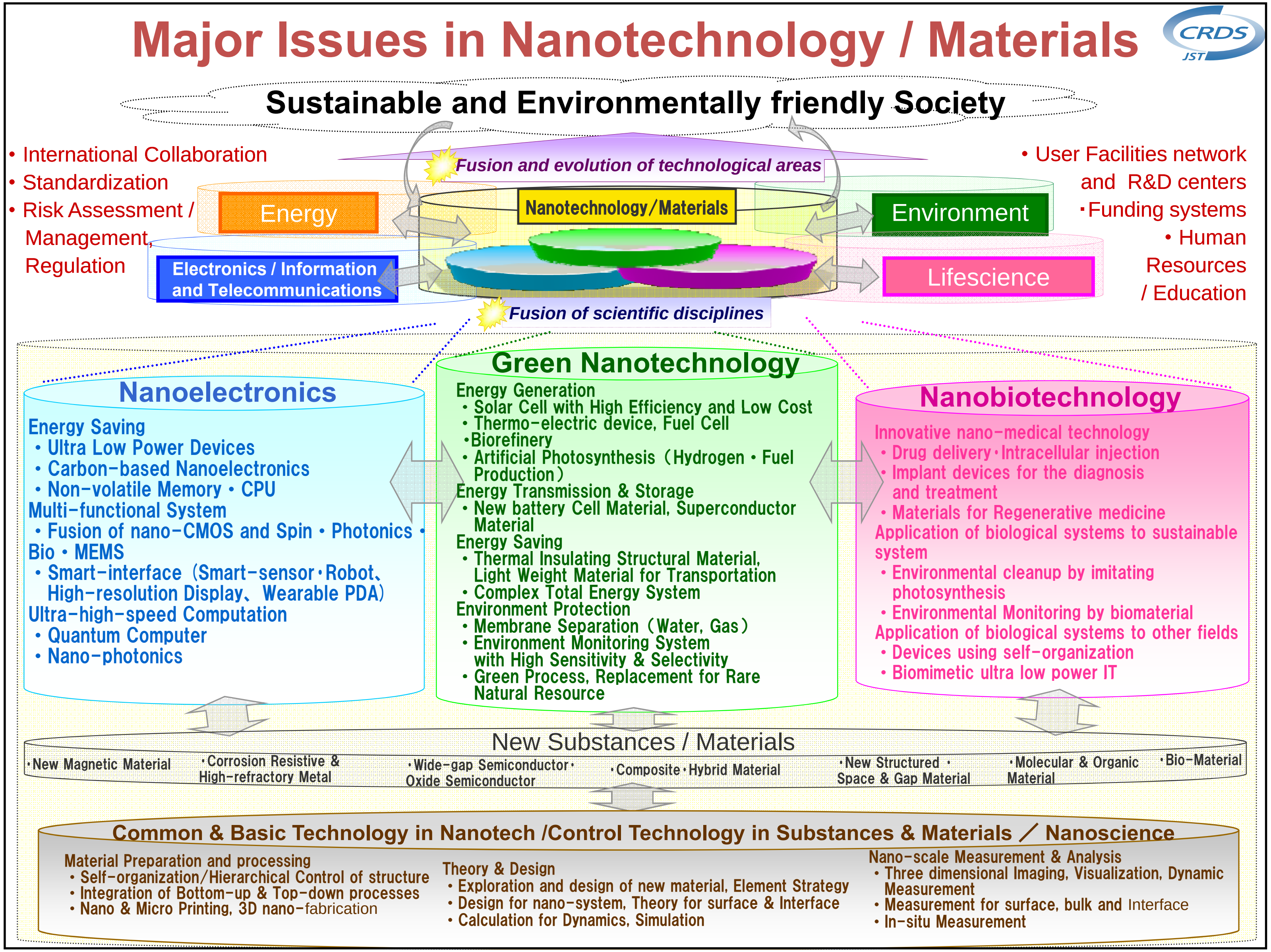
Major Issues in Nanotechnology / Materials
CRDS JST
Sustainable and Environmentally friendly Society
• International Collaboration
• Standardization
• Risk Assessment / Management, Regulation
Fusion and evolution of technological areas
Energy
Nanotechnology/Materials
Environment
Electronics / Information and Telecommunications
Lifescience
• User Facilities network and R&D centers
・Funding systems
• Human Resources / Education
Fusion of scientific disciplines
Nanoelectronics
Energy Saving
• Ultra Low Power Devices
• Carbon-based Nanoelectronics
• Non-volatile Memory • CPU
Multi-functional System
• Fusion of nano-CMOS and Spin • Photonics • Bio • MEMS
• Smart-interface (Smart-sensor・Robot、High-resolution Display、 Wearable PDA)
Ultra-high-speed Computation
• Quantum Computer
• Nano-photonics
Green Nanotechnology
Energy Generation
• Solar Cell with High Efficiency and Low Cost
• Thermo-electric device, Fuel Cell
・Biorefinery
• Artificial Photosynthesis (Hydrogen • Fuel Production)
Energy Transmission & Storage
• New battery Cell Material, Superconductor Material
Energy Saving
• Thermal Insulating Structural Material, Light Weight Material for Transportation
• Complex Total Energy System
Environment Protection
• Membrane Separation (Water, Gas)
• Environment Monitoring System with High Sensitivity & Selectivity
• Green Process, Replacement for Rare Natural Resource
Nanobiotechnology
Innovative nano-medical technology
• Drug delivery・Intracellular injection
• Implant devices for the diagnosis and treatment
• Materials for Regenerative medicine
Application of biological systems to sustainable system
• Environmental cleanup by imitating photosynthesis
• Environmental Monitoring by biomaterial
Application of biological systems to other fields
• Devices using self-organization
• Biomimetic ultra low power IT
New Substances / Materials
・New Magnetic Material
・Corrosion Resistive & High-refractory Metal
・Wide-gap Semiconductor・Oxide Semiconductor
・Composite・Hybrid Material
・New Structured・Space & Gap Material
・Molecular & Organic Material
・Bio-Material
Common & Basic Technology in Nanotech /Control Technology in Substances & Materials ／ Nanoscience
Material Preparation and processing
• Self-organization/Hierarchical Control of structure
• Integration of Bottom-up & Top-down processes
• Nano & Micro Printing, 3D nano-fabrication
Theory & Design
• Exploration and design of new material, Element Strategy
• Design for nano-system, Theory for surface & Interface
• Calculation for Dynamics, Simulation
Nano-scale Measurement & Analysis
• Three dimensional Imaging, Visualization, Dynamic Measurement
• Measurement for surface, bulk and Interface
• In-situ Measurement

Area

GreenNanotech

- •Thin-film high-efficiency solar cell(20%)
- •Fuel cell:SOFC/PEFC
- •New material for rechargeable battery
- • Thermal Insulating Structural Material (building, transportation)
- •Material for light transport
- •Low-pressure High-strength environmental purification separation membrane(water, gas)
- •New superconducting material
- •Superconducting power transmission
- •Super-lubricant material (nano-tribology)
- • Replacement for Rare Natural Resource
- •Room-temperature production process(energy-saving•material-saving)
- •Organic thin-film solar cell (20%)
- • High-efficiency thermo electric element (ZT＞3@room temperature)
- •For auto mobile low-cost, long-life rechargeable battery
- •Radiation-proof self-repairing material (nuclear power generation)
- •Low/cost•high-efficiency solar cell(7yen/kwh、30%)
- •Super high-efficiency solar cell (condensing/concentration/converging•multi-junction, 60%)
- •Pt (platinum) free fuel cell(PEFC)
- •Complex smart energy system
- •Biorefinery(with the same cost as oil)
- •Artificial photosynthesis (hydrogen• fuel production)
- •High-sensitivity high-selectivity environmental monitoring

Nanobio

- •Materials for Regenerative Medicine
- •Protein chip
- •DNA chip
- •Nano-DDS
- •Molecular Imaging
- •Environmental Monitoring by Biomaterial
- •Highly advanced Regenerative Medicine
- •Cell chip
- •Integrated System of Drug Delivery, Diagnosis and Treatment
- •Devices using Self-organization
- •Metabolic chip
- •Environmental Cleanup by mimicking Photosynthesis
- •Implant Devices for Diagnosis and Treatment
- •Nano-Cell Surgery
- •3D-Imaging in Cell
- •Ultra low power IT by Biomimetic

Nanoelectronics

- •Flexible Electronics
- •Carbon-based Nanoelectronics
- •Novel Non-volatile Memory
- •Fusion of Nano-CMOS and MEMS
- •Smart Grid
- •High-definition Display
- •Smart Sensor Network
- •Fusion of Nano-CMOS and Photonics
- •Silicon Nano-photonics
- •Fusion of Nano-CMOS and Spin
- •Super Smart Grid
- •Fusion of Nano-CMOS and Bio
- •Wearable PDA
- •Spin-wave Electronics
- •Ultra-high-speed Quantum Computer

2015 | 2020 | 2030 | year

CRDS JST

Platforms: past and future

Achievements

Plans

Field	Big National Projects	Industrial Achievem.	Examples of Research Centres for Innovation (planned ,not yet financed)
Energy	Sunshine Project(74-00) : solar, fuel cell, geothermal, bio-e. Moonlight Project(73-93) : heat pump, insulation	Solar cell E conserving commodities	**Innovative Energy R.Centre**
Manufacturing	Fully automated flexible manufacturing(77-88, 13.7by) : Automation of batch production, metamorphic machine tool	Productivity Automation	**High-tech Manufacturing Research Centre**
Robotics	Robotics for extreme condition(83-90, 20by) : Tele-operation, Intelligent robot, Multiple degree of motion	(basic Knowledge)	**R.Centre of Social Robotics**
Nano tech	Atom technology(92-02, 26.2by) : Nano science, New material, New observation	(basic Knowledge)	**R.Centre of Nano-technology**
Optics	Femto-second technology(95-04, 10.8by) : High speed communication, Energy-conserving network	(basic Knowledge)	**R.Centre of Optical Network**

National Projects, Public Consortium, Private Consortium,

Examples in the future (dreams?)

Energy	**Hydrogen society**	**Computational science**	**Four dimensional lens**
Manufacturing	**Integrated Design/Manuf**	**Service**	**Medicine, public s., new industry**
Robotics	**Cheap-labour Robotics**	**Education**	**Work-is-learning project**
Bio	**Health industry**	**Security**	**Mitigation, adaptation**
Ocean	**Ocean industry**		
Geology	**New resource, waste**		

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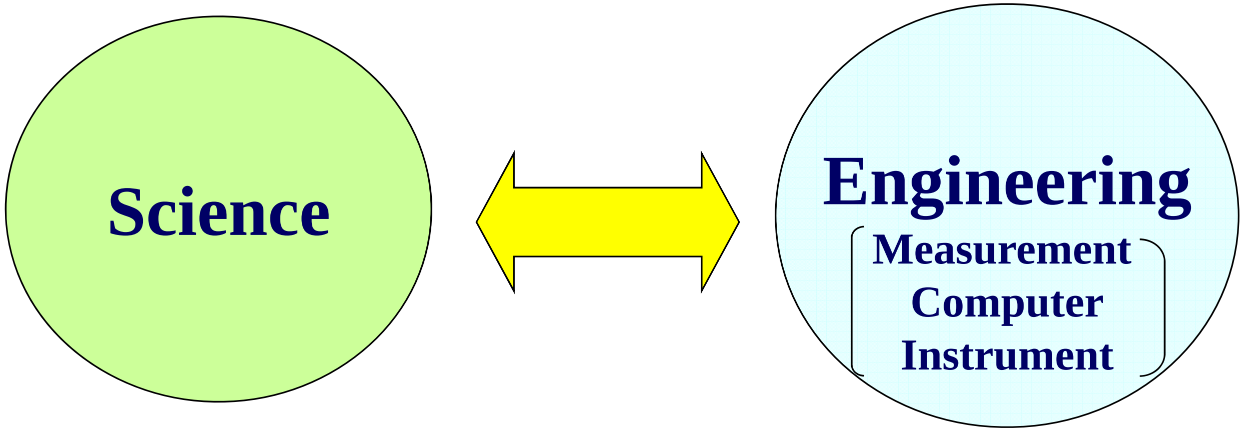
Science-based Engineering
Engineering-based Science



- ❍Nobel Prize
- ❍bio-science, nano-material, climate change research, complex system
  e-science, e-education
- ❍analysis– synthesis, prediction, forecast/foresight
  system thinking, design thinking
- ❍US/DOE, NIH-road-map, US/NIST, EU 7th program

ノーベル賞と関連の分析機器(1950年以降)

年	受 賞 者 名	受 賞 の 理 由	関連する現在の製品
1952	F.Bloch(米) E.M.Purcell(米)	核磁気共鳴吸収による原子核の磁気モーメントの測定	核磁気共鳴装置
	A.J.P.Martin(英) R.L.M.Synge(英)	分配クロマトグラフィーの開発と物質の分離・分析への応用	ガスクロマトグラフ
1953	F.Zernike(蘭)	位相差顕微鏡の研究	位相差顕微鏡
1959	J.Heyrovsky(チェコ)	ポーラログラフィーの理論及びポーラログラフの説明	ポーラログラフ
1962	F.H.C.Crick(英) J.D.Watson(米) M.H.F.Wilkins(英)	核酸の分子構造及び生体における情報伝達に対するその意義の発見	
1964	C.H.Townes(米) N.G.Basov(旧ソ) A.M.Prokhorov(旧ソ)	メーザー、レーザーの発見及び量子エレクトロニクスの基礎的研究	レーザー顕微鏡
	D.C.Hodgkin(英)	X線回折法による生体物質の分子構造の研究	X線回折装置
1979	G.N.Hounsfield(英) A.M.Cormack(米)	コンピューターを用いたX線断層撮影技術の開発	X線CT診断装置
1980	P.Berg(米)	遺伝子工学の基礎となる核酸の生化学的研究	
	F.Sanger(英) W.Gilbert(米)	核酸の塩基配列の解明	DNAシーケンサー
1981	K.Siegbahn(スウェーデン)	高分解能光電子分光法の開発	X線光電子分光装置
1984	R.B.Merrifield(米)	固相反応によるペプチド合成法の開発	ペプチド合成装置
1986	E.Ruska(旧西独)	電子顕微鏡に関する基礎研究と開発	透過型電子顕微鏡
	G.Binnig.(旧西独) H.Rohrer(スイス)	走査型トンネル顕微鏡の開発	走査型プローブ顕微鏡
1989	N.F.Ramsey(米) H.G.Dehmelt(米) W.Paul(旧西独)	精密な原子分光学の開発への重要な貢献	質量分析装置(四重極検出器)
1991	R.Ernst(スイス)	高感度・高分解能磁気共鳴法の開発と実用化	フーリエ変換型核磁気共鳴装置
1993	K.B.Mullis(米)	Polymerase Chain Reaction(PCR)法の発明	DNA増幅・検出装置
2002	田中耕一(日本) J.B.Fenn(米)	生体高分子の同定及び構造解析のための手法の開発	質量分析装置
	K.Wuthrich(スイス)		核磁気共鳴装置

World Conference on Science
(ICSU / UNESCO)
Declaration on Science and the Use of Scientific Knowledge
- Science for the 21st Century
A New Commitment -

1999

20th Century

☆Science for knowledge;
Knowledge for progress

21st Century

☆Science for knowledge;
knowledge for progress
☆Science for peace
☆Science for development
☆Science in society and
Science for society

WSF 2009 in Budapest

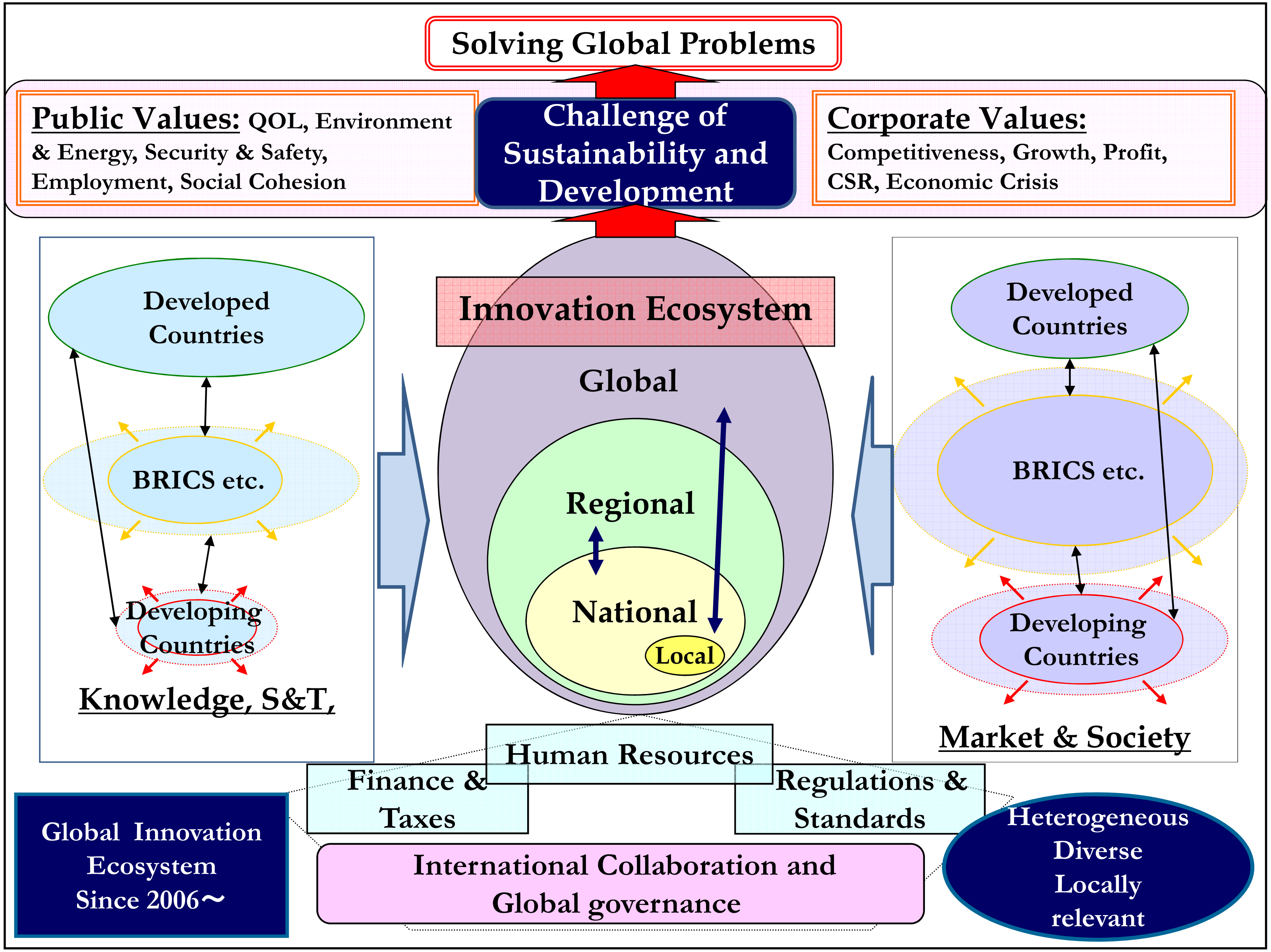
University in the 21st century

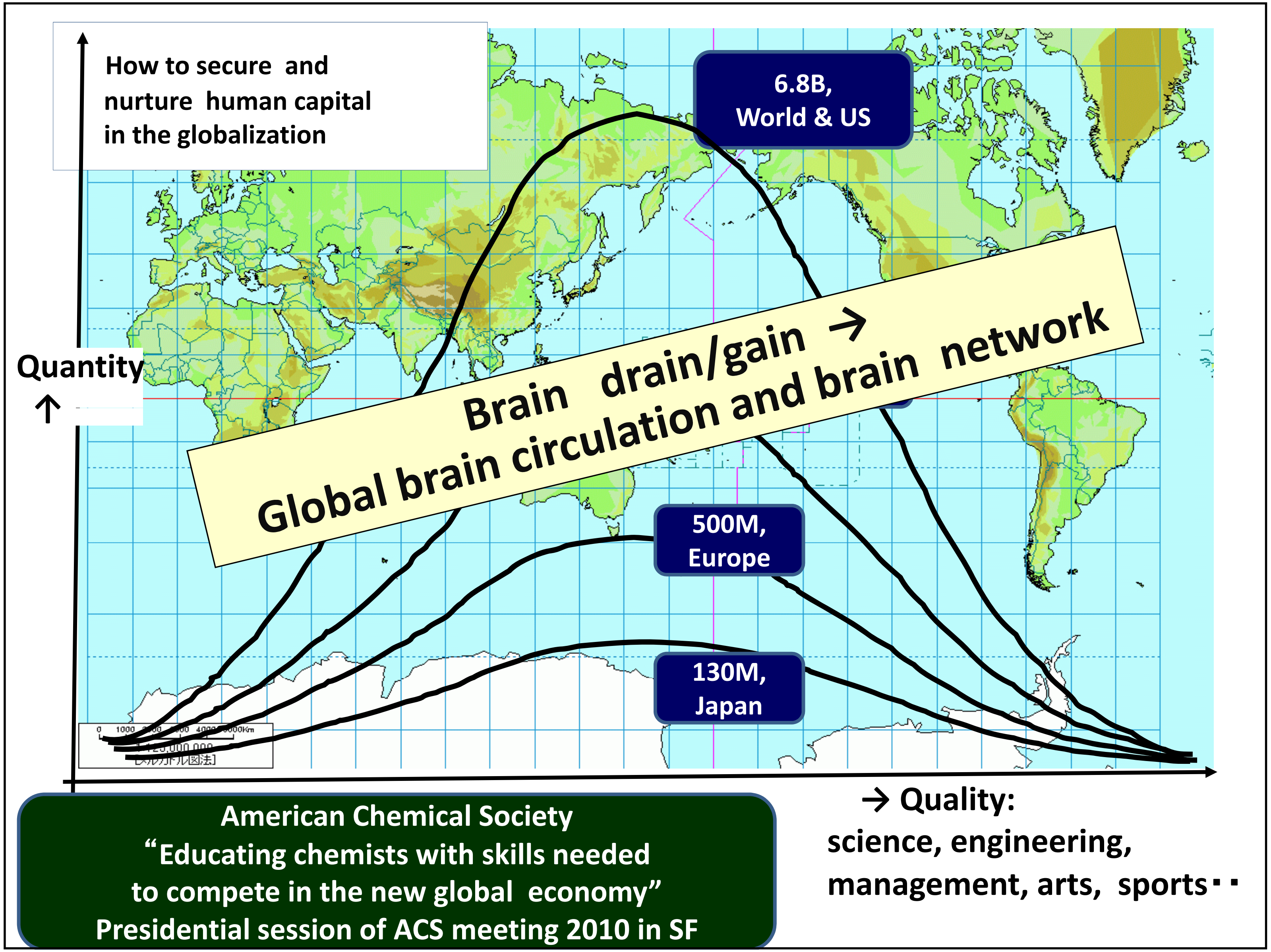
Transforming and reinventing universities
for the new world order and value systems

Universities in the 21st century

- global university, global career, global brand,
  . brains business.
- instruments of national competition as well as of peace.
  A powerful force for global integration, mutual understanding, geopolitical stability and foreign policy.
- brain circulation & network, university network,
  open innovation, collective intelligence
- COE(Center of Excellence)
  ⇔ NOE(Network of Excellences)

Exploring the future of modern university system


Solving Global Problems
Public Values: QOL, Environment & Energy, Security & Safety, Employment, Social Cohesion
Challenge of Sustainability and Development
Corporate Values: Competitiveness, Growth, Profit, CSR, Economic Crisis
Developed Countries
BRICS etc.
Developing Countries
Knowledge, S&T,
Innovation Ecosystem
Global
Regional
National
Local
Developed Countries
BRICS etc.
Developing Countries
Market & Society
Human Resources
Finance & Taxes
Regulations & Standards
International Collaboration and Global governance
Global Innovation Ecosystem Since 2006～
Heterogeneous Diverse Locally relevant


How to secure and
nurture human capital
in the globalization
6.8B,
World & US
Quantity
↑
Brain drain/gain →
Global brain circulation and brain network
500M,
Europe
130M,
Japan
American Chemical Society
"Educating chemists with skills needed
to compete in the new global economy"
Presidential session of ACS meeting 2010 in SF
→ Quality:
science, engineering,
management, arts, sports・・

Promoting Global Green Innovation

<u>Green Innovation Symposium</u>:

JST held an international symposium <u>"International Challenge for Promoting Green Innovation to Realize a Low Carbon Society Worldwide"</u> on May 17, 2010, Tokyo.

"**<u>Joint Statement</u>**" says:

- Various support activities for international cooperation are crucial
- The experts of each funding agency would have a network meeting to specify problems to be solved by international cooperation between/among the funding agencies and to consider concrete measures to be taken

Participant Agencies (From 9 Countries)

- National Natural Science Foundation of China (NSFC)
- German Research Foundation (DFG)
- French National Research Agency (ANR)
- National Research Foundation of Korea (NRF)
- National Council on Science and Technology of Mexico (CONACYT)
- Swedish Governmental Agency for Innovation Systems (VINNOVA)
- Engineering and Physical Sciences Research Council of UK (EPSRC)
- National Science Foundation of USA (NSF)
- Japan Science and Technology Agency (JST)

<u>Green Innovation Working Group</u>:

"The first Working Group Meeting"
April, 2011 in Germany
Organized by German Research Foundation (DFG)

Contents

JST / Center for Low Carbon Society Strategy (LCS)

" Japan will aim to reduce its green house gas emissions by 25% by 2020 for its mid-term goal "

LCS：Social Scenario Research for Low Carbon Society

Founded in Dec 2009
in JST (Japan Science and Technology Agency)

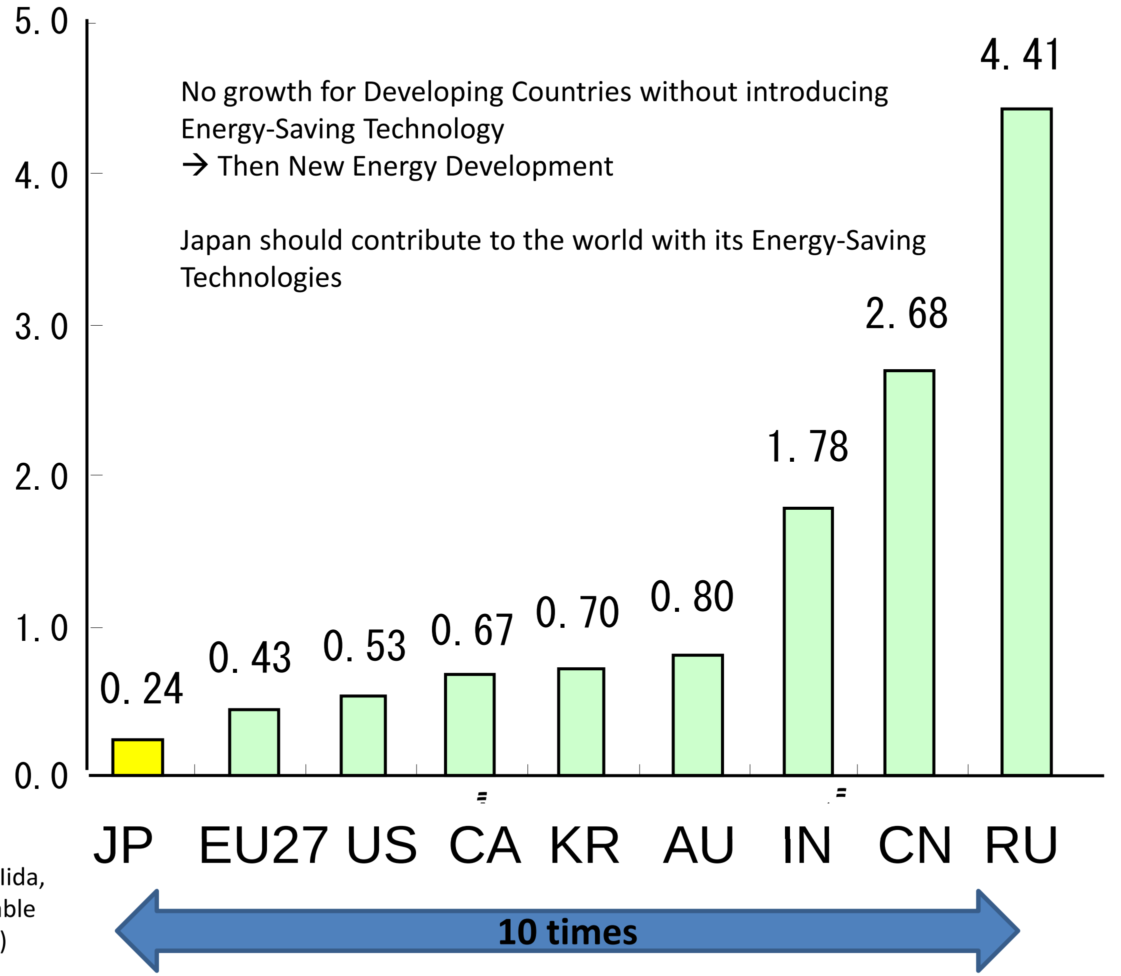
Director-General:
Hiroshi Komiyama,
Former President of the
University of Tokyo

We are running out of time
We need a concurrent approach to accelerate the process.
Structuring of knowledge and actions is the key.

- **Improve energy efficiency by three times**
- **Double the use of renewable energy**
- **Establish recycling system of materials**

CO2 Emission per GDP (As of 2005)

[KgCO2/US$ (Central Currency Exchange Rate of 2000)]

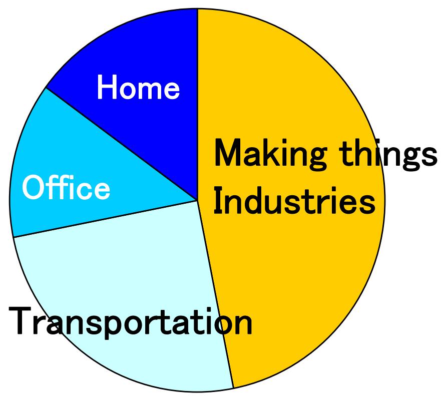


Data by Dr.Tetsunari Iida, Institute for Sustainable Energy Policies (ISEP)

CO_2 Reduction for each sector (1990 basis)　1/2
by JST LCS Center

Reduction rate

Daily Life	Residence/ Office 6 %	Solar power (80% of new houses) High efficiency electrical appliances (100%) Insulation Smart Energy Management System (100%) Removal of old house by compact city (4%)
	Transportation 6%	Hybrid car (20%) Energy saving car (30%) Modal shift
	Agriculture 2%	・Treatment of plant disease ・Reduction of fertilization ・CO_2 fixation



Energy consumption by final use (Japan)

スライド 33

k1 kitaza, 2010/05/16

CO2 Reduction for each sector (1990 basis) 2/2

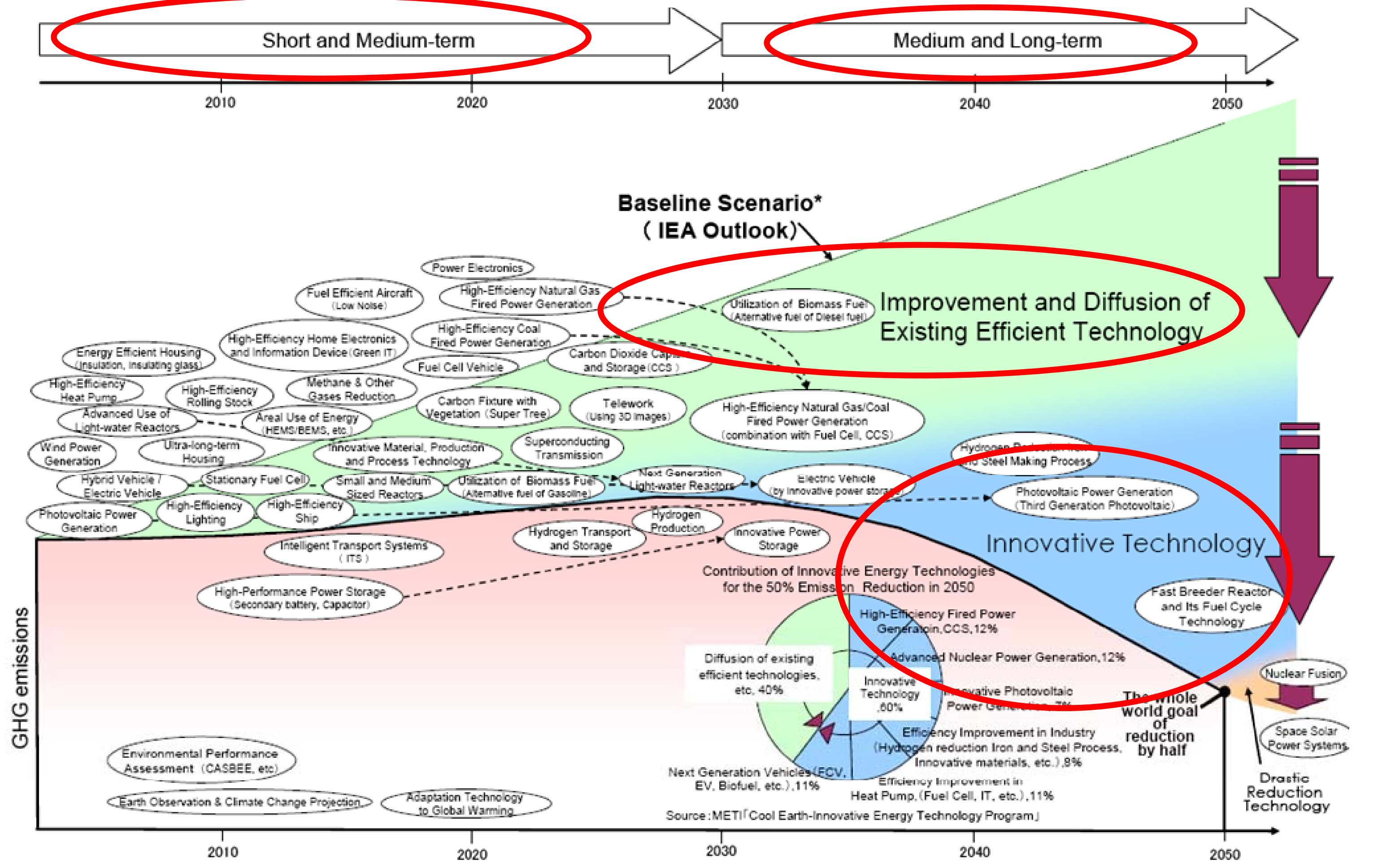
Electricity 5%	・Nuclear power (6%, operating rate → 90%) ・High eff. power plant ・Coal –biomass mixed fuel (50%) ・Solar power, Wind, Geothermal ・Higher voltage (1w → 2W/400V)
Industry 3%	Annual reduction rate of 1%/y
Forest 3%	Regeneration

New CDM α

Total 25%＋α

Reduction : 410 Mt-CO2/y

Development and Diffusion of Environment & Energy Technology - Short/Medium/Long term - (CSTP, 2008)



(Note) This is a figure indicating images of GHG emissions reduction in the whole world.
* Baseline includes the effects of technology developments and improvements in energy efficiency that can be expected on the basis of government policies already enacted.

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New Perspectives for Science and Innovation:No.1

○ Gravity of scientific activities moving to developing countries

"Silent Sputnik" (Rita Colwell);

(AAAS2010 Annual Conf. "Bridging Science and Society")

(AAAS2011 " "Science without Borders")

"Royal Society Global Science Report" ; "New entrants are reshaping the landscape for science and innovation in the world. But what do these changes mean? How should policymakers, scientists and business leaders respond? And how do we strike the right balance between competition and collaboration? "

○ Reshaping science and innovation system, Design & system thinking and foresight under the complex and uncertain world

○ Scientific integrity, Quality control of science

・Global governance of science ・Science diplomacy

New Perspectives for Science and Innovation:No.2

〇Bridging science and society

〇Beyond the boundaries(disciplines, organizations, generations, nations)

〇Network, Platform & Connectivity for Innovation

COE(Center of Excellence)

⇔ NOE(Network of Excellences)

〇Transformative research, Converging Tech.

....

〇<u>New innovation model</u>

*Disruptive Innovation（by Christensen)

*Reverse Innovation（by Immelt)

*Frugal Innovation (by the Economist)

New Perspectives for Science and Innovation:No.3

- National, Regional and Global
  science and innovation ecosystem
  - Open innovation
  - Global governance of science
  - Globally integrated enterprise
  - System of systems (ex. ERA, ARA etc)

- Brain circulation & network, collective intelligence
  S&E workforce: non-traditional skills and sense
  Global leaders under the uncertain and complex world

Thank you very much for your attention!!

Questions:
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