Governments role for Innovation

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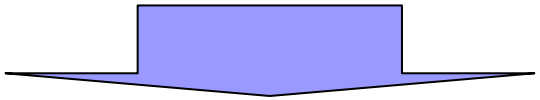
What is asked for?

1. Which policy instruments have been most effective in promoting environmentally-related innovation?
2. Are some policy instruments ineffective and lead to market distortions?
3. How are governments' strategies for environmentally-related innovation affected by globalization??
4. How can government policies contribute to both meeting environmental objectives and promoting competitiveness in global markets?
5. What is the role of governments in financing environmental innovation?

Long term nature of Climate Change Problem



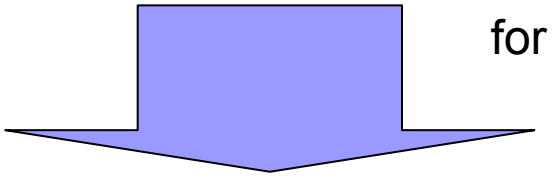
Two different type of strategies would be needed

1)Long-term strategy = Super long-term energy technology strategy
2)Short and medium term = Construction of innovative Society

What kind of innovation?

■ For Long term innovation
- ✓ Long term vision
- ✓ Clear shared target
- ✓ Importance of public sector

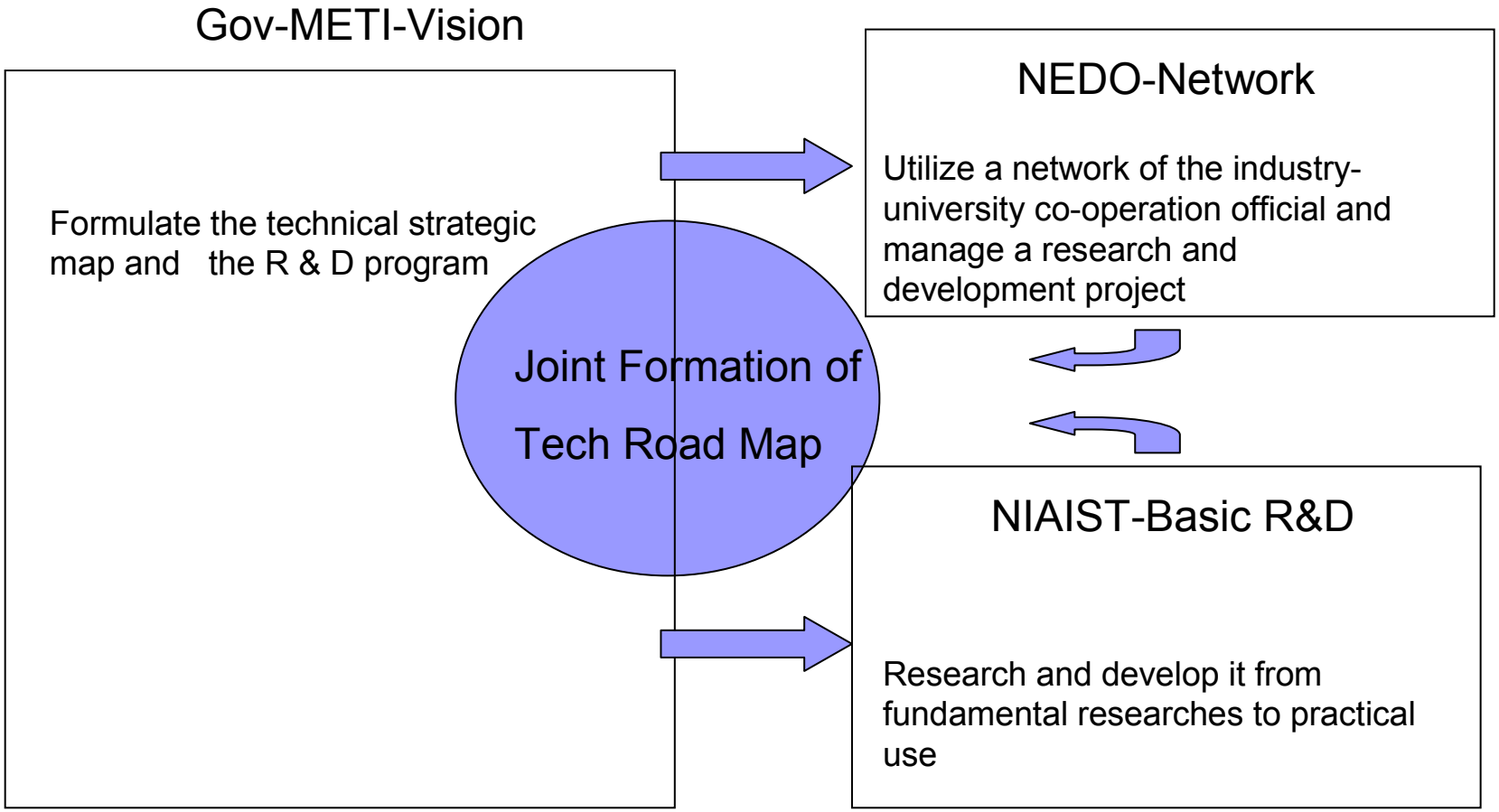
■For Short and Medium Innovation
- ✓Main role = private-sector
- ✓Role of Public Sector
  = provide “environment”
  - •for enterprises to make profits
  - •for existing hidden technologies to become market
  - •for CEOs to have proper foresight for innovation



■Difference in Player/Phase/ Subject /Incentive/etc..

For long term innovation

① Presentation of Clear Vision/Roadmap inc. “Ultra long term vision”
② Public Organization for basic R&D
③ Construction of Private/Public/University Network



Why Ultra Long Term Vision?

-unique nature of climate change problem-

- Existence of clear targets for long term
- Fundamental Innovation needs long incubation
- Socio-Economic Model have to be reformed comprehensively
- Little incentives for Private Sector
- Possible oversight for necessary techs
- Unexpected requirement for Techs
- Other critical points for consideration ex. Energy securities

Ultra long Term Technology Perspective for Japan

(Methodologies)

- Back Casting
- Consideration for Energy Security
- Decomposition of area and techs
- Short and Mid term clear Roadmap

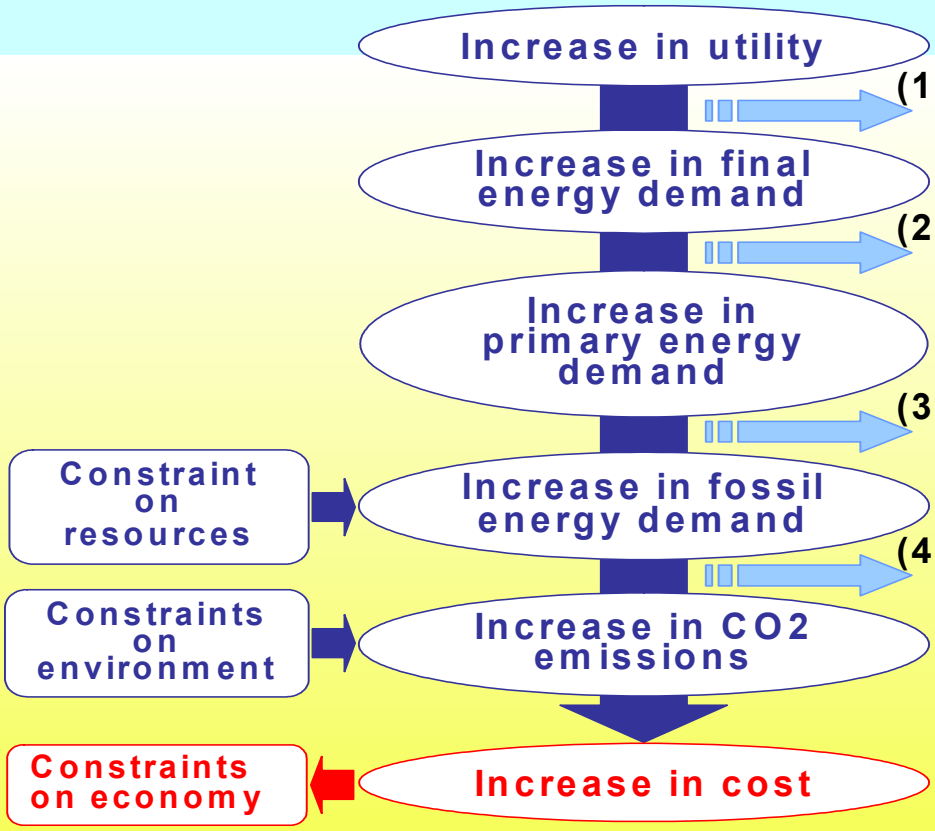
(Premises)

- CO2 /GDP=1/3 in 2050, 1/10 in 2100
- Oil Production Peak in 2050
- Natural Gas Production Peak in 2100

Ex. Fundamental Analytical work

Achievement of Increased Utility and Breakaway from Chain of Increase in Risk

To cut off the chain between the increase in utility and the increase in the usage of fossil energy and CO2 emissions, the development and diffusion of technology as well as the economic growth to realize such development and diffusion are important.



(1) To cut off the chain between "utility" and "energy demand"
Energy saving, highly efficient utilization and self-sufficiency

(2) To cut off the chain between "final energy demand" and "primary energy demand"
Improvement of conversion efficiency

(3) To cut off the chain between "primary energy supply" and "fossil energy"
Utilization of nonfossil energy

(4) To cut off the chain between "fossil energy" and "CO2 emissions"
Carbon dioxide capture and sequestration

・・・Gains from the reduction in CO2 emissions are appropriated to the cost of measures.

Res/Com		2000	2030	2050	2100
Total energy demand		1 time		1.5 times	2.1 times
Energy supplied from transformation sector*	Residential		45% reduction	60% reduction	80% reduction
	Commercial		35% reduction	55% reduction	80% reduction
CO_2 intensity	Residential	3.5 t-CO_2/household (1 time)	1.9 t-CO_2/household (1/2 times)	1.1 t-CO_2/household (1/3 times)	0 t-CO_2/household
	Commercial	118 kg-CO_2/m^2 (1 time)	77 kg-CO_2/m^2 (2/3 times)	40 kg-CO_2/m^2 (1/3 times)	0 kg-CO_2/m^2

*The percentage of reduction of energy per unit should be supplied from the transformation sector, compared with total energy demand increases in proportion to GDP.

Energy saving

Efficiency improvement of equipment

Lighting with less heat loss → *Equipment with less heat loss*

Improving thermal performance of housing and building → *Active control of sun shading and thermal insulation*

Efficient heating → *Efficient heat transfer, preheating by unused energy*

Improving electric power conversion efficiency → *Electric power conversion with least loss*

Food storage at room temperature

Use of ubiquitous energy
(minute pressure, temperature difference, vibration, radiowaves, etc.)

Energy saving enables equipment using little energy

Energy creation from ubiquitous energy

Self-sustaining

0 t-CO_2/household

0 kg-CO_2/m^2

Photovoltaic generation

Installation in all places such as PV paint

Installation in windows

Installation in curved surfaces

Installation facilitation

Energy creation *Efficiency improvement and increase of durability*

Energy management

BEMS•HEMS

Self-sustainable housing and building

Demand management → *Management of demand and energy creation* → *Energy accommodation in community*

(Energy supply in community) → *Supply and storage management in community* *Supply and demand management in community*

TEMS **Self-sustainable community**

Transport

	2000	2030	2050	2100
Utility (person-km, ton-km)	1 time		1.5 times	2.1 times
Energy supplied from transformation sector* (overall)		20% reduction	50% reduction	70% reduction
Automobiles Energy demand		30% reduction	60% reduction	80% reduction
Share of electricity and/or hydrogen	0%	1% or more	40%	100%
CO_2 intensity	160 g-CO_2/km (1 time)	100 g-CO_2/km (2/3 times)	50 g-CO_2/km (1/3 times)	0 g-CO_2/km → Consequentially, 1/10 or less is achieved.
Aircraft, ships, and trains Energy demand		10-20% reduction	20-35% reduction	30-50% reduction

*The percentage of reduction of energy per unit should be supplied from the transformation sector, compared with utility increases in proportion to GDP.

Energy Conservation

Automobiles

(Engine) → *Engine/Electric motor (hybrid system)* → *Electric motor Fuel cell/Battery*

Energy saving by vehicle weight reduction

Super-light compact cars for regional use

0 g-CO_2/km (Automobiles)

Liquid fuel (Oil) → *Synthetic fuel (mixture)*, *Biomass fuel (mixture)*

Hydrogen storage: *Compressed hydrogen* → *liquid hydrogen, hydrogen storage material*

Hydrogen supply: *Batch transportation region)* → *Effective on-site production* → *pipeline transportation (limited*

Electric energy storage: *Battery and capacitor, etc.*

Electricity supply: *Cable-connected charge* → *Cable-less non-contact charge*

Fuel switch

Aircraft, Ships, Trains, Transport systems

Engine efficiency improvement

Energy saving by body weight reduction

Hybrid drive

Hydrogen drive, Superconducting motor drive

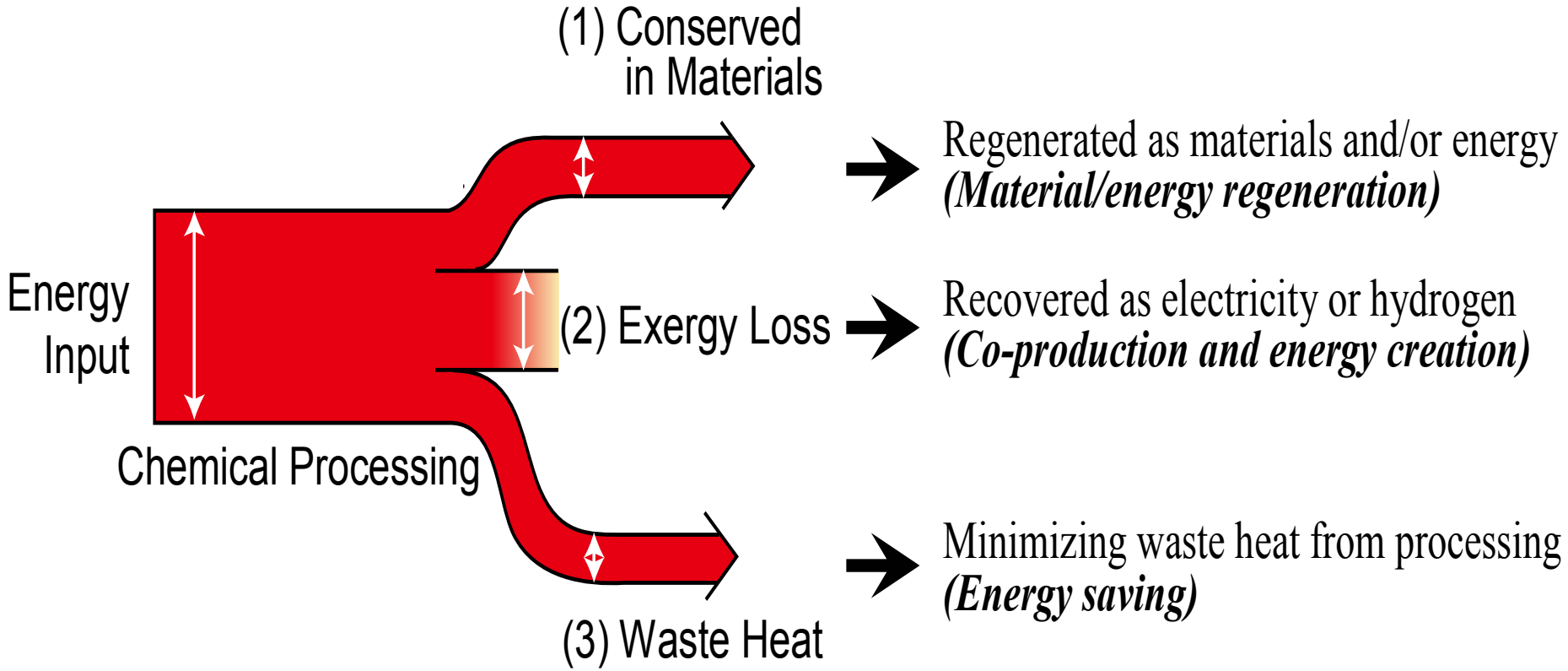
Ship enlargement, Low-speed operation

Energy saving by transport system cooperation

3 Dimension for Industrial Sector

-another example for analytical work-

- ***High level of energy use at production process "create skillfully“***
- ***Regeneration of material/energy "use skillfully"***
- ***Energy reduction for production with few resources "create good things"***



Industry

	2000	2030	2050	2100
(Production) X (Value of product)	1 time		1.5 times	2.1 times
Energy supplied from transformation sector*		25% reduction	40% reduction	70% reduction
1) Production energy intensity		20% reduction	30% reduction	50% reduction
2) Material/energy regeneration ratio		50%	60%	80%
3) Improvement of functionality such high-strength etc. (functionality / amount of material)	1 time	2 times	3 times	4 times

*The percentage of reduction of energy per utility (production x value of product) should be supplied from transformation sector, compared with the case where total energy demand increases in proportion to GDP.

High level of energy use at production process ***"create skillfully"***

(Energy saving in process)

Development of innovative production process
Use of bio/nano catalyst etc

Zero-emission process

Cogeneration & cascade use of heat

Integration and cooperation of material and energy

Co-production
(simultaneous production of material and energy)

(Fossil resource use) → *Biomass/hydrogen use*

Regeneration & utilization of material/energy beyond sectors

Regeneration of material/energy ***"use skillfully"***

Efficiency improvement of material regeneration process

Regeneration and utilization of material/energy in products

Cross-boundary measures beyond sectors

Design technique for easy separation & sorting

Durability improvement

Improvement of functionality of material and parts

Material saving of products

Energy reduction for production with few resources ***"create good things"***

Transformation	2000	2030	2050	2100
Total energy demand on the demand side (maximum case)	1 time		1.5 times	2.1 times
Share of electricity and/or hydrogen in final energy	1 time		2 times (Case A and C) 3 times (Case B)	4 times (Case A and B) 3 times (Case C)
CO_2 Intensity	370 g-CO_2/kWh (1 time)	270 g-CO_2/kWh (2/3 times)	120 g-CO_2/kWh (1/3 times)	0 g-CO_2/kWh *110 g-CO_2/kWh (1/3 times)* *In the case of fossil fuel use with CCS*

Reduction in fossil use

Efficiency improvement of fossil fuel use

Fuel switching and efficiency improvement

(oil) → *Natural gas*

(coal) → *Coal (clean coal technology + CO_2 capture and sequestration (CCS))*

0 t-CO_2/kWh

Nuclear energy use

Nuclear fuel cycle

Load following operation

Efficiency improvement

Renewable energy use

Solar — *Technology that can be set up in all places such as roads and dams*

Geothermal

Wind power — *Onshore* → *Offshore*

Biomass — *Wood and biomass (waste and unused biomass)* → *Fuel crops production*

Efficiency improvement

Installation simplification

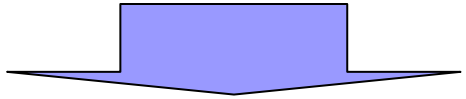
Energy storage

Introduction of non-fossil energy

For short to midterm innovation

-How to construct “Innovative Society”?-

- Economic and social system reform is needed



- “Report on 7 Keys for innovation” - METI, July 07.

1. Mind change at CEO level for tech management
   - ✓ Share scenario by revealing the technological strategy map
   - ✓ Build up matching found for inducing bi-directionally operation
   - ✓ Implement pioneering R&D by integrating the exit strategy
2. Grasp fundamental needs and return to science
   - ✓ Strengthen innovation related tax system
   - ✓ Change system for accelerating R&D
3. Sharing knowledge and conversion of idea
   - ✓ Enlarge intellectual café for exchanging knowledge

4. Strategic action to secure market

- ✓ Implement of R&D and international standardization in an integrated
- ✓ Promote international standardization
- ✓ Create impact simulation model
- ✓ Promote responsible innovation
- ✓ Implement public initiative procurement of new technology from SMEs and venture companies

5. Coordinator from seeds to market

- ✓ Implement of creative industry-academia-government collaboration
- ✓ Build the network of excellence
- ✓ Put research achievements into practical use by strengthening of collaboration between dependent corporations

6. Project management for human resource development

- ✓ MOT personnel by AIST
- ✓ Innovate personnel by utilizing pioneering R&D project
- ✓ Research personnel by academic-industrial collaboration
- ✓ Regenerate researchers and engineers by AIST

7. Strict requirement and unique standard for products

- ✓ New challenge from SMEs and venture companies
- ✓ Fuse knowledge by utilizing project of industrial cluster
- ✓ Promote regional innovation by wide-range cooperation
- ✓ Implement beneficial use of resource for research by SMEs and venture companies

How it affected by globalization?

- Short sighted global financial market sometimes hampers Innovation
- Increasing Importance for international academic interchange
  (but not always G to G Project)
- Changing strategy to secure global market
- Technology leakage problem
- Needs for Global cooperation for assessment of key technologies

Caution for ineffective policy

- ~~Short term Policy~~

  Ex. Energy supply technology strategy without thinking oil and natural gas production peak
- Short range policy

  Ex. Pursuing energy efficiency without considering life cycle assessment

  Ex. Hydrogen strategy without considering overall advantage
- Partial Equilibrium

  Ex. Optimal solution for specific region but not for the world
- Excessive expectation for specific technology

  Ex. CCS, bio-fuel, solar.

How to finance innovation?

- Public finance is far less than necessary fund.
- How to mobilize private investor = Institutional investors should be focused
- Common benchmark should be adopted to send clear message to CO2 emitters in order to diffuse innovation.

Conclusion for Role of Government

- For Long term innovation
  - ✓ Long term comprehensive vision and strategy sharing
  - ✓ Concentrate to strategic technology
  - ✓ Construction of network of human resources
- For Short and Medium term innovation
  - ✓ Guidance for CEOs
  - ✓ Market creation ex. “Greenization” of supply chain mechanism
  - ✓ Mobilize private fund
- What Governments should not do
  - ✓ Short and narrow sighted resource allocation and regulation