

**Global Focus on Knowledge Lecture Series
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Sustainability of the Earth's Environment

Hiroshi Komiyama

**Chairman of the Institute,
Mitsubishi Research Institute, Inc.**

**President Emeritus,
The University of Tokyo**

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Questioning common knowledge?

What should we question?

What should we trust?

Vision 2050

3 × Higher Energy

Efficiency

2 × More Recyclable Energy

Establishing a Material Cycle System

Solutions to issues in global warming, energy, and material

Japan has advantages in its global vision

Hiroshi Komiyama, “Chikyu-jizoku no Gijutsu”

(Shin-akaban 647, Iwanami Shinsho) Iwanami Shoten, Japan (1999)

Important Perspective 1

Artificial Products Should Be Saturated

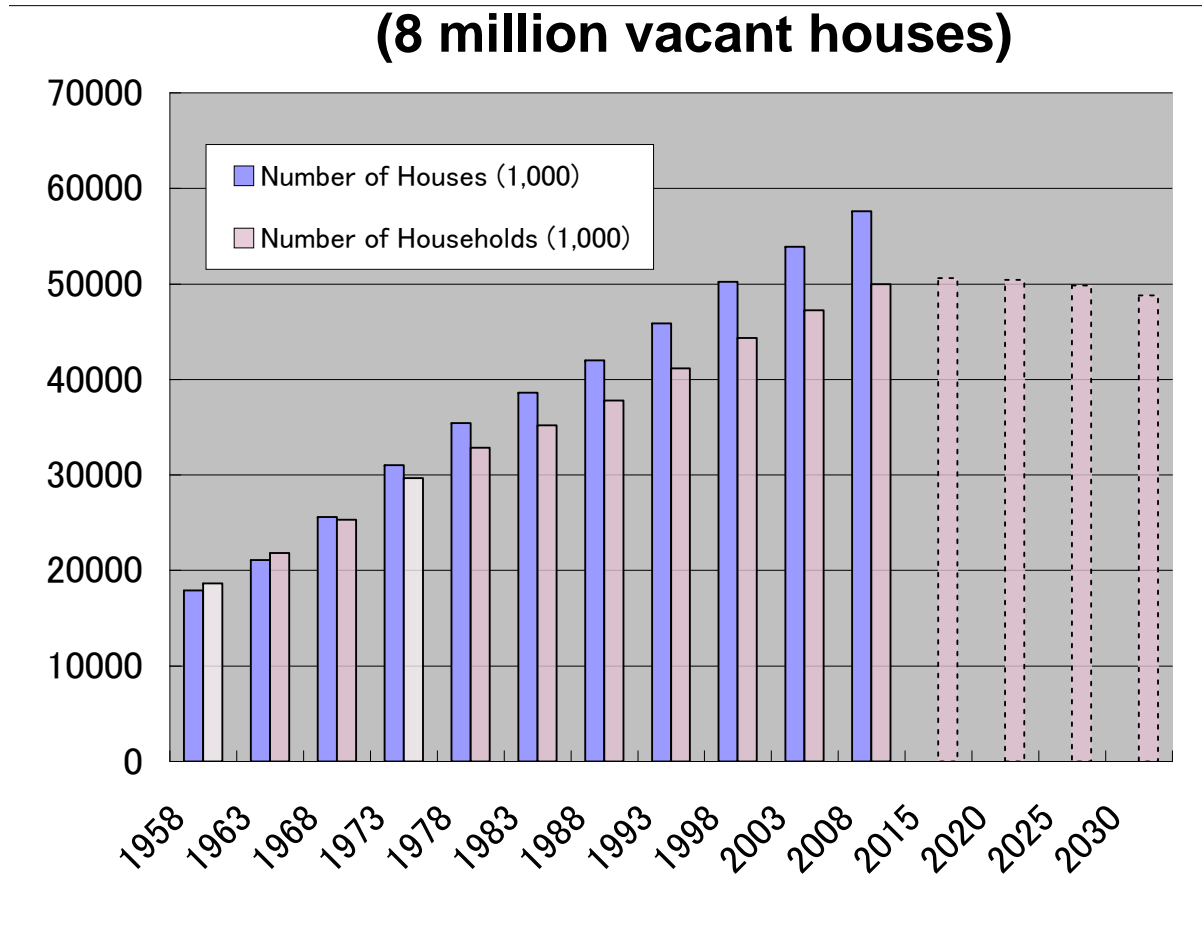
Example: Number of automobiles in major countries (2007)

	No. of automobiles (million)	No. of automobiles/capita
UK	31	0.51
France	31	0.50
Germany	41	0.49
Japan	58	0.45
US	138	0.45
China	32	0.02
India	13	0.01

Sources: Japan Automobile Manufacturers Association, Inc.,
Statistics Bureau, the Ministry of Internal Affairs and Communications

Saturation of Artificial Products in Japan

**Number of total houses and households
(8 million vacant houses)**

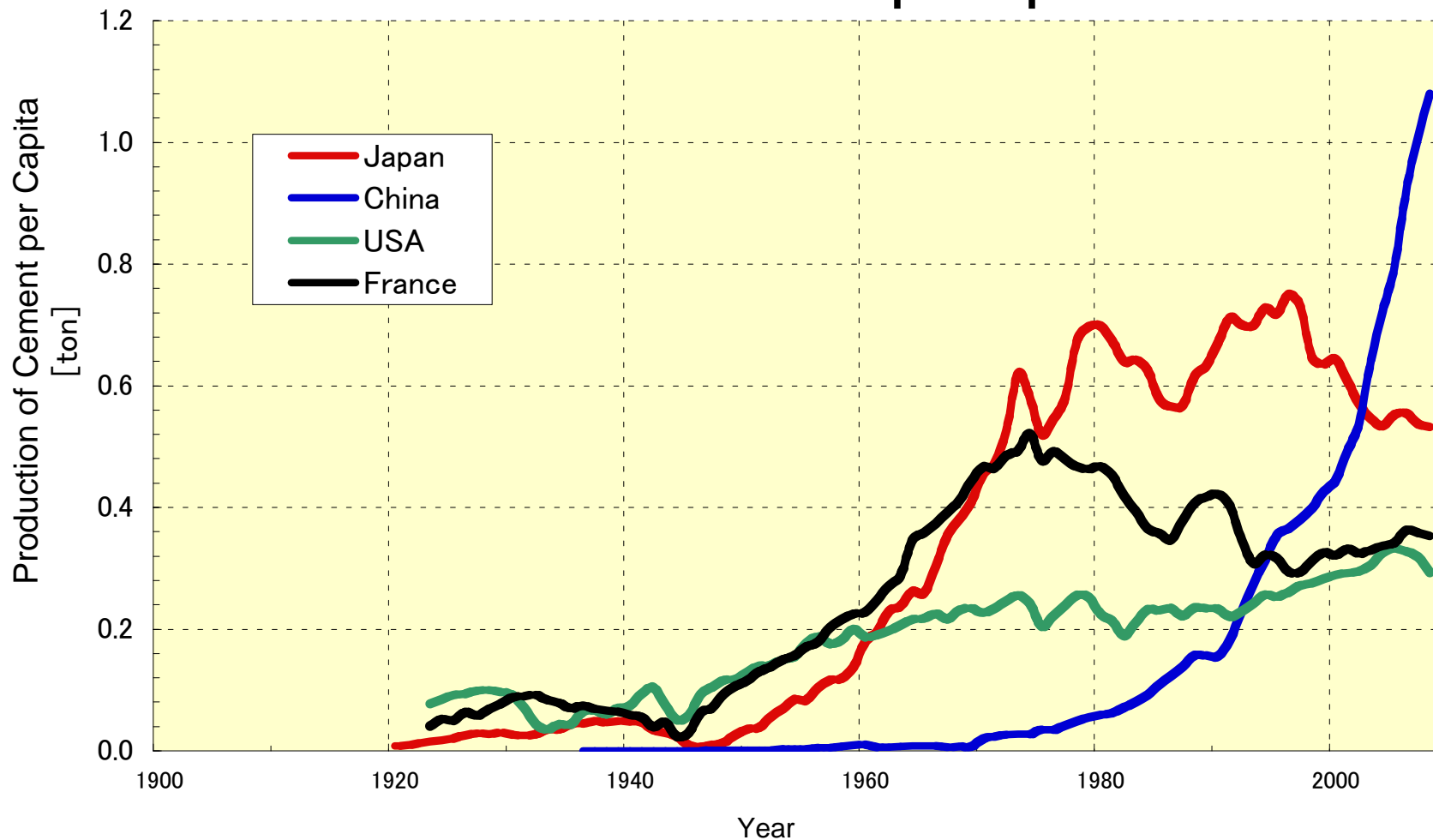


Sources: 1958–2008: “House and Land Statistics 2008 (Preliminary Report) Abstract”, The Ministry of Internal Affairs and Communications of Japan

2015–2030: “Estimation of Future Households in Japan (National Estimation) March 2008”, National Institute of Population and Social Security Research

Saturation Will Occur in 5–10 Years in China

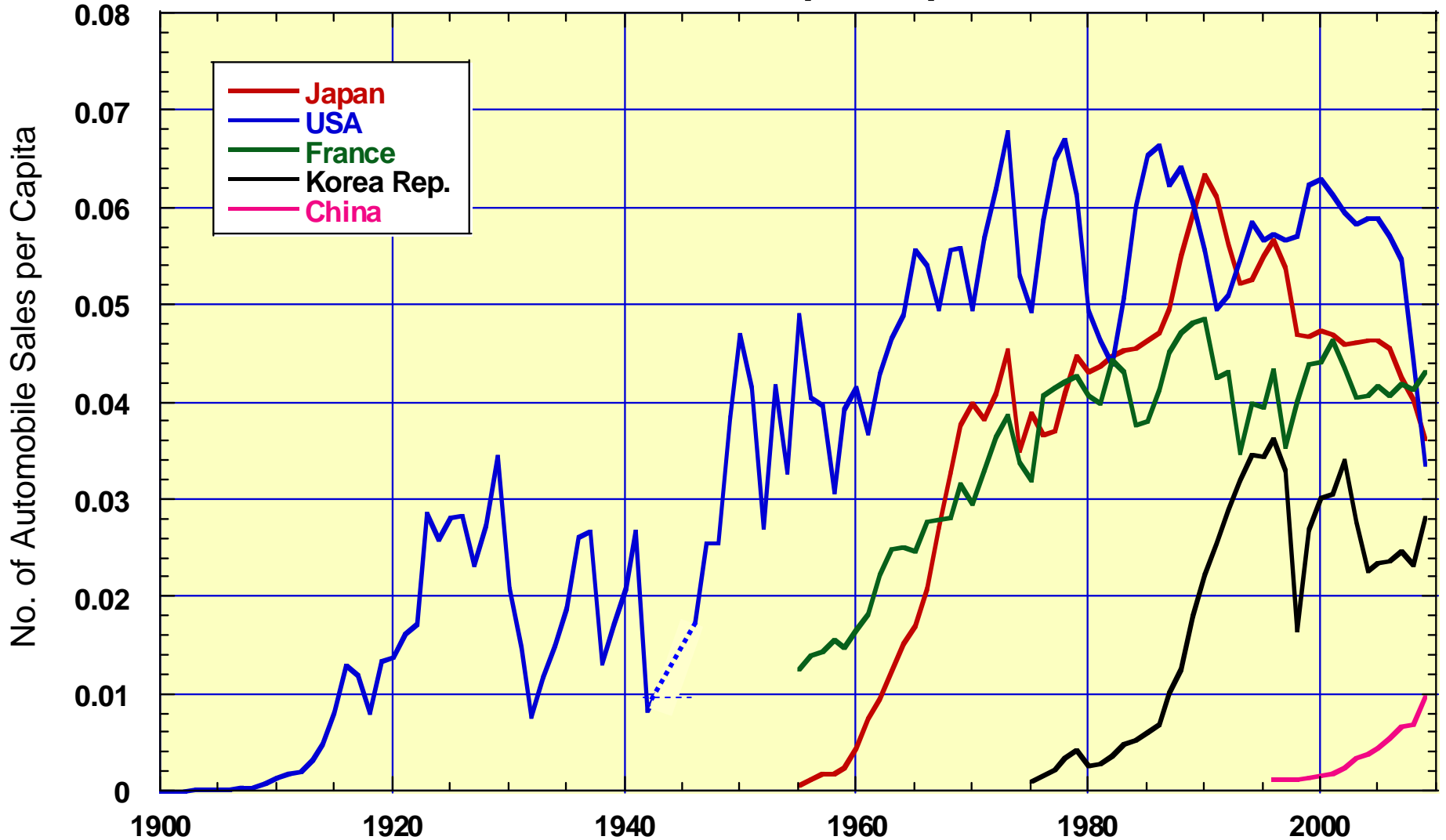
Production of cement per capita



Sources: Production of Cement, UN Statistical Year Book
Population, UNSD Demographic Statistics and UN Statistical Year Book

Automobiles in China Predicted to Be Saturated within 5–10 Years

Automobile sales per capita



Sources:

Automobile Sales: Automobile Annual Statistics, Automobile Industry Handbook, Automobile Annual Book, and U.S. Automobile Production Figures from Wikipedia

Population: UNSD Demographic Statistics

Two Important Types of Demand

Diffusion-type demands →

Saturation is heading to highly-advanced countries

- Currently available products

Examples: Houses, automobiles, TVs, trains, nuclear power plants

Creation-type demands →

Creating domestic consumption and employment

- Currently emerging demands → “Green” industries are growing
Examples: Highly efficient water heaters, LED lighting, solar panels
(Japan has advantages)
- Demands that will emerge in the future

→ Growing industries for the elderly

Essential commodities in an aged society

Sharing vision and
exploiting “manufacturing power” and “cultural power”

Vision 2050

Establishing a Material Cycle System

3 × Higher Energy

Efficiency

2 × More Non-Fossil Fuel-Based Energy

Solutions to issues in global warming, energy, and material

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Important perspective 2

Energy efficiency

Metal recycling can save energy

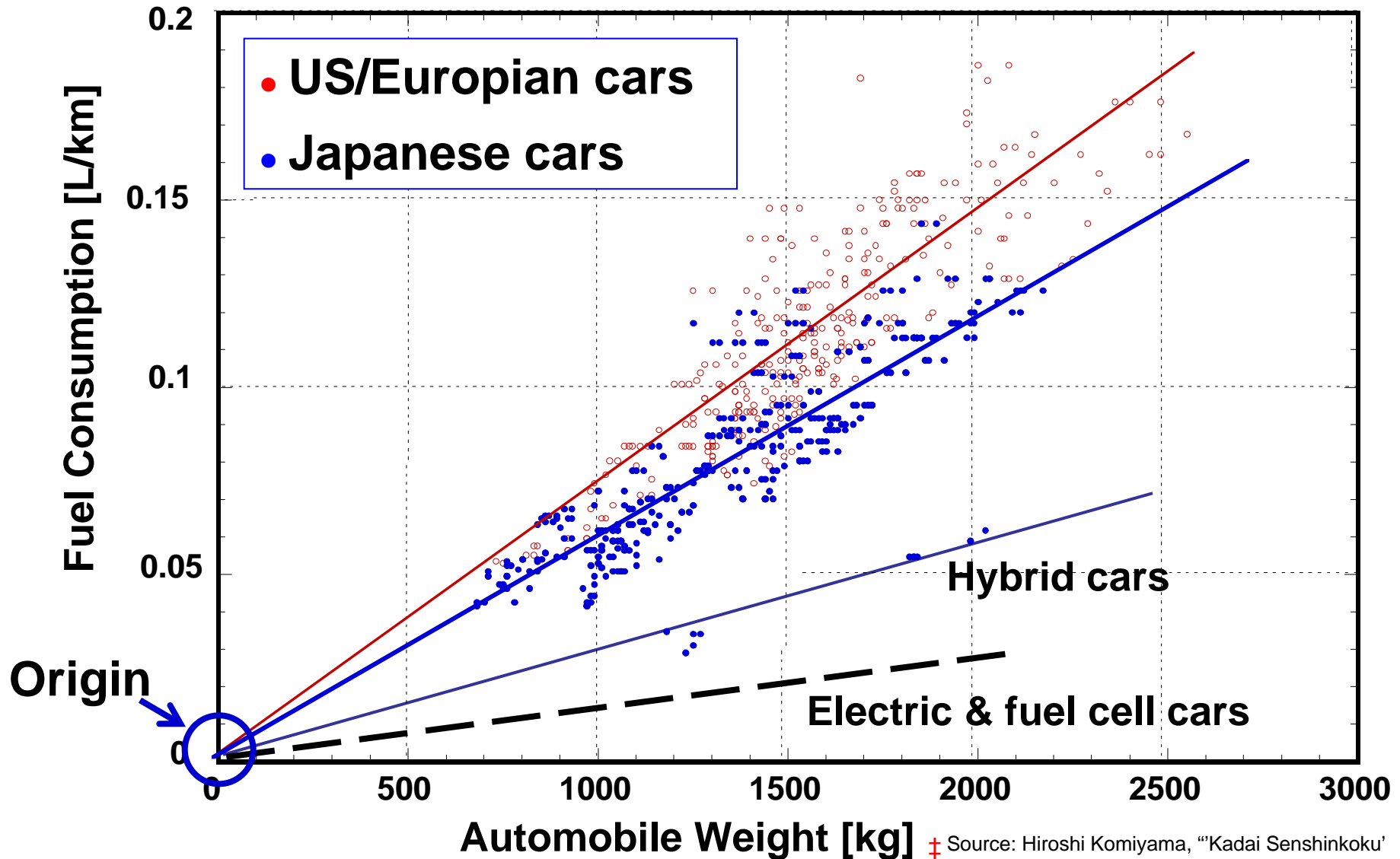
Energy ratio of reduction to fusion

Iron **27 ×**

Aluminum **83 ×**

Theory represents a good guideline for practice

Automobile Energy Efficiency can Improve to 5–10 × in 2050



Data Source: Yahoo! Japan Autos

† Source: Hiroshi Komiyama, "Kadai Senshinkoku" Japan: From Catch-up to Front-runner" P.24 Chuo-koron (2007)

Difference Between Theory and Reality is the Potential for Better Efficiency

Theoretical value of heating energy is zero

Heat insulation of houses/buildings

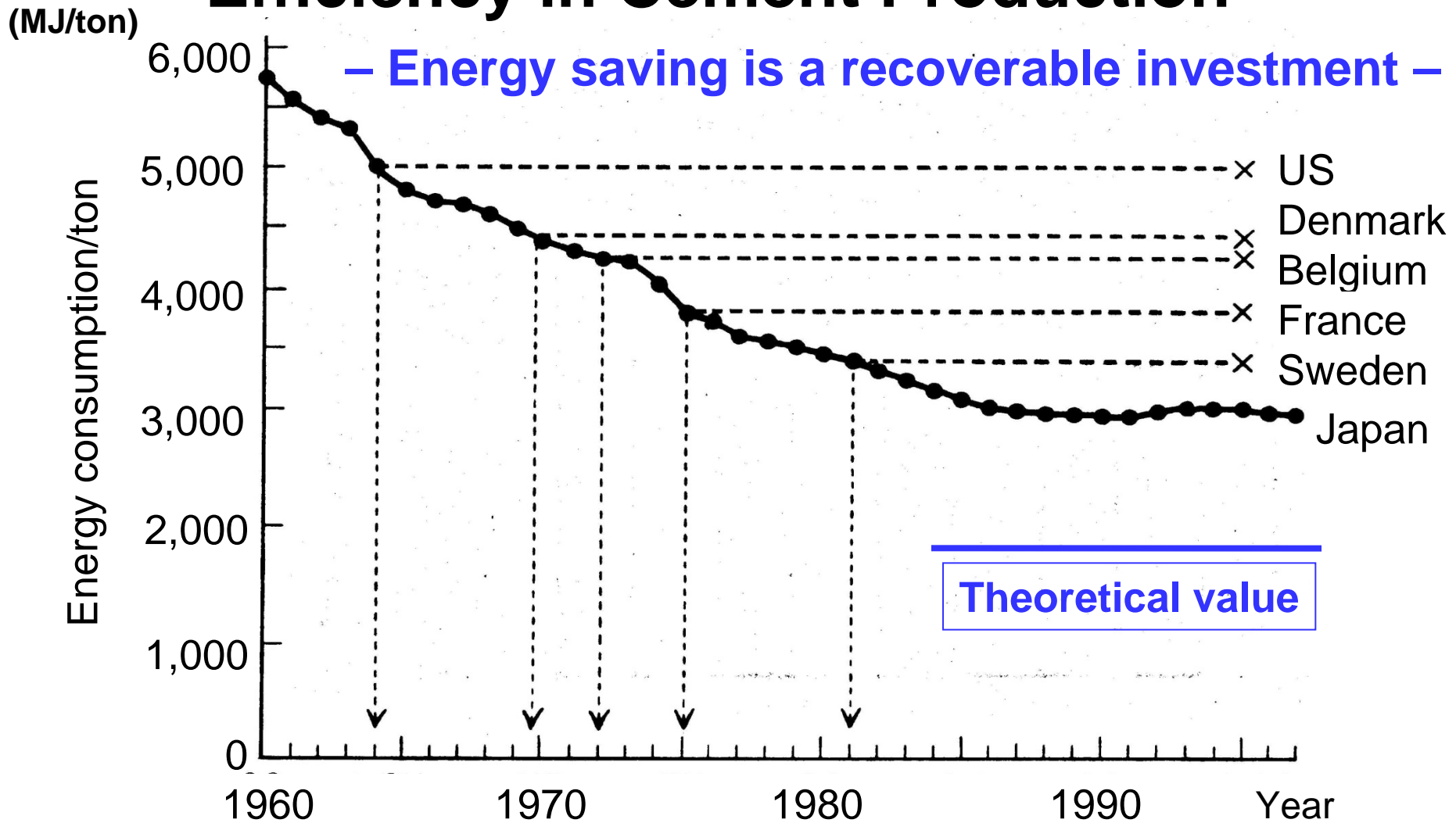
Bonfire	Hovel	Temple	Common house	Eco-house	Ideal house
0	1	5	30	100	∞

Air conditioners

Before 1990	1997	2004	2006	2010	Vision 2050	Theory
3	4	5	6	7	12	43

$$1/4 \times 1/3 = 1/12$$

Technology Transfer can Improve Efficiency in Cement Production



3 × overall energy efficiency is desirable in 2050

Important Perspectives

for Global Warming and Energy Resource/Material

Saturation of Artificial Products

Energy Efficiency

Non-Fossil Fuel-Based Energy

Prediction of Results from Implementation of Vision 2050

(a) Current



Fossil fuel resources Non-fossil fuel-based resources

(b) 2050 (if no action is taken)



(c) Vision 2050

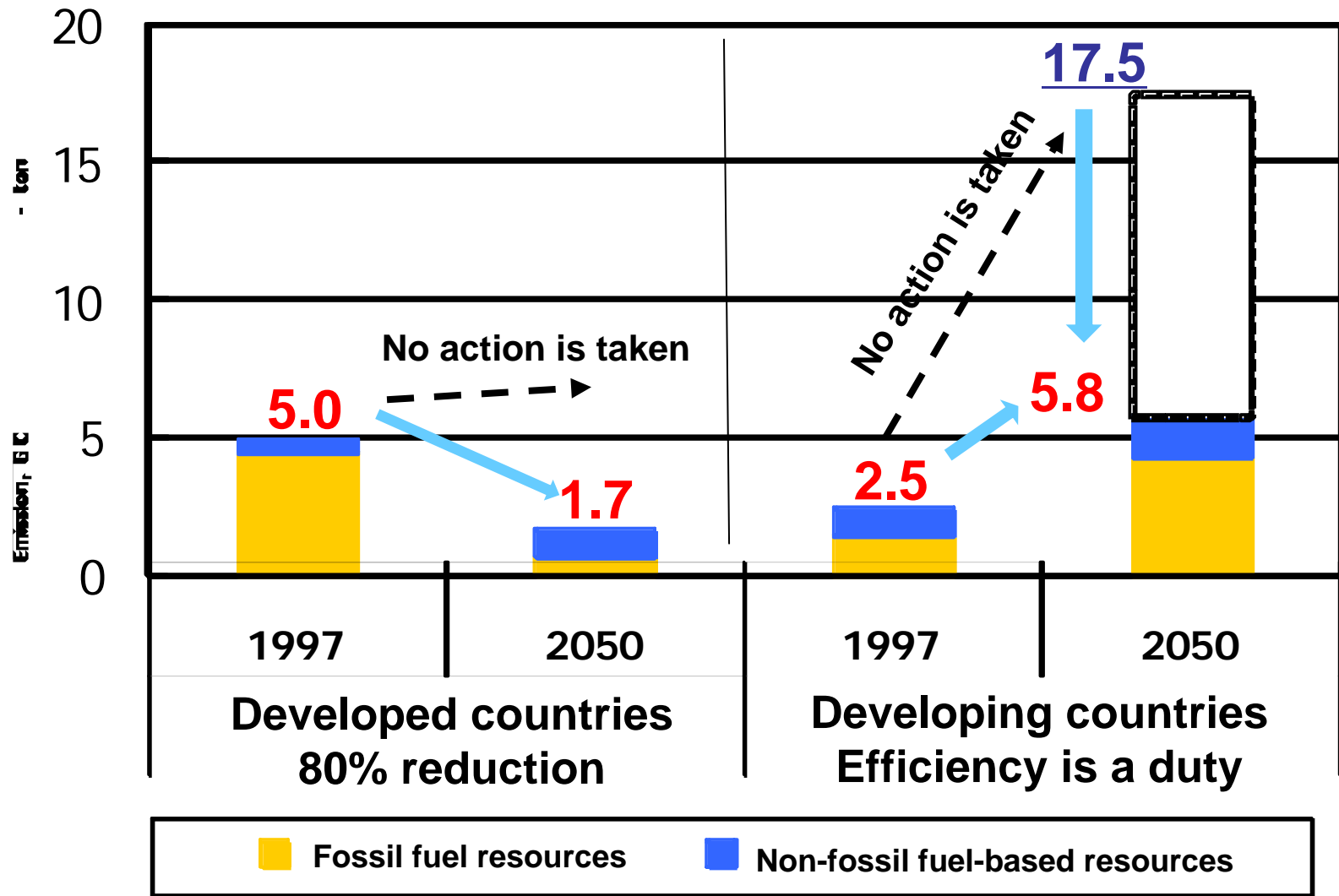


(d) After the 22nd century



Future is bright once Vision 2050 is achieved!

Production is a Right, Efficiency is a Duty

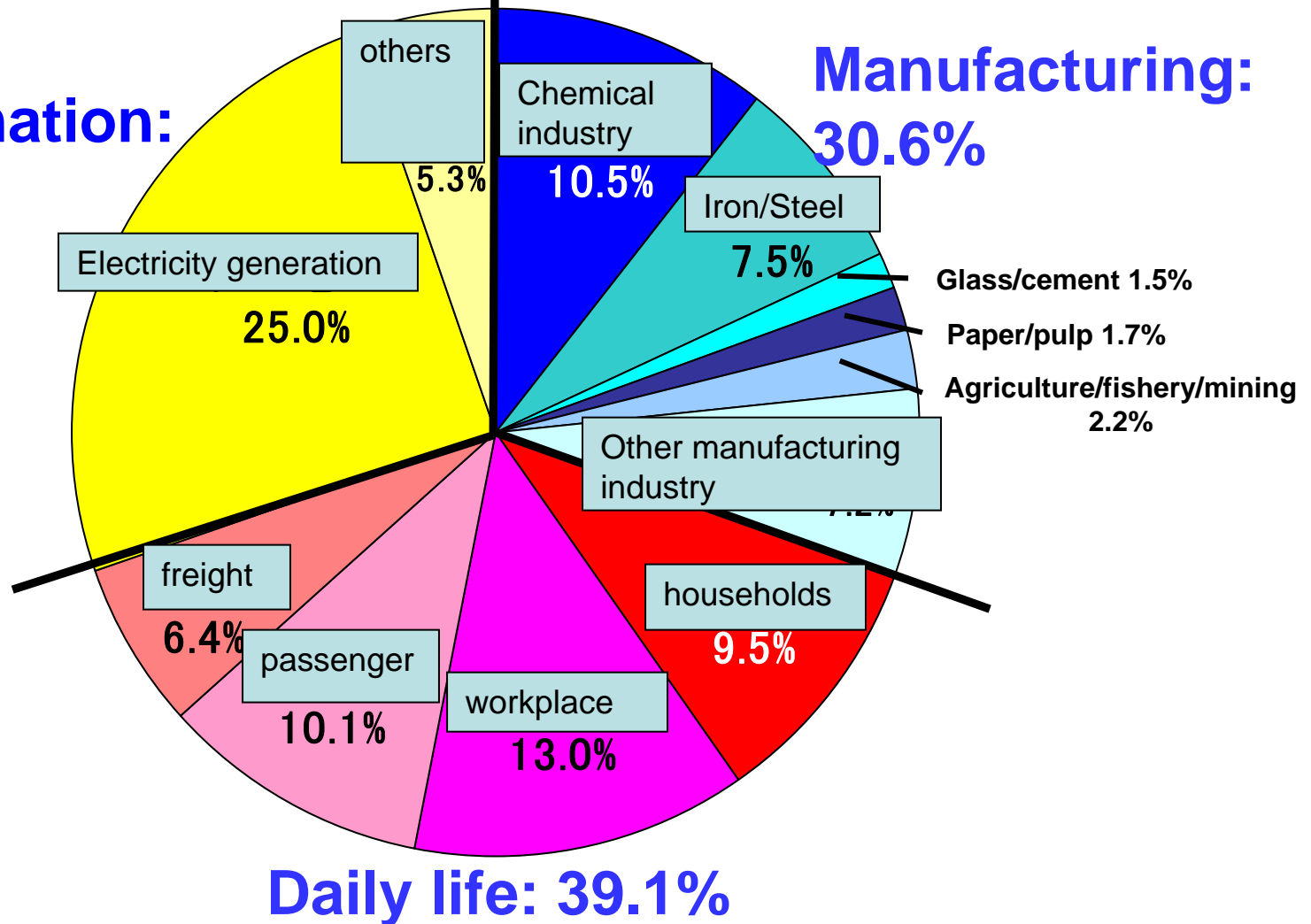


Knowledge Structuring

Energy Consumption in Japan

**Energy transformation:
30.3%**

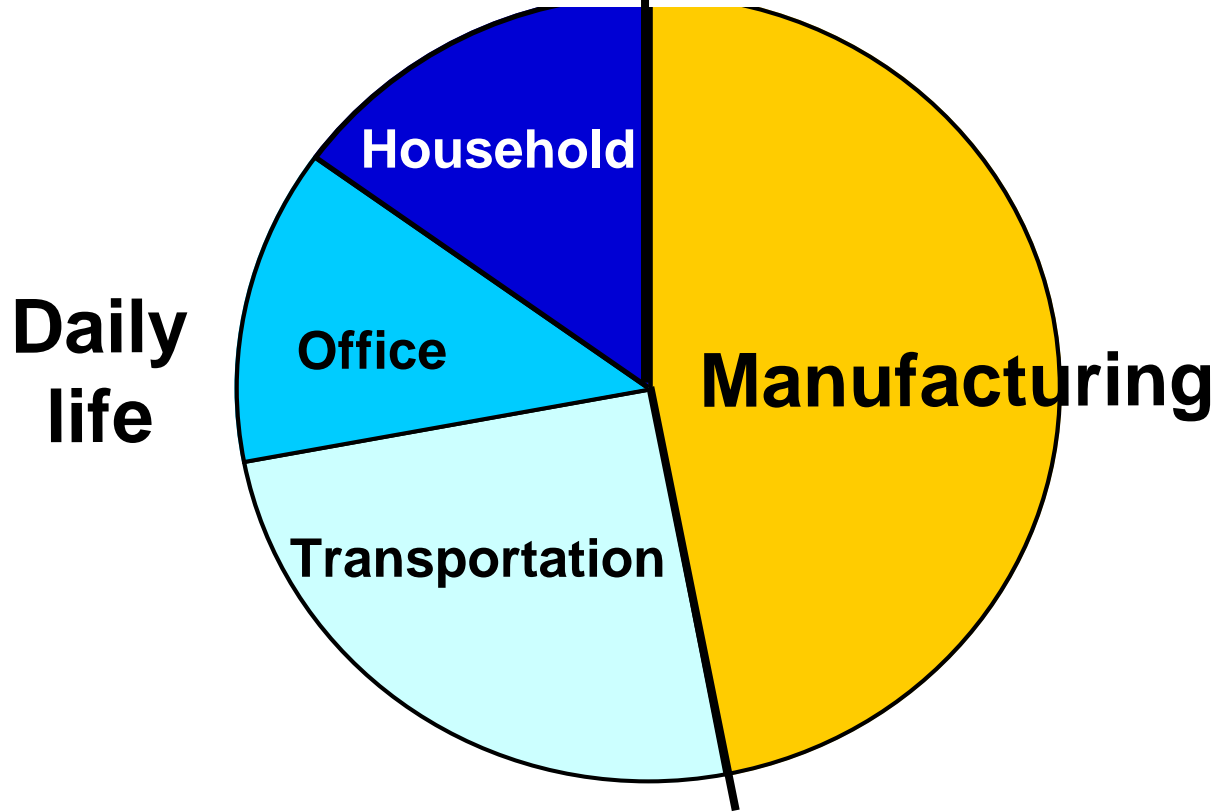
**Manufacturing:
30.6%**



Energy Statistics 2007 (Data is for 2005)

Note: Consumption in the Energy transformation category includes the dissipation that is not converted into electricity and captive use at power plants.

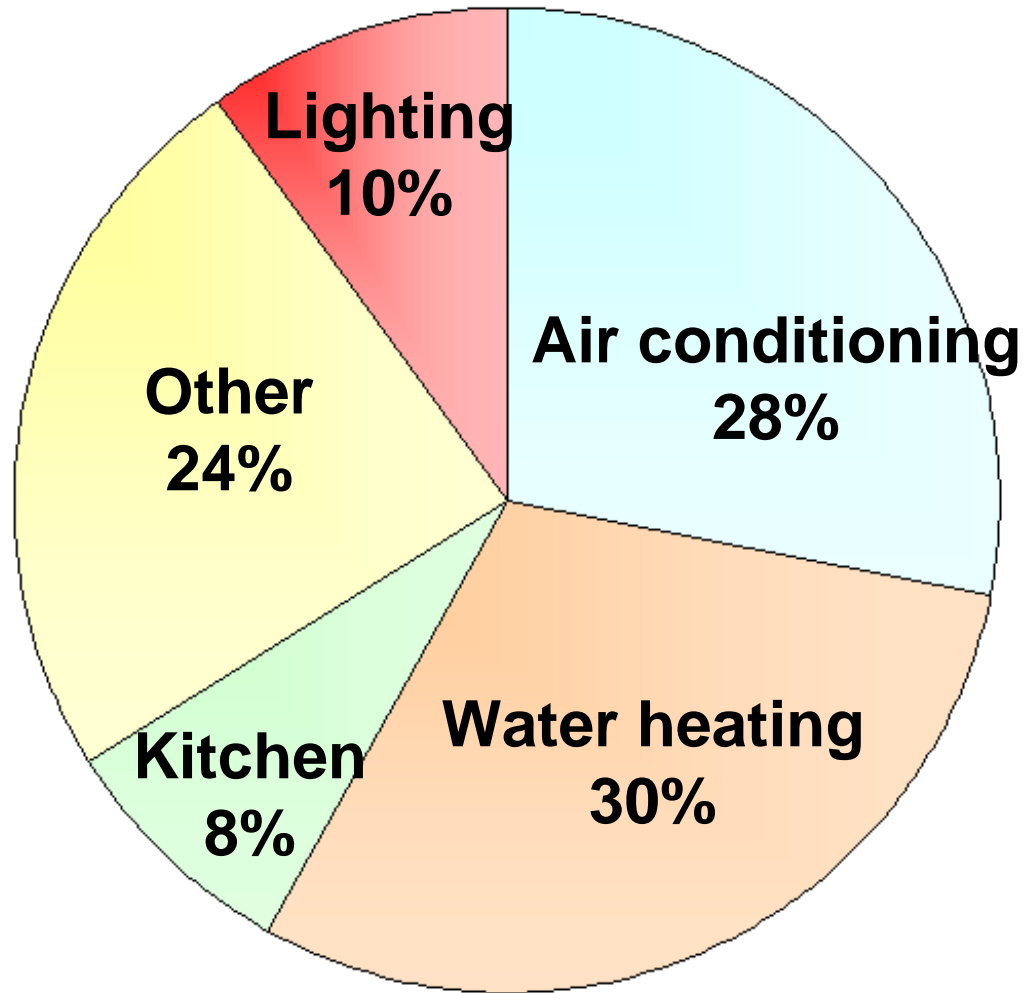
“Japan is a Wrung-out Rag” is a Misleading Perception



Strategy is clear:

**Reduce consumption in daily life
and promote energy-saving manufacturing**

Energy Consumption in Households



In comparison
In offices
Air conditioning: 50%
Lighting: 20%

Energy consumption through air conditioning could theoretically be zero

University in Action

Model for Effective Offices

– Sustainable Campus Project at the University of Tokyo –

Installation of second windows inside of outer windows

Comfortable Life, Recoverable Cost, and
Reduction of CO₂ Emission



Comparison of Heat Pumps and Fuel Cells

Heat pump Electricity $\times 4 = 200\%$

On-demand water heater: 80%

Storage-type water heater: 40%

Fuel cell 36% + 50%

Thermal power generation 42% \rightarrow 36%

CO₂ emission of water heater is zero

Creation of a huge new market from Japan

Komiyama Eco-house

Technologically easy to achieve!

Heat pump water heater: COP = 4

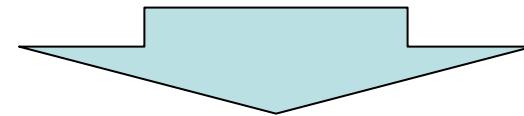
High insulation: $K = 1.6 \text{ W/m}^2\text{K}$

New air conditioner

New types of refrigerator & lighting

Hybrid car: 22.6 km/l

Solar panel: 3.6 kW



**81% reduction in household
and transportation sectors**

**Investment can be recovered
in 12 years**

**Investment in manufacturing efficiency
can be recovered**

**Investment in household, office, and
transportation can be recovered**



Is CO₂ reduction really burdens?

Do economic circles actually oppose the investment?



Virtual experiments

25% Reduction is Feasible: Team Komiyama's Proposal

Daily life	House/Office	Visualization of energy management, Encouraging new construction of eco-buildings, Promoting reform for energy saving	6	12
	Transportation	Early adoption of the eco-car, Improvement in transportation/goods distribution	6	
Manufacturing		Implementation of further energy saving in industry	3	3
Power generation & transmission		Improvement in operation rate of nuclear power generation, Utilization of biomass, Higher voltage for households	5	5
Agriculture		Reducing damage to crops due to plant diseases, Producing compost/green manure in cultivation of abandoned/reserved firm land	1	5
Forest		Saving forests that are properly maintained	4	
Clean development mechanism		Steel, Cement, Paper/Pulp, Power generation, Train, Nuclear power generation	5	5
Total			30%	30%

Theoretically possible

Technologically possible

Economically possible

Politically impossible

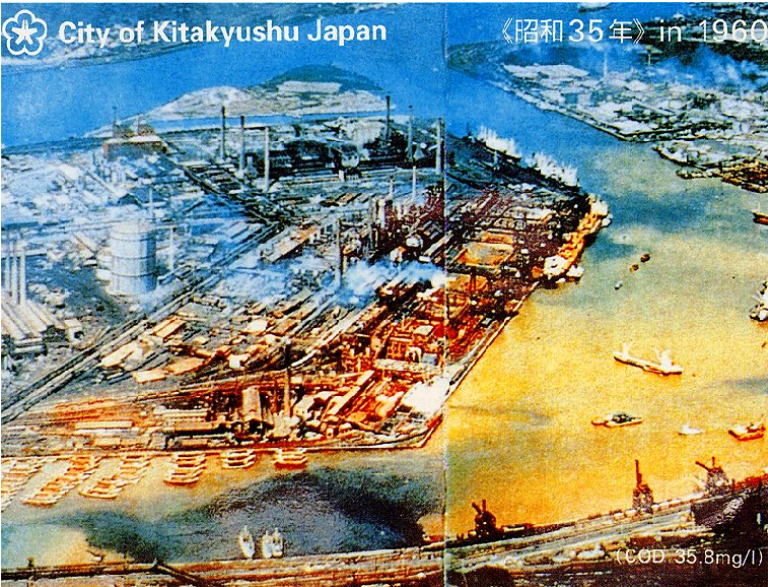
“Both the world and Japan will benefit” = Strategy

Japan's Vision 2050: Self-sufficiency

Energy	70%
Resources	70%
Food	70%
Water	100%

**From “Importing country of resources” to
“Model country for the 21st century”**

Pollution Problems in Kitakyushu have been overcome



Source: Hiroshi Komiyama, "Kadai Senshinkoku' Japan: From catch-up to front-runner", P27, Chuo-koron (2007) Courtesy of Kita-Kyushu)

Sumida River in 1967



Now



‡ Visual Report on the Environment, The Ministry of the Environment, 1972
<http://www.env.go.jp/policy/hakusyo/zu/eav11/eav110000000000.html>

‡ http://commons.wikimedia.org/wiki/File:Picture_121.jpg

Pollution Problems in Yokkaichi have been overcome

In the 1950s



Now



✚ ©Yokkaichi City

<http://www.city.yokkaichi.mie.jp/kankyo/kogai.htm>

A Country Where Environment and Economy Coexist



Genkai Nuclear Power Plant (Saga)

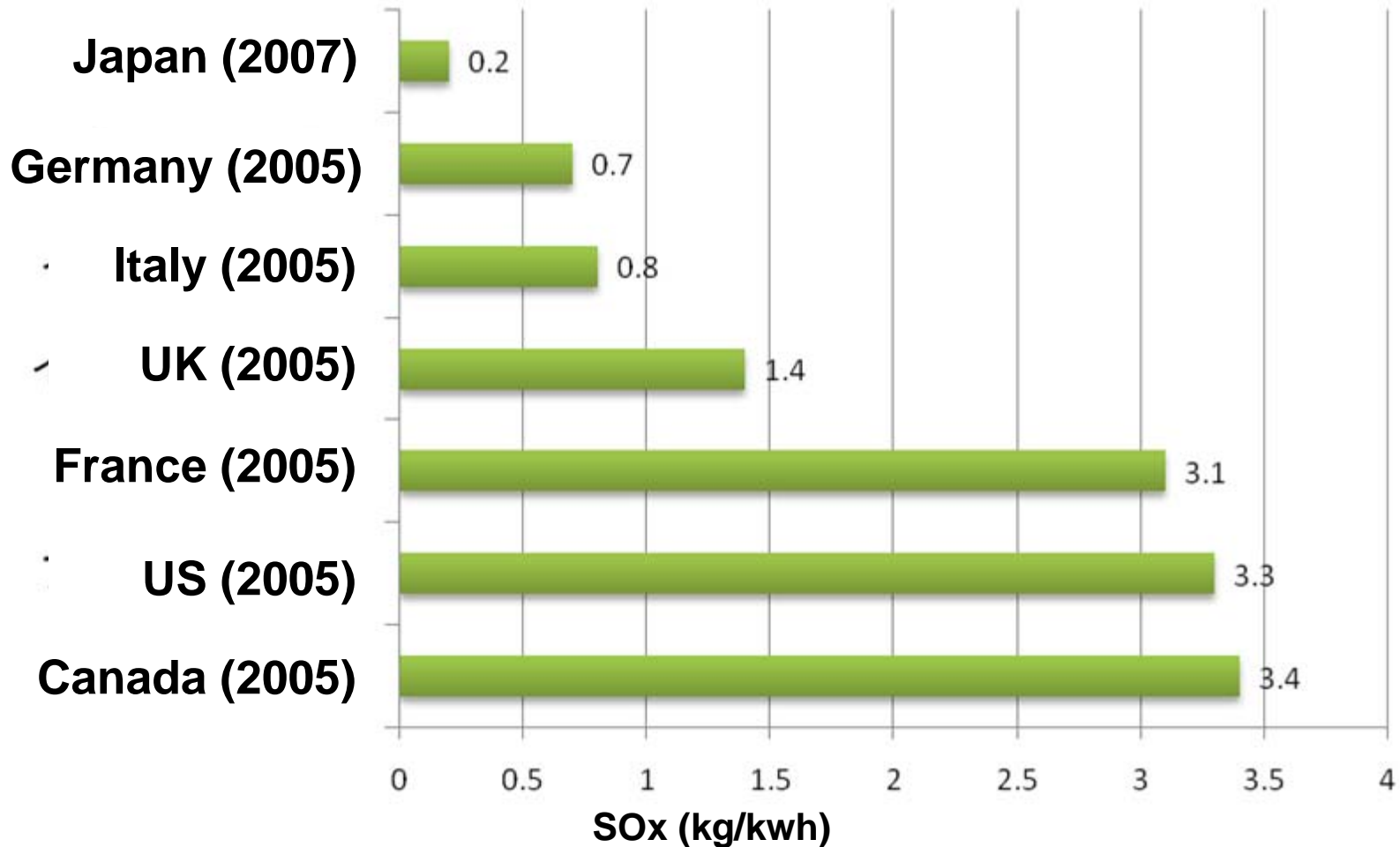
✚ National-Land Information (Color aerial photo) The Ministry of Land, Infrastructure, Transport and Tourism of Japan
http://commons.wikimedia.org/wiki/File:Genkai_NPP_1977.jpg



Mt. Fuji and Tokyo Metropolis

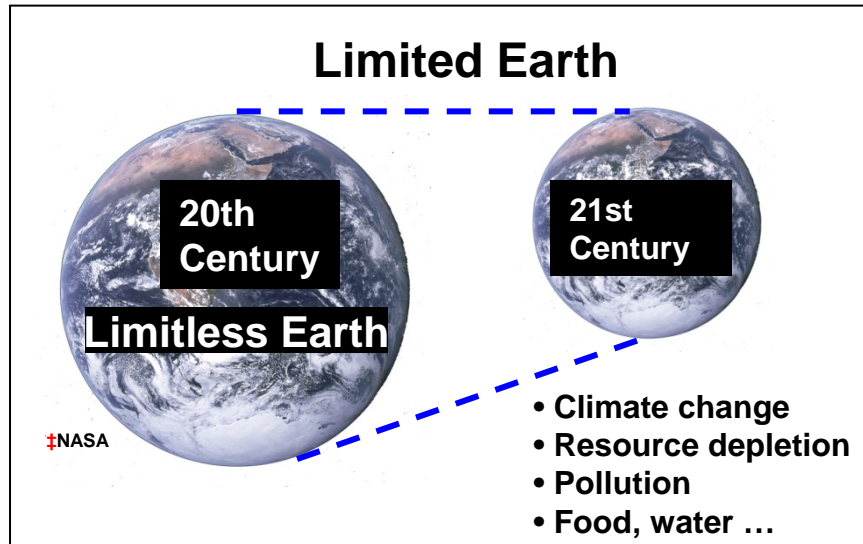
✚ http://ja.wikipedia.org/wiki/ファイル:Skyscrapers_of_Shinjuku_2009_January.jpg

“Emission Control in Manufacturing” Has Dramatically Reduced Pollution

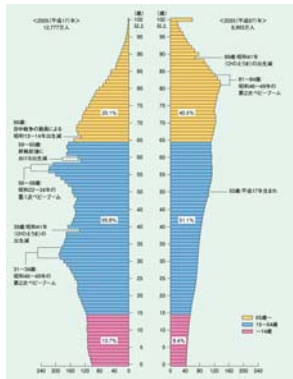


Emission of sulfur oxides per unit electricity from thermal power plants

Paradigm in the 21st Century



Aging society

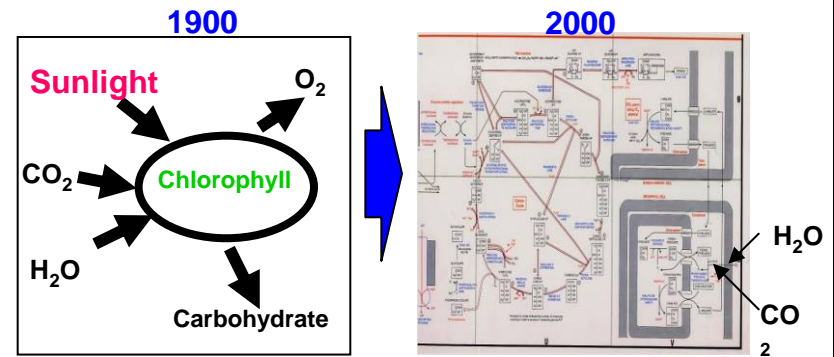


- Longevity
- Low birth rate
- Saturating demand
- Pension
- Medical services
- Nursing care
- Work sharing
- Barrier free ...

†Sources: "National Census 2005", The Ministry of Internal Affairs and Communications of Japan
"Future population of Japan", National Institute of Population and Social Security Research

<http://www8.cao.go.jp/shoushi/whitepaper/w-2009/21webhonpen/html/i3100100.html>

Exploding knowledge



† Source: Hiroshi Komiyama, "Kadai Senshinkoku" Japan: From Catch-up to Front-runner" P. 134, Chuo-koron (2007)

Who Leads the World?

Rome, Tang dynasty, Venice, France, UK, US

Artificial products should be saturated

Attractive cities

Attractive places for studying, traveling, and living

Platinum Society is the Goal

Ecological society

Society where the elderly can participate

Society where people can achieve personal progress

Society where employment is assured

**Model of the 21st century created by
national manpower**

New Industry, New Employment, Economical Vitalization

**Eco house
Eco appliance
Eco car
Solar panel
Wind-power generation
Water, food, etc ...**

**Barrier-free infrastructure
Uniform-temperature house
Health management
Safe/secure transportation
Visual/hearing support
etc ...**

**Knowledge structuring
Structured knowledge base
Education
Lifelong learning
Added-value creation
etc ...**

Let's aim for a platinum society!

Shift in National Model and Action

“Aiming for Upslope Cloud” era

Developing country model → Income-doubling plan

Introduction of industry through government’s initiative can increase GDP, thereby **improving** people’s quality of life

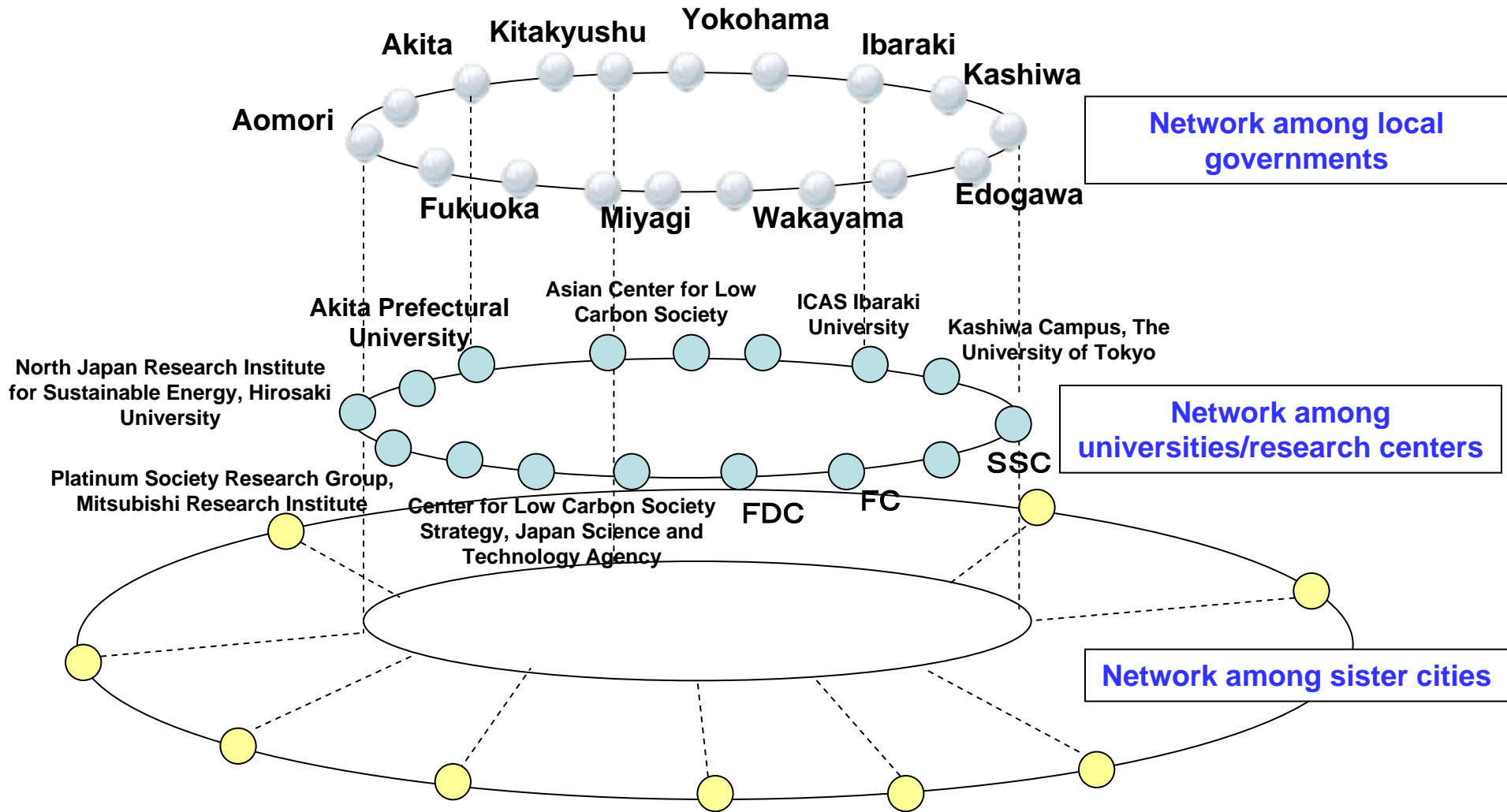
“Fog in the Cloud”

Developed country model → Platinum plan

Effort to improve life through citizen’s initiative can **create new industry**, thereby increasing the GDP and strengthening the nation’s economy

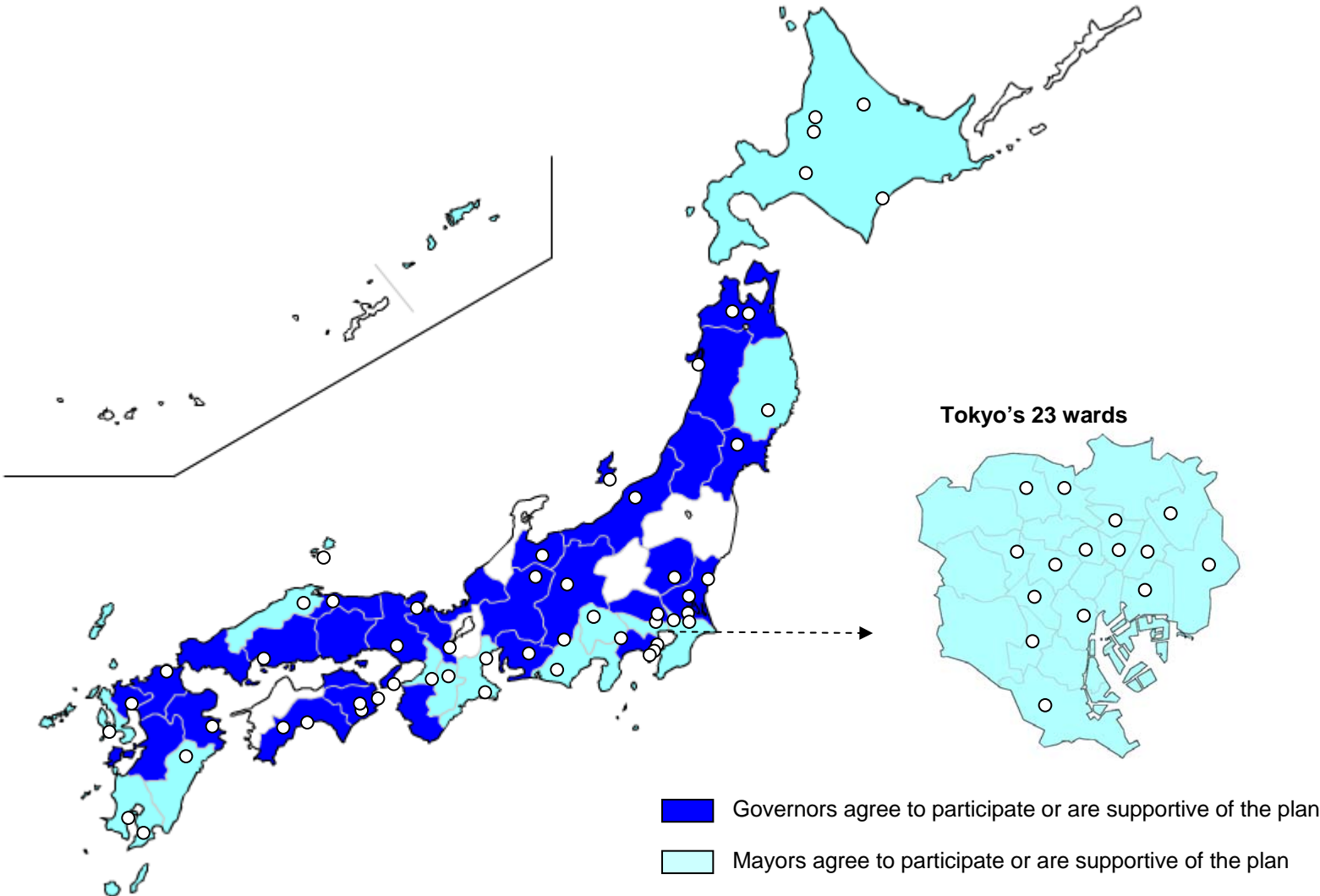
The platinum plan network has been initiated!

Platinum Network as a Moving Body



Platinum Network as a Moving Body

Local government members (as of Dec. 22, 2010)



Factorial and Implementation with IT

- Volume order of energy saving devices (Ecology × Economy)
= (HEMS* Standardization) × (Mass production)
= (Volume purchase of eco-refrigerator) × (Charge-free lease)
- Plastic greenhouse equipped with solar panel (Ecology × Agriculture)
= (Developing thin & light-weight solar panel) × (Installing on greenhouse) × (In-house power generation)
- Trimming and transportation of thinned wood (Ecology × Forestry)
= (Developing collection & transportation tractors for wood thinned) × (Mass production)
- Integrating efficient firming and biomass (Ecology × Ecology)
= (High-yield rice) × (Development & sales of rice powder products) × (Mixed combustion of rice straw)
- Industrializing rental solar panels (Ecology × Economy)
= (Solar panel rental) × (Local investment) × (Insurance system)
- Local pilot program harmonized with nature (Ecology × Agriculture × Tourism)
= (Eco-house competition) × (Japanese crane) × (Ranch) × (Iodine hot spring)
- Highly efficient firming (Agriculture × Economy)
= (Distributing GPS terminals) × (Data collection) × (Business analysis)

*HEMS: High-level entity management system

Knowledge Structuring is the Key!

- Housing improvement and utilization of health-related data (Ecology × Aging society)
= (Providing eco-house) × (Integration of medical exam, prescription, and nursing care data) × (Introduction of membership system)
- Zero-emission school (Ecology × Education × Employment)
= (Eco school building) × (Visualization) × (Technician training)
- Central Japan Health Valley Plan (Aging society × Employment × Economy)
= (Telemedicine network) × (Cutting-edge medical technology) × (International conference) × (Development of high-speed transportation system)
- Implementing an on-demand bus system throughout the country (Aging society × Economy × Employment)
= (Ensuring transportation by utilizing IT) × (Termination of fixed-route bus)
× (Implementation of golden route)
- Specialized local economic development project (Ecology × Agriculture × Education × Art)
= (Deodorization using native bacteria) × (Shochu making) × (Hometown re-generation school) × (Invitation of artists)
- Specialized local economic development project (Art × Internationalization × Village)
= (Pottery) × (Exploiting locally made kilns around the world) × (International festival)
× (Lodging village)

Questioning common knowledge?

What should we question?

Judgment

What should we trust?

Science