Global Focus on Knowledge Lecture Series

Energy and the Earth

Governance of Energy and Environmental Problems

2.Social Induction Processes of Energy Related Technologies

Hideaki Shiroyama

University of Tokyo Graduate Schools for Law and Politics

At First...（1）

- “Energy-related technologies”
  - Various technologies which affects energy needs in society in aspects of energy production, transport and uses, including soft technology and know-how.（ include technology for energy-saving, uses of transportation technologies)
- Technologies deeply related to publicness
  - Energy security, environment conservation, regional improvement, employment･･･
- Social infrastructure is needed
  - Electric transmission, electric distribution, transportation, safety regulations, industrial infrastructure, education and training
- Social symbolism is extremely high

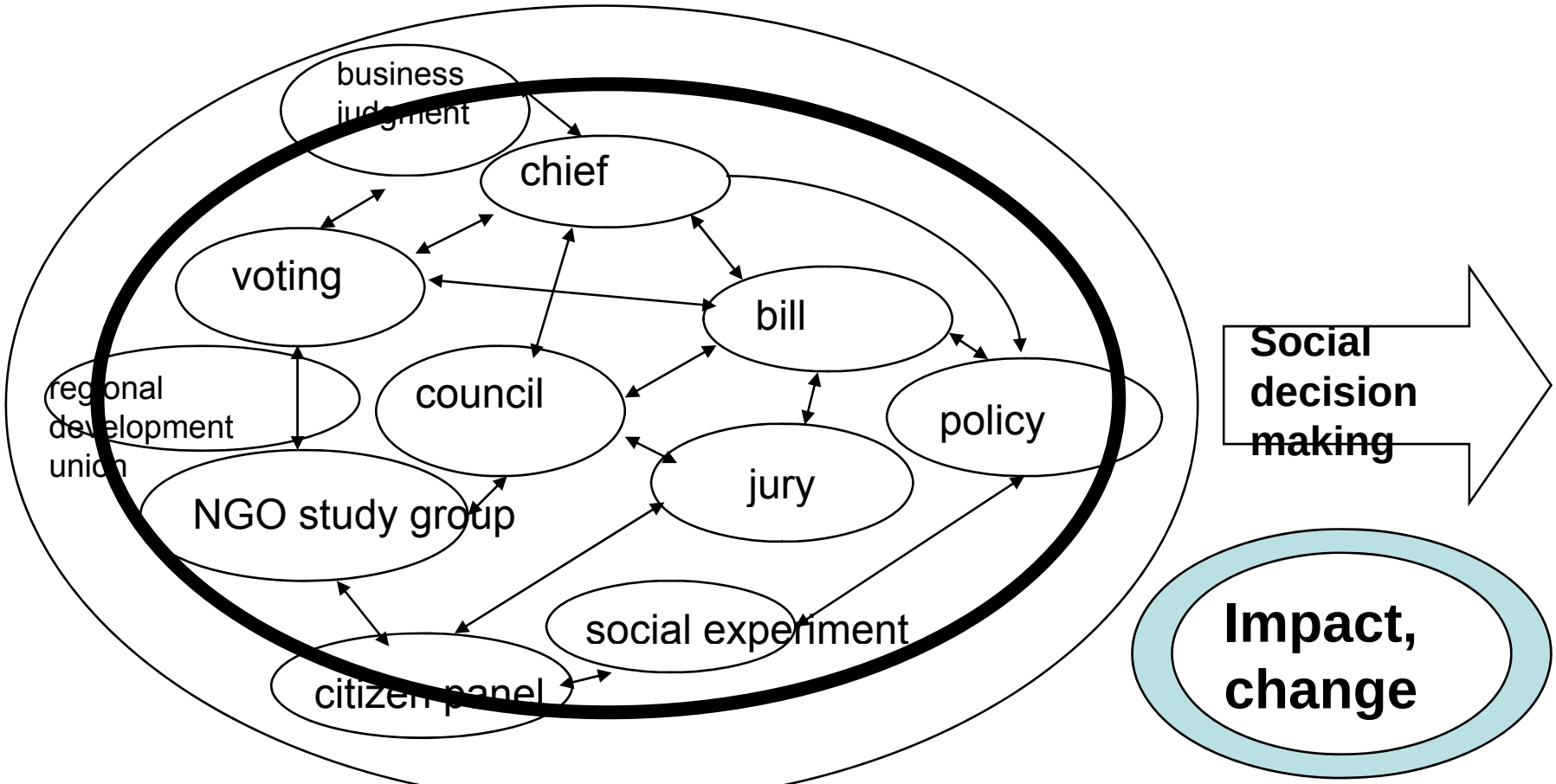
At First...（2）

- “Social Induction of Technology”
  - “Society”：defined by a range a public purpose concerning the energy technology to be induced aims at（international society, nation, state, cities, towns, villages）
    - “Public purpose” may be different in different societies. Who determines that “ public purpose” ?
  - Decision making at inducing process requires a certain involvement of government (including municipalities)
  - Uncertainty is extremely high at inducing process
  - Decision making at inducing process might determine relationship between technology and society

At First...（3）

- “Social Decision Making Process”
  - We must consider not jus decision making in individual facilities but collective decision making
  - “Process toward social decision making not only by public processes by government agencies which are given with public authority by laws and systems, but also by complex linkages with various non-public processes such as organizations without public authority, groups, individuals and networks”
    - In cases when there is a particular decision making that affects social decision making greatly
    - In cases when whole decision making is done by coordination of individual decision makings
- By that decision, effects and changes are brought to the overall society.

Image of Social Decision Making



Theoretical Viewpoints

- Regulations and Innovation

（1）Porter Hypothesis（environmental regulations→competitive force）：Japanese cars－possibility of win-win by technology innovation

（2）Technology Forcing：environmental regulations→technology development：cars in 1970s

- Focus on Processes

（1）Multi-tiered steps：regulation→technology development（？）→competitive force（？）

（2）Focus on interactions among various bodies－government, company, NGO …

（3）Focus on interactions between government policies and company strategies change in company's strategy（CNG：Sagawa, Toyota: hybrid)

（4）PEN（Public Entrepreneurship Network）

Public functions of non-government bodies（NGO etc,） electric tramway

Step-by-step development under uncertainty－importance of experiments car sharing

- Induction processes：importance of framing to show what that technology is for－diachronic changes：electric tramway（differences in Okayama and Takaoka），limits in biomass－Only taking environmental measures is not enough
- Lock-in and release－relationship between technology and system：importance of infrastructure（CNG, car sharing←→hybrid）－importance of time-axis needed for investment；importance of significant outsider(wind power) and significant boundary actors (eco-cute)

1. Primary Emissions Control of Exhaust Gas from Cars

①Japan

- Emissions control：Conduct of the American model, Muskie Act（NOx0.25g/km）in 1975 and 1978－concerns about photochemical smog, trading, local political pressure　　cf. Technology consideration regime and competitions among industries
- Fuels regulation：1970, Ushigome-Yanagimachi Case (meanings of mistake) caused low use of lead, non-lead for catalytic car was introduced in 1975

②USA

- Emissions control：Remission of Muskie Act（NOx0.6g/km）and delay（resulted in 1983）－concerns about photochemical smog, regional differences (control in California proceed), heat-up and chill-out of the presidential election
- Fuels regulation： low use of lead from 1973, non-lead for catalytic car was introduced in 1974

③Europe

- Emissions control：

  ignored until early 1980s（harm to health were uncertain）

  After 1982, concerns for “death of forests” (acid rain) in West Germany. England ignored issue because of differences in environmental conditions

  EC regulations at level of USA in 1983 was finally adopted in 1989（started in 1992）
- Fuels regulation：For health concerns, low use of lead and non-lead gasoline for catalytic cars started in each country. General use started in 1989.

Short Summary

- Compulsive Creation of Needs by Regulations

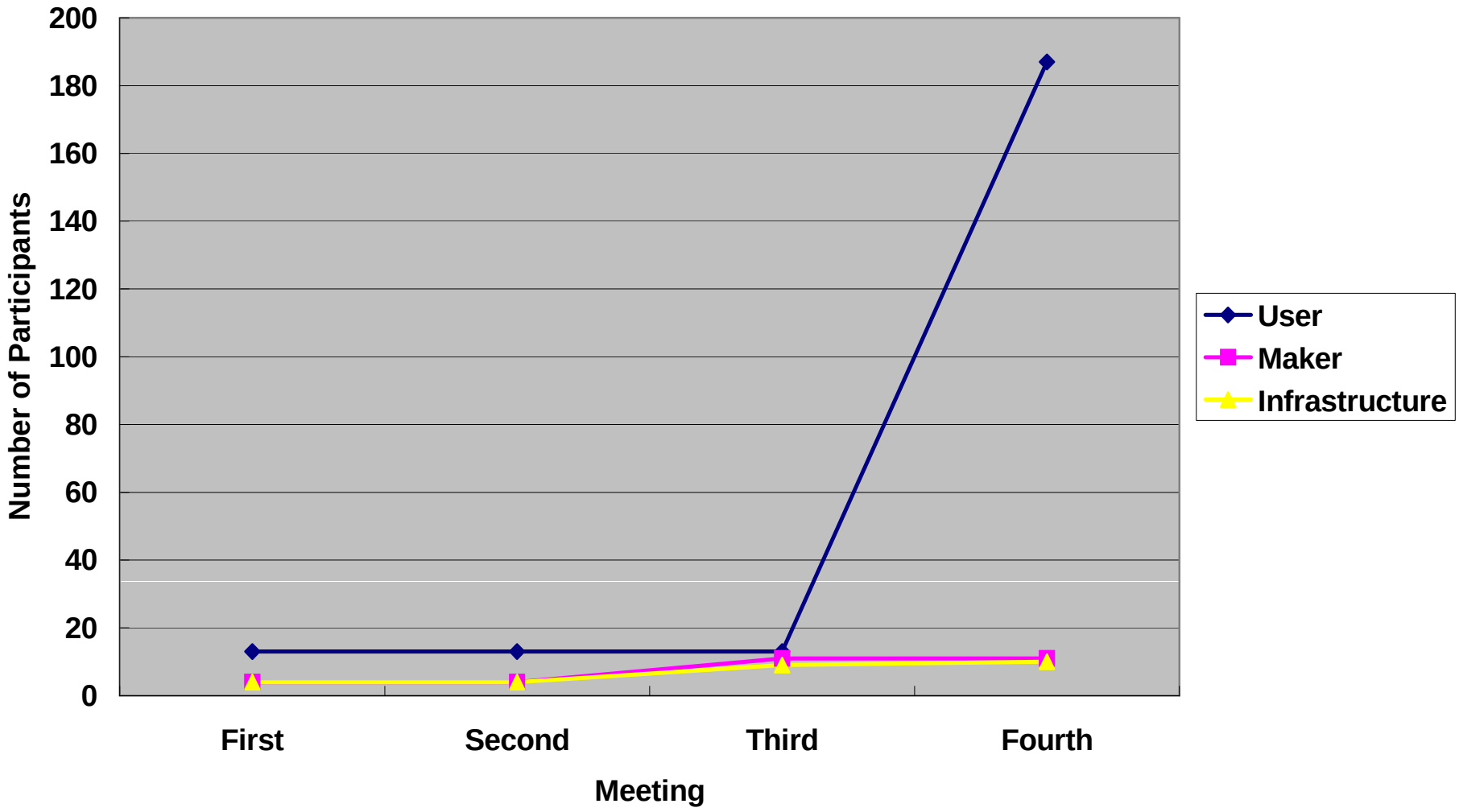
Response to risk trade-off might be a response to citizen's response in each country ?

- Issues of suppliers' readiness－meanings of competitions among companies cf. Honda, power relationship of manufacturer and oil company
- Pressure from public movements on background

2. CNG（Compressed Natural Gas）Players

- Government（Tokyo Metropolitan Government headquarters・Ministry of Environment)
- Infrastructure（Tokyo Gas, Cosmo Oil）
- Manufacturer（Isuzu, Toyota, Nissan Diesel）
- User（Sagawa Express, Yamato Transport, Seven-Eleven, Co-op）

Participants in the Strategic Council for New Market Creation



Price, Technology, Infrastructure

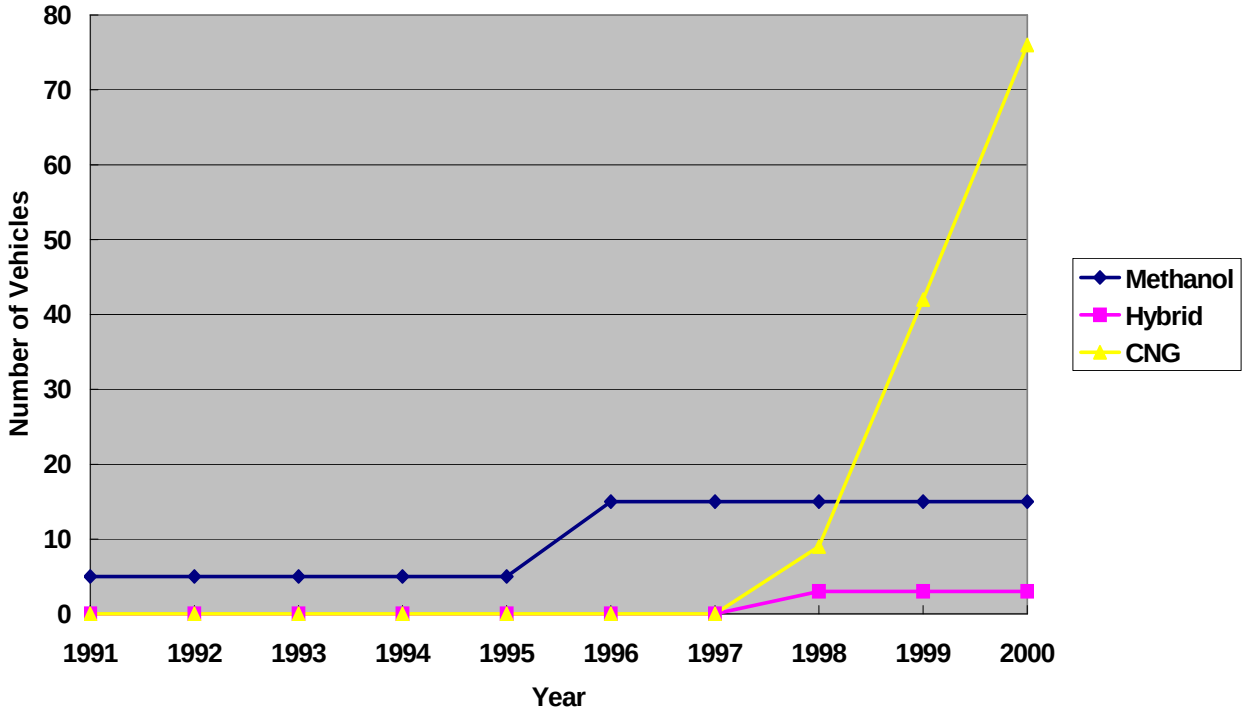
- Price：subsidy（NEDO, Tokyo）
  producers' issues（30-50% increase）
- Technology：Technological difficulties are relatively small.
- Infrastructure：Tokyo Gas's efforts and limits

Tokyo Gas's Commitment
Number of Gas Stations

Firm	2000	2001	2002	2003	2004	2005
Tokyo Gas	3	5	5	5	5	5
Cosmo Petroleum	0	5	-	-	-	-
Nichimen Energy	1	2	-	-	-	-
Hino Motors	1	0	-	-	-	-
TMG	1	0	-	-	-	-
Other	0	6	-	-	-	-

Commitment of Sagawa Express

- Motive：Improvement of social image, Kyoto Conference
- Conditions：concentration of distribution station, size of clients



Systems: Adjustment of Regulations

- High-pressure gas safety law

  （ministerial order, announcement correction, the 1st-4th ）
- Gas Supply Law

  （ministerial order, announcement correction, the 1st-3rd ）
- Fire Defense Law

  （ministerial order, announcement correction, the 1st-2nd ）
- Road Trucking Vehicle Law(ministerial order OK)

3.Hybrid
Toyota's Strategies

- Top-down Decision Making
  - Vision of the 21st Century car（twice as much fuel consumption ）
- Environmental Strategy
  - Bitter experience of Muskie Act
- Innovation of Company-specific Process

Price, Technology, Infrastructure

- Infrastructure：no need for new construction（GS can be used）
- Technology ：technological innovation, collaborative development of battery
- Cost ：Earn benefits through models (red at first), subsidy（Clean Energy Cars Inducing Granted Project）

4.Car Sharing

- Join a a car sharing group
- Reserve a time you want to use the car.
- Go to station (of cars)
- Drive the car.
- Return the car to the station.

Case in Yokohama（1）

- History
  - Started by *Jidosha Soko Denshigijutu* Committee
  - JSK gathered interested companies, and developed car sharing system with a research development support from NEDO
  - Established CEV Sharing Company with co-funding of experiment-participating companies.

Case in Yokohama（2）

- Points
  - Technological development of car sharing system using electric cars
  - Issues of regulation：negotiations with jurisdictional ministries and agencies (regulation of rent-a car (face -to- face lending), Garage Law (distance from parking area)
  - Issues of insurance：development of insurance for car sharing

Case in Fukuoka（1）

- History
  - West-Japan Citizen's Committee for Recycling Activity：car sharing as "environment business which can afford money to live on."
    - Installation supporting business with Kyushu Electric company before.
  - Collaboration with Kyushu Electric and Fukuoka Development Company
  - 3 bodies shared costs and established new NPO
    - Initial cost (electric car, lease, system development), Kyushu Electric and City of Fukuoka paid
    - Cost of management paid by income of business

Case in Fukuoka（2）

- Points
  - Partnership of NPO, electric company and city office
  - Existence of precursory example：

    Large merit from Yokohama in terms of regulations and such

    Collaboration with the urban development union in Hakozaki area：setting-up of stations, finding potential customers－Did not work well, and switched to marketing study of youth
  - Absorption by Mazda Rent-a-car

Short Summary（2.3.4.）

- To induce substitute technology, 4 barriers (technology, cost, hard infrastructure and soft infrastructure = system）must be overcame.
  - Especially, how to deal with infrastructure is important.
    - CNG：high-pressure gas
    - hybrid：by-path for infrastructure issues
    - CS：whether to be regulated as rent-a-car, insurance
- Niche
  - CNG：Tokyo（serious traffic pollution）, car distribution of Sagawa
  - hybrid：environmentally-friendly customers
  - CS：Yokohama is an office area, Fukuoka is a community（→youth）
- Social Consensus Building
  - hybrid：minimize contact with society
  - CNG：strategic conference for creation of new market
  - CS：Yokohama was an experiment→feedback, partnership of 3 companies at first in Fukuoka（→under companies）

5. Rebirth of Electric Tramways－ Okayama, Takaoka, Shin Minato

- Okayama：Taking the opportunity afforded by a nationwide electric tramway summit in 1997, a project to extend existing tramway was proposed. Precise plan proceeded, and the project gathered momentum, but was not realized.
- Takaoka, Shin Minato：Electric tramway, Manyo Line in Takaoka, Toyama was supposed to be defunct, but effort centered on Takaoka City and citizens stopped this.

‡ **Source:** OKAYAMA ELECTRIC TRAMWAY http://www.okayama-kido.co.jp/

Okayama 1995-1997：Establishment of RACDA and Electric Tramway Summit

- In October, 1995, RACDA (Working group to consider the future of tramways and city) was established by demands from the Chamber of Commerce.
- In 1997, National Electric Tramway Summit was held in Okayama. RACDA invited this, and the Ministry of Labors and the Ministry of Transportation supported. It was to be realized by participation of officials who are directly in charge of tramways.
- Department in charge in the Ministry of Labor：Had a strong interest in modernization of tramway and proceeded collecting information of examples in Europe. It may have been a measure to escape from criticisms over special tax revenues.

Okayama 1995-1997：Establishment of RACDA and Electric Tramway Summit

- In October, 1995, RACDA (Working group to consider the future of tramways and city) was established by demands from the Chamber of Commerce.
- In 1997, National Electric Tramway Summit was held in Okayama. RACDA invited this, and the Ministry of Labors and the Ministry of Transportation supported. It was to be realized by participation of officials who are directly in charge of tramways.
- Department in charge in the Ministry of Labor：Had a strong interest in modernization of tramway and proceeded collecting information of examples in Europe. It may have been a measure to escape from criticisms over special tax revenues.

Feb. 1997-Feb.2000：Extension Project

- Discussions at “The Exploratory Committee for Transportation Project Research for Urban Development”
- Subsidy from the Ministry of Labor to plan the project
  - “Research expense” in 1997, “project expense” from 1998.
  - The Ministry of Labor considered Okayama City to have started the project.
  - They could not discuss the option of not extending the system.
  - The extension project advanced.

Feb. 1997-Feb.2000：Extension Project（Standpoint of Okayama）

- Okayama City seemed to be committing to extension.
  - How “project expense” was given：The mayor was asked by the official and accepted it when he went to receive a petition from the Ministry of Labor.
  - A councilor said：”The extension problem of the tramway has advanced, and now, it is on the edge of realization as an accomplished fact. “
- Okayama City was bewildered…
  - Because the mayor accepted the project at the Ministry of Labor, the project is irreversible. The project proceeded at such speed that personnel in charge at the city government could not control it.

Feb. 1997-Feb.2000：Extension Project ：Final Proposal

- Feb. 2000, the Exploratory Committee presented the final proposal.
  - Extension from Okayama Station to the University Hospital through City Hall was proposed as the first line.
  - Assigning expenses of needed costs are as follows.
    - Initial investment
      - Close-to-walkway plan（center of the road plan）
      - Prefecture +city ：1.23 billion yen（0.785 billion yen）
      - Subsidy from nation：1.23 billion yen（0.785 billion yen）
      - Railway employers：1.7 billion yen（1.7 billion yen）
      - Operating cost support
      - Would run in red for a while for any performance or style of management.
      - （Expense is now in surplus, so there is no deficit-covering）

June 2000-August 2001：Social Experiment

- The first social experiment was conducted(Feb., 2001）
  - Blocked off one road from the station to the city hall. Blocked road was in the middle.
  - The traffic did not become heavy.
  - There were many opinions opposing to the extension in the survey conducted during the experiment.
- The second social experiment was cancelled.
  - A plan to block off a road next to walking road. There was opposition from bus drivers, taxi drivers and shops along the road.
- Stagnation

‡ Source: Manyosen http://www1.coralnet.or.jp/manyosen/ensenmap.html

Takaoka, Shin Minato

- Mayors of 2 cities：They wished to continue the tramway.
  - Takaoka：The mayor was in charge of the liquidation of National Railway Company when he was in the Ministry of Finance.
  - Shin Minato：Manyo line was the only railway in the city.
- However, the process was advanced deliberately without initiative of mayors. There were attempts to keep the balance, such as induction of a community bus.
- Prefecture played the role of referee.
- There was some opposition, but not severe.

1997：Study on Transportation

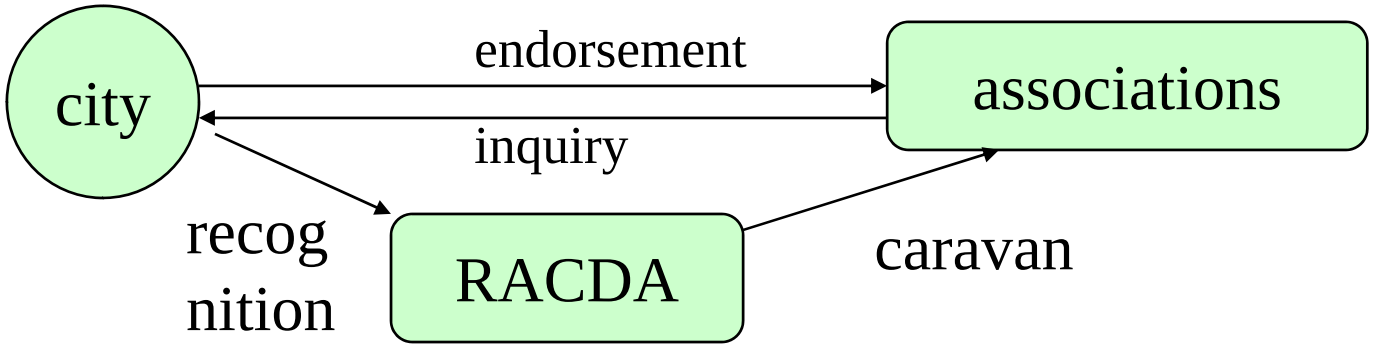
- Department of Life Environment, Transportation Section ＝ a counter for subsidies, does not have much knowledge about public transportation.
- Development of a vision for public transportation with a consultant.
  - The consultant Labored as a coordinator and gave lectures. Many people joined this.
  - Mr. Oka from RACDA participated.
  - Mr. Oka was invited to Takaoka City, was introduced to Mr. Shima and RACDA Takaoka was established.。

1999-May, 2000 Research on Management Improving Efficiencies

- Toyama Prefecture, Takaoka City and Shin Minato City entrusted Institute for Transport Policy Studies for a research. 5 academic experts as board members.
- Conclusion
  - It is better to keep the tram for social benefits.
  - 0.6 billion yen deficit in 10 years since start.
  - 0.2 billion yen primal investment was needed excluding the asset for obtaining resources for railway construction. Other 1.6 billion yen investment was needed.
  - The asset was very precise.
- Later, Kaetsunou railway claimed that the property should be transferred at market price. The prefecture and the city claimed lower price.There was a difference of a billion yen.

RACDA Caravan

- Touring forum：To diffuse own made “regeneration plan” , RACDA goes to community associations or women’s associations to give lectures and debate. Emphasis is not on one-way communication, but on two-way communication （usage of “fluid fuel”）→Self-evaluated that they had find out silent majorities’ opinions.
- The community association of Takaoka city：The community association related with the municipality—community associations at schools—community association units（560） （More than 90% citizens participate in this）



Moves by City Council and Economic Quarters

- June 2000, the conference between the prefecture and both cities
  - June 28, 2000, morning edition of Yomiuri Shimbun reported that prefectural assembly member from the LDP said “It is no good to invest in the tram with its continual deficits.”
  - Takaoka city assembly was clear about this.
- The economic quarters（chamber of commerce and industries）did not support continuation of the tram actively.

The Conference on the Manyo Line

- The prefecture reasoned that the local community should decide whether the tram must be continued or not, and held a conference on the Manyo Line－The president of Royama Junior College of Takaoka became the chairman. 13 communities from both cities participated as board members.
- The 3rd conference(August 11, 2000）
  - Morning edition of the day reported “Many opinions that Manyo Line must be abolished, no investment for 3rd sector.—Takaoka, Shin Minato Chamber of Commerce and Industries”→However, conclusion of the actual conference was that “Continuing management of Manyo Line will be admitted if both cities were to ask for citizen’s support.”
  - Other groups（including community assemblies and women’s assemblies）had a positive opinion
  - Mr. Royama said “There is no absolute opposition” and there was no opposition for this word. → Consensus was made.→The chairman sewed up a proposal and submitted it at the next conference.

The Conference on the Manyo Line

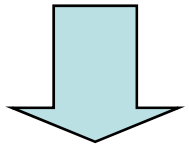
- The 4th Conference（September 11）
  - “The proposal for the Manyo Line’s future”
    - Continuation by the 3rd sector
    - For the asset negotiation for railway construction, both mayors are to be responsible, and citizens would have faith in this.
    - Investment and donation from citizens
    - Etc.

Short Summary：Comparison of Example Cases

	Okayama	Takaoka
	Duration	Continuation
Competitive access provider	Many buses	Few buses
	Covered population is small	Covered population is large
	Led by citizens	Led by administration
	Mayor’s commitment is small	Mayor’s commitment is large
	Small partnership with civil groups	Large partnership with civil groups
framing	No other traffic service was involved	Linkage with community bus
	No mediator	Mr. Royama

6. Induction of Wind Power Generation Dependency on Pathway and Outsider

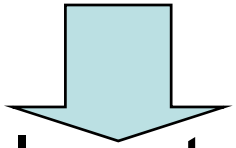
- “Wind power generation myth” was built and destructed（Wind power generation cannot be distributed as an economical power source）
- Technologies invented by domestic manufacturers were the mainstream at first, but imported technologies were mainly used later.



- Importance of “non-public process”
- Change in agenda setting by “outsiders”（Municipality’s usage as a symbol）－breakthrough in dependency on pathway

7. Woody Biomass

- Conditions for woody biomass technology system to be rooted in the society



- Importance of social context to rescue forest industry（a fear for providers to lead discussions）
- “inclusion”（provision and usage）and “utility”（insurance of a certain size）
- Importance of “coordination” and “commitment”

8. Domestic High- Efficiency Water Heater

diversity of research and importance of continuation

- The example of Eco-cute（heat pump）
  - Accumulation of heat pump water heater technologies at Den-chu ken
    - Commercialization failed twice, but technology development continued.
    - Commitment of leader and reexamination of the system making much of new fundamental research（←the benevolent corporation）
    - Continuation is important even if the asset was small（lower than hundred million yen per year）
  - Development of natural refrigerating technology by Den-chu ken and Denso
  - Marketing by power companies
  - Advantage in fire insurance
- The example of Eco-will (co-generation）
  - Honda transferred energy technology developed at domestic production in the past.
  - Disadvantage in Fire Defense Law
  - A problem in choosing when to heat water（Need for power to be produced is small at night.）
- Both grasped a chance for productization by emergence of needs at change in market environment to correspond to global warming
- Not innovative technology, but improvement of existing technology
- Before the “Death Valley”, diversity and continuation of research were important to secure public benefits

Actual State of Eco-Cute Distribution

- Released in May, 2001, more than 6000 in the first year
- More than a million sales in July, 2007
- Power companies promoted selling “Whole electrical house”
- The government aimed to install more than 5.2 million before 2010

‡ Source: Heat Pump & Thermal Storage Technology Center of Japan
http://ecocute.hptcj.or.jp/shakai/03kanwa/index.html

Setting Agenda and Creation of the Market by Regulations and Policies

- 1997, The Kyoto Protocol proposed an ambitious agenda to “reduce CO_2”
  - The government rushed to make policies for this
    - Energy top-runner system by the ministry of electricity??????????????????????????
- As a result, environmental merit was well-defined at the market
  - New regulations or promotion for saving energy were not implemented for domestic water heaters
  - However, opinions and market change for them were common
  - New market＝appearance of energy saving water heaters
  - Niche strategy

Niche Strategy and Function of Relevant Marginal Players

- Non-mainstream players were active in development of eco-cute
  - Home electricity department at Tokyo Electric Power Company（7 Laborers at first（38000 Laborers in TEPCO））
  - Heat pump development team at Den Chu Ken
  - Denso was a new participant in the field of household equipment
- However, they were not total outsiders
  - TEPCO team：eyes on both power generation market and home equipment market
  - Den Chu Ken：an expert of both power and energy technology
  - Denso is the top manufacturer of air conditioner for cars and also an expert of heat pump technology
- “Relevant marginal players” contributed to development of innovative product

In Conclusion: Theoretical Viewpoints, Another Look

- Regulations and Innovation

（1）Porter Hypothesis（environmental regulations→competitive force）：Japanese cars－possibility of win-win by technology innovation

（2）Technology Forcing：environmental regulations→technology development：cars in 1970s

- Focus on Processes

（1）Multi-tiered steps：regulation→technology development（？）→competitive force（？）

（2）Focus on interactions among various bodies－government, company, NGO …

（3）Focus on interactions between government policies and company strategies change in company's strategy（CNG：Sagawa, Toyota: hybrid)

（4）PEN（Public Entrepreneurship Network）

Public functions of non-government bodies（NGO etc,） electric tramway

Step-by-step development under uncertainty－importance of experiments car sharing

- Induction processes：importance of framing to show what that technology is for－diachronic changes：electric tramway（differences in Okayama and Takaoka），limits in biomass－Only taking environmental measures is not enough
- Lock-in and release－relationship between technology and system：importance of infrastructure（CNG, car sharing←→hybrid）－importance of time-axis needed for investment；importance of significant outsider(wind power) and significant boundary players (eco-cute)

Complement：9 factors regulating distribution of energy and environment technology induction found from stakeholder interviews

消費者ニーズ
Consumer needs

企業経営
Corporate Management

法規制システム
Legal/Regulative Systems

技術の位置づけ
Positioning of Each Technology

行政の取り組み
Government Initiatives

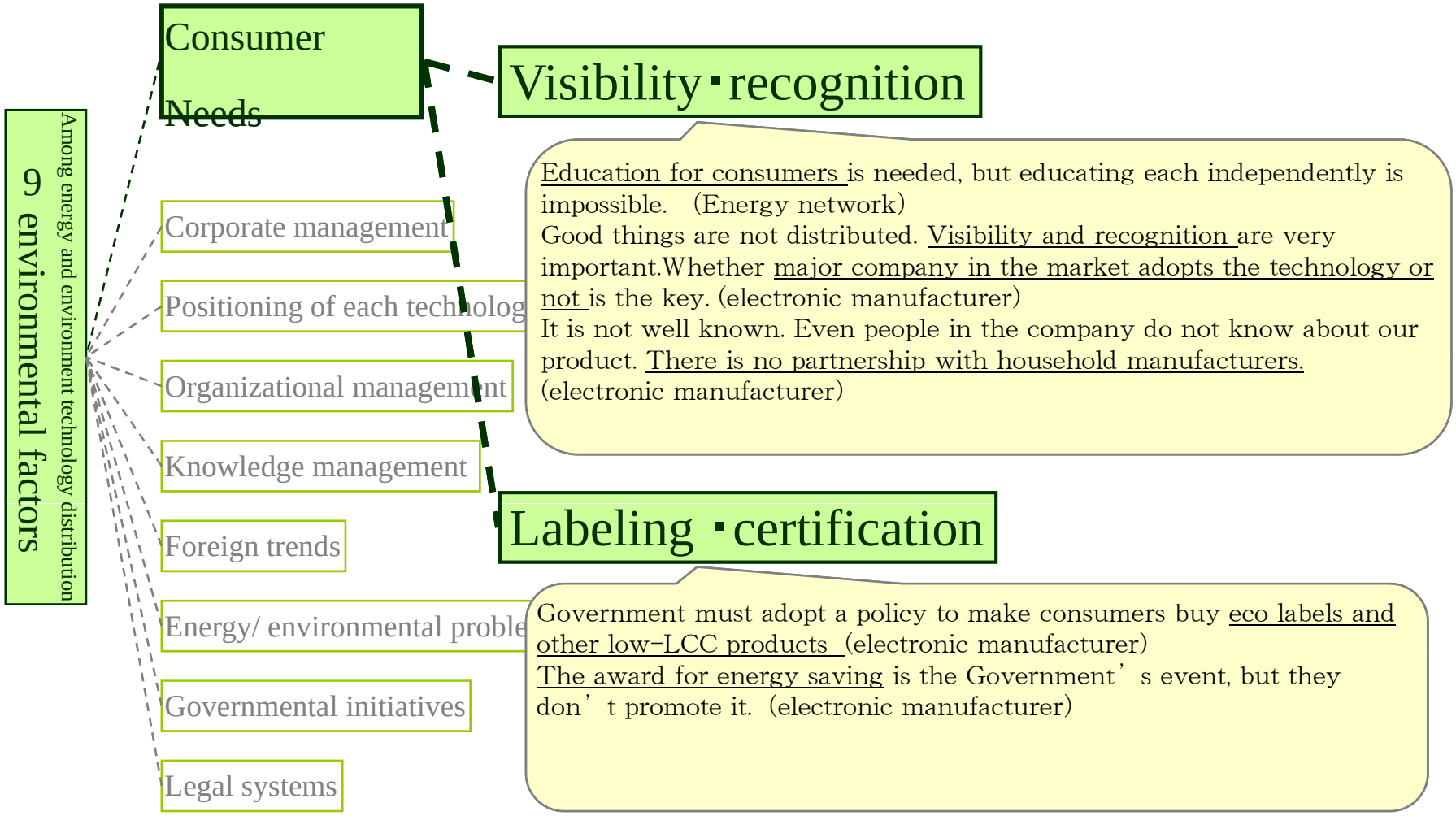
組織マネジメント
Organizational Mgmt.

エネルギー・環境問題
Energy/Environment Problems

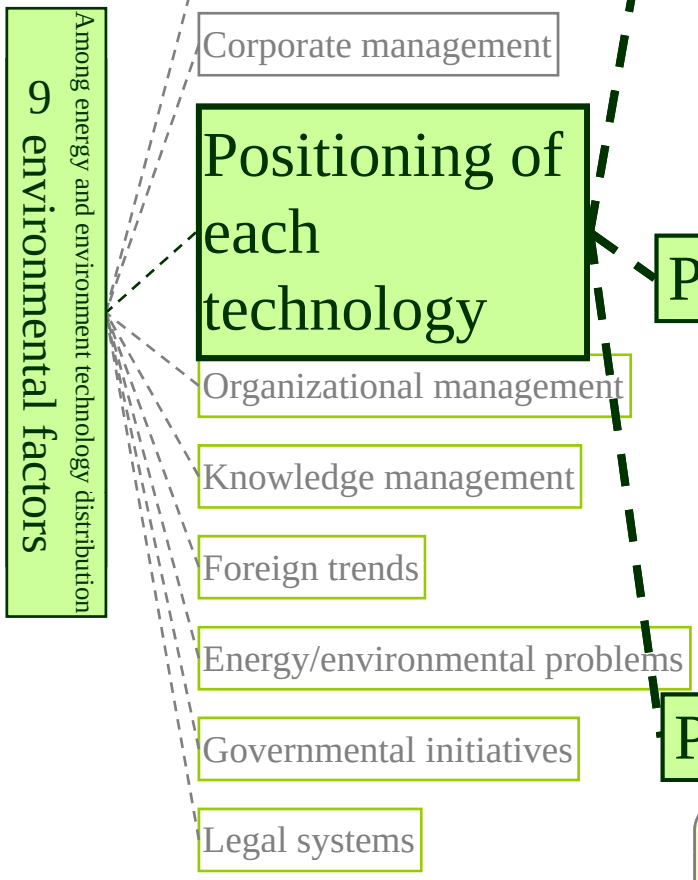
知識マネジメント
Knowledge Mgmt.

海外の動向
Foreign Trends

Environmental Factors: Consumer Needs



Environmental Factor：Positioning of Each Technology



Price competitiveness（productive cost）

Cconsumers do not use products with low competitiveness. It is not just a technological problem, but a political issue （electronic manufacturer）

Energy saving household equipments do not sell well if its initial cost is expensive. Initial cost has a larger impact than low running cost. （urban house business）

Positioning as a social mission of the company

Our company has a position as the ×××　company, and the CEO shows his commitment. ××× seems to pursue pure benefit. （a certain company）
I am explaining the importance of ＣＯ２ reduction in the future to executive officers. We have a responsibility to develop technology as a manufacturer. （electronic manufacturer）

Public image of technology

There is a bad image for diesel vehicles. Manufactures fear that they will not sell well. (energy company)

Environmental Factors：Governmental Initiatives