New and Renewable Energy Promotion in Japan

Workshop

National Renewable Energy Strategies in Response to the WSSD

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Outline

1. ***Energy in Japan in Comparison to the World***
2. ***Japan's Basic Policy Strategies for New and Renewable Energy Promotion***
3. ***Japan's Major Policy Tools for New and Renewable Energy Promotion***

(1) Outline

(2) RPS-Background, Outline, Explanation

(3) PV

(4) Wind

(5) Biomass

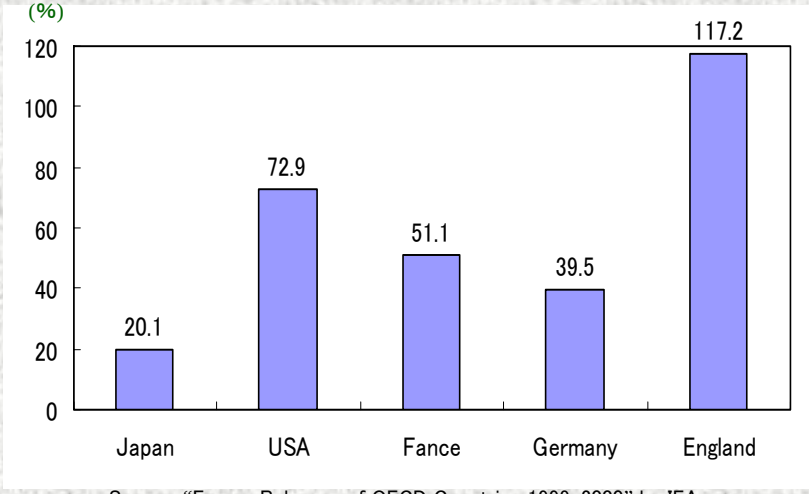
1. Energy in Japan in comparison to the world

Characteristics

Fragile Energy Supply Structure

- *Scarce domestic energy resources*
- *Low ratio of self-supply of energy compared to other major countries*
- *High dependency on oil from the Middle East*

[Ratio of the Self-supply of Energy in Major Countries (2000)]



Source: "Energy Balances of OECD Countries 1999-2000" by IEA

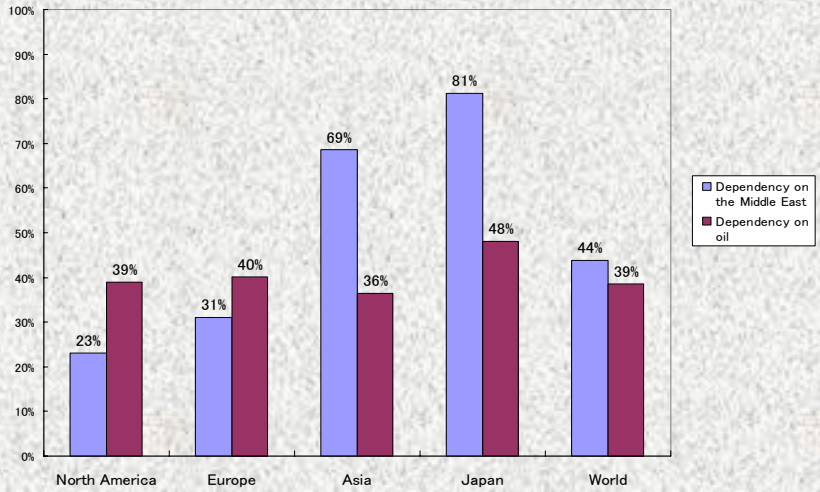
【Primary Energy Supply and Its Ratio in Major Countries (2000)】

(%)

	Japan	U.S.A	France	Germany	UK
Primary energy supply (oil conversion: one million ton)	525	2300	257	340	233
Coal	18	24	6	24	16
Oil	51	39	34	39	36
Natural gas	12	24	14	21	38
Nuclear power	16	9	42	13	10
Hydraulic power	1.4	0.9	2.2	0.6	0.2
Recyclable energy, etc.	2	4	2	3	2

Source: "Energy Balances of OECD Countries 1999-2000"

[Dependency on the Middle East for Oil and Dependency on Oil in the World (1999-2000)]



Source: BP Statistics 2002

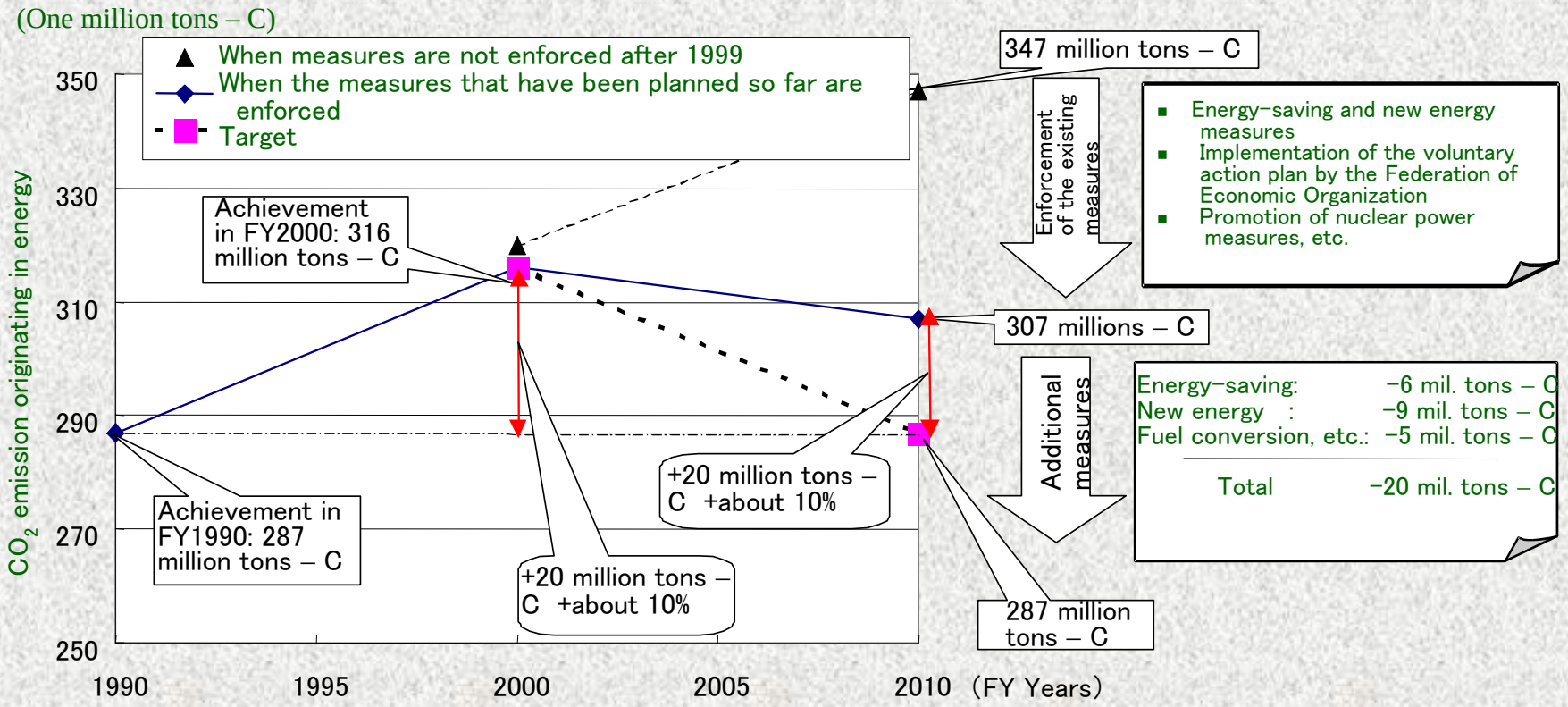
Control of CO_2 Emissions Originating from Energy and Energy Supply Outlook

Goal

Approximately 90% of emission greenhouse effect gases are carbon dioxide originating in energy sources. This needs to be controlled to the same level as that of FY1990 in FY2010 (Policy for Promoting Global Warming Control Measures)

Problem

Demand side: A constant increase primarily in the people's livelihood and transport sectors
Supply side: Prolongation of the construction plan of nuclear power plants



Source: Report by the Advisory Committee for Resources and Energy

Control of CO_2 Emissions Originating from Energy and Energy Supply Outlook

Targets of measures to control greenhouse effect gases

CO_2 originating in energy: To reduce to approximately 287 million tons of C (the level of FY1990)

▲2．5％	Regulations on the emission of CO_2,
	(Out of them) ±0%: To control CO_2 from energy
	If no additional measures taken (simply maintaining the existing measures): It will exceed by approximately 20 million tons – C
	Measures Energy-saving: ▲6 million tons – C New energy: ▲9 million tons – C Others (fuel conversion, etc.): ▲5 million tons – C
▲3．9％	Absorption by changes in land use and forest activity
＋2．0％	To regulate the emission of alternative chlorofluorocarbon gases (HFC, PFC and SF6)
Balance (▲1．6％)	To enforce jointly or trade the quantity of emission

Outlook for the supply of primary energy

(Point)

Oil dependency: To reduce its level to about 45% in FY2010

(Long-term perspective on energy)

Item \ Fiscal year	FY2000 (Distribution ratio)	FY2010 (Targets) (Distribution ratio)
Oil	51.8%	About 45%
Coal	17.9%	About 19%
Natural gas	13.2%	About 14%
Nuclear power	15.0%	About 15%
Hydro	3.2%	About 3%
New energy	1％	About 3%

Outlook for generated power (Electric companies)

(Unit: One billion kWh)

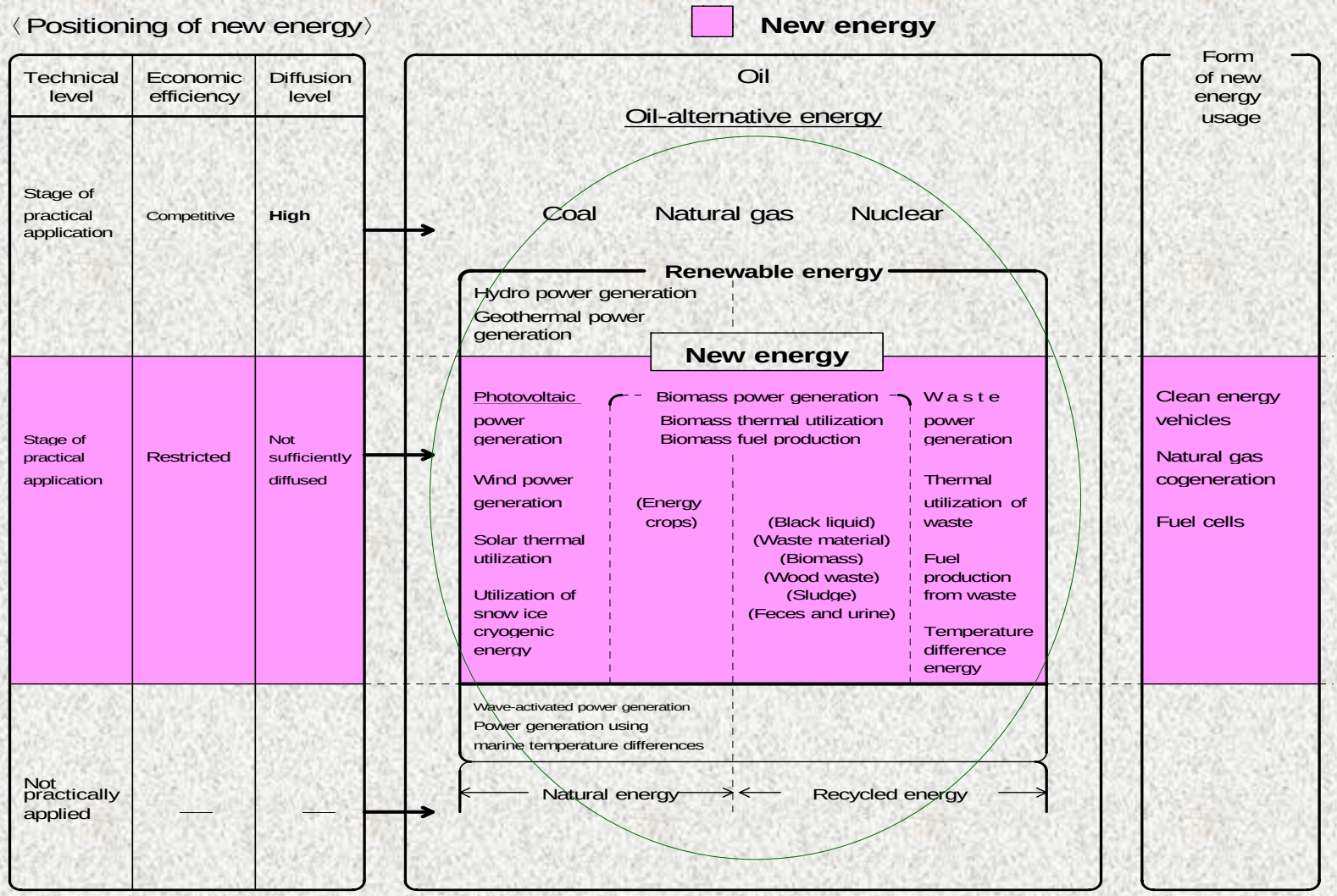
Fiscal year	FY2000		FY2010	
Generated power	939.6		Approximately 997.0	
Classification by energy source	Actual	Distribution ratio (%)	Actual	Distribution ratio (%)
LNG	247.9	26.4	About 254.9	About 26
Coal	173.2	18.4	About 159.9	About 16
Oil, etc.	100.5	10.7	About 53.3	About 5
Nuclear power	321.9	34.3	418.6	About 42
Hydro	90.4	9.6	96.2	About 10
Geothermal	3.3	0.4	3.7	About 0..4
New energy	2.3	0.2	115	About 1
CO_2 emission (g-C/kWh)	90.1		Approximately 73.6	

Definition of New Energy

(1) Among manufacturing, generation, use, etc. of oil-alternative energy,
(2) energy that is not being spread due to economic restrictions,
(3) energy that especially contributes to the promotion of oil-alternative energy.

(The Special Measures Law on Promoting Use of New Energy (enacted in 1997)

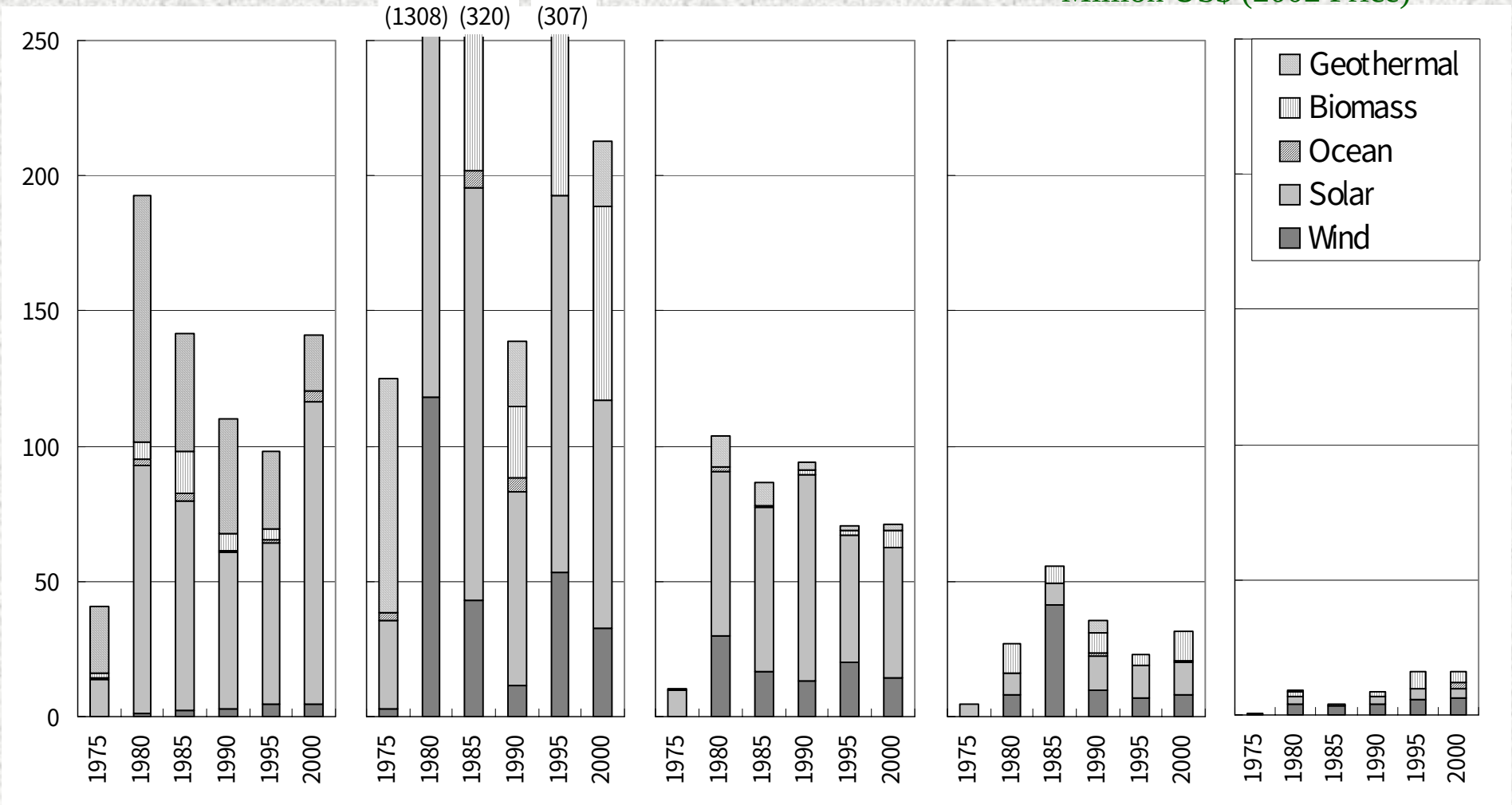
〈Positioning of new energy〉



(Remarks) Black liquid means waste liquid generated from the pulp production process.

Renewable Energy R&D

Million US$ (2002 Price)



Japan United States Germany Netherlands Denmark

(Source: IEA Energy R&D Statistics)

[Courtesy of Mr. Taishi Sugiyama (CRIEPI)]

2. Japan's Basic Policy Strategies for New and Renewable Energy Promotion

~ Take a practical approach and use voluntary maximum efforts in the private sector ~

- NEEDS: Long-term technological change toward zero CO2 emissions
- POLICY: Promote RD&D
- SEEDS: Based on national circumstances

Japan: High technological competence, high energy security needs, high energy costs, high population density

* WSSD Plan of Implementation 19(e)

Diversify energy supply by developing advanced, cleaner, more efficient, affordable and cost-effective energy technologies, including fossil fuel technologies as well as renewable energy technologies, including hydropower, and their transfer to developing countries on concessional terms as mutually agreed. Consider a sense of urgency. Substantially increase the global share of renewable energy sources, with the objective of increasing its contribution to total energy supply, recognizing the role of national and voluntary regional targets as well as initiatives where they exist, and ensuring that energy policies are supportive to developing countries efforts to eradicate poverty. Regularly evaluate available data to review progress to this end.

Japan's New and Renewable Energy Indicators

Energy Sources	FY 2001 Results		FY 2010 Indicators for New Energy Introduction (Revised)	
	Oil Equiv.	Installed Cap.	Oil Equiv.	Installed Cap.
	1,000 x kl	MW	1,000 x kl	MW
Photovoltaic (Solar Power)	**110**	**452**	**1,180**	**4,820**
Solar Thermal	**820**	**-**	**4,390**	**-**
Wind Power	**127**	**312**	**1,340**	**3,000**
Waste Power	**1,250**	**1,110**	**5,520**	**4,170**
Waste Thermal	**45**	**-**	**140**	**-**
Biomass Generation	**48**	**71**	**340**	**330**
Biomass Thermal	**-**	**-**	**670**	**-**
Black Liquor, Waste Wood, etc.	**4,460**	**-**	**4,940**	**-**
Unused Energy (Including Cooling by Snow & Ice)	**44**	**-**	**580**	**-**
New Energy Total (Ratio of total primary energy supply)	**6,900 (about 1.2%)**	**-**	**19,100 (about 3%)**	**-**
Total primary energy supply (in million kl)	**588 Mkl**	**-**	**about 602 Mkl**	**-**

(Source: Advisory Committee for Natural Resources and Energy (2002))

International Comparisons of Japan's Achievement in the Applications of New Energy

〈 International Comparison of Photovoltaic Power Generation and Wind Power Generation 〉

Capacity of facilities (one thousand kW)

Photovoltaic power generation (As of the end of FY2002)			Wind power generation (As of the end of December 2002)		
① Japan	636.8	48.5%	① Germany	10,900	37.4%
② Germany	277.3	21.1%	② U.S.A.	4,708	16.2%
③ U.S.A.	212.2	16.2%	③ Spain	4,079	14.0%
④ Australia	39.1	3.0%	④ Denmark	2,889	9.9%
⑤ Netherlands	26.3	2.0%	⑤ India	1,702	5.8%
⑥ Italy	22.0	1.7%	⑥ Italy	755	2.6%
⑦ Swiss	19.5	1.5%	⑦ Netherlands	677	2.3%
⑧ France	17.2	1.3%	⑧ UK	552	1.9%
⑨ Mexico	16.2	1.2%	⑨ China	399	1.4%
⑩ Canada	10.0	0.8%	⑩ Japan	351	1.2%
⑪ Austria	9.0	0.7%	⑪ Sweden	310	1.1%
⑫ Norway	6.4	0.5%	⑫ Greece	276	1.0%
⑬ Korea	5.4	0.4%	⑬ Canada	221	0.8%
⑭ UK	4.1	0.3%	⑭ Portugal	171	0.6%
⑮ Sweden	3.3	0.3%	⑮ France	147	0.5%
⑯ Finland	3.1	0.2%	⑯ Ireland	138	0.5%
World total	131.17	100%		2,914.0	100%

* As for wind power, the value of Japan is based upon the survey by NEDO (as of the end of March 2002).

[Source]
・The figure of photovoltaic power generation as of the end of 2002 is based upon the IEA/PVPS data.
・The figure of wind power generation as of Dec. 2002 is taken from "Wind Power Monthly April 2001."

〈 Ratio of Recyclable Energy in the Total Supply of Energy by Country 〉

(Recyclable energy: sunlight, wind, waste, hydraulic (excluding pumping) and geothermal)

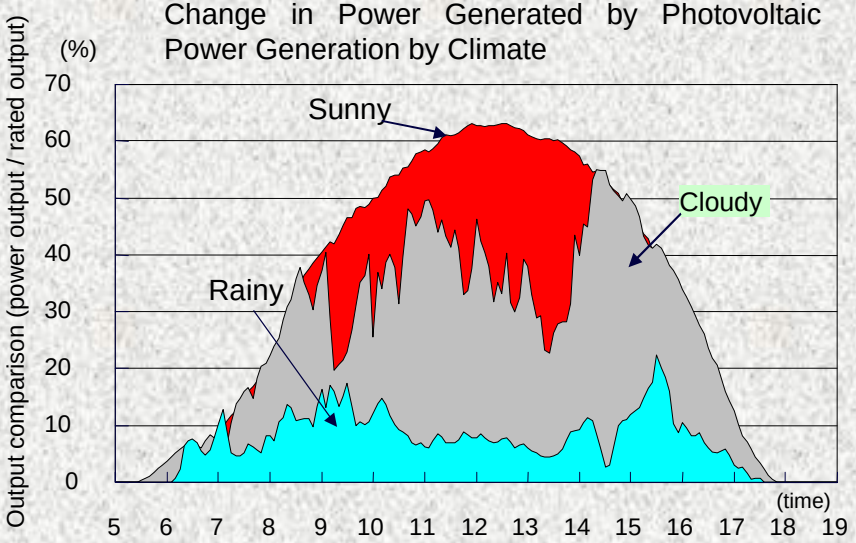
	Supply of primary energy		In terms of generated power	
	Result In 2001	Target for 2010	Result in 2001	Target for 2010
Japan	4.9%	About 7%	9.1%	About 11%
U.S.A.	4.5%	6.9%	7.6%	9.2%
Canada	15.8%	-	57.9%	-
E.U.	6.0%	12.0%	15.9%	22.1%
UK	1.2%	-	2.6%	10.0%
France	7.0%	-	14.3%	21.0%
Germany	3.1%	-	7.6%	12.5%
Italy	5.7%	-	20.3%	25.0%
Denmark	11.1%	-	17.1%	29.0%
Sweden	30.0%	-	51.4%	60.0%
Austria	22.4%	-	70.5%	78.1%

[Source]
- ・ Japan's result for FY2001: by Agency for Natural Resources and Energy
- ・ Japan's target for FY2010: General Resources Energy Investigation Response (July 2001)
- ・Overseas' results for 2001 : "Energy Balance of OECD Countries 2000-2001"
- The 2010 target figure of USA for the total supply of primary energy: The above-stated report
- The target of EU for 2010: EU Injunction for 2010 (September 2001)

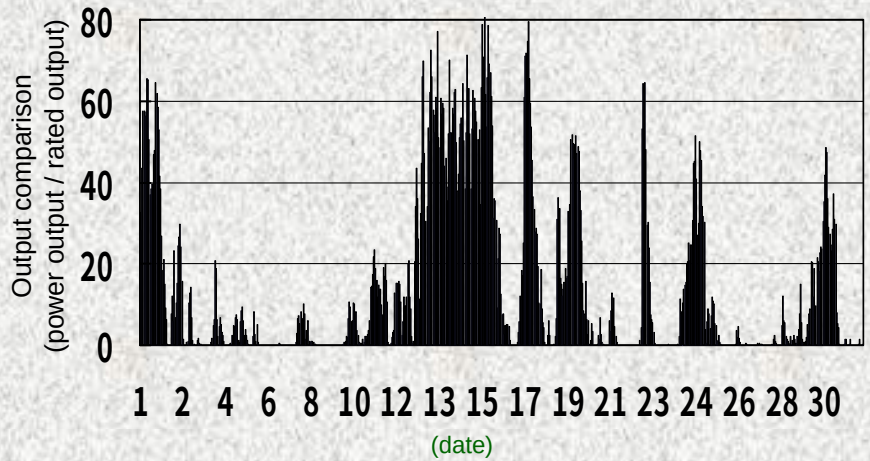
Problems in New Energy Introduction and Efforts to Overcome Them

Problems concerning output stability

Change in Power Generated by Photovoltaic Power Generation by Climate



Change in Power Output in August 1999 at Tappi Wind Park



Problems concerning economic efficiency

● Power Generation Cost of New Energy

(unit: about yen/kWh)

Type	Photovoltaic power generation		Wind power generation		Waste power generation		Biomass power generation	Small- and medium-scale hydro power generation
	Residential	Non-residential	Large scale	Small and medium scale	Large scale	Small and medium scale		
Power generation cost	46~66	73	9~14	18~24	9~11	11~12	7~21	14

[Source] Report (July 2001) by the New Energy Subcommittee of the Advisory Committee on Energy and Natural Resources and others

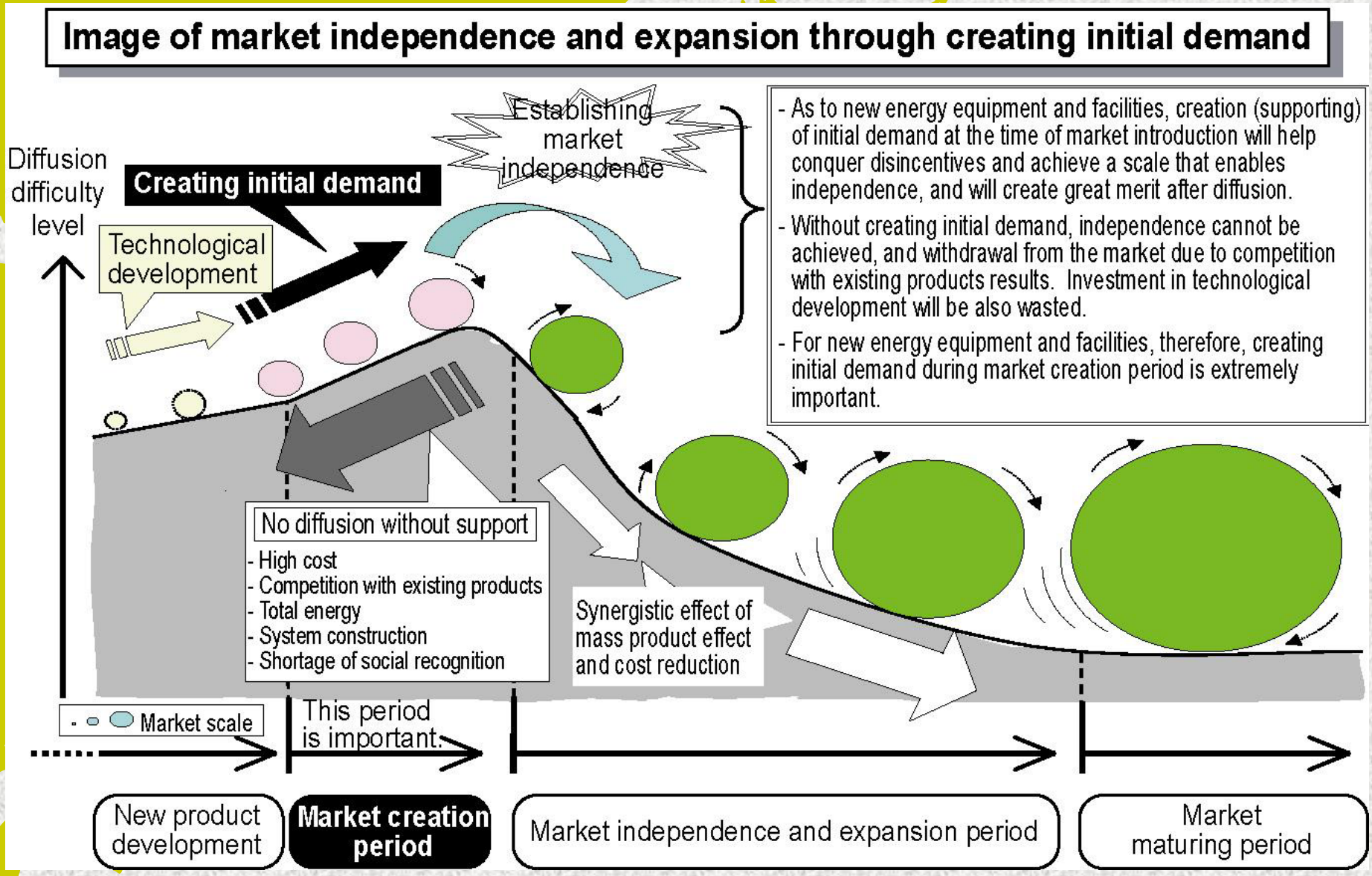
● Power Generation Cost by Power Source

(unit: yen/kWh)

Type	Nuclear power generation	LNG-fired power	Coal-fired power	Oil-fired power
Power generation cost	5.9	6.4	6.5	10.2

[Source] Data of the 70th Nuclear Power Subcommittee (December 1999) of the Advisory Committee for Energy

Image of Efforts to Improve New Energy Economic Efficiency



3. Japan's Major Policy Tools for New and Renewable Energy Promotion

(1) Outline

- Research & Development: Subsidies for 30 years
- Diffusion: Ten-year buy-down program for solar
- Renewable Portfolio Standard:
  Beginning from 2003. Indicator: 3.1% of primary energy in 2010
  (PV 4,820 MW, Wind 3,000 MW, Biomass 330 MW)

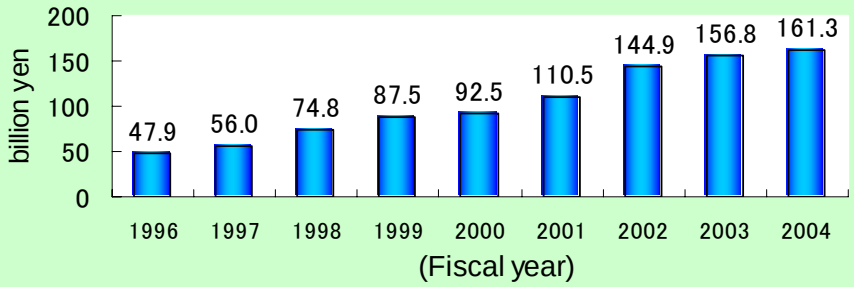
Japan's Major Policy Tools for NRE Promotion ~ Outline ~

Budget Aspect

・Budget of 161.3 billion yen requested for new energy development is requested for FY2004. This represents an increase of \4.5 billion over that of FY2003.

The budget for new energy has increased three-fold over the last eight years.

Change in budget related to new energy



Legal Aspect

January 2002	Two new energy sources, biomass and snow ice, added to the new energy sources stipulated in the Law on Promoting Use of New Energy. In FY2002, the government began supporting projects to introduce these energies.
May 2002	The "Special Measures Law on Promoting Use of New Energy, etc., by Electric Enterprises" was enacted. This new law made it obligatory, starting in April 2003, for electric enterprises to increase the power generation rate of new energy sources such as photovoltaic power, wind power and biomass.)

Japan's Major Policy Tools for NRE Promotion
~ Outline: Budget Aspect ~

Fiscal year	FY1998	FY1999	FY2000	FY2001	FY2002	FY2003
Budget (in 100 million \)	**748**	**875**	**925**	**1,105**	**1,449**	**1,568**
(in million US$)※	706	825	873	1,042	1,367	1,479

※US$1 = \106

Ⅰ. Technological Development

(Budget for FY2003:
about \43.4 billion ≒ US$347 million)

- Fundamental investigation
- Development for practical application

Ⅱ. Demonstrative Testing

(Budget for FY2003:
about \18.8 billion ≒ US$150 million)

- Field tests
- Demonstrative research

Ⅲ. Introduction Promotion (full utilization of market mechanism)

(Budget for FY2003: about \94.6 billion ≒ US$757 million)

- Creation of initial demand for inducing market independency
- Creation of environment suitable for introducing leading-edge new energy systems
- Financial support (tax system, fiscal investment and loans)
- The Green Purchase Law
- Enlightenment and public information activities
- New market development mechanism ～RPS (Renewable Portfolio Standard) ←**Additional Measure**

3.Japan's Major Policy Tools for NRE Promotion

(2) RPS- Background, Outline, Explanation

Background for RPS

- **Difficulty in achieving the new 2010 indicator with only current measures.**
- **To promote power generation using renewable energy, legislation in the US, Europe, etc. has already been introduced/enacted for various systems.**

Necessity of studying the introduction of a new system adapted for Japan.

【Considerations】

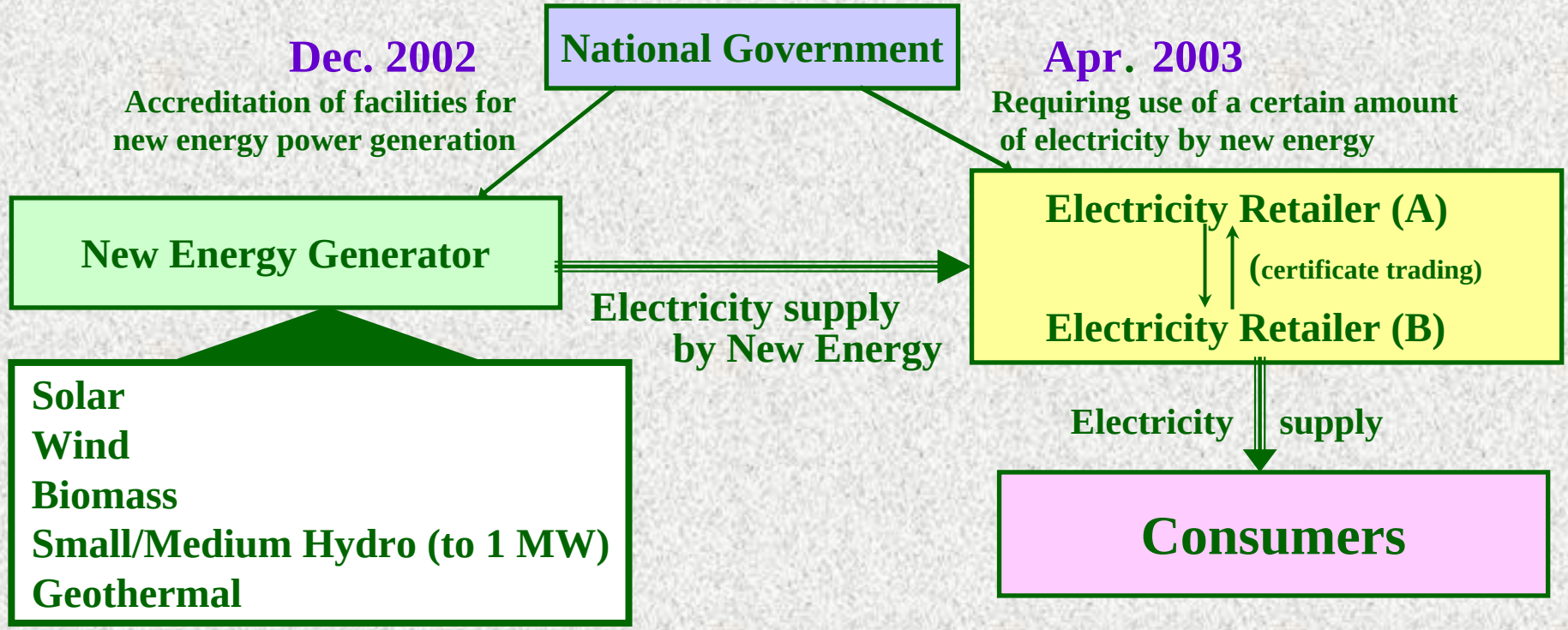
- **Certain effectiveness of new measures**
- **Wide choice of sources for electric power companies**
- **Incentive for cost reduction**
- **Maintenance of free competition in the energy market**
- **Effect of financial burden on government, etc.**

Conclusion

The Japanese government decided to introduce a new measure making use of the market mechanism – the Renewable Portfolio Standard (RPS).

Establishment of the Law Concerning the Use of New Energy by Electric Utilities (June 2002)

System Outline of the Law Concerning the Use of New Energy by Electric Utilities



The indicator for 2010 is 12.2 TWh,
which would comprise 1.35% of national electric supply.

Basic Explanation of the RPS System

The national government requires each electric power company to use a certain amount of electricity arising from new energy based on the amount of its electricity sales.

Electric power companies can select the most advantageous way from among the following to meet their obligation:

a) Self-generation of new energy

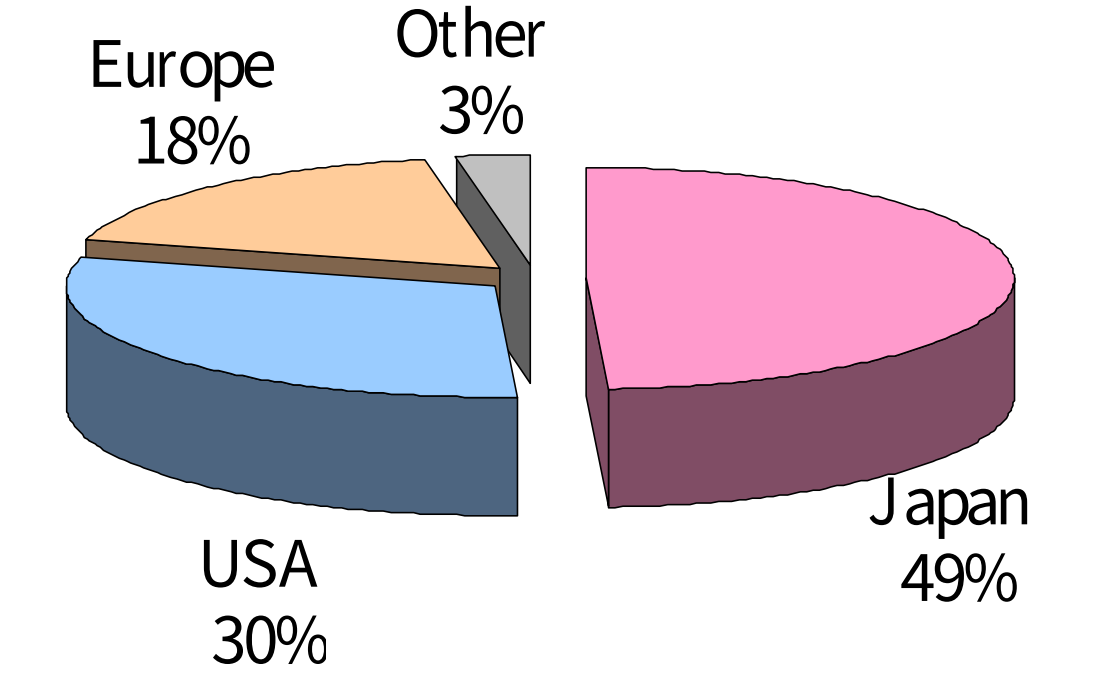
b) Purchasing of new energy from others

c) Subrogation of the obligation to another company

The national government verifies each electric power company's use of electricity arising from new energy every fiscal year.

(3) PV

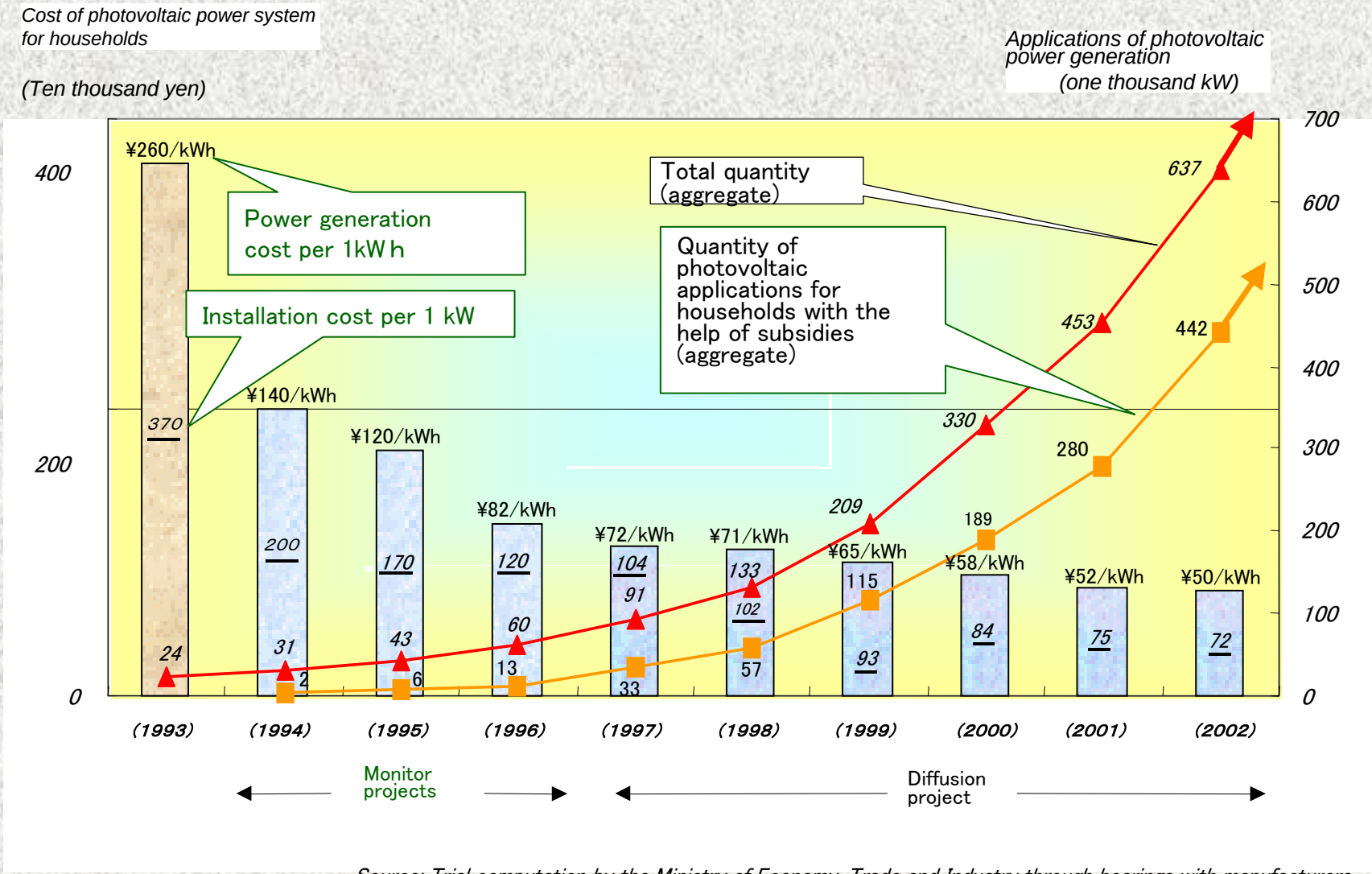
PV Cell Production by World Region, 2001



Total: 345 Megawatts

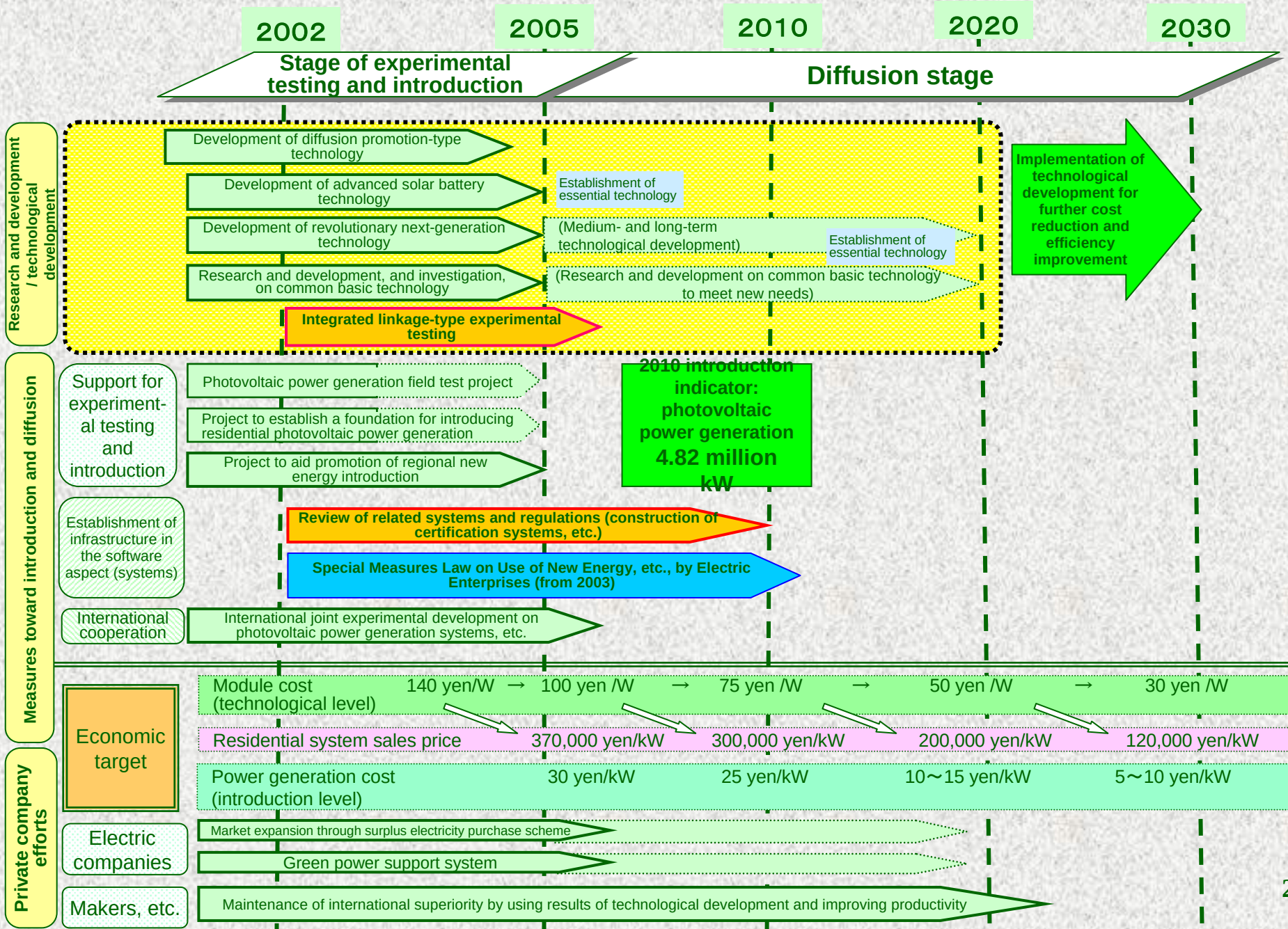
Source: IEA-PVPS (2002).
[Courtesy of Mr. Taishi Sugiyama (CRIEPI)]

Transition of the Application of Photovoltaic Power Generation Systems for Households, Price and Generation Cost



Source: Trial computation by the Ministry of Economy, Trade and Industry through hearings with manufacturers.

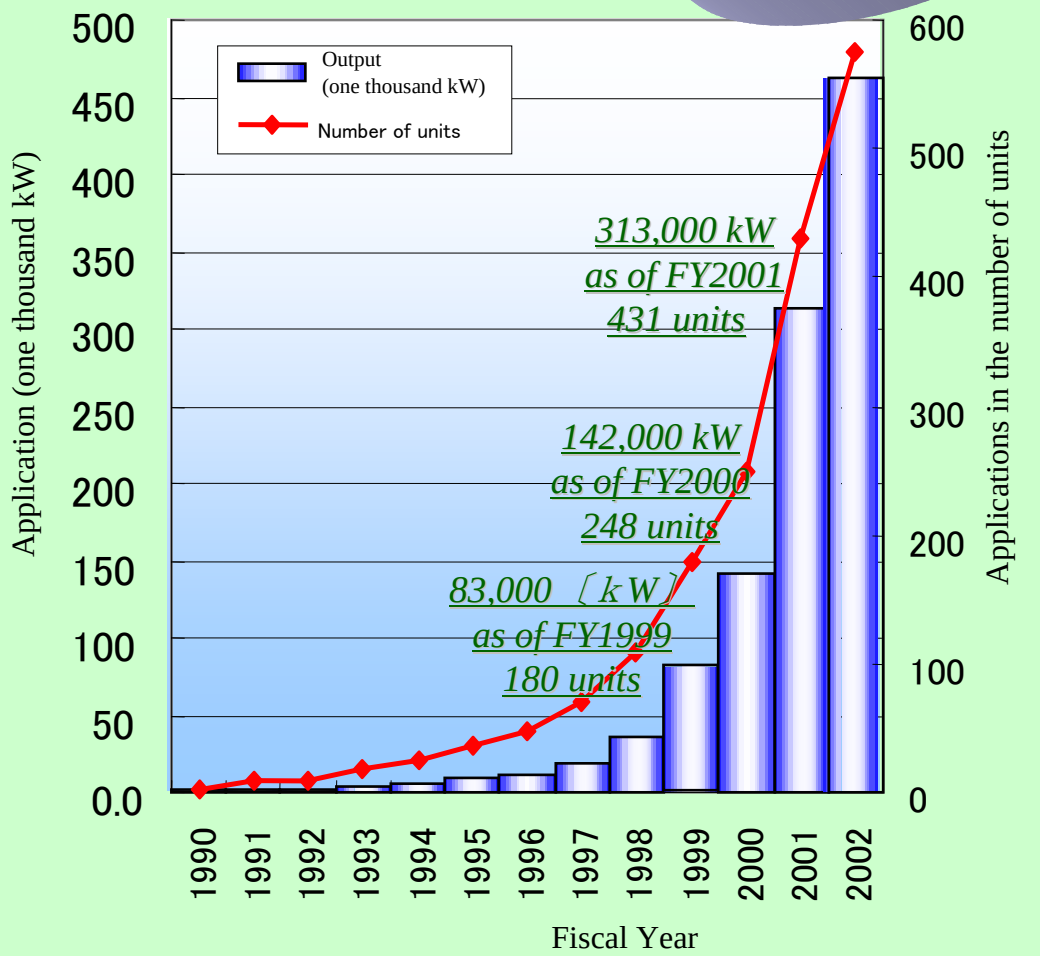
Scenario for Introduction and Expansion of Photovoltaic Power Generation



(4) Wind

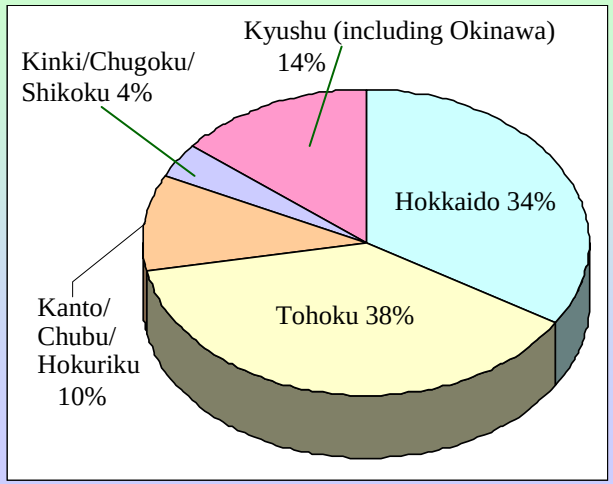
Change in Domestic Application of Wind Power Generation

Actual Application



* Source: NEDO survey data

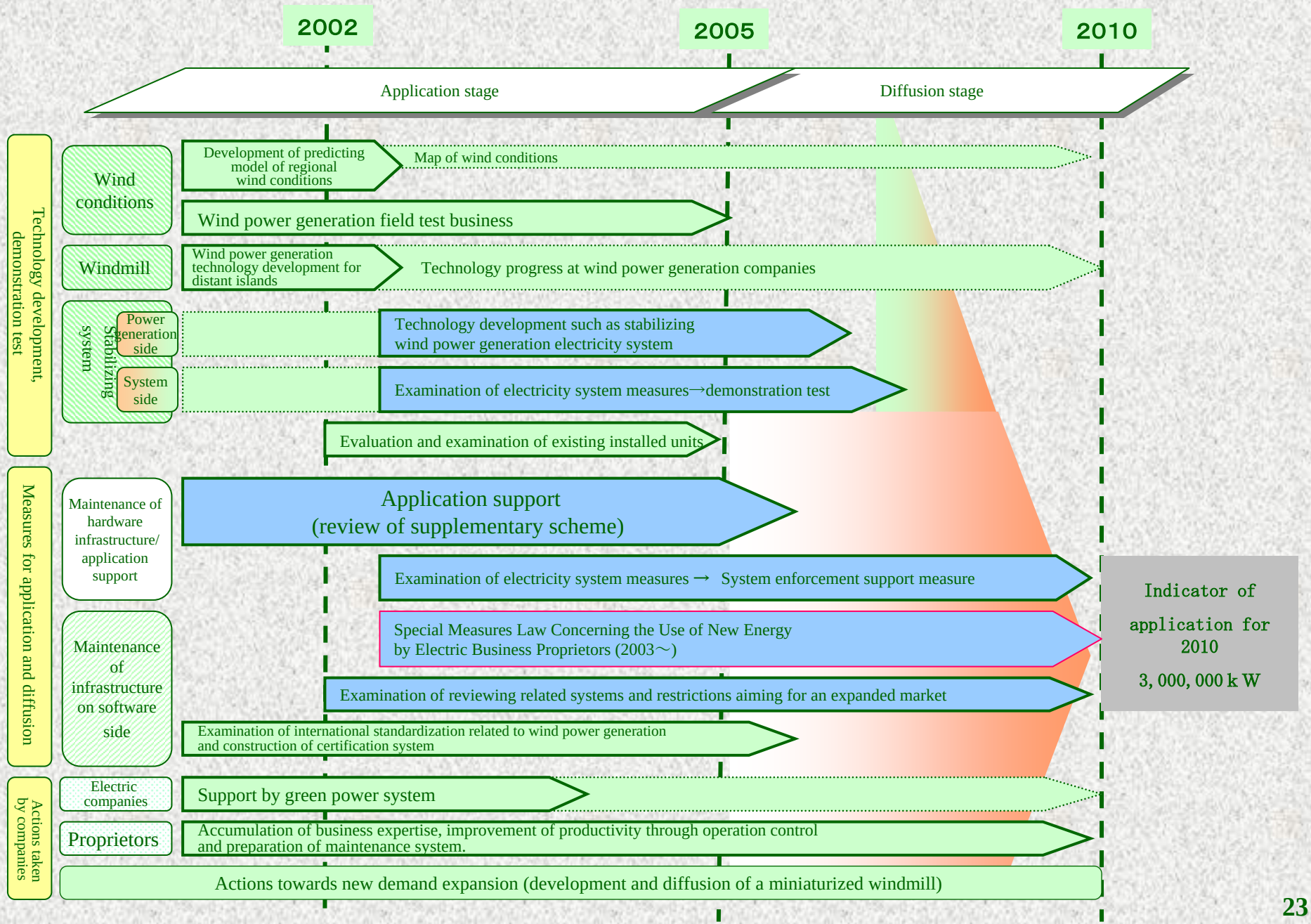
Applications by Region (FY2002)



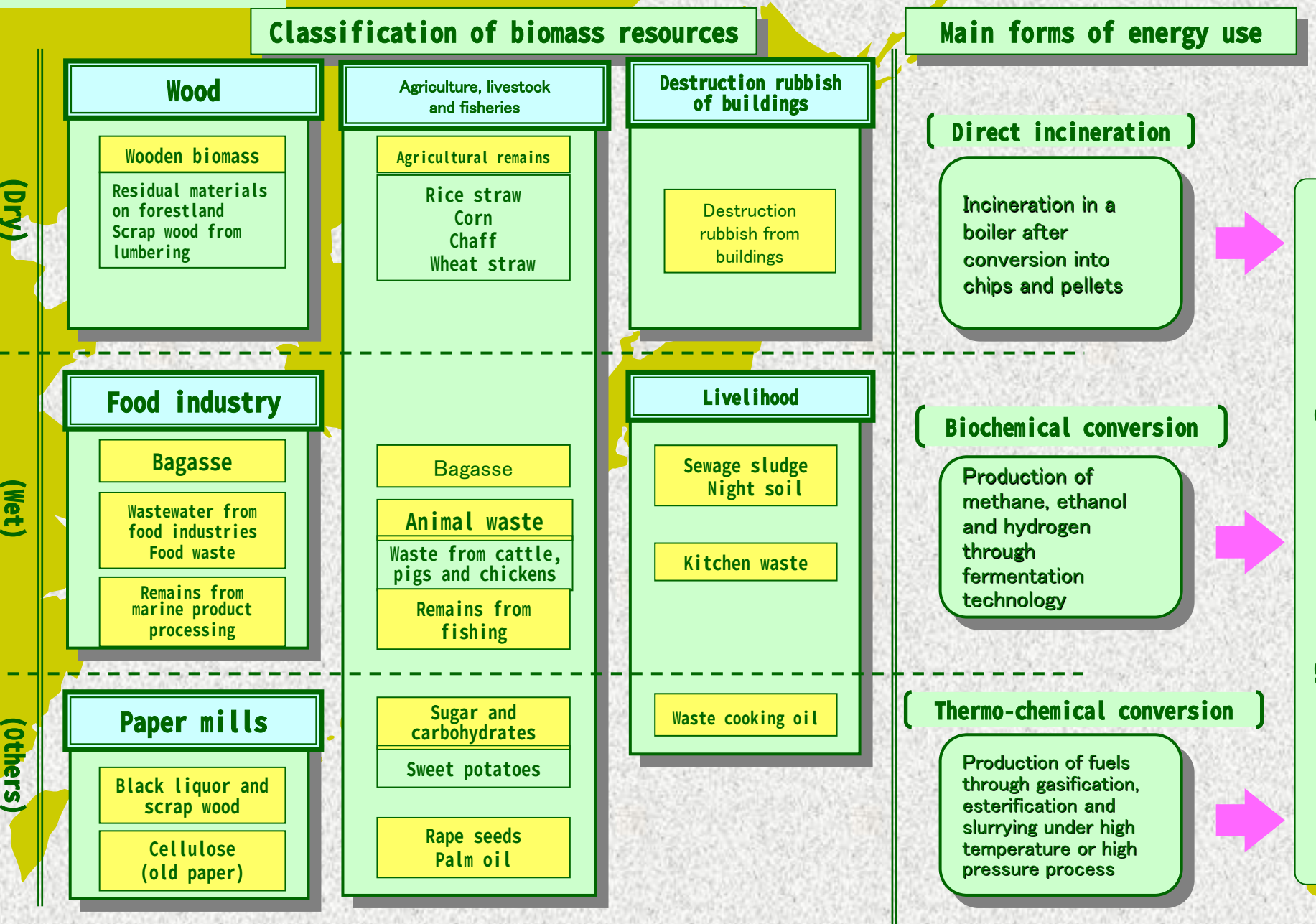
Photovoltaic Power Application by Prefecture (as of the end of FY2002)

Hokkaido	156,000 kW
Aomori	102,000 kW
Akita	61,000 kW
Kagoshima	19,000 kW
Mie	17,000 kW
Fukuoka	15,000 kW
Nagasaki	14,000 kW
Okinawa	14,000 kW
Niigata	7,000 kW
Yamagata	7,000 kW

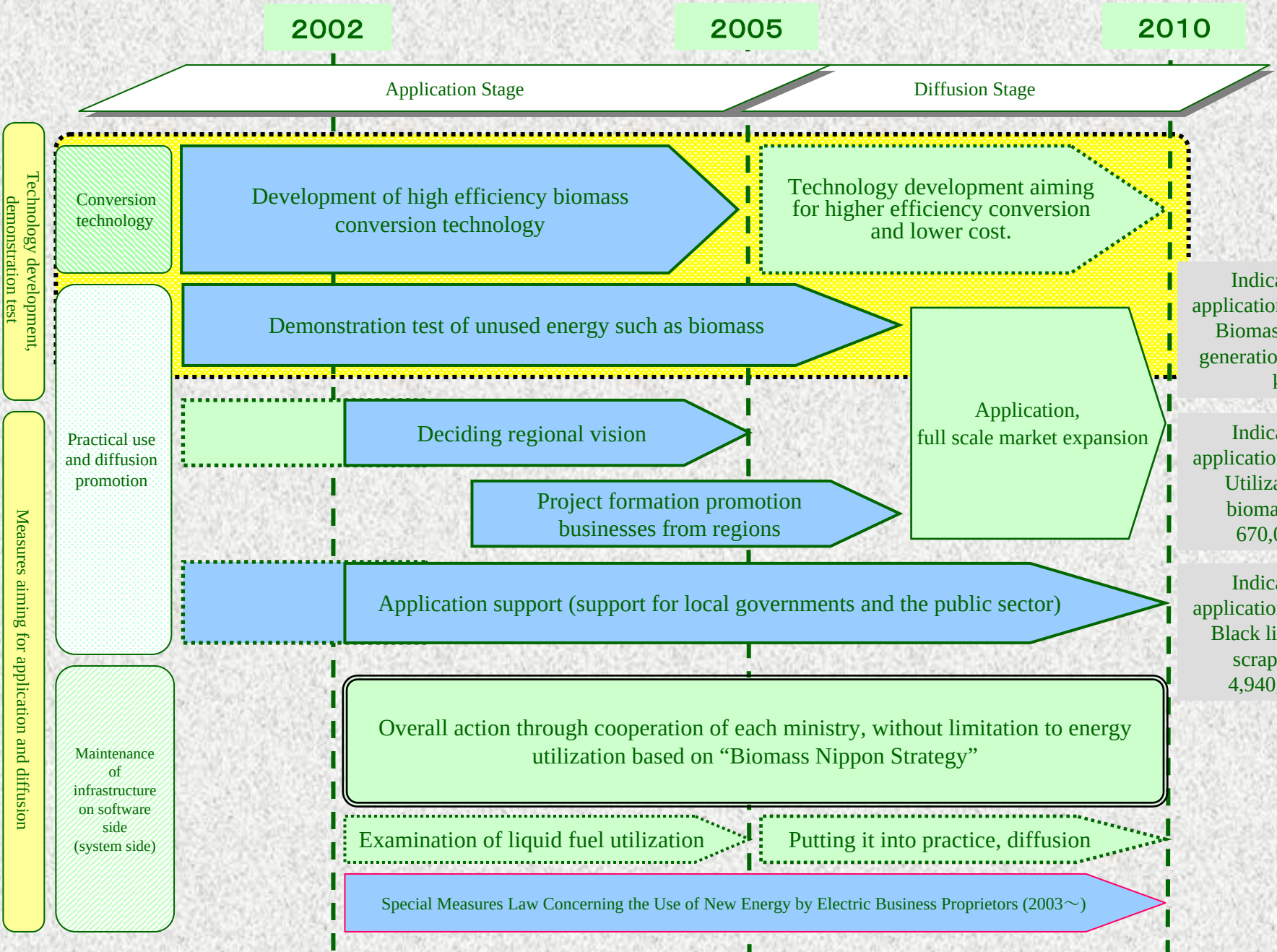
Expanded Application of Wind Power Generation Scenario



(5) Biomass


Classification of biomass resources
Main forms of energy use
(Dry)
(Wet)
(Others)
Wood
Wooden biomass
Residual materials on forestland
Scrap wood from lumbering
Agriculture, livestock and fisheries
Agricultural remains
Rice straw
Corn
Chaff
Wheat straw
Destruction rubbish of buildings
Destruction rubbish from buildings
Food industry
Bagasse
Wastewater from food industries
Food waste
Remains from marine product processing
Bagasse
Animal waste
Waste from cattle, pigs and chickens
Remains from fishing
Livelihood
Sewage sludge
Night soil
Kitchen waste
Paper mills
Black liquor and scrap wood
Cellulose (old paper)
Sugar and carbohydrates
Sweet potatoes
Rape seeds
Palm oil
Waste cooking oil
Direct incineration
Incineration in a boiler after conversion into chips and pellets
Biochemical conversion
Production of methane, ethanol and hydrogen through fermentation technology
Thermo-chemical conversion
Production of fuels through gasification, esterification and slurrying under high temperature or high pressure process
Power generation and energy use

Expanded Application of Biomass Energy Scenario




Thank you!!!