CIGS キヤノングローバル戦略研究所
The Canon Institute for Global Studies

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National Energy Policy and the Role of Renewable Energy In Japan

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Adviser of the Cabinet

Outline

-Review of national energy policy

-The role of renewable energy and necessary policies

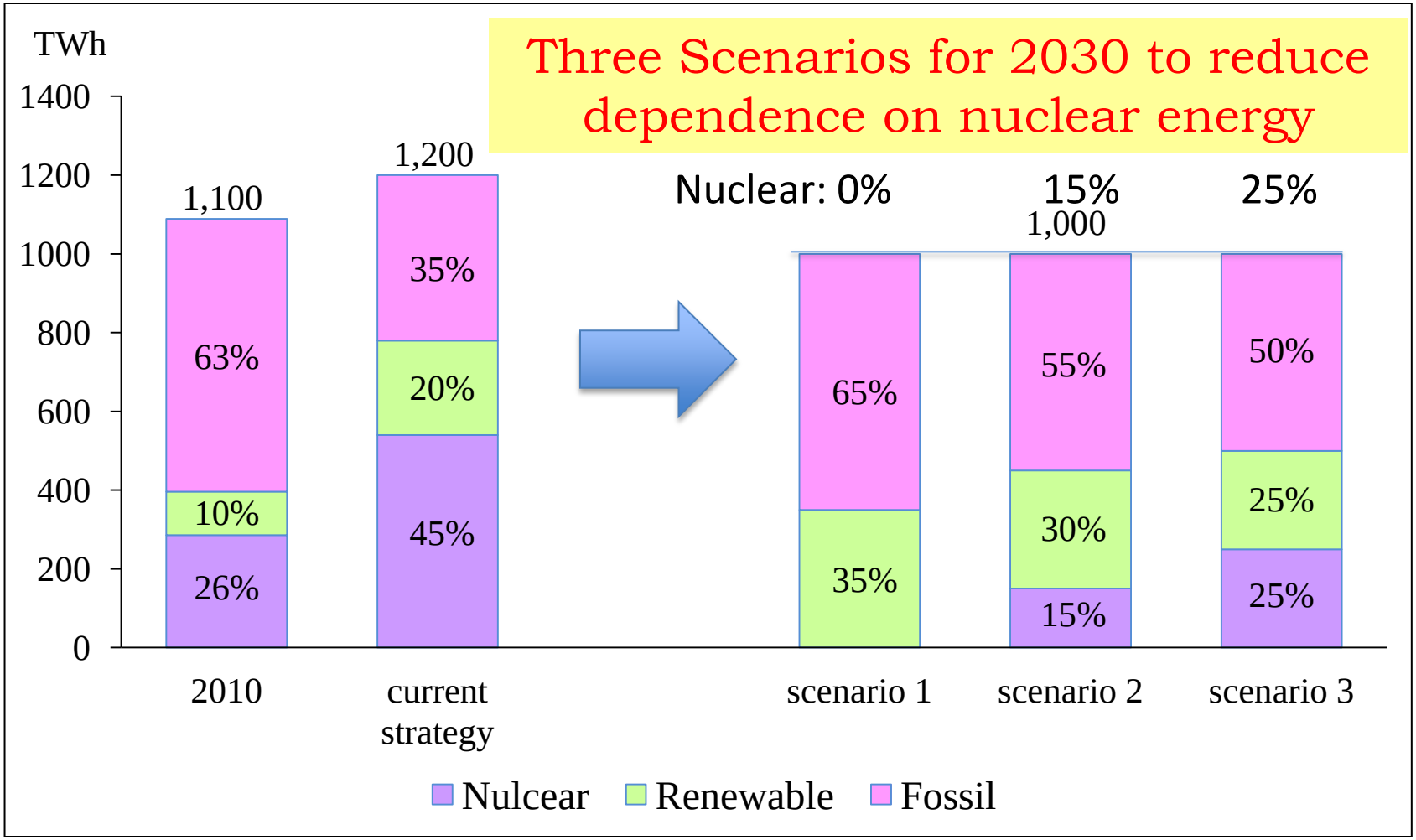
-Technologies and policies
  Solar energy (PV and thermal)
  Wind energy
  Storage hybrid power generation

-Perspectives on global utilization of renewable energy against global warming

-New approach of Japan— China cooperation

-Summary

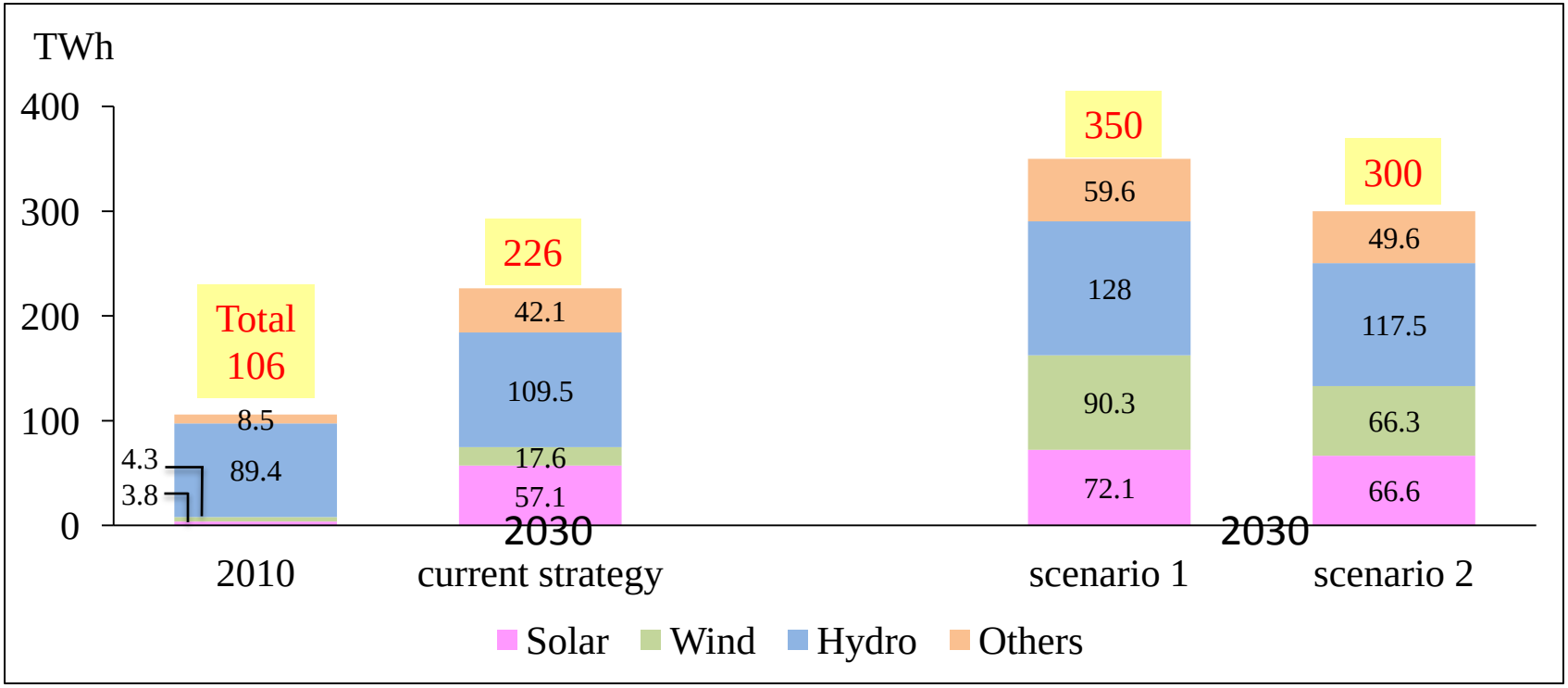
Review of National Energy Policy
ELECTRICITY



Data Source: National Policy Unit, http://www.npu.go.jp

Expected Role of Renewable Energies by 2030

Compared with current levels (CL: 2010) and current strategy (CS), extensive promotion is necessary.
Solar (PV): 19 times to CL and 1.3 times of CS
Wind: 21 times to CL and 5 times of CS
Hydro: 1.4 times to CL and 1.2 times of CS
Others (Bio, Geothermal, Ocean, etc.): 7 times of CL and 1.5 times of CS



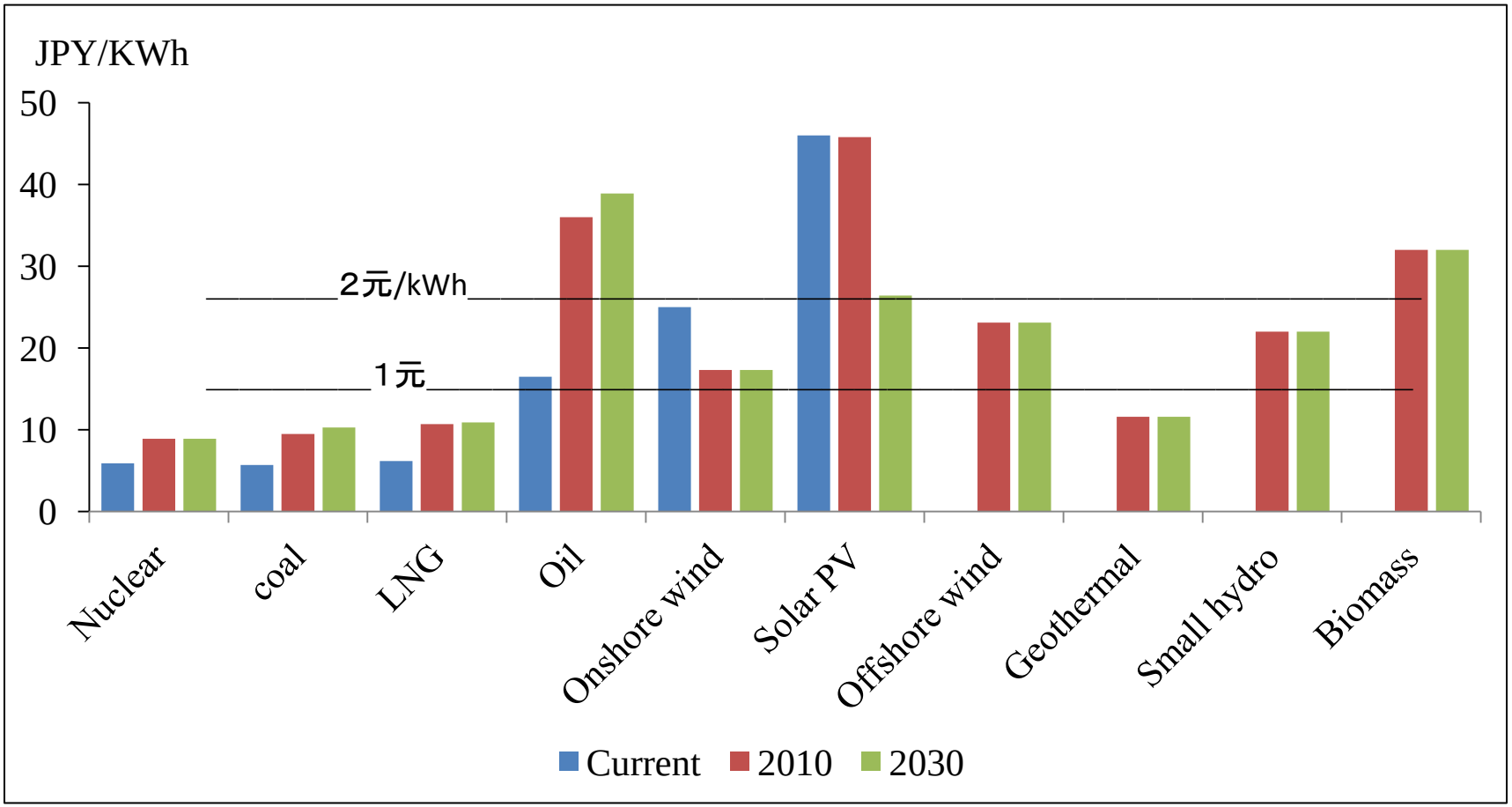
Data Source: National Policy Unit, http://www.npu.go.jp

Investigation of Necessity and Potentials

2030		MOE (2012.8.31) 環境省						EE Council (2012.6.29)			Total
Energy sources		Wind offshore	Geo-thermal	Bio-mass	Ocean		Sub total	Solar	Wind onshore	Hydro	
					Tide/ wave	Current					
Operating rate %		30	80	80	40	75		12	20		
Sce. 1 0%	Capacity (GW)	8.0	3.9	6.0	4.0	2.0	25	69	52	78	194
	Share in power %	2.1	2.7	4.2	1.4	1.3	11.7	7.2	9.0	7	35
Sce. 2 15%	Capacity (GW)	8.0	3.9	6.0	1.5	-	19	63	38	48	168
	Share in power %	2.1	2.7	4.2	0.5	-	9.5	6.6	6.6	7	30

The technological potential of onshore wind is estimated as 25 GW (JWPA). Therefore, the plan that renewable energy contribute 35% of power can not be achieved without 20 GW of offshore wind and 10 GW of ocean energy.

Costs of power generation technologies



Data Source: National Policy Unit, http://www.npu.go.jp

The power generation costs of renewable energy will be still very high even in 2030 compared with the fossil fired or nuclear.

Examination of Feed-in Tariff

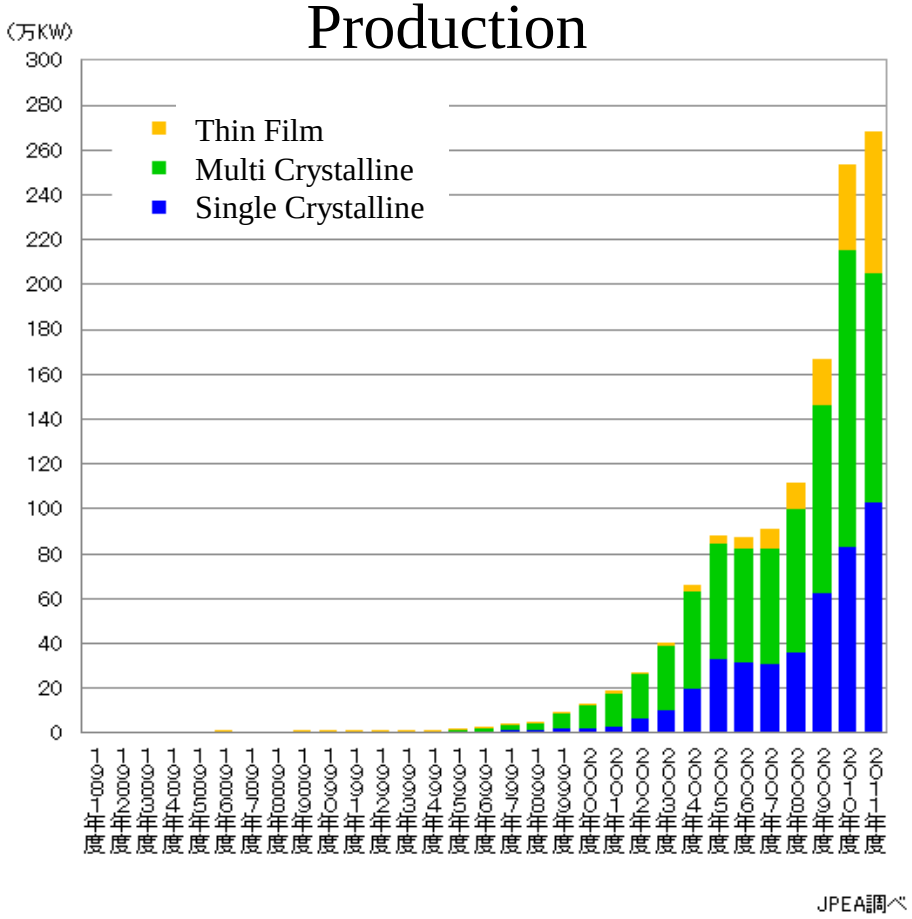
Resource		Price (JPY/KWh)	Period (years)
Solar PV	>10KW	42.00 (3.4元)	20
	<10KW	42.00	10
Wind	>20KW	23.10 (1.9元)	20
	<20KW	57.75	
Geothermal	>15MW	27.30	15
	<15MW	42.00	
Small Hydro	>1000KW	25.20	20
	200-1000KW	30.45	
	<200KW	35.75	
Biomass	Methane generation	40.95	20
	Waste	17.85	
	Woods (recycle)	13.65	
	Woods (normal)	25.20	
	Woods (unused)	33.60	

Data Source: http://www.meti.go.jp

The price of Solar PV seems to be a little high. It is based on cost and project risk analysis, and compared with the cases in other countries.

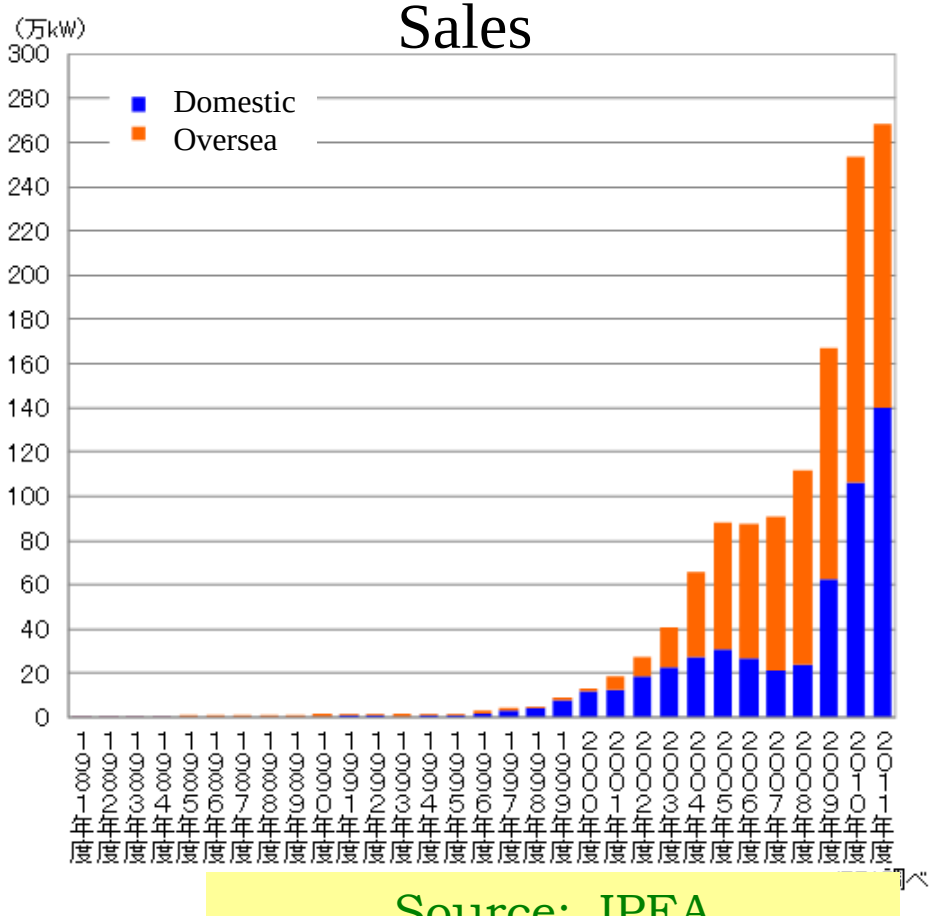
Progress of Solar PV in Japan

Production



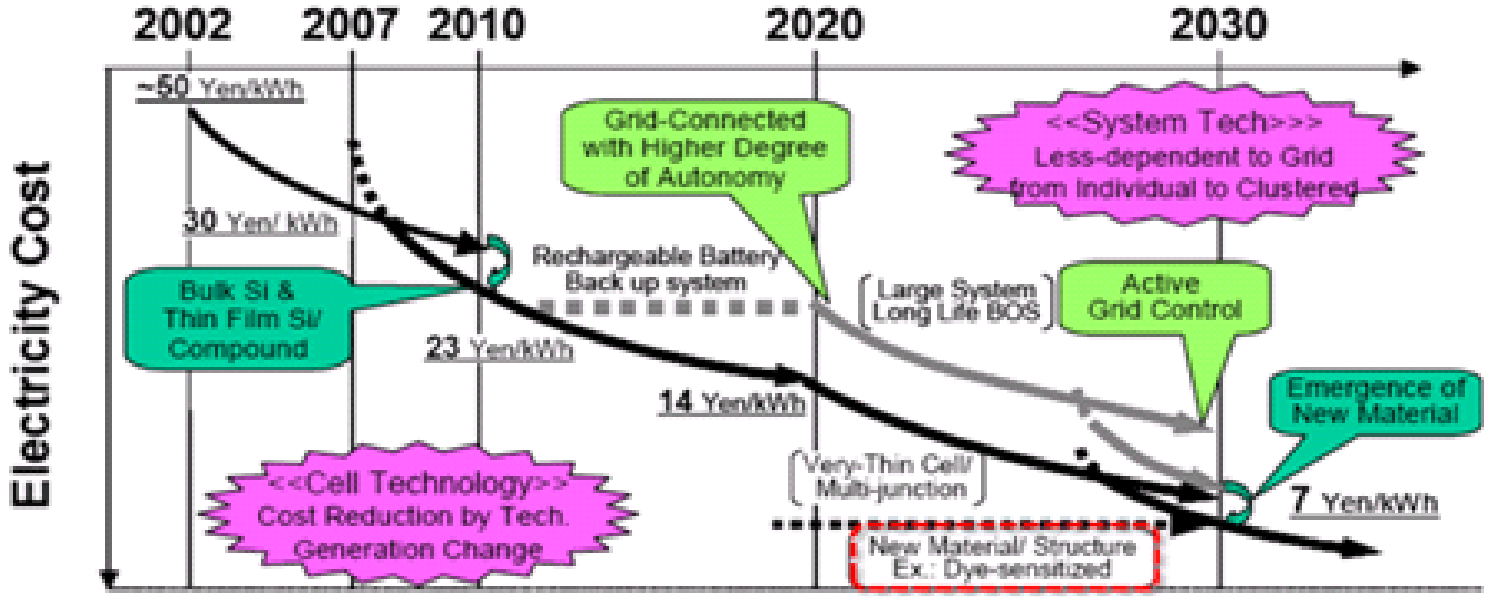
JPEA調べ

Sales



Source: JPEA

Technology Roadmap of Solar PV in Japan

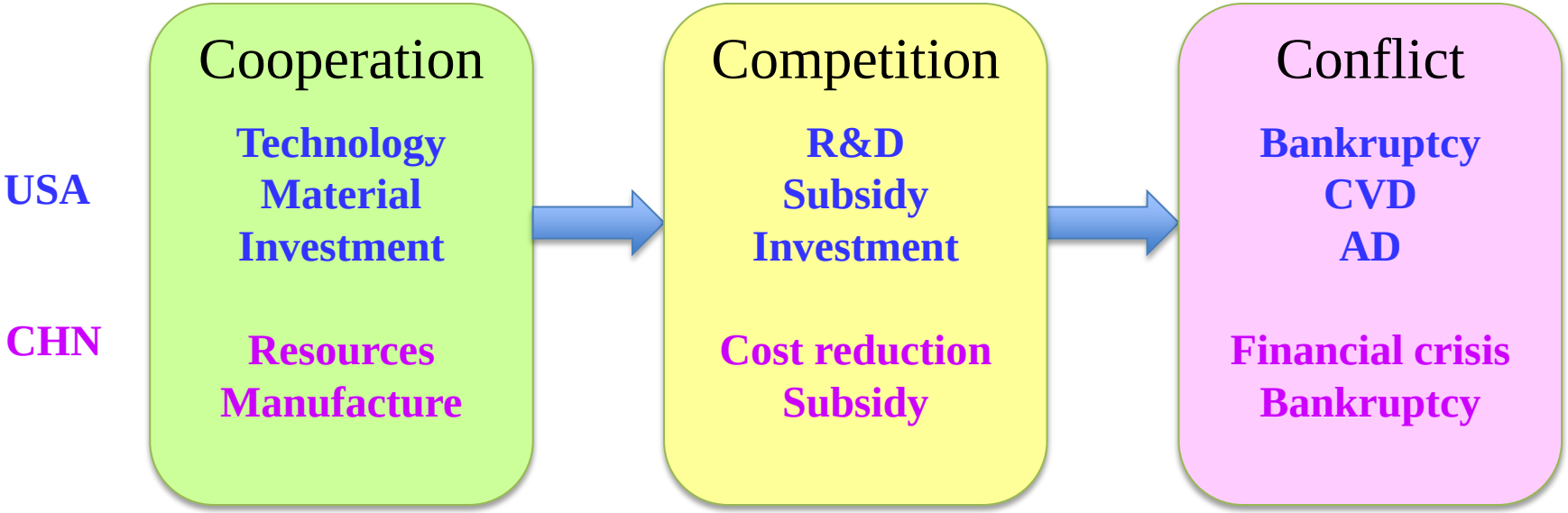


Type	Current efficiency %		2017 efficiency %		2025 efficiency %		2050 Efficiency %
	Module	Cell	Module	Cell	Module	Cell	
Crystalline Si	~16	25	20	25	25	(30)	Module 40~
Thin Films	~11	15	14	18	18	20	
CIGS	~11	20	18	25	25	30	
Junction	~25	41	35	45	40	50	
DSC	-	11	10	15	15	18	
Organic	-	5	10	12	15	15	

Source: NEDO PV2030

Competition vs. Cooperation on Solar PV

-Current status



-Perspectives

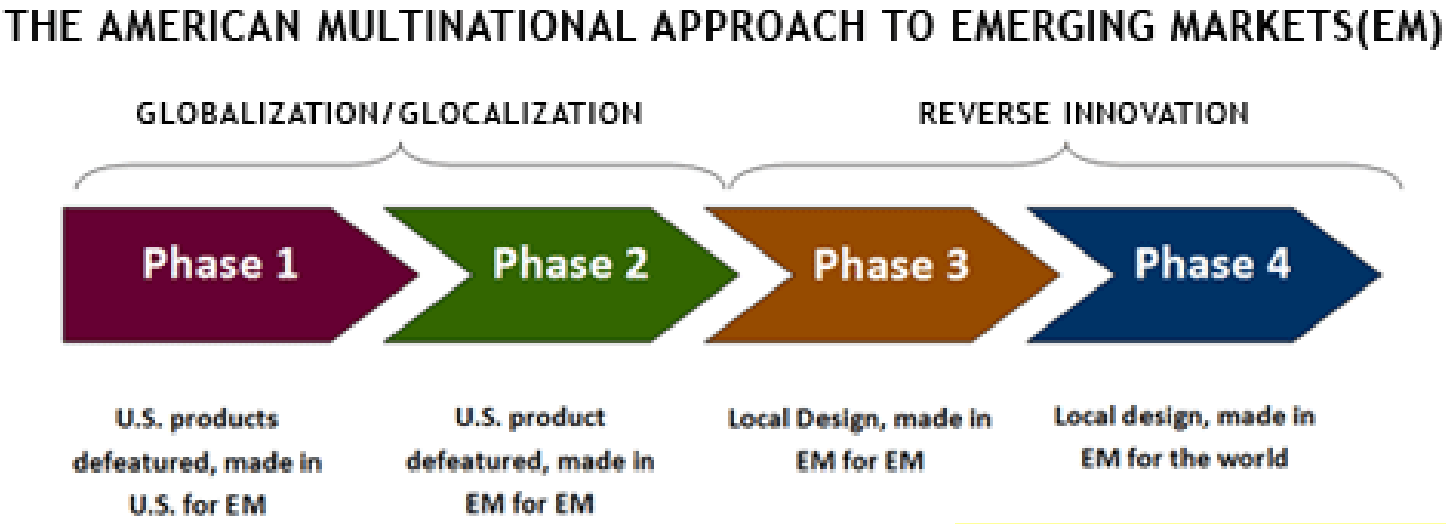
domestic market creation

R&D institution establishment

Innovation generates new relationship between China and Japan in the field of solar energy

New Approach of Japan China Cooperation

Reverse Innovation



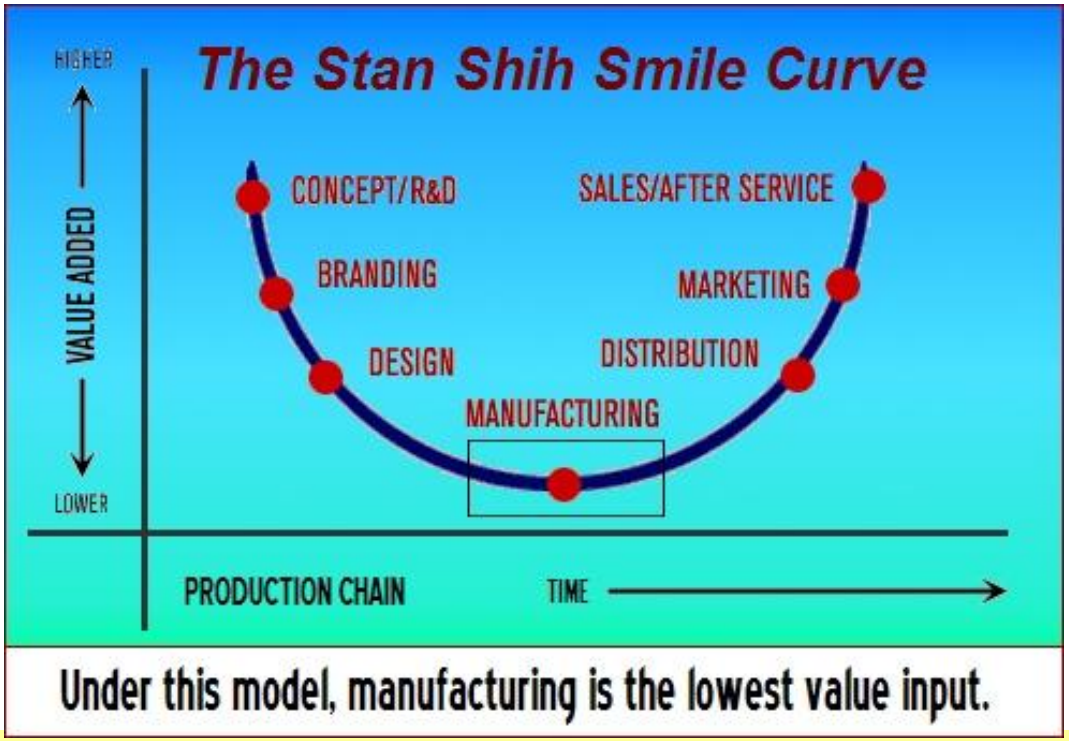
Source: The Wall Street Journal

Practice by GE with China (ultrasound machine)

1990s: export with a price over $100,000 but not fit to China
2002: development of portable unit collaborating with local team in China supported by GE with the price of $30,000 to 40,000
2007: price down to $15,000
2008: sales of $278 Million globally

New Approach of Japan China Cooperation

Smile Curve



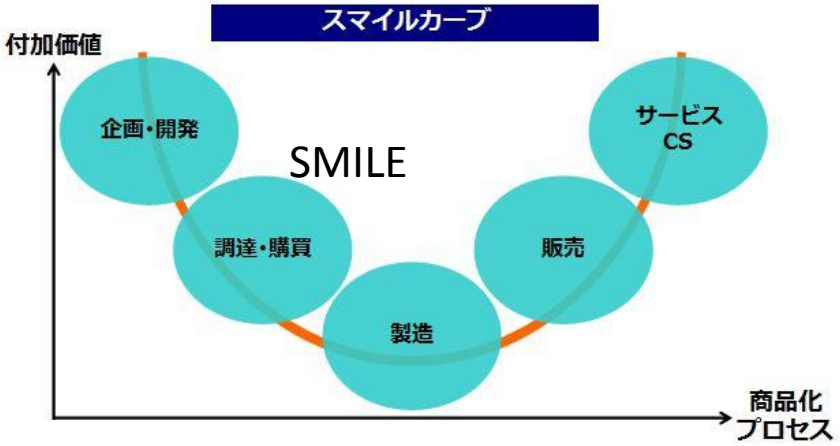
Distribution of added value among the production chain for hi-tech industry forms a smile curve. However, the benefit of a company in developing countries tend to be a reverse one. Therefore…..

image from http://ritalogisticsblog.wordpress.com/

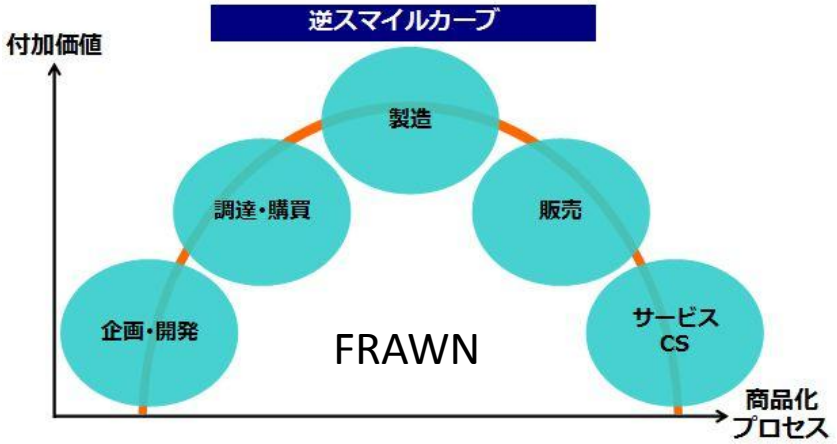
New Approach of Japan China Cooperation

Example of cooperation

「ryoko174の混沌日記」から
http://d.hatena.ne.jp/ryoko174/20120327/1332851928



SHARP

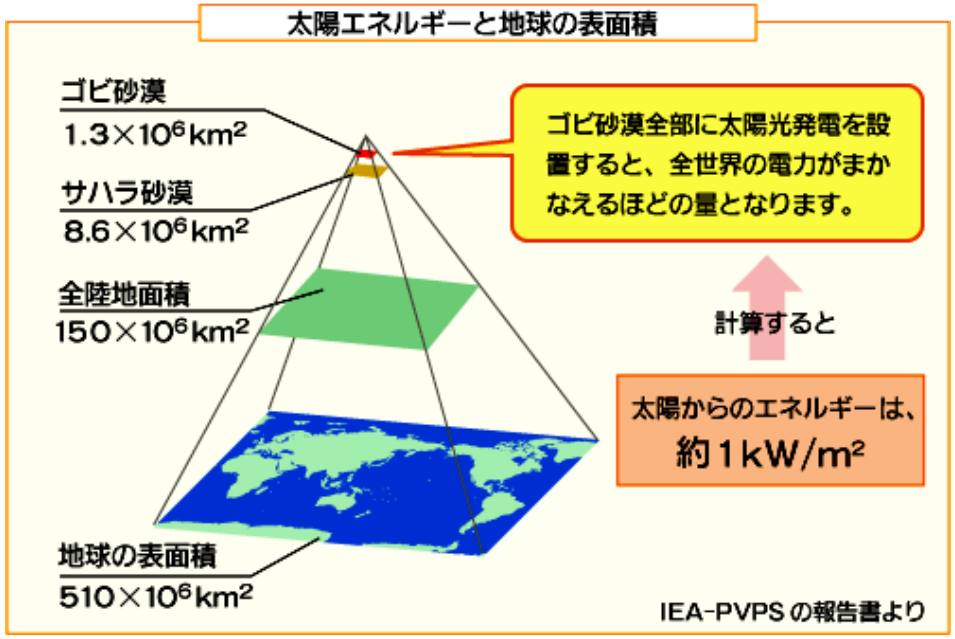


FOXCONN 鴻海

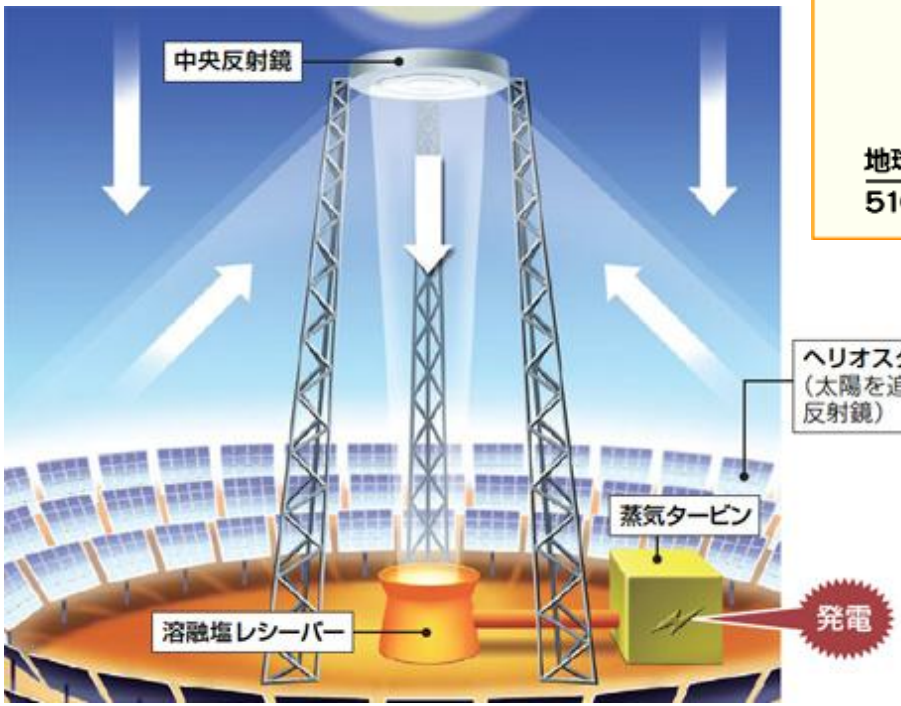
Source: NHK news
http://www3.nhk.or.jp

Solar Thermal generated electricity – Future dominating technology?

Setting up solar thermal power plants in all of the Gobi desert in the world could supply the global demand.



http://green-reo.com/natural/taiyou.html



http://eco.nikkeibp.co.jp/style/eco/report/080530_taiyonetsu/index2.html

Tokyo Tech beam down CSP Reflecting light to the molten salt receiver by heliostat and central reflecting mirror. Storing energy into the molten salt enable 24 hours power generation.

Progress of Wind Power in Japan

Annual Installed Capacity

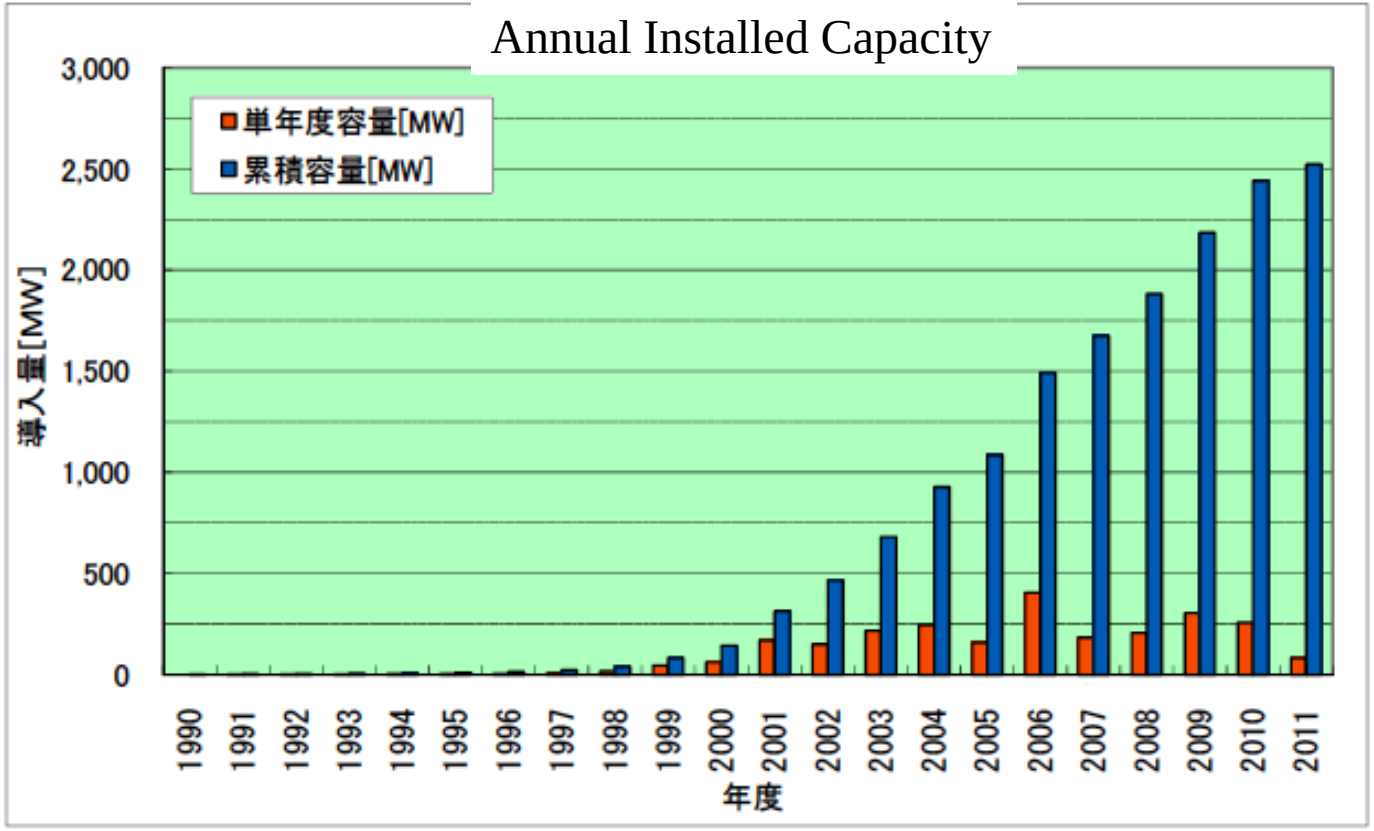


図 1-1　1990 年度から 2011 年度までの単年度および累積導入量

表 1-1　累積導入量と累積台数

年度	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
累積容量[MW]	1	10	144	313	464	681	925	1085	1490	1675	1880	2184	2440	2522
累積基数[基]	9	54	259	434	576	741	920	1059	1316	1413	1531	1679	1807	1840

Source: JWPA

Roadmap of Wind Power in Japan

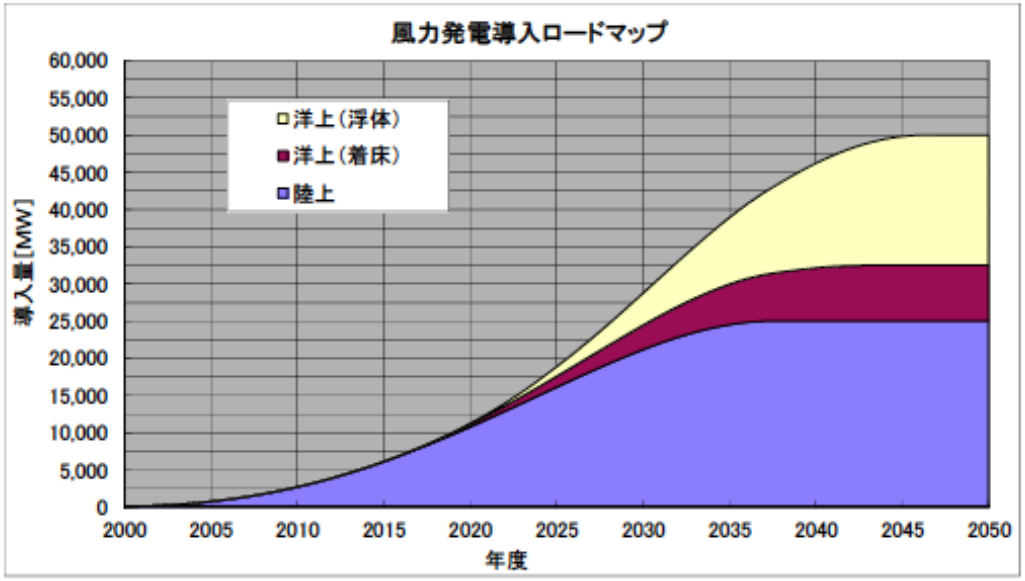


図 3-2　JWPA 試算：ロードマップ

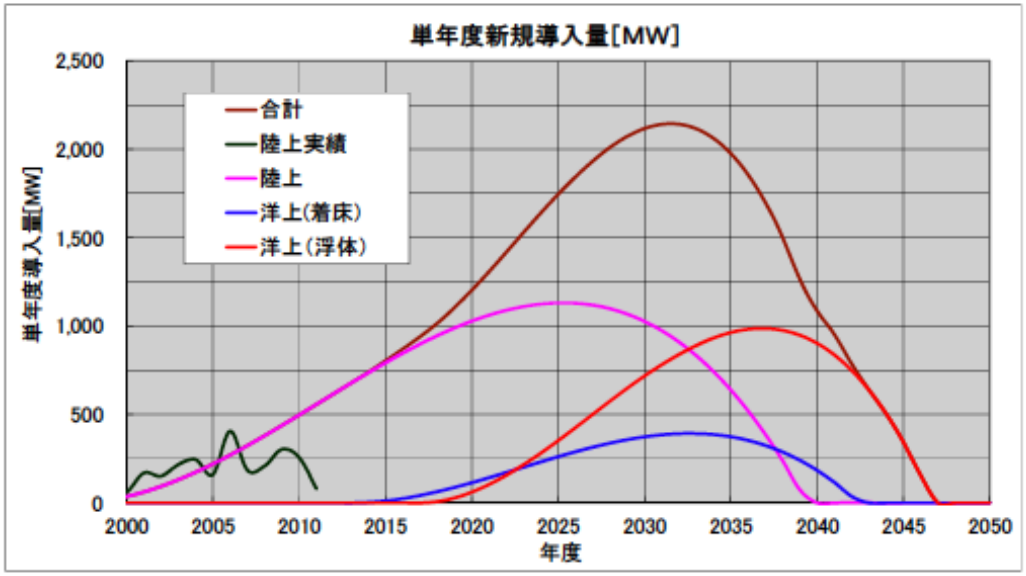


図 3-3　JWPA 試算：単年度新規導入量

TOTAL generation 30GW in 2030
50GW in 2050

FLOATING OFFSHORE

FIXED OFFSHORE

ONSHORE (<25GW)

Due to the limitation of onshore wind potential, the offshore utilization will be essential from 2020 on.

Source: JWPA

Storage Hybrid Power Generation

Advantage: stable output reducing load of grid connection

Challenges: scale up (stability, cost)

safety (fire accident)

Key element: storage device

Futamata NaS battery hybrid wind farm(2008～)

http://www.21aomori.or.jp/windpower/institution.html

Next Generation Storage Device

Type

Rechargeable Battery

Lead-acid, Lithium-ion, Lithium-air, Nickel-hydrogen, NaS, etc.

Capacitor

Chemistry, Double-layer, etc.

SMES

Point of R&D

Scale up: Energy intensity, Cycle life

Safety: Fire, Shock, Explosion

Cost: Commercial use needs a low price of about 15 JPY/Wh

Current situation of R&D

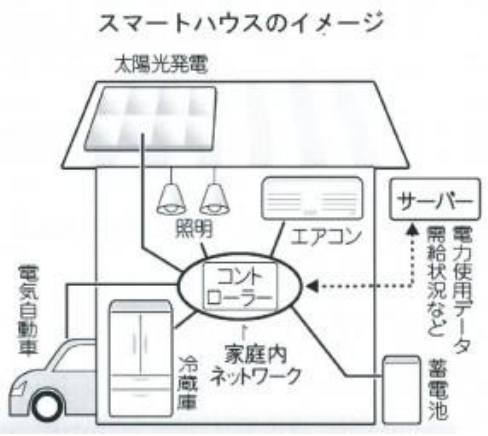
USA: DOE (basic research) + Venture (commercial use)

EU: Collaboration among government, industry, and university

Japan: NEDO basic research

China: National project (863, 973, etc.)

Self Dependent House to Smart Community



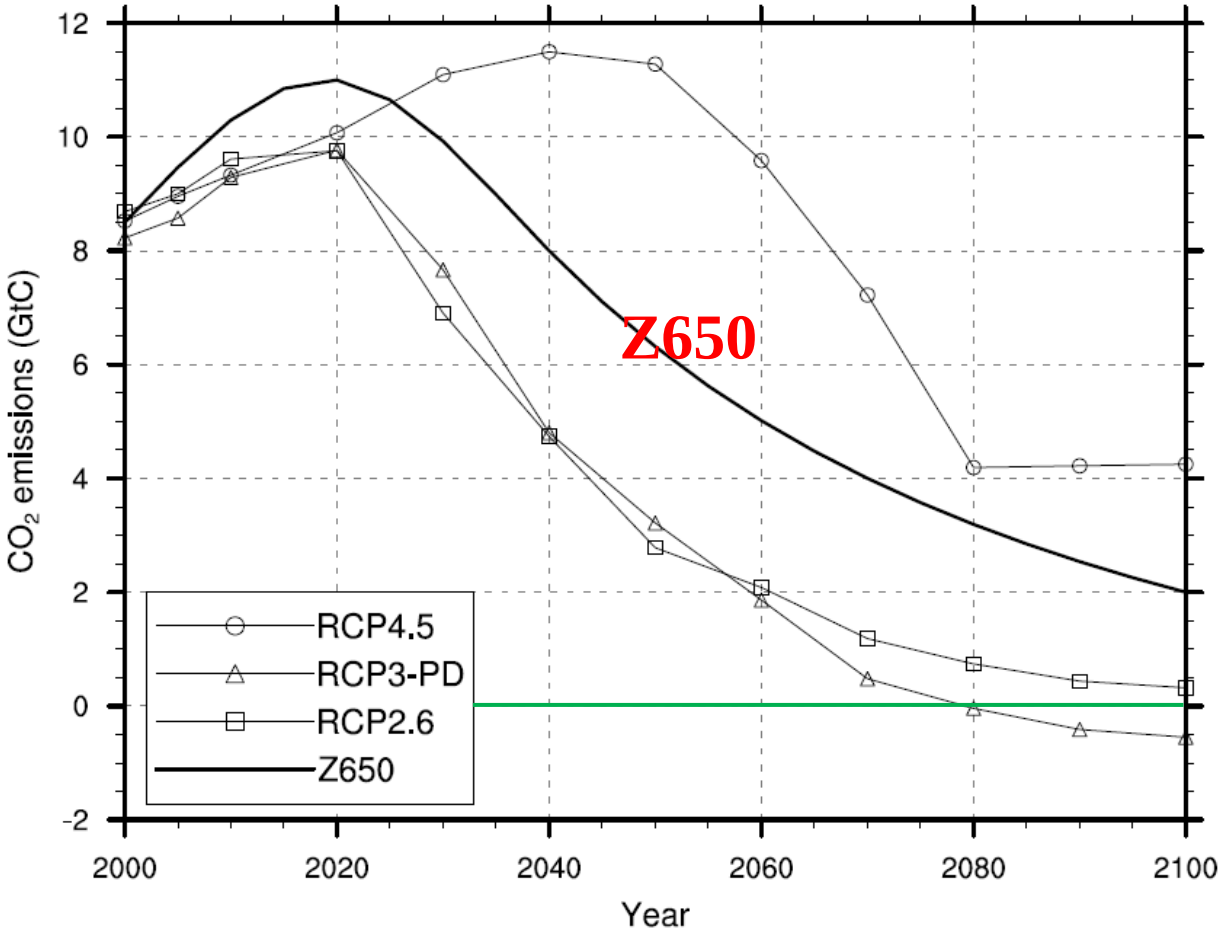
当社が目指す「エコハウス」構想における
インテリジェントパワーコンディショナの位置付け

Response.jp

http://www.cocoro-house.com/presidentblogs
http://www.meti.go.jp/policy/energy_environment/smart_community/doc/smartcommu.pdf

http://greenpost.way-nifty.com/sinaken/cat1160531/index.html
http://www.meti.go.jp/policy/energy_environment/smart_community/doc/smartcommu.pdf

New Scenario (Z650) against Global Warming



Source: Matsuno et al., "Stabilization of the CO2 concentration via zero-emission in the next century", presented at the CIGS Symposium on Oct. 27, 2009

Z650 is located in the middle of the two RCP scenarios, therefore it could take the advantage of second best solution, i.e., to be more feasible than RCP2.6, and to have better climate performance than RCP4.5.

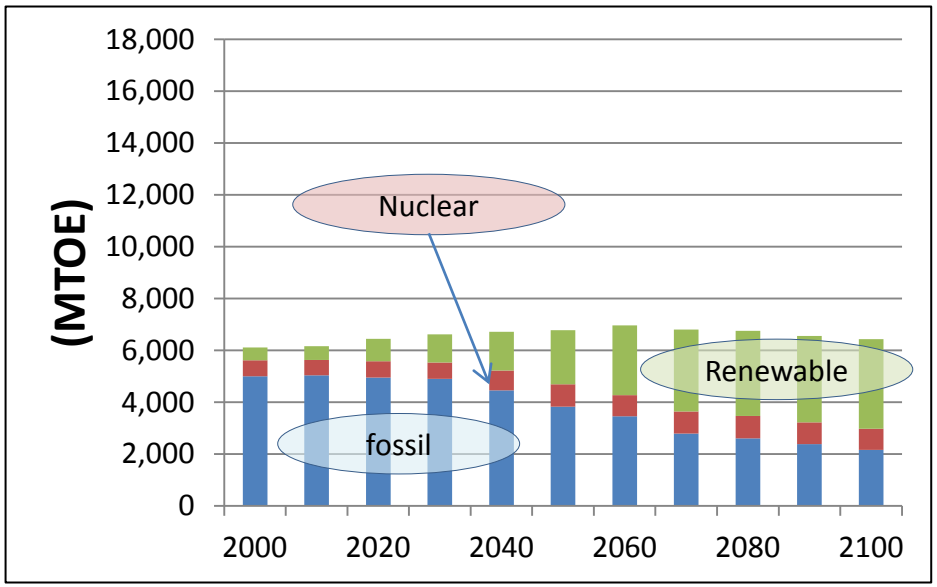
Best Energy Mix for Z650

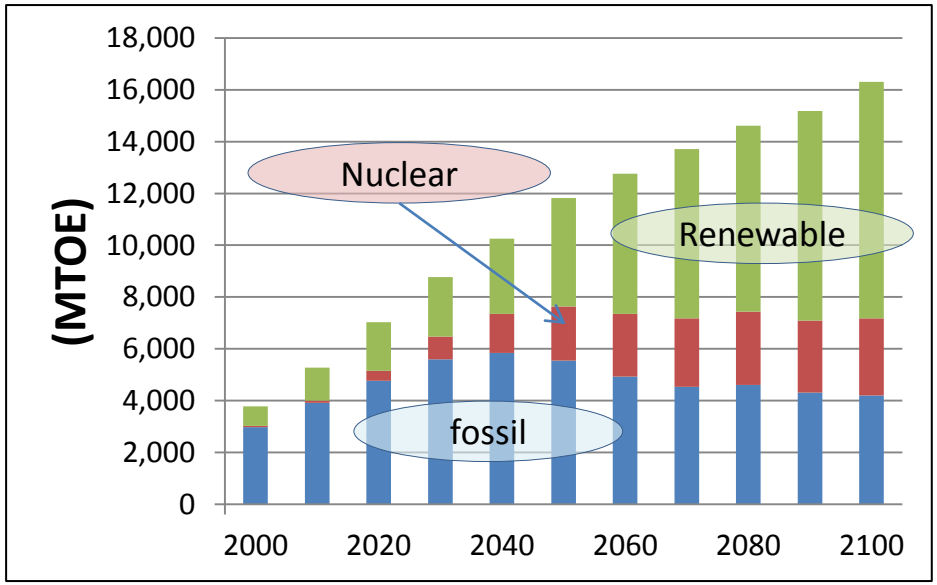
Industrialized countries

- Total Primary Energy is almost constant up to 2100.
- Share of fossil fuel gradually decreases
- Alternatively, share of renewable energy mainly increases

Developing countries

- Total Primary Energy continuously increases up to 2100
- Peak of fossil fuel consumption at 2040
- Both Nuclear and renewable energy increase remarkably





Summary and Suggestion

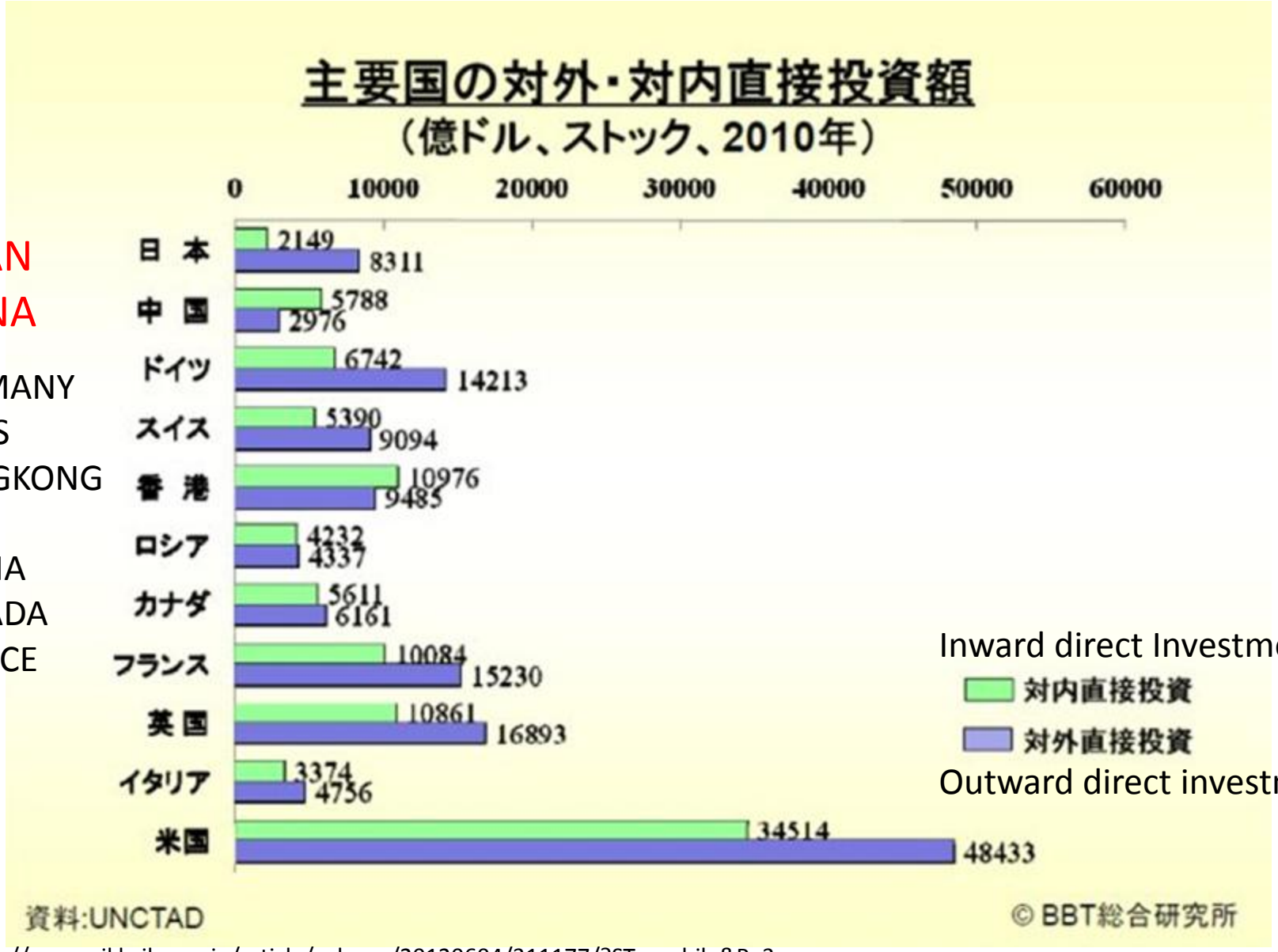
- Towards large scale utilization of renewable energy

  Solar PV and wind (especially offshore wind) will be the key
- To deploy the self dependent house and building, and to promote the establishment of smart community
- The R&D competition on PV and rechargeable battery intensifies, the basic research will directly link to production development and promote innovation
- To draw a smile curve based on reverse innovation for establishing a low carbon society in Asia based on healthy competition and cooperation

Net external assets of major countries

From http://www.nikkeibp.co.jp/article/column/20120604/311177/?ST=mobile&P=3

Inward and Outward direct investment by major countries



JAPAN
CHINA
GERMANY
SWISS
HONGKONG
RUSSIA
CANADA
FRANCE
UK
ITALY
USA

Inward direct Investment

Outward direct investment

From http://www.nikkeibp.co.jp/article/column/20120604/311177/?ST=mobile&P=3