

**APEC EGNRET41, Beijing, China**

# **Current New and Renewable Energy Priorities in APEC Member Economies**

October 16, 2013

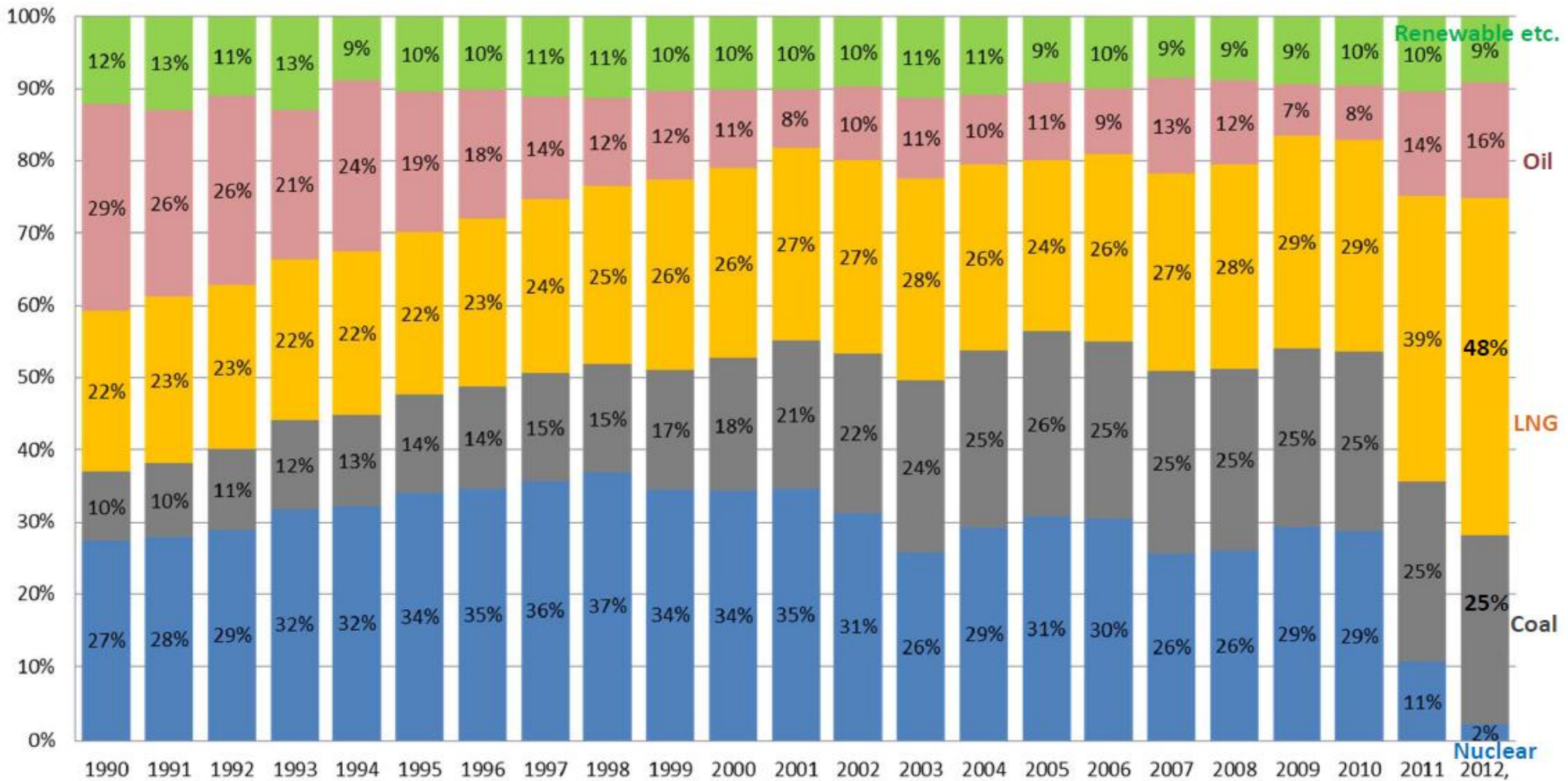
Satoshi Nakanishi  
The Institute of Energy  
Economics, Japan (IEEJ)



# Generation Mix

# Generation Mix Trend in Japan

§ LNG mainly compensates for the decline of nuclear after 2011

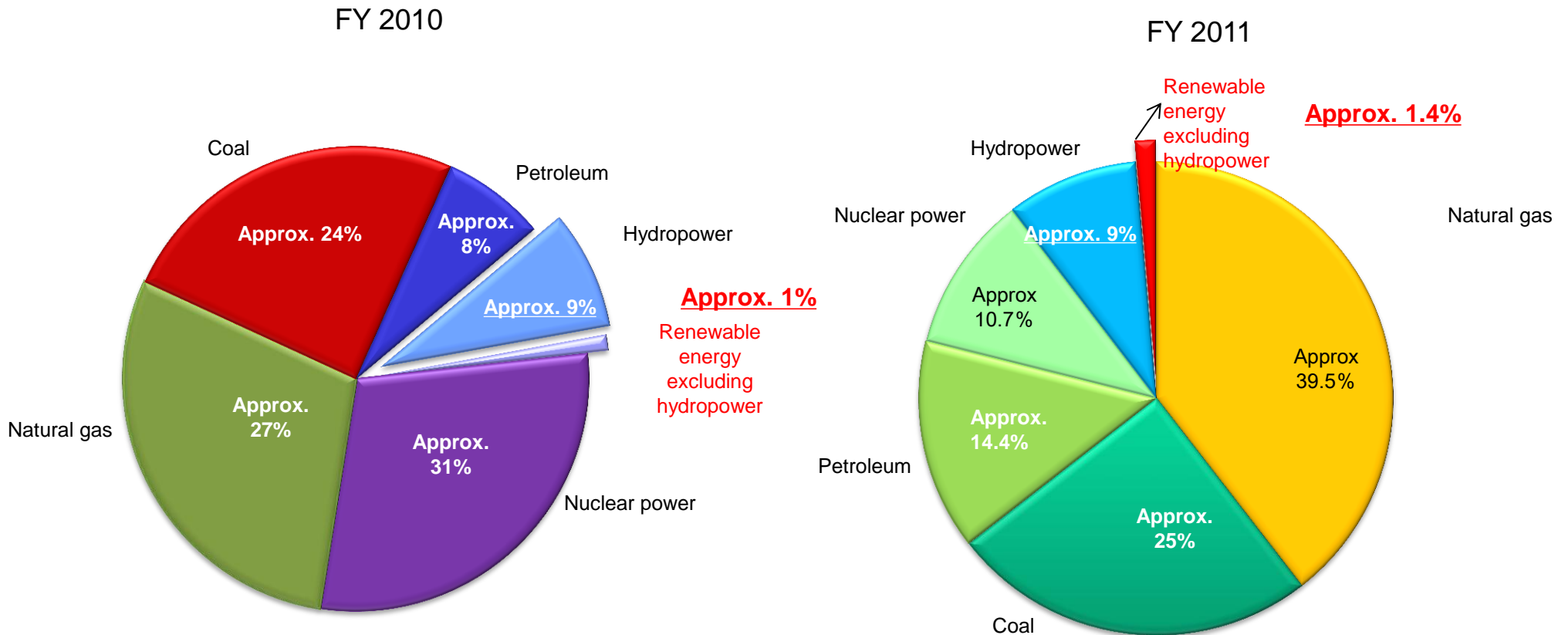


(Source) METI

# Current Generation Mix in Japan

- Among the total electricity generated in fiscal 2010, renewable energy, etc. accounted for approximately 10%; approximately 9% of which is hydraulic power generation.
- Other renewable energy is still cost prohibitive.

Composition of annual electricity generated in Japan



Note: "Etc." of "Renewable energy, etc." includes the recovery of energy derived from waste, refuse derived fuel (RDF) products, heat supply utilizing waste heat, industrial steam recovery, and industrial electricity recovery.

Source: Prepared based on the Agency for Natural Resources and Energy's "Outline of Electric Power Development in FY 2010"

# **Promotion and Pricing Mechanism of New and Renewable Energy**

# Outline

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2003

## **RPS (Renewable Portfolio Standard)**

- wind, solar, small hydropower, biomass power generation , binary geothermal
- 8-year target set by every 4 years

2009 Nov

## **Buyback surplus PV electricity from residence**

- Developed from Utilities' voluntary Net metering system

2011 Aug

## **Passage of FIT Law**

2012 Apr

## **Proposal from the Advisory Committee**

- Proposal from Advisory committee for the purchasing rate and the duration

2012 May

## **Public Comment**

- From May 16 to June 1

2012 Jul

## **Commencement of FIT**

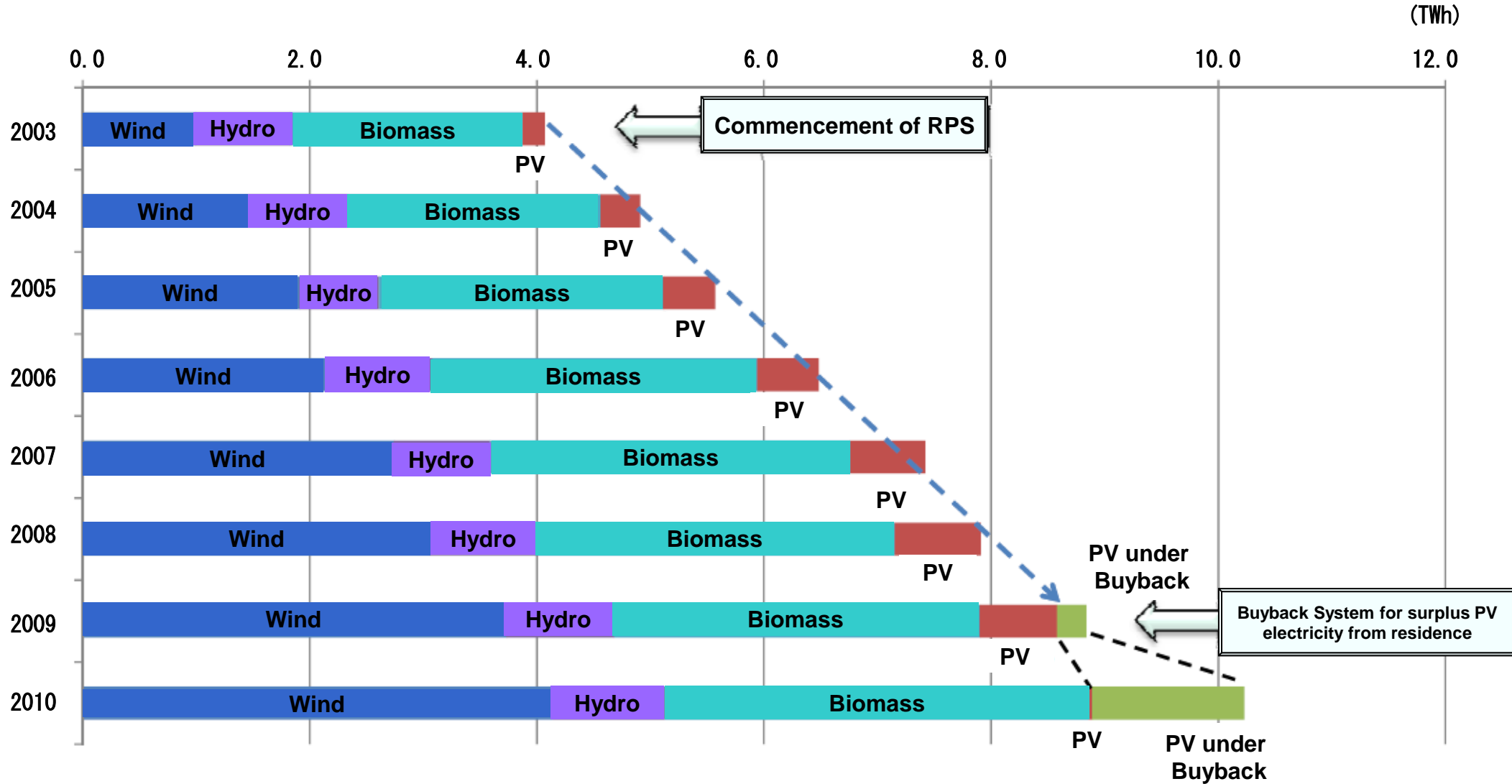
- Start from July 1

FY 2013

## **Revision of PV tariff**

- Based on the PV system price decline

# Renewable Energy Purchased by Utilities under RPS

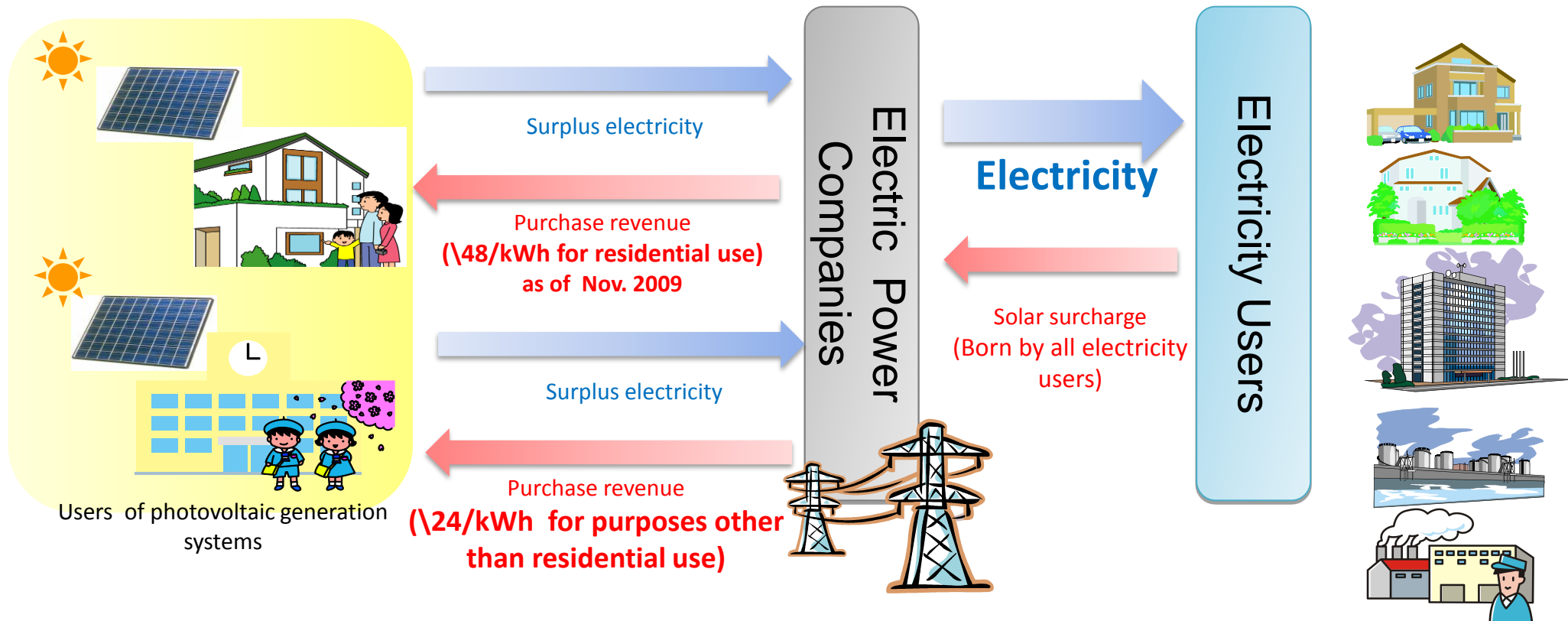


Source: METI

# Buyback System started from Nov 2009(1)

## Major points of the buyback system

- Of the electricity generated by photovoltaic generation systems, surplus electricity will be purchased.
- The buyback period is within the 10 years from the start of the program. The buyback price is fixed.  
(※The buyback price may differ depending on the fiscal year in which a panel is installed. In the initial stages, it is ¥48/kWh for residential use [less than 10kW].)
- Expenses will be born by all electricity users.



※In the initial stages after installation, ¥48/kWh for residential use (less than 10kW) and ¥24/kWh for other uses. In the case where a private electric generator is also installed, ¥39/kWh and ¥20/kWh, respectively.



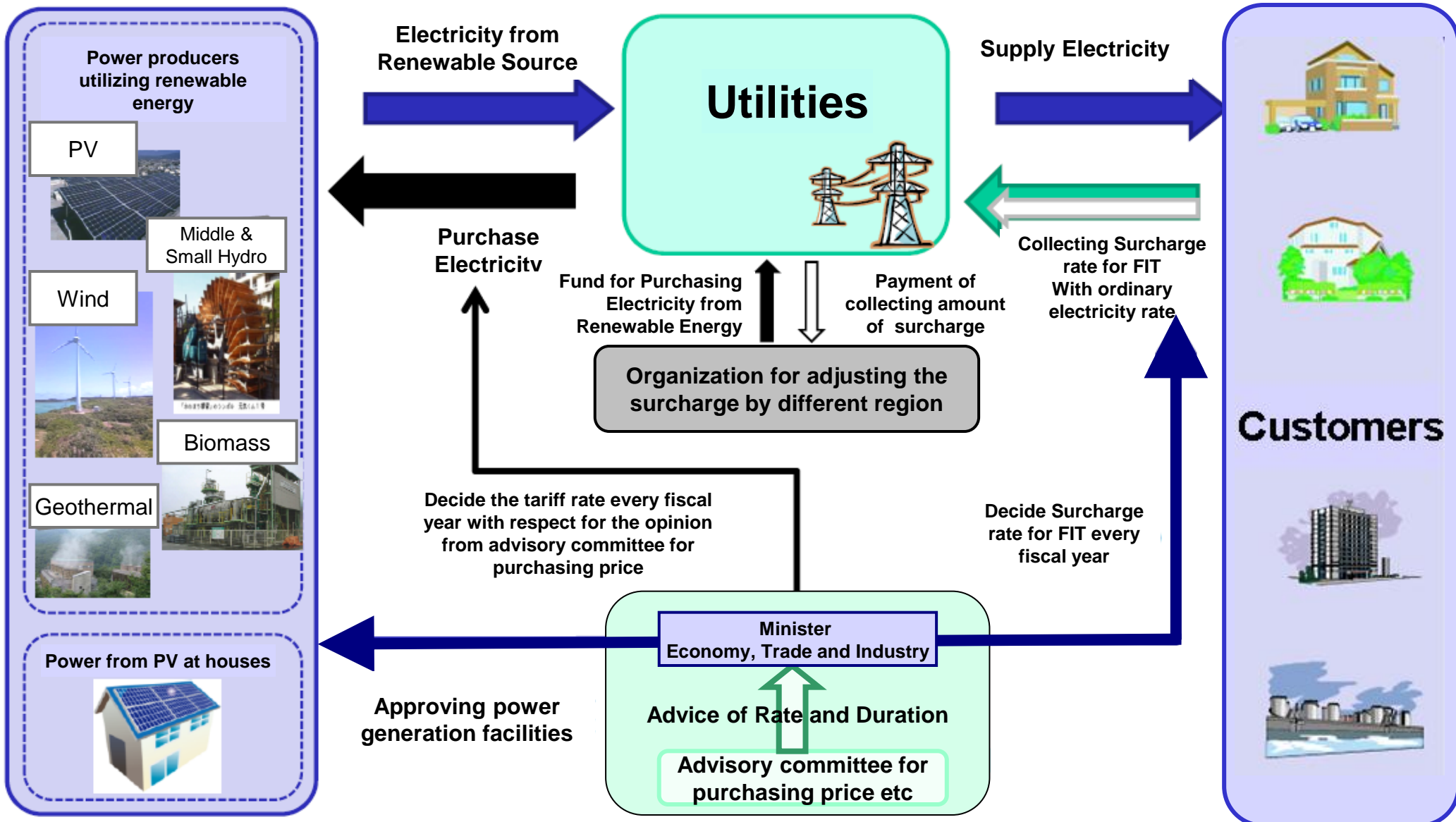
# Buyback System started from Nov 2009(2)

	November 2009 - March 2011	April 2011 -March 2012 (FY2011) Continued until April 2013 (FY2012)
Residential Use Under 10kW	48 JPY/kWh (39 JPY/kWh)	42 JPY/kWh (34 JPY/kWh)
Non Residential Use and Residential Use Over 10kW	24 JPY/kWh (20 JPY/kWh)	40 JPY/kWh (32 JPY/kWh) *Rate increased because of finishing subsidy

Rate inside the brackets are for the houses/ facilities using **private generation system** (photovoltaic generation plus fuel cells, etc.)

Buybacks rate will be decide each year and the rate continues for 10 years after the start of the program.

# FIT Basic Scheme (Started From July 2012)

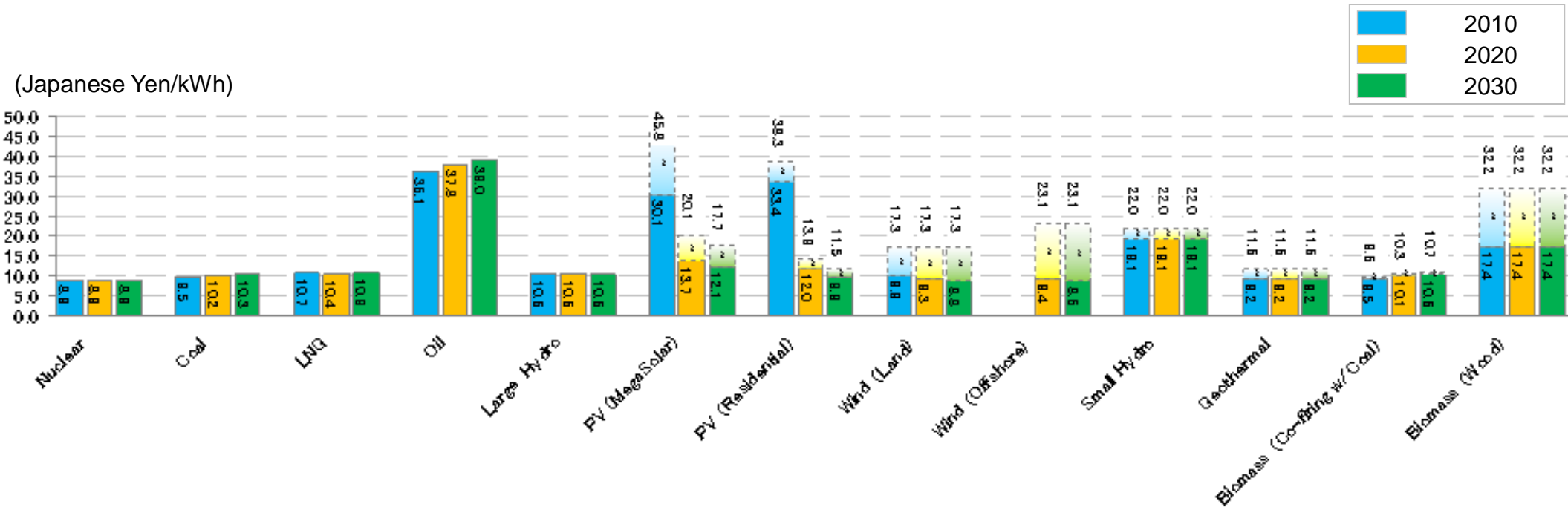


# Major Revision from RPS to FIT

	<b>RPS (PV: Buyback)</b>	<b>Feed in Tariff</b>
<b>PV</b>	Under about 500kW	No Limitation by Capacity
<b>Wind</b>	-	-
<b>Hydro</b>	Under 1MW	Under 30MW
<b>Geothermal</b>	Only Binary Cycle power plant	No Limitation (Including Flash Steam Plant)
<b>Biomass</b>	No category	Differentiate the purchase rate by category

Source: METI

# Electricity Cost Estimation in Japan



Source: National Policy Unit, Cabinet Secretariat  
[http://www.npu.go.jp/policy/policy09/archive02\\_shisan\\_sheet.html](http://www.npu.go.jp/policy/policy09/archive02_shisan_sheet.html)

# Feed in Tariff started from July 2012

Renewable Energy		PV		Wind		Geothermal		Middle and Small Hydro		
Classification (Plant Size)		≧10kW	<10kW (Surplus)	≧20kW	<20kW	≧15,000kW	<15,000kW	30,000kW> ≧1,000kW	1,000kW> ≧200kW	<200kW
Cost	Initial Cost (Thousand JPY/kW)	325	466	300	1,250	790	1,230	850	800	1,000
	Operation Cost (Thousand JPY/kW)	10	4.7	6	-	33	48	10	69	75
IRR(Before Tax)		6%	3.2%	8%	1.8%	13%		7%	7%	
Tarriff (JPY/KWh)	With Tax	42.00	42(*)	23.10	57.75	27.30	42.00	25.20	30.45	35.70
	Without Tax	40	42	22	55	26	40	24	29	34
Duration(Years)		20	10	20	20	15	15	20		

FY 2013; PV 10kW >=: \37.8(36.0+Tax)/kWh, 10kW< \38.0/kWh (Incl. Tax)

Renewable Energy		Biomass						
Kind of Biomass		Gasification (Sewage)	Gasification (Livestock Excreta)	Solid Fuel (Unutilized Wood)	Solid Fuel (General Wood)	Solid Fuel (General Waste)	Solid Fuel (Sewage)	Solid Fuel (Recycled Wood)
Cost	Initial Cost (Thousand JPY/kW)	3,920		410	410	310		350
	Operation Cost (Thousand JPY/kW)	184		27	27	22		27
IRR(Before Tax)		1%		8%	4%	4%		4%
Tarriff (JPY/KWh)	Classification	Gasified Biomass by Methane Fermentation		Unutilized Wood	General Wood (Incl. Palm EFB)	Waste Biomass (Other than Wood)		Recycled Wood
	With Tax	40.95		33.60	25.20	17.85		13.65
	Without Tax	39		32	24	17		13
Duration(Years)		20						

# Deployment under FIT(July 2012 – June 2013)

Major part of deployment under FIT is PV due to the development Terms

	Cumulative Deployment before July 2012 (Approximate)	Operational	Approved	Development Term
PV (Residential)	4,700	1,379	1,633	2–3months
PV (Non Residential)	900	2,120	19,755	1 Year
Wind	2,600	66	805	4–5 Yrs
Middle and Small Hydro (More than 1MW)	9,400	0	65	2–3Yrs
Middle and Small Hydro (Less than 1MW)	200	2	14	2–3Yrs
Biomass	2,300	98	639	3–4Yrs
Geothermal	500	1	4	9–13Yrs

(MW)

Source: METI News Release  
4 Oct 2013

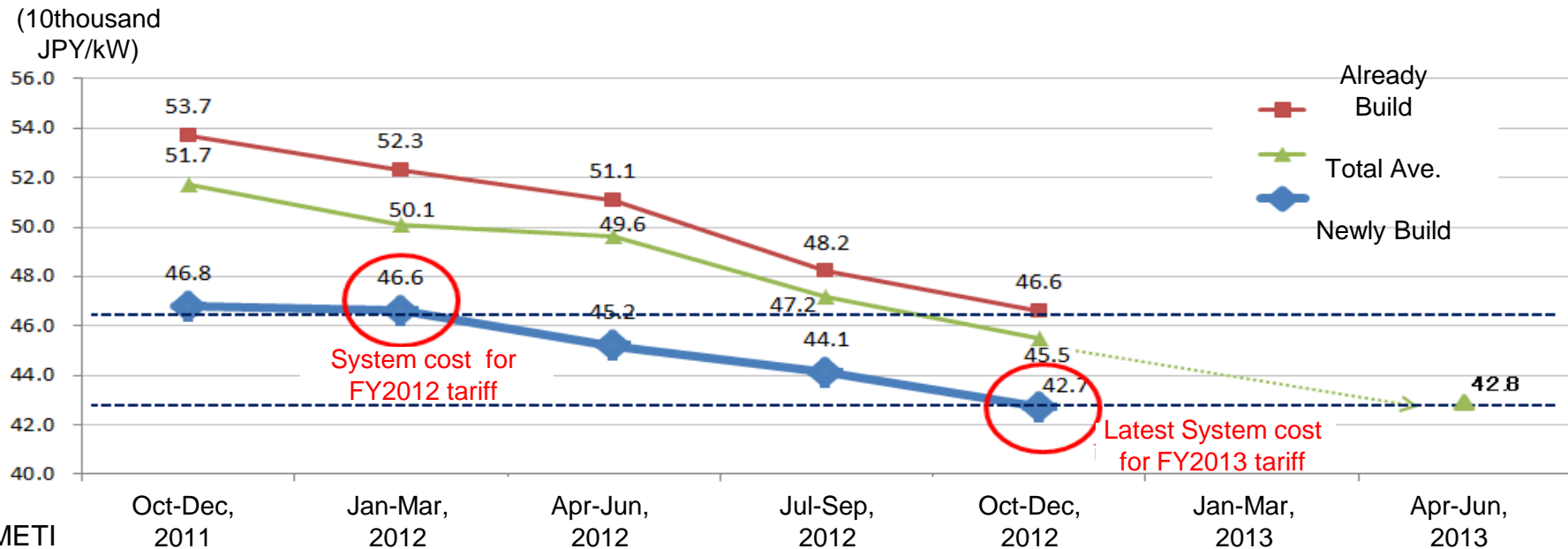
20,600

3,666

22,915

# PV System cost revision (residential use)

- FIT for PV residential sect which is started from July 2012 was based on the PV System cost of JPY(10 thousand) 46.6 / kW in 1<sup>st</sup> Q 2012.
- Revised FIT for residential PV for FY 2013 should be based on the latest (4<sup>th</sup> Qtr) cost which is JPY(10 thousand) 42.7 / kW.
- About JPY(10 thousand) 4 / kW has dropped



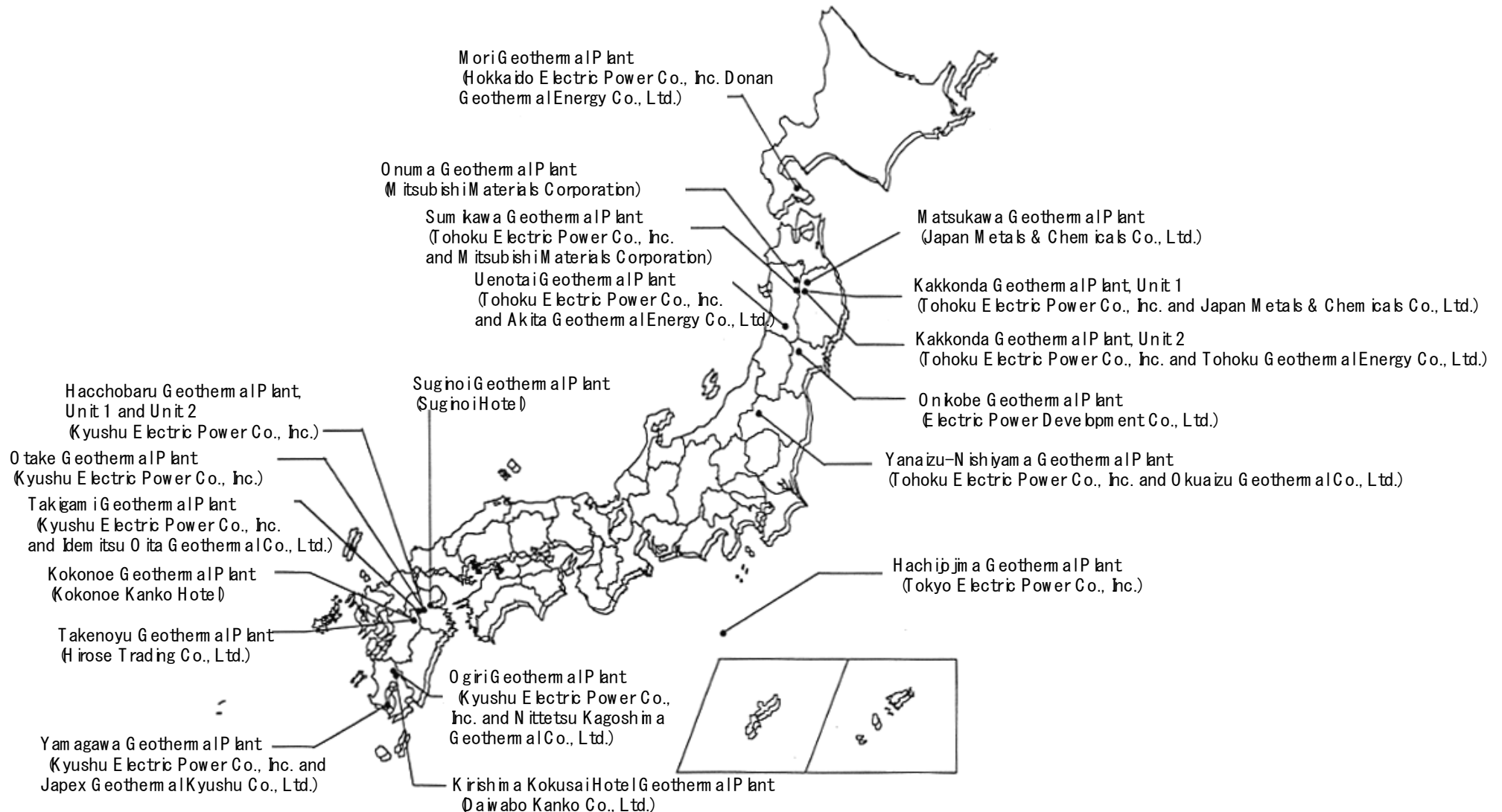
## National Government Subsidy for Residential PV system

Fiscal Year	Subsidy (10Thousand JPY/kW)	Condition (10Thousand JPY/kW)	Buy BackTariff (JPY/kWh)
2010	70	650	48
2011	48	600	42
2012	35	475	42
2013	20	410	38

# Development in the Future



# Geothermal Power Plants (Japan)



(Source) Agency for Natural Resources and Energy, Ministry of Economy, Trade and Industry (METI), Japan

# Governmental support measures FY 2012 budget

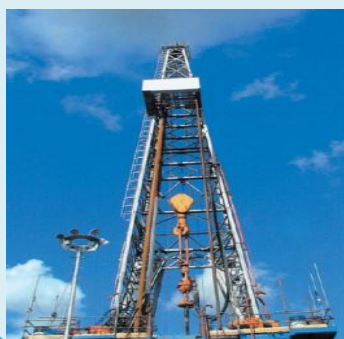
## Choice of Energy Options: Issued on June 2012

The geothermal amount of introduction is made into **3%** of the total electric power production (**27,200 millions kwh**) at the maximum in 2030. ※2010 track record: **0.2%** (**2,600 millions kwh**)

### Geological survey



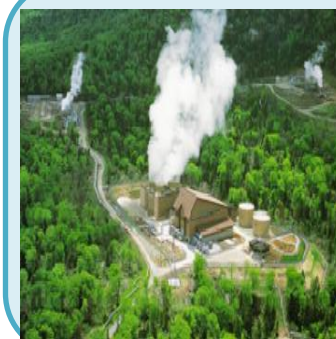
### Exploration (drilling of exploration wells, etc.)



### Construction stage



### Installation of power generation facilities



## Risk

### Subsidy

[Targets] Cost of test drilling, etc. including geological surveys.

Budget: ¥9.05 billion  
Subsidy ratio: 50% to 75%

### Investment

[Targets] Cost of drilling exploration wells to check whether a sufficient volume of steam can be stably extracted from heat sources.

Budget : ¥5 billion  
Investment ratio: 50%

### Loan guarantee

[Targets] Cost of drilling wells necessary for power generation

Budget: ¥1 billion  
Loan guarantee ratio: 80%

### Feed-in tariff scheme

Electric utilities purchase electricity generated from renewable sources including geothermal at the procurement price and for the procurement period.

# Regulations on geothermal development

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## 1. Natural Park Act

Geological surveys and drillings for geothermal energy in national parks are restricted according to the protection zones.

## 2. Hot Spring Act

Drilling in pursuit of hot springs (hot water, mineral water, steam and other gas from underground) requires a permission of the prefectural governor.

## 3. Forest Law

Cutting down protected forests for constructing a base for drilling or a power generation plant requires delisting from protected status. Delisting requires a proven necessity for the public interest.

## 4. Act on Special Measures concerning Reform of National Forest Business Management

Constructing a base for drilling or a power generation plant in a national forest requires loaning. A national forest can be used for public use or within 5ha in area, otherwise it cannot be used.

## 5. The Environmental Impact Assessment Law

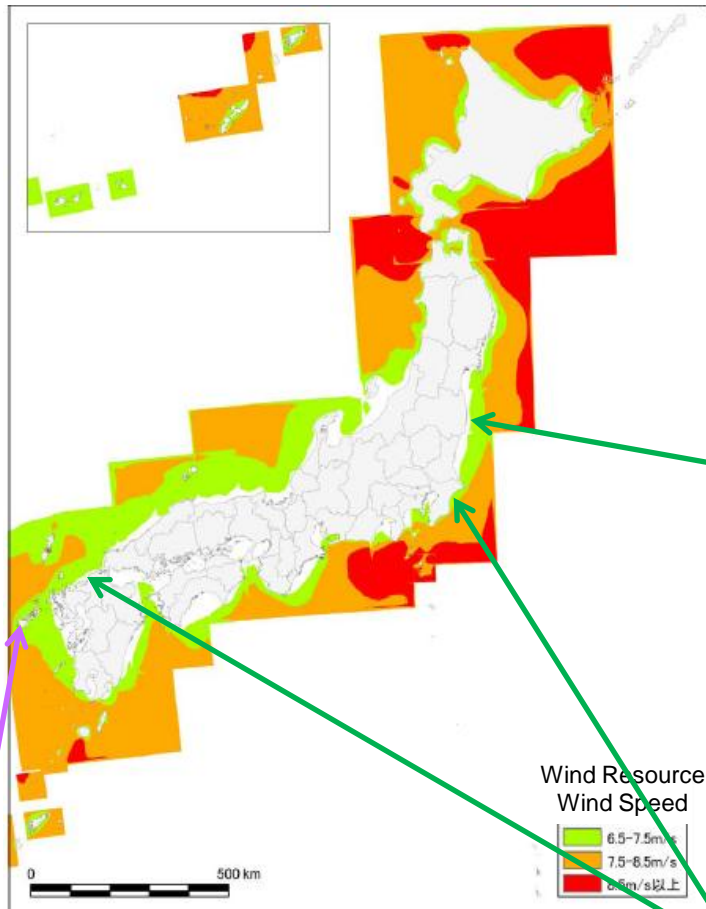
Constructing a power generation plant with output of 10,000kW or over requires EIA.

When constructing a power generation plant with an output of 7,500kW–10,000kW, the necessity of EIA is judged by project.

## 6. Electric Utilities Industry Law

Power facilities requires placing chief engineers in charge of supervision of safety matters of construction work, maintenance and operation of the power facilities.

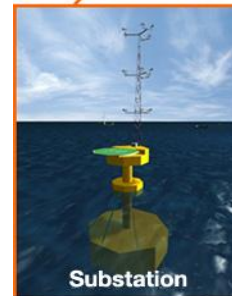
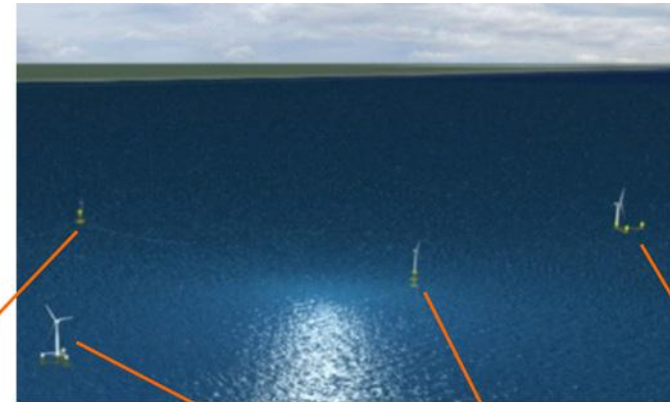
# Offshore Wind demonstration project



## Offshore of Fukushima Pref.

**METI**

2MW class Floating offshore wind turbine and  
2 set of 7 MW class floating wind turbine  
Floating substation from FY2013



## Offshore of Goto, Nagasaki Pref.(2.4MW)

**MOE**

100KW class floating wind  
turbine from FY2012  
2MW class floating Wind  
from FY2013



## Offshore of Choshi, Chiba Pref.(2.4MW)

/Offshore of Kitakyushu, Fukuoka Pref (2.0MW)

**METI (NEDO)**

2MW class wind turbine  
Wind observatory tower  
demonstration projects  
started from FY2012





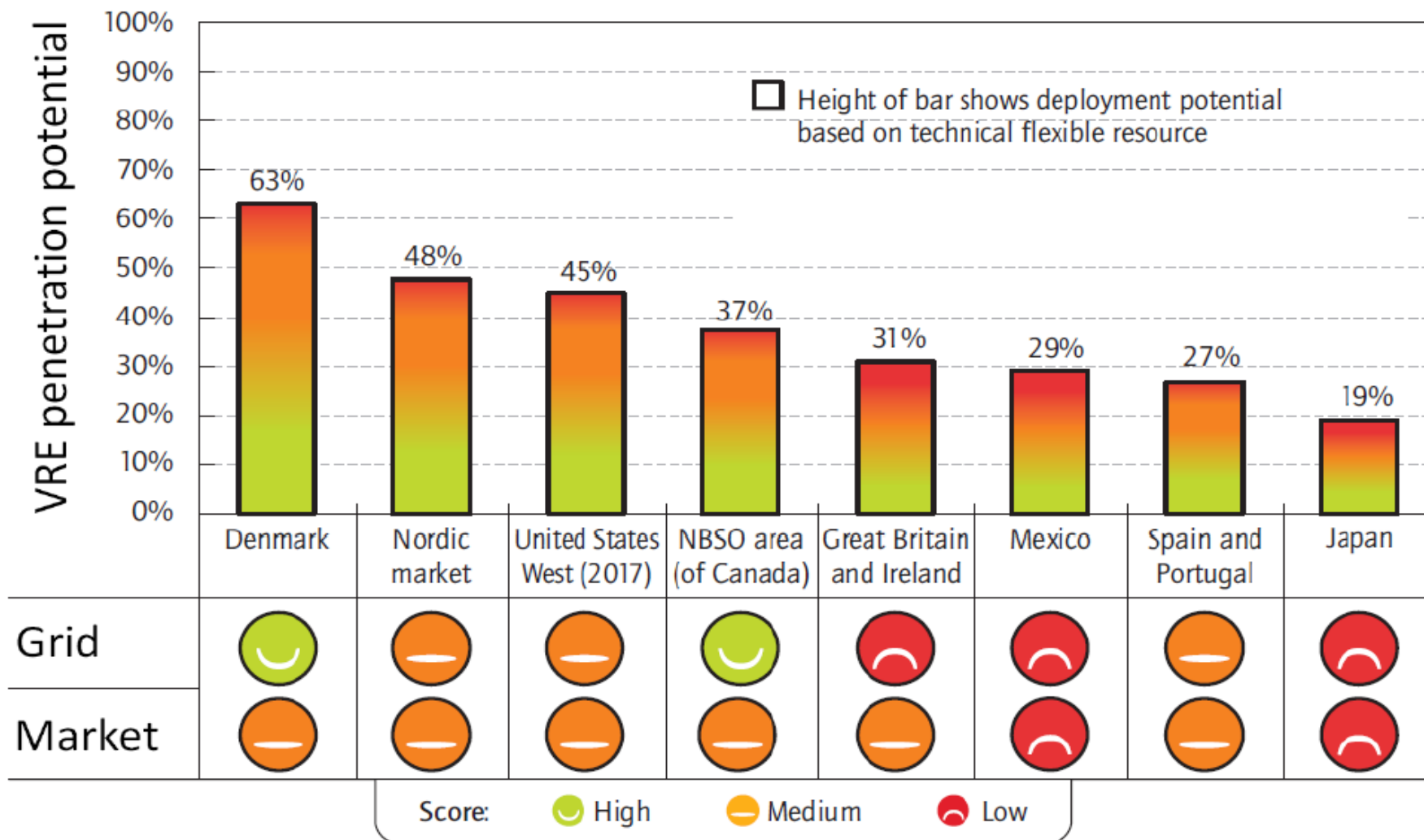
# Renewable Energy Deployment Potential in Japan -19%



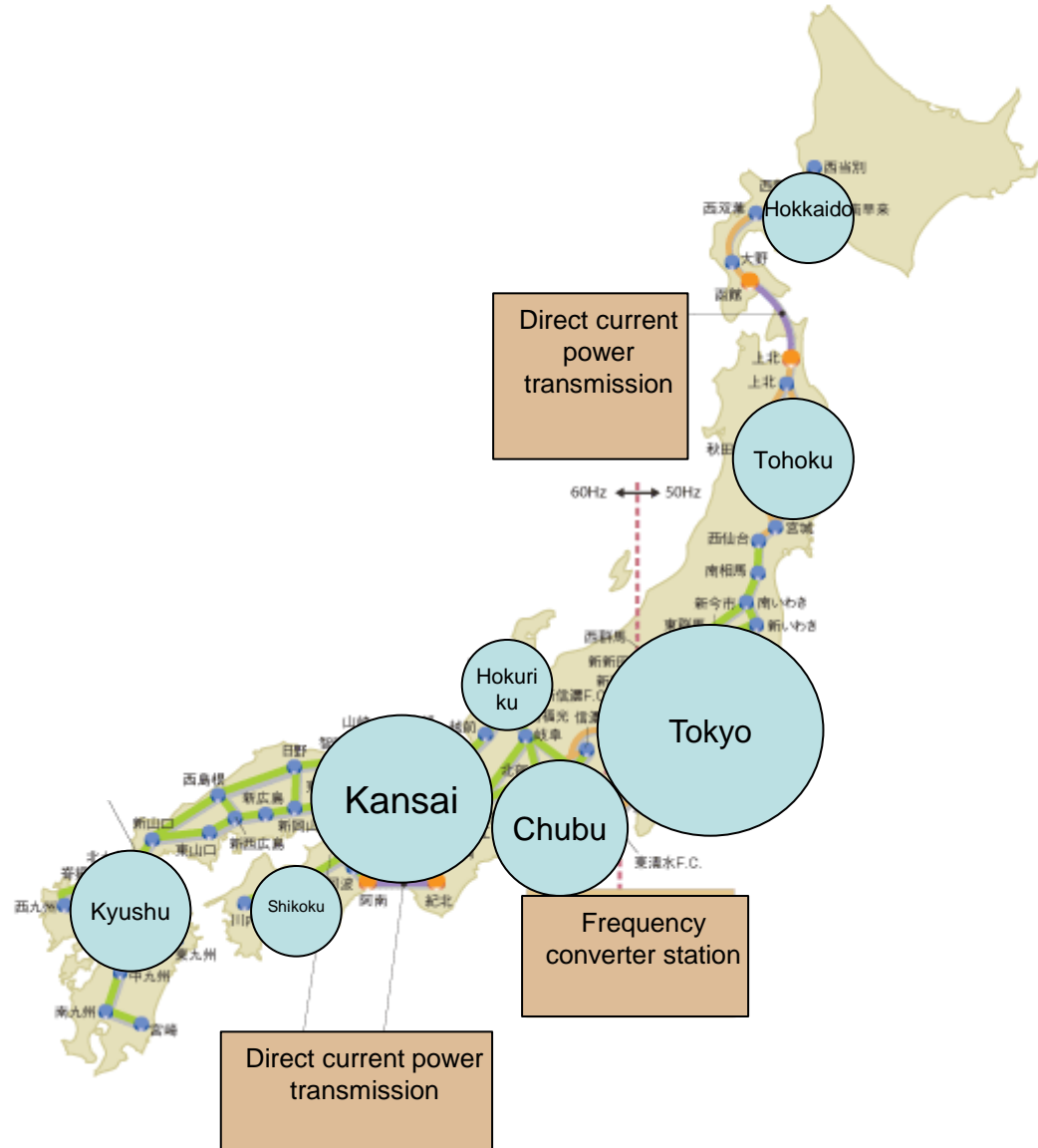
International Energy Agency

GIVAR

## Snapshot of present penetration potentials



# Grid Framework in Japan



# Solar and Wind Power Deployment Potential in Japan

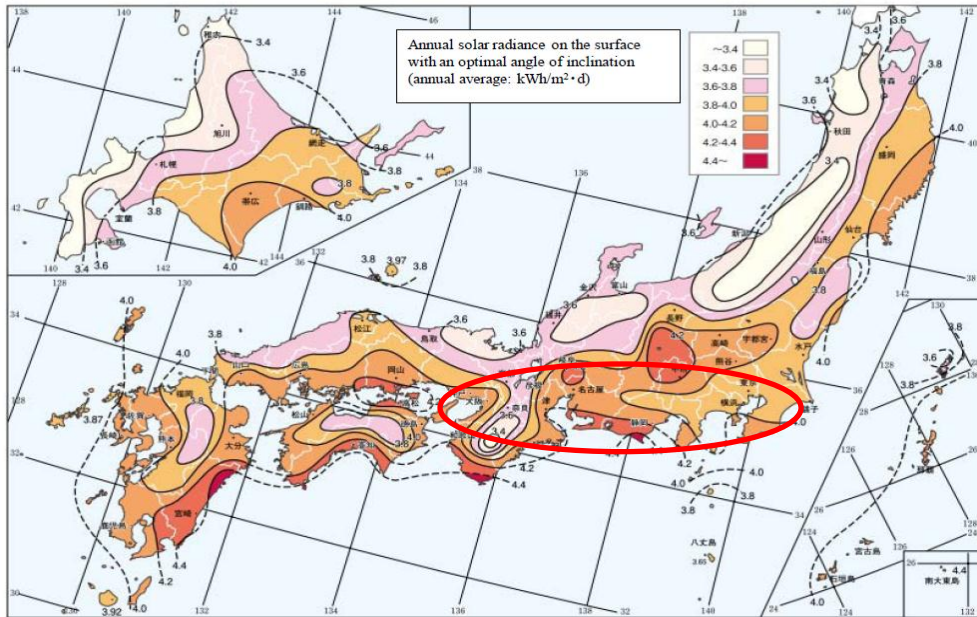
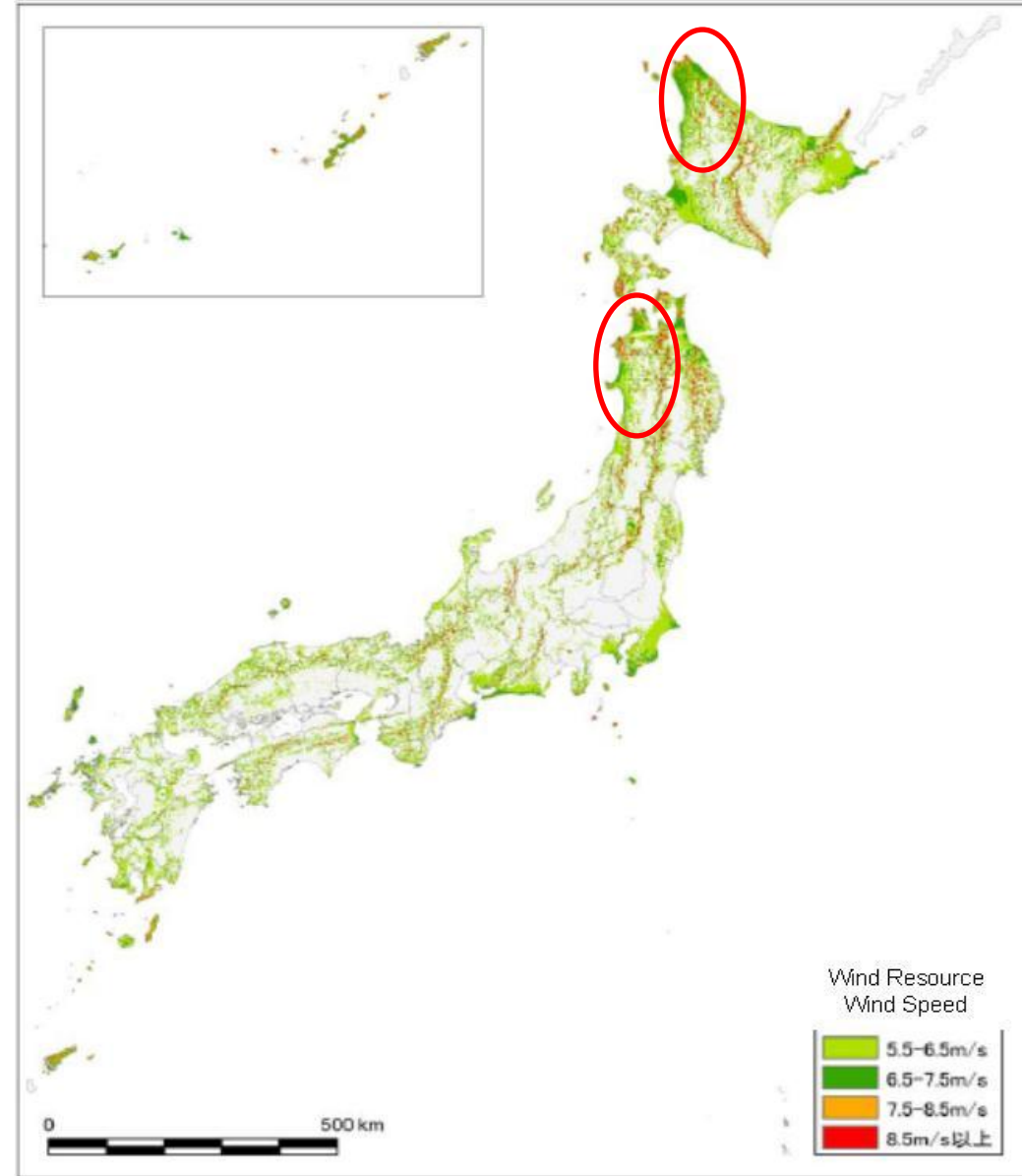


Fig. Annual solar radiance on the surface with an optimal angle of inclination in Japan (kWh/m<sup>2</sup>·d)  
Source: NEDO, Guidelines for PV Power Generation Field Test Project (Design, Construction and System), 2010



# Large Battery Demonstration Projects

Large Battery Demonstration Projects for Grid Stabilization

	Hokkaido Electric Company	Tohoku Electric Company	Chubu Electric Company Kansai Electric Company
Type of Battery	Redox Flow battery	Lithium-ion Battery	NAS Battery
Capacity	40MW	20MW	6MW
Project Objective	Surplus Electricity from Wind power	Frequency Fluctuation	Grid Stabilization from PV (Surplus Elec. & Frequency Fluctuation)

R&D Target : Cost reduction of batteries as same level as Pumped Hydro in 2020



Redox Flow Battery



Lithium-ion Battery



NAS Battery





Thank you  
for your attention!