IRENA

International Energy Storage Policy and Regulation Workshop

Policies and Regulations for Electricity Storage in Japan

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IEE JAPAN

Contents

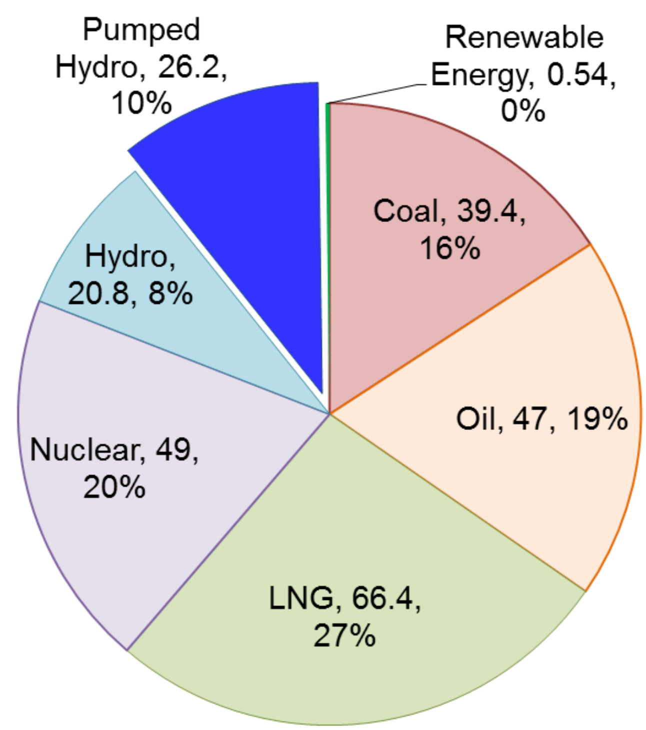
Electricity Storage in Japan

- Electricity storage is important for load leveling and reliability/quality improvement
- Pumped hydro stations are practically used for grid level storage in Japan. (26 GW)

- Construction of new pumped hydro stations was estimated to become difficult due to shortage of appropriate site and environmental concerns.
- By contrast, battery could be installed at any place.

Focusing on battery R&D

Generation Capacity(GW) by Energy Source



(*Source*) *IEEJ (end of 2011)*

Basic Energy Plan

- The previous **Basic Energy Plan** compiled in 2010 called for a boost in nuclear power to about half of Japan's electricity needs by 2030 from about one-third.
- After change of administration from LDP (Liberal Democratic Party) to DPJ (Democratic Party of Japan) and Great East Japan Earthquake on March 2011, energy policy in Japan have been moving to "zero-nuclear"..
- After change of administration from DPJ to LDP again, based on the discussion in the committee, the Japanese government made a **draft of the new Basic Energy Plan** on 25th February 2014.

  - A mix of nuclear, renewables and fossil fuel will be the most reliable and stable source of electricity to meet Japan's energy needs.
  - Not specified the exact mix, citing uncertain factors such as the number of reactor restarts and the pace of renewable energy development.

- Nuclear energy dependency will be reduced as much as possible, but that reactors meeting new safety standards set after the 2011 nuclear crisis should be restarted.

*(**Source**) Ministry of Economy, Trade and Industry*

Priority Issues of New Energy Policy

Sector		Contents	
Production	Diversify electricity source	Maximize introduction of renewable energy	Deregulation
			Promote wind and geothermal power, through enhancing grid, etc.
		Restart nuclear power plants once safety is assured	
		Introduce high-efficiency thermal power plants (coal and LNG) while considering the environmental impact	
	Diversify fuel source	Procure low-cost LNG	
		Promoting development of domestic energy sources including methane hydrate	
Distribution		Electricity market reform	①Full liberalization of generation and retail. ②Unbundling ③Nation wide transmission operation
		Strict assessment of power rate (Cut down fuel cost)	
Consumption		Enhance competitiveness and promote energy efficiency by installing cutting edge and efficient facilities in industries	
		Enhanced energy conservation by adding house/buildings	
		Promote efficient energy management systems such as demand response	

*(**Source**) Ministry of Economy, Trade and Industry (METI), modified by IEEJ*

Storage Battery Strategy (2012)

Storage Battery Strategy Project Team
in the Ministry of Economy, Trade and Industry (METI)

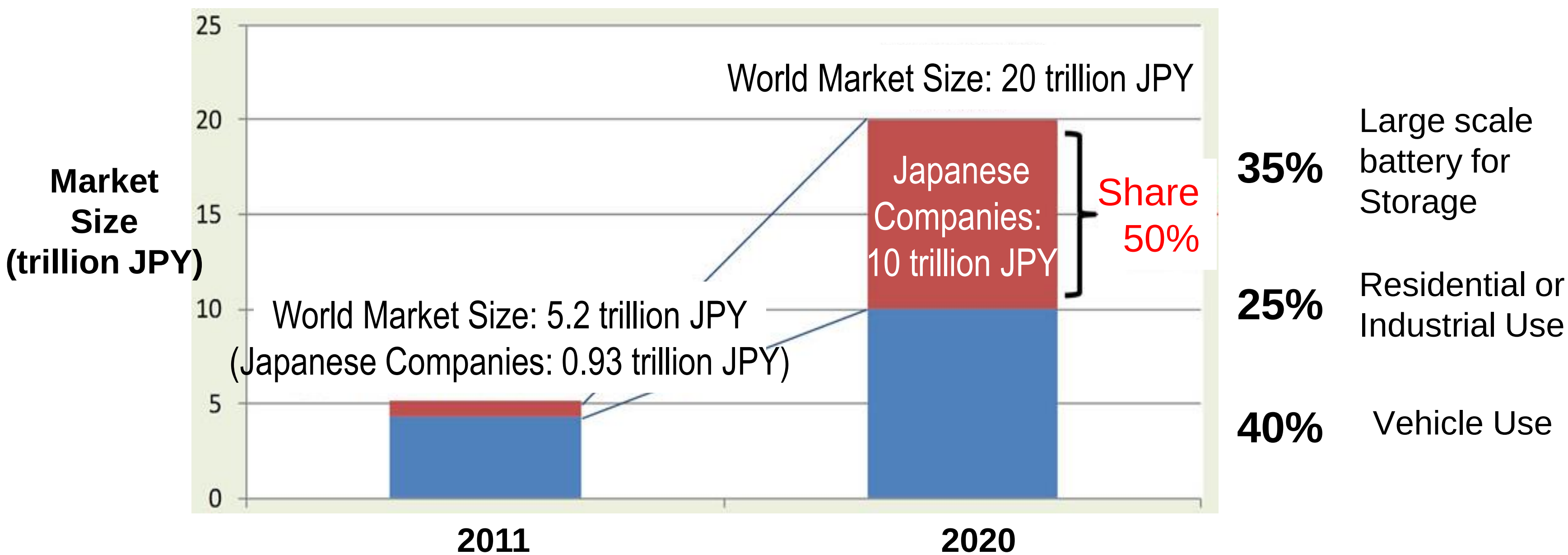
Commerce and Information Policy Bureau	Agency for Natural Resources and Energy	Manufacturing Industries Bureau
*responsible for battery **industry** and **information** policies*	*overseeing **energy policies***	*supervising **industrial policies** (application of storage batteries, next-generation vehicles*

- The goal of the team is to formulate and implement integrated strategic policies for storage batteries, including creation of future storage battery markets, industrial competitiveness enhancement, and international standardization of relevant technologies.
- The government will also create a certification system
  - transmission lines to facilitate linkage between them and storage batteries
  - formulating specifications and promoting international standardization for large lithium-ion batteries and other devices to ensure their safety

*(**Source**) Storage Battery Strategy*

Target for Installing Storage Battery

- METI announced its strategy on storage batteries in July 2012.
- The strategy aims that Japanese companies acquire about half of the world's storage battery market share by 2020.
- Within this share, a little more than one third is envisaged for large scale storage batteries.



(**Source**) *National Policy Unit, (modified by IEEJ)*

Technology Roadmap for Stationary Battery

- NEDO revised RM2010 in July 2013.

	Application	Present (end of FY2012)	around 2020	around 2030
Grid	Long-time fluctuating control	Life span 10-15 years **\50,000-100,000/kWh**	Life span 20 years **\23,000/kWh**	Life span 20 years expecting lowered
		Demonstration	Installation Start	Commercially Installation
	Short-time fluctuating control	Life span 10-15 years **\200,000/kWh**	Life span 20 years **\85,000/kWh**	Life span 20 years expecting lowered
		Demonstration	Start	Commercially Installation
Demand Side	Middle-scale grid, factory, building, apartment	Life span 10-15 years **\500,000-600,000//kWh**	Life span 15 years expecting lowered	Life span 20 years
		Demonstration	Spread Start	Spread Period
	Emergency, Disaster	Spread Start	(CEMS, FEMS, BEMS *Integration)*	
	Home	Life span 5-10 years **\100,000-250,000//kWh**	Life span 15 years expecting lowered	Life span 20 years
			Spread Start	Spread Period
	Emergency, Disaster	Spread Start	(HEMS *Integration)*	
	Wireless base station, data center backup	Life span 10 years **\200,000-400,000//kWh**	Life span 15 years expecting lowered	Life span 20 years
		Spread Start		Spread Period

*(**Source**) NEDO, "Battery RM2013", modified by IEEJ*

R&D Challenges for Batteries

Battery	Current Features	Challenges	Major Manufacturer
Li-ion	200 Wh/L 80 Wh/kg 100 W/kg	cost reduction, enhanced safety, temperature character, .overcharge, recycle technology	GS Yuasa, Hitachi, Hitachi Maxell, Mitsubishi Heavy Industry, NEC, Panasonic (Sanyo), Toshiba etc.
Lead Acid	40 Wh/L 10 Wh/kg 300 W/kg	discharge/charge efficiency, cycle degradation, corrosion, maintenance	GS Yuasa, Shin-kobe Electric Machinery etc.
NiMH	84 Wh/L 20 Wh/kg 100 W/kg	cost reduction, discharge/charge efficiency, energy efficiency, temperature character, rare earth	Kawasaki Heavy Industry FDK(Fujitsu) Panasonic (Sanyo) etc.
NAS	160 Wh/L	enhanced safety, cost reduction, energy efficiency, recycle technology	NGK Insulators
Redox Flow	8.5 Wh/L	environmental acceptability, cost reduction, durability, energy density, resource restriction	Sumitomo Electric
Common Challenges	cost reduction of power conditioner (inverter), long time backup (more than 24hours). V2H/V2G, secondary use, recycle, residual performance, standardization, etc.		

*(**Source**) NEDO, "Battery RM2013", modified by IEEJ*

Major Subsidy Programs in 2012-2013

Governing Agency	Program Name	Maximum Subsidy	Note
METI	Stationary Li-ion battery	1/3	Total 21bn JPY
	Large-scale battery	plan	-
	Stand alone renewable energy generation (with batteries)	1/2	less than 30m JPY
	Smart Energy System	1/3 (SMEs:1/2)	Earthquake affected area
	Smart Community	2/3	
	Renewable energy generation (with batteries)	1/3	
MOE	Storage battery for renewable energy generation	1/2	>1MW
	Renewable energy in local area	1/2	Total 1bn JPY

- METI: Ministry of Economy, Trade and Industry
- MOE: Ministry of Environment

(***Source***) *Several materials, (modified by IEEJ)*

Regulations for Electricity Storage

- In case of installation, applications and permissions are required.
- Some procedures have been simplified or removed for promoting batteries. (Deregulation)

Type	Regulations		Governing Organization
Guideline (Technical Requirement)	Technical requirements guideline of grid interconnection to secure electricity quality (2004, revised in 2013)		Ministry of Economy, Trade and Industry (METI)
	Grid Interconnection Code (JEAC 9701-2006) (superseded by JEAC 9701-2012.)		Japan Electric Association (JEA)
Low	Electricity Business Act	Required approval for large electricity storage system more than 80,000kWh	Ministry of Economy, Trade and Industry (METI)
	Fire Service Act	Dangerous material for more than 1,000ℓ organic electrolyte solution	Fire and Disaster Management Agency, Ministry of Internal Affairs and Communications
	Fire Prevention Ordinance	Required approval for large battery (4,800Ah/cell)	
	Building Standards Act	Construction application for building regarding to fire prevention property	Ministry of Land, Infrastructure, Transport and Tourism

Wakkanai Mega Solar Project

5MW Solar with 1.5MW NAS Battery

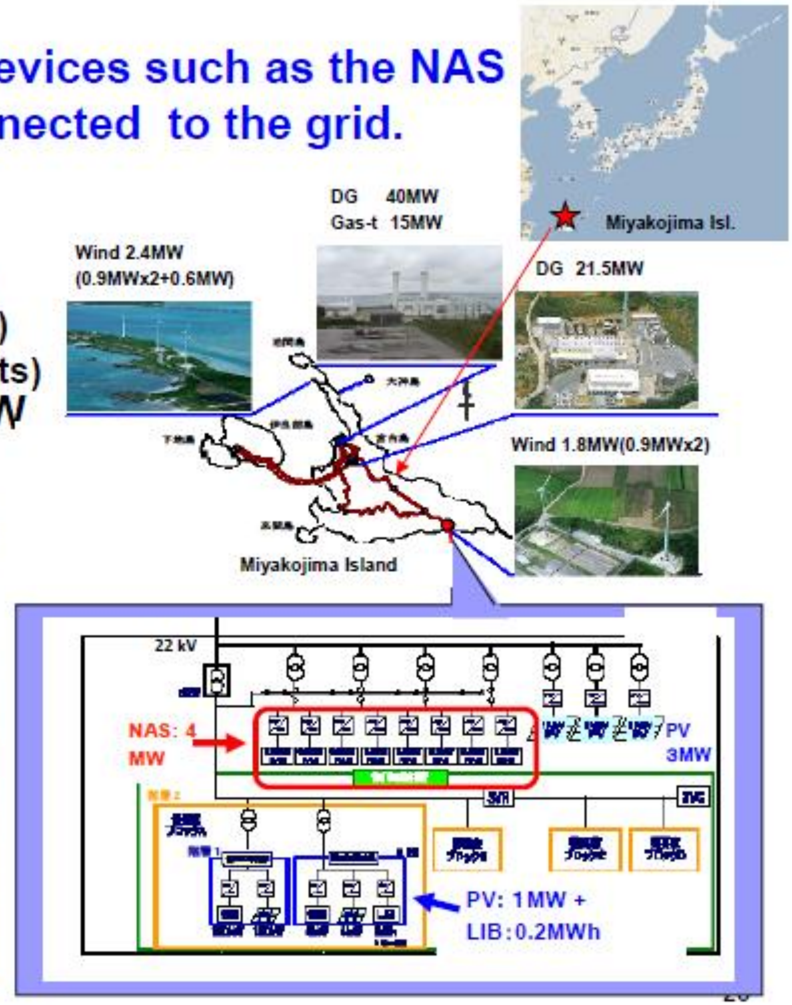
ほくでん
Hokkaido Electric Power Company, Incorporated

(***Source***) *NGK Insulators, Ltd.*

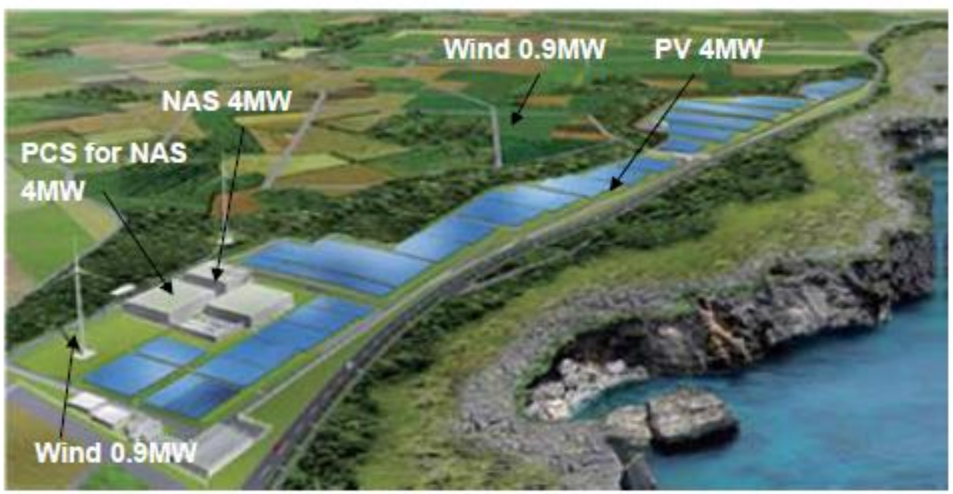
Miyakojima Remote Island Microgrids

Purpose:

•To demonstrate and test grid stabilization devices such as the NAS battery when PV & Wind generators are connected to the grid.



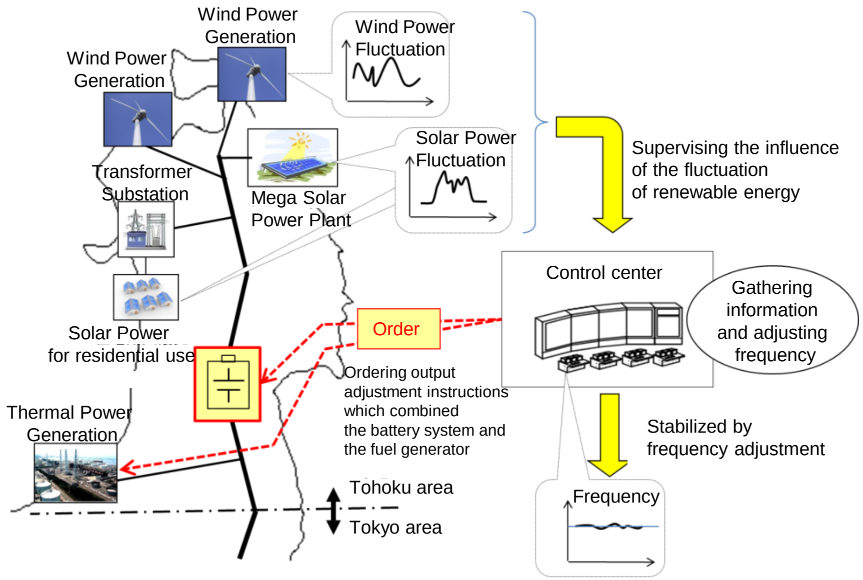
PV : **4MW** (Area : 45,000m²)
Wind : **4.2MW** (0.9MW x 4units + 0.6MW x1 unit)
Battery : **NAS battery 4MW** (0.5MW x 8 units)
Li-Ion battery 0.2MWh (8kWh x 25 units)
Existing : **DG 61.5MW + Gas-turbine 15 MW**
Operating from Oct., 2010.



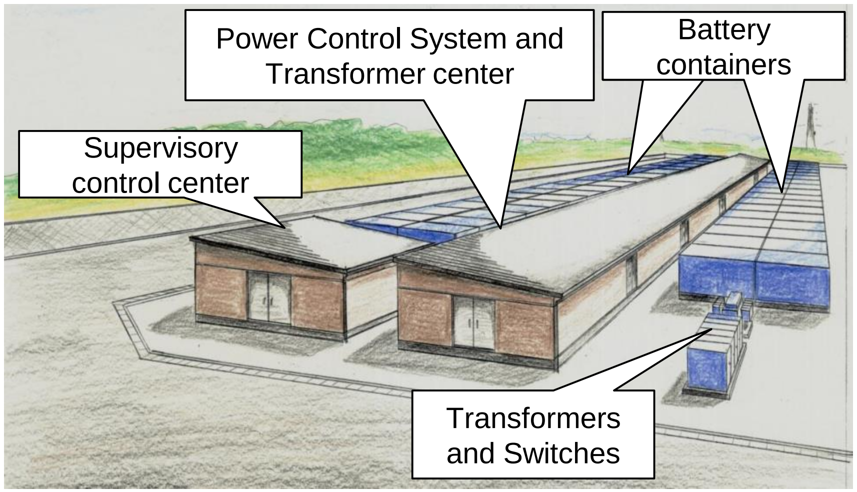
*(**Source**) NGK Insulators, Ltd.*

Large-scale Battery Energy Storage System

Tohoku Electric Power Co.,Inc.



Overview of battery system
(Toshiba)



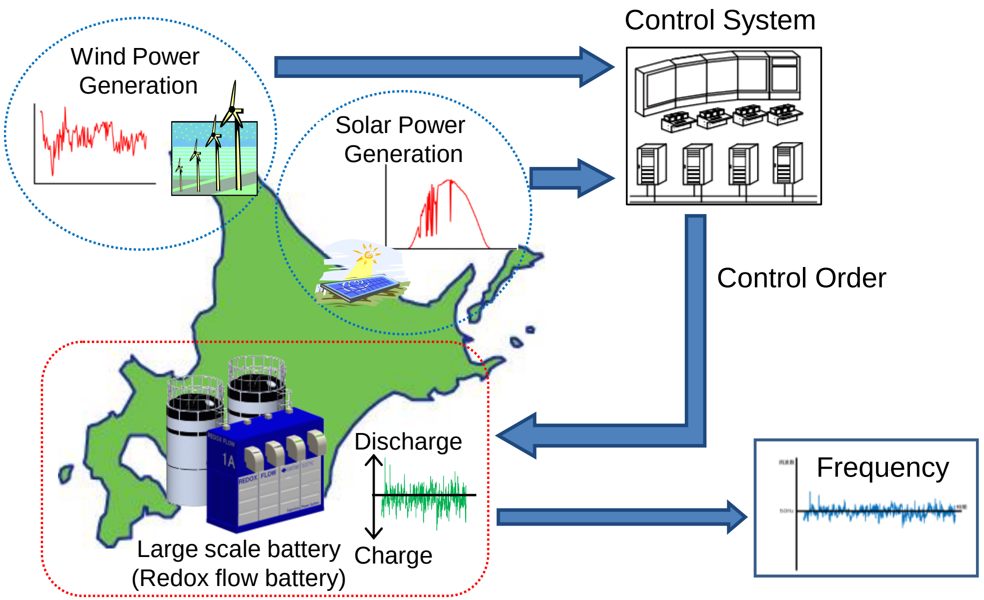
Conceptual drawing

Subsidized Company	Battery type	System Capacity	Location
Tohoku Electric Power Co., Inc.	Lithium ion Battery	20 MWh	Substation in Tohoku

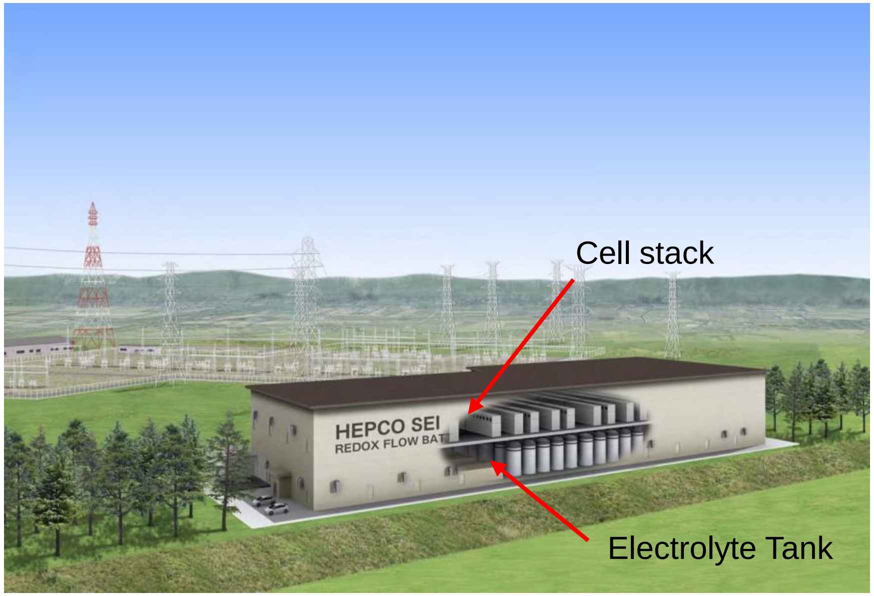
*(**Source**) NEDO.*

Multi-purpose Grid Storage Project

Hokkaido Electric Power Co.,Inc.



Overview of battery system
(Sumitomo Electric Industries)



Conceptual drawing

Subsidized Company	Battery type	System Capacity	Location
Hokkaido Electric Power Co., Inc. Sumitomo Electric Industries Ltd	Redox Flow battery	60 MWh	Substation in Hokkaido

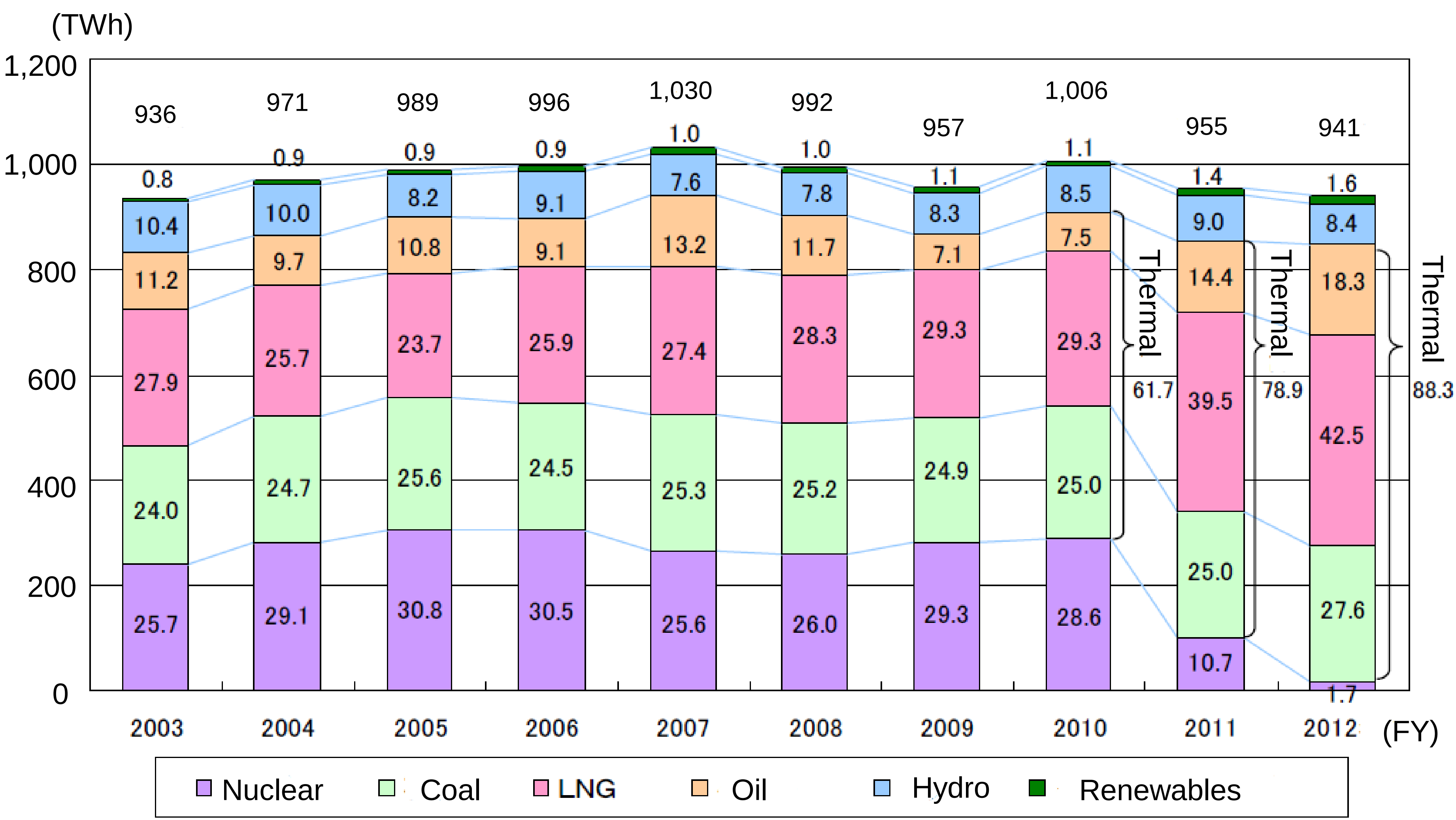
(***Source***) *NEDO.*

Summary

- Government of Japan is now redesigning **Energy Policy** after the Great East Japan Earthquake.
- **Storage Battery** is a core technology under the current tight electricity supply and demand situation.
  - promoting electric-load leveling for both the supply and demand sides
  - promoting distributed power sources system like smart-grid society
- Storage battery industry is expected to be a growth sector with a potential for market expansion.
- To develop this potential growth sector into a strategic industry, the government will accelerate sophistication, cost reduction and widespread use of storage batteries.
  - Subsidies for installations and demonstration projects (large-scale)
  - Grants for R&D
- Regulations are also being relaxed for expanding markets for batteries.

Reference

Trend of Power Generation In Japan

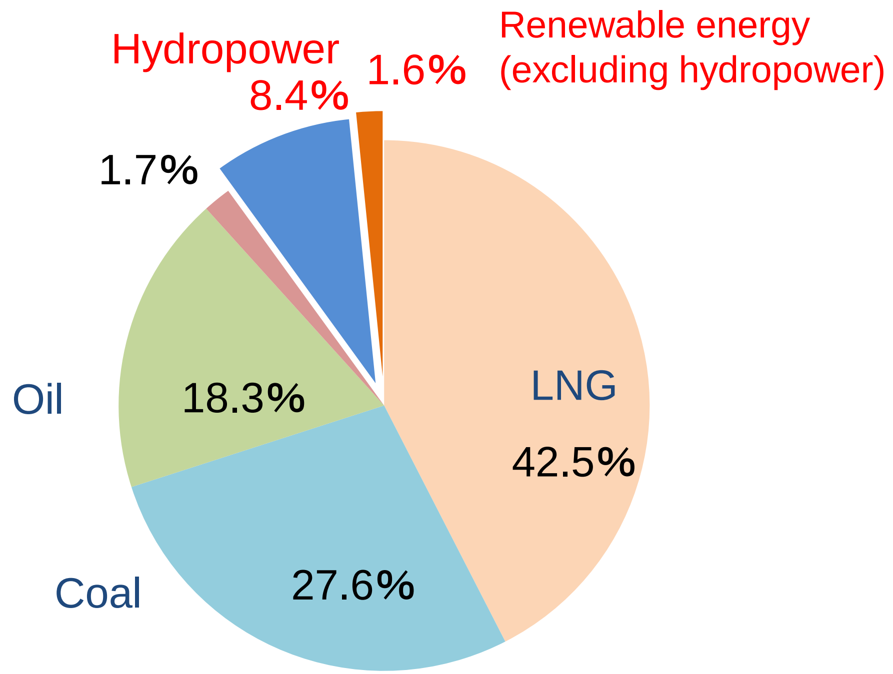


(*Source*) *Federation of Electric Power Companies of Japan*

Current Status of Renewable Energy in Japan

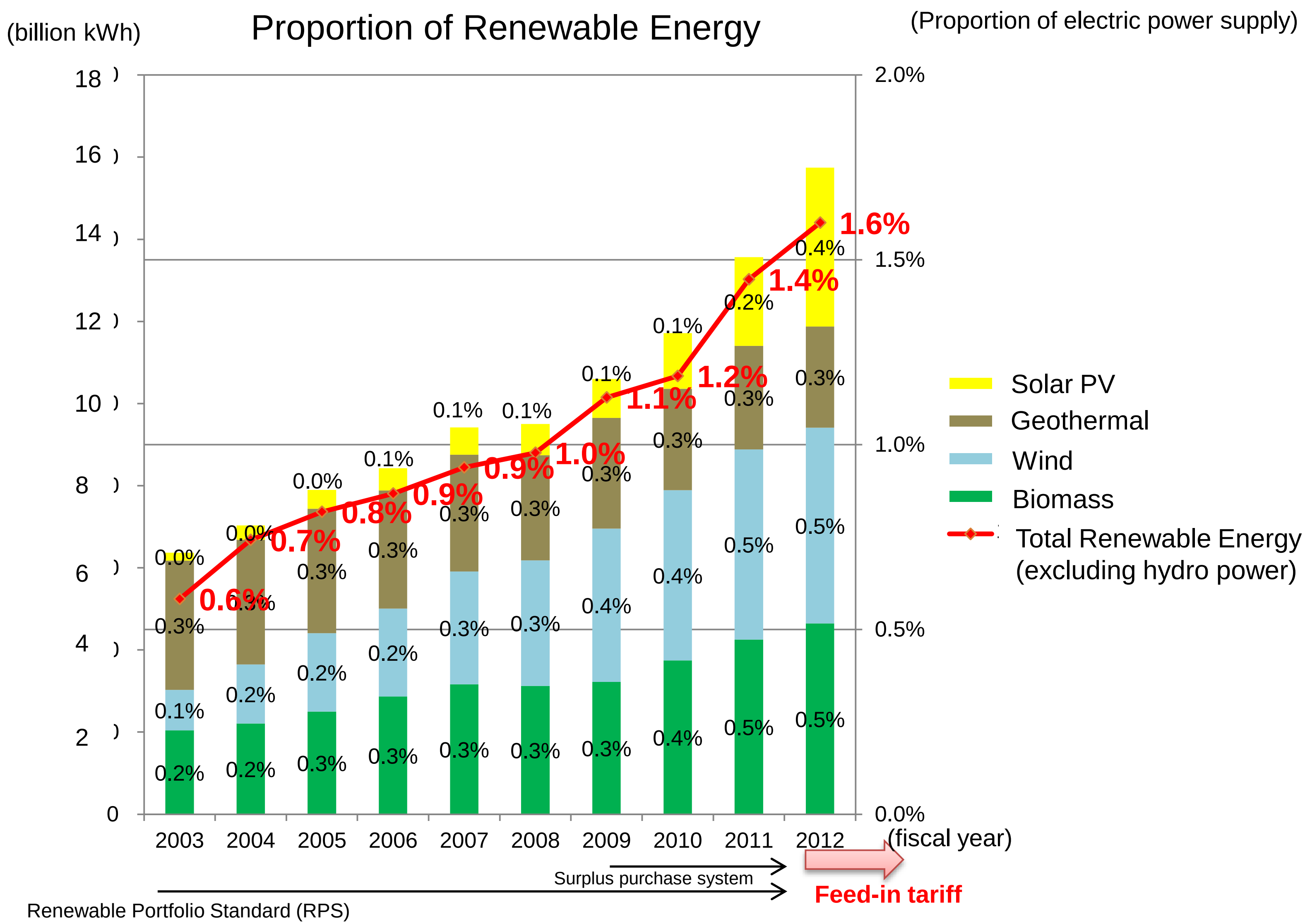
- Renewable energy accounted for approximately 10% of power generation in Japan before the March 11, 2011, Great East Japan Earthquake.
- More specifically, hydroelectric power generated by large-scale dams, etc., accounted for 9.0%, with solar PV, wind, geothermal and biomass power accounting for over 1%.

Composition of power generation by energy source in Japan (FY 2012)



(*Source*) *Federation of Electric Power Companies of Japan*

Proportion of Renewable Energy in Japan



*(**Source**) Ministry of Economy, Trade and Industry*