

CHP Market & Policy Movement in Japan

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Agenda

- 1 . **The Outlook of City Gas Industry in Japan**
- 2 . **The Fact of Japan's CHP Market**
- 3 . **The Recent Changes in Market's Sense of Value**
- 4 . **CHP Policy Movement in Japan**
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1 . The Outlook of City Gas Industry in Japan

Japan's Natural Gas Chain

- Japanese gas utility is so-called vertically integrated company.

Japan

Major gas utility in Japan

Gas Well

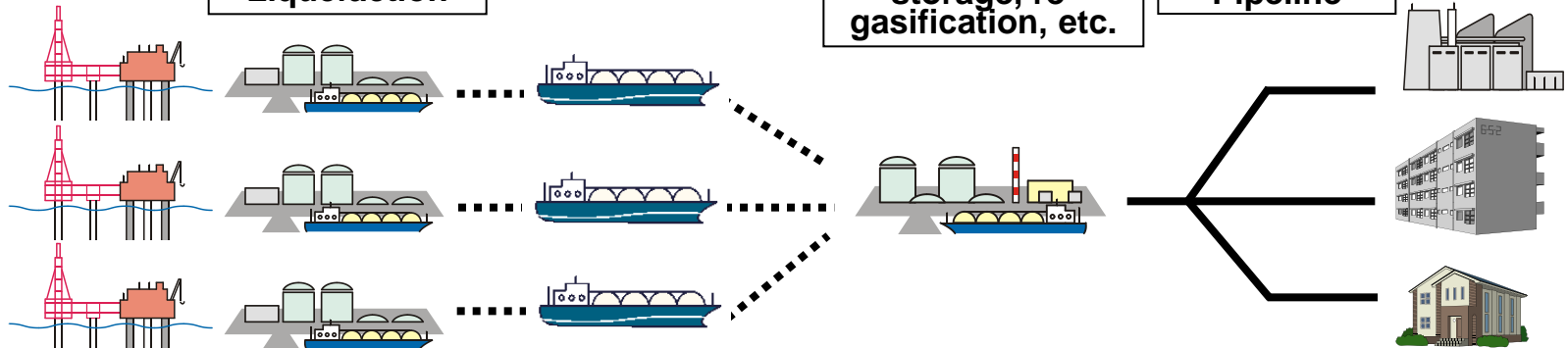
Gas Liquefaction

LNG Importing

LNG loading, storage, re-gasification, etc.

Distribution Pipeline

Customer



International trading

LDC (Local Distribution Company)

EU

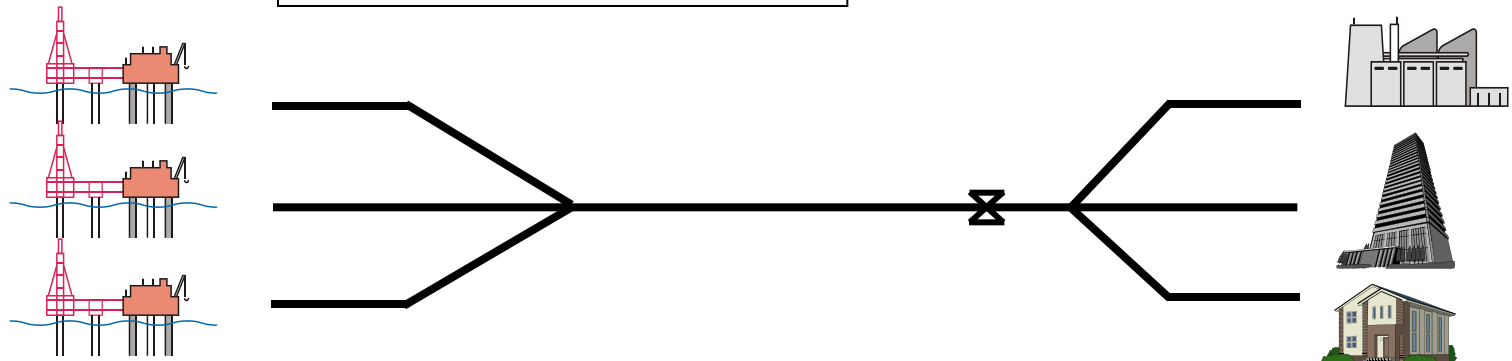
Gas Well

TSO

City Gate

DSO

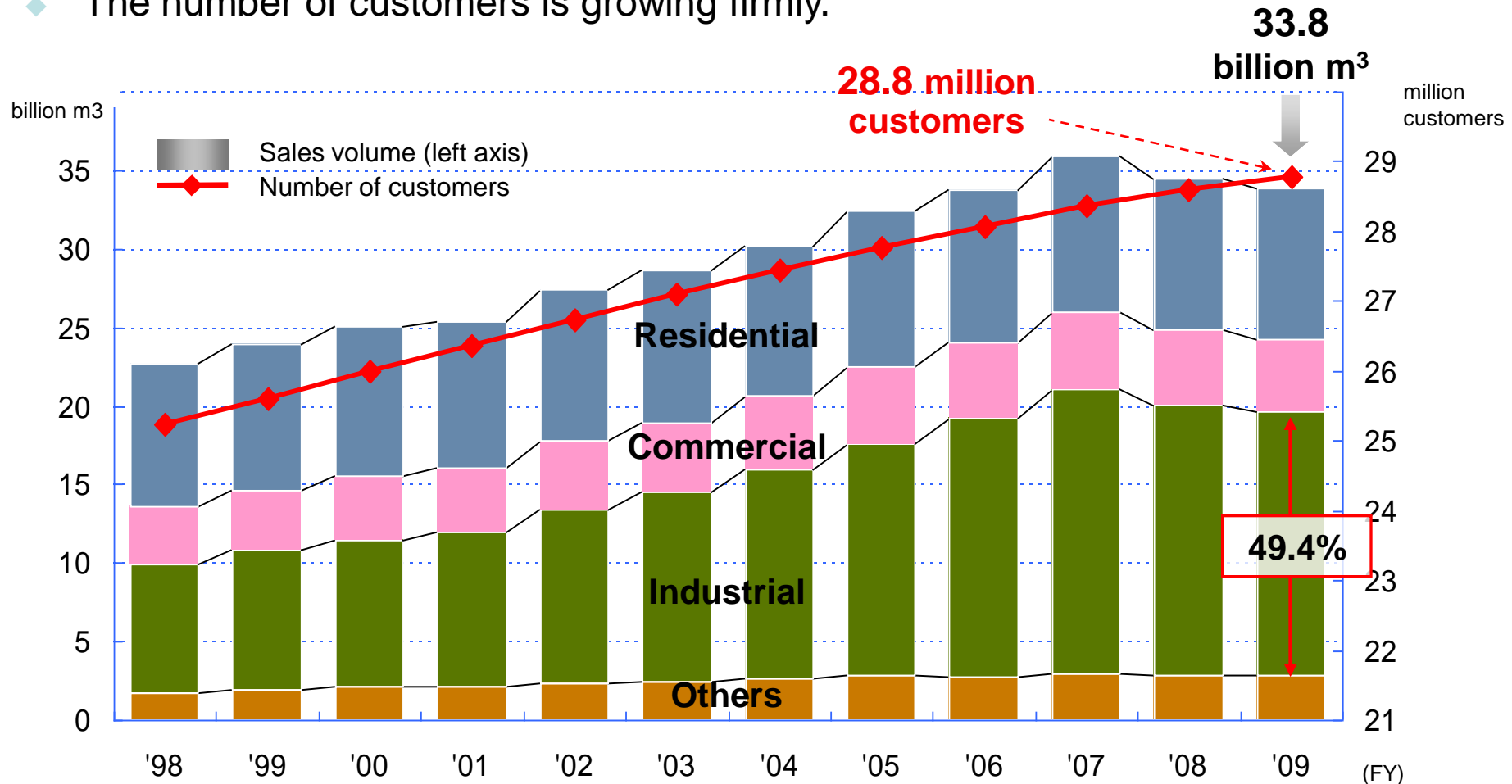
Customer



DSO (Distribution System Operator)

Total Gas Sales Volume and Number of Customers

- Gas sales grew continuously for more than 30 years, but annual sales fell in 2008 for the first time due to the global recession.
- The number of customers is growing firmly.



●Residential: General households (cooking, water heating, air cooling and heating, drying, etc.)

●Commercial: Companies/business establishments, wholesale/retail stores, restaurants, inns/hotels, department stores/supermarkets, beauty parlors, dry cleaning stores, amusement/entertainment facilities, boarding houses/dormitories, etc.

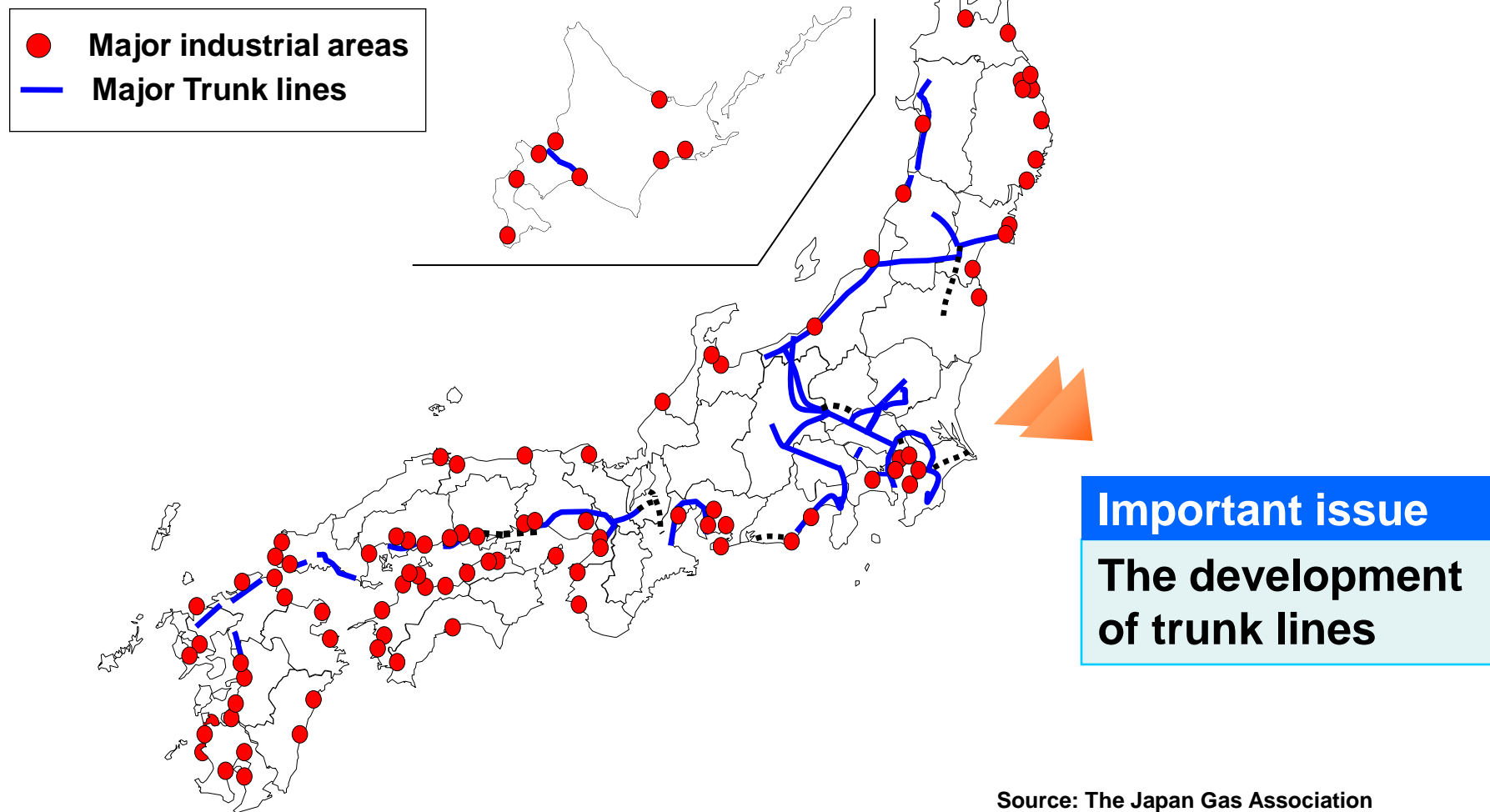
●Industrial: Manufacturers, etc. in fields such as foodstuffs/food products, textiles, paper/pulp, chemicals, ceramics/earth/stone, steel, non-ferrous metals, metals, machinery, etc.

●Others: Schools, public agencies, hospitals, clinics, medical offices, etc.

Source: The Japan Gas Association

Major Industrial Areas and Development of Trunk Lines

- ◆ Meanwhile, many industrial areas have no natural gas supply due to the inadequate pipeline networks.
- ◆ This fact has significant impact of the diffusion of gas fired CHP.

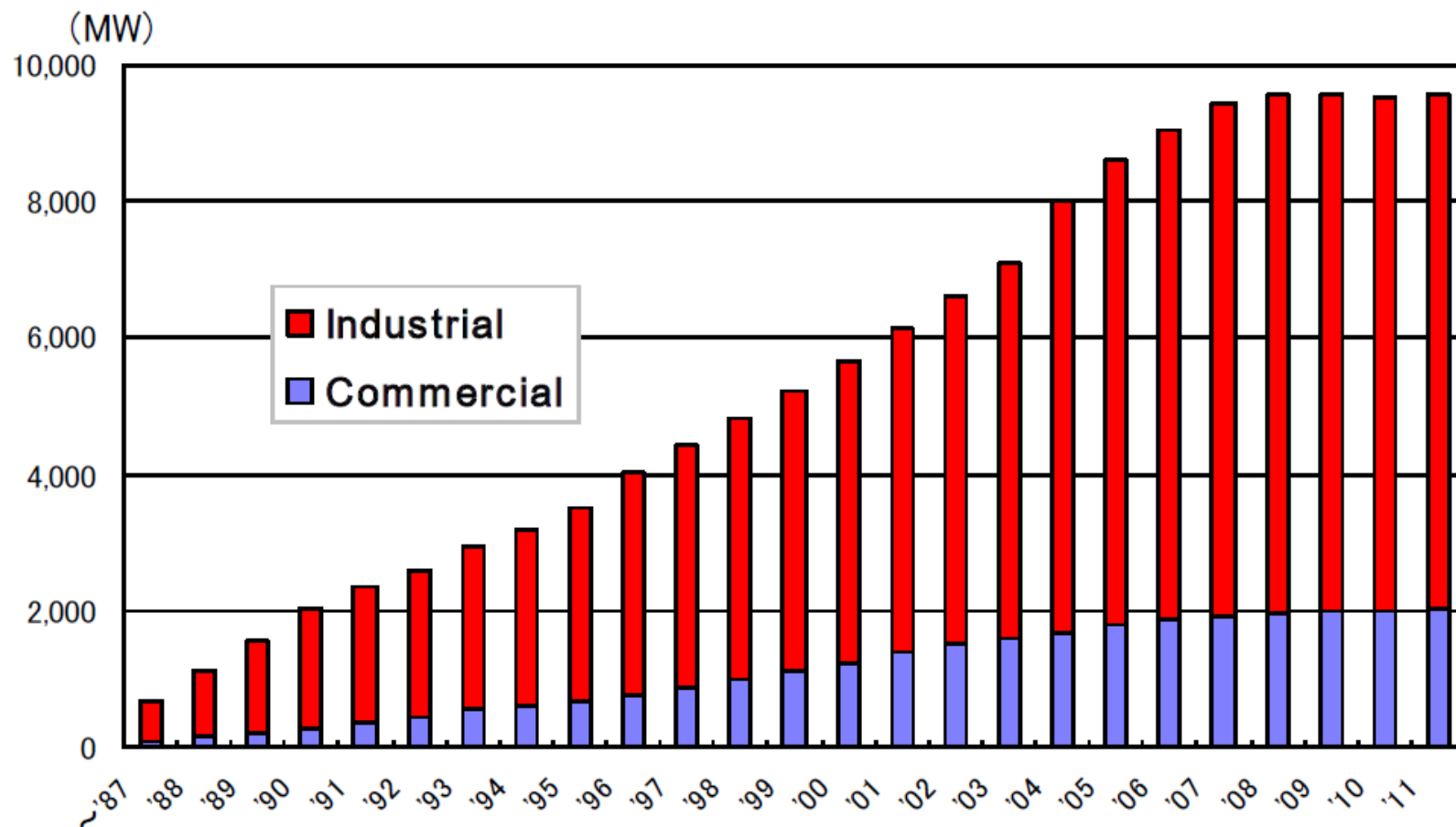




2. The Fact of Japan's CHP Market

Japan's CHP market situation by capacity

- Existing CHP in 2011: 9.5GW(8783sites)
- Industrial users represent 79% of CHP capacity.

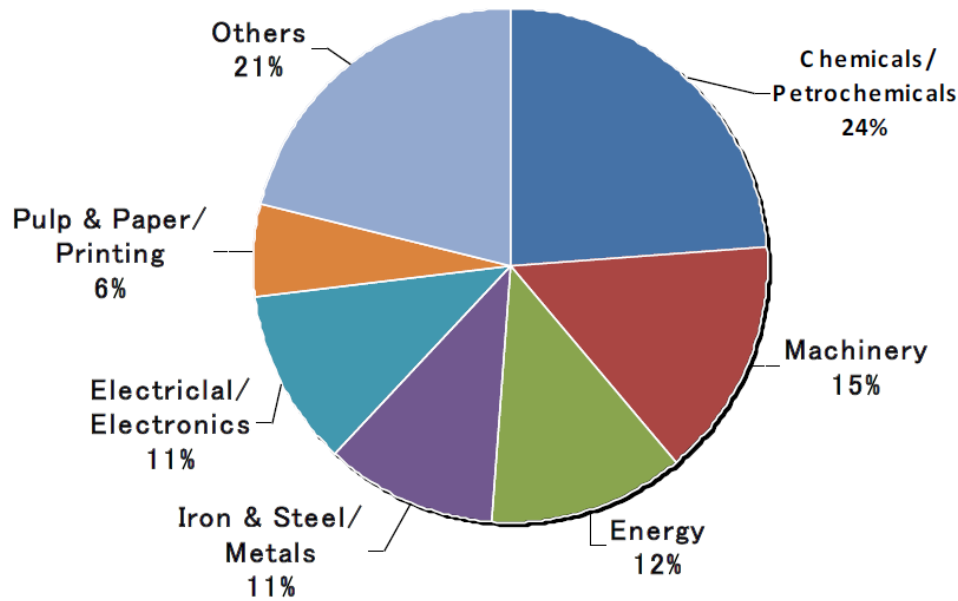


Source: The Advanced Cogeneration & Energy Utilization Center Japan

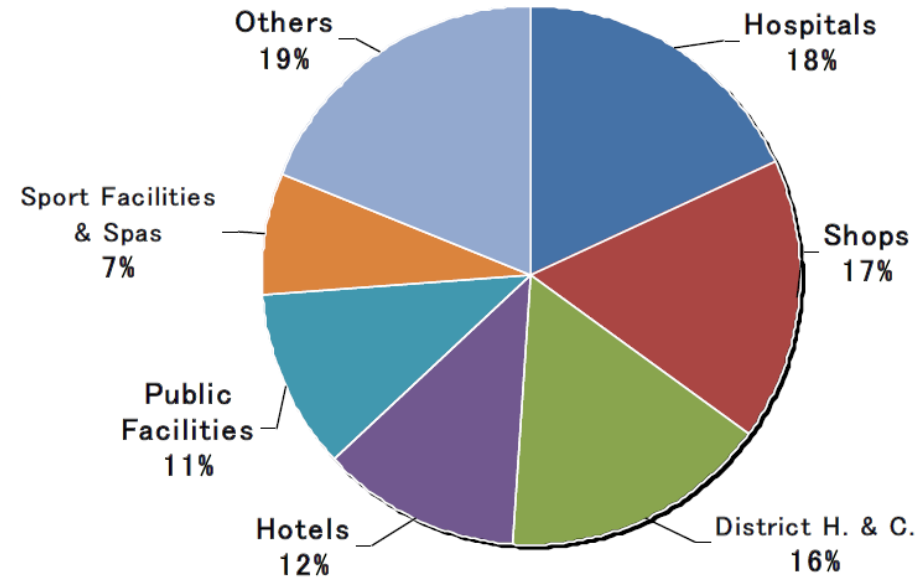
Japan's CHP market situation by application in Industrial & Commercial

- ◆ In industrial segment, CHP capacity is found in various industries , such as chemicals, petrochemicals , machinery, and energy , etc..
- ◆ In commercial segment, hospitals , shops , DHCs , hotels , public facilities , sport facilities & Spas represent more than 80% of commercial CHP capacity.

Industrial Segment



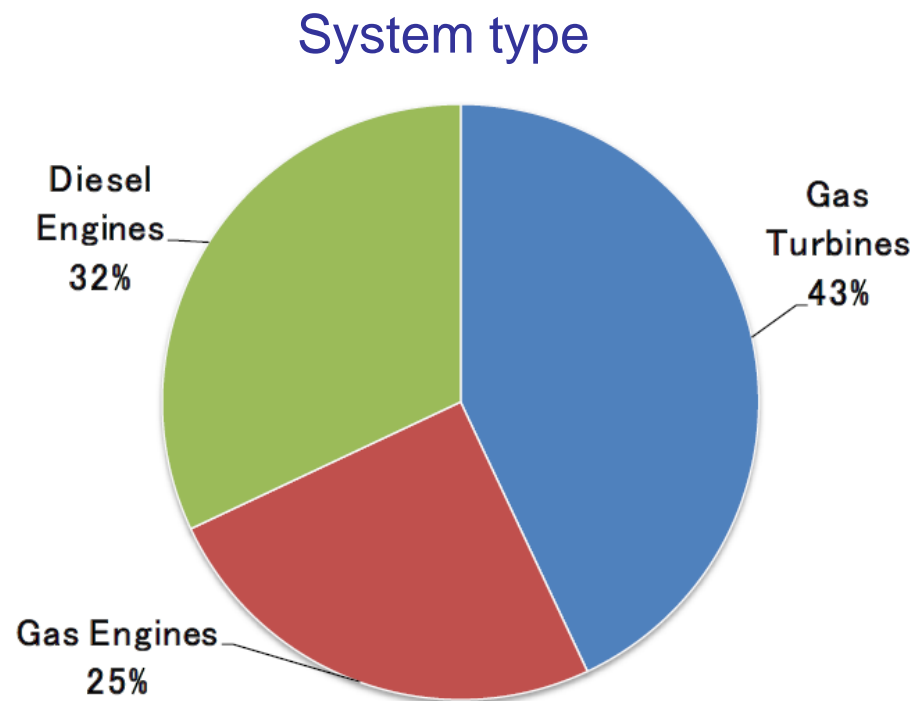
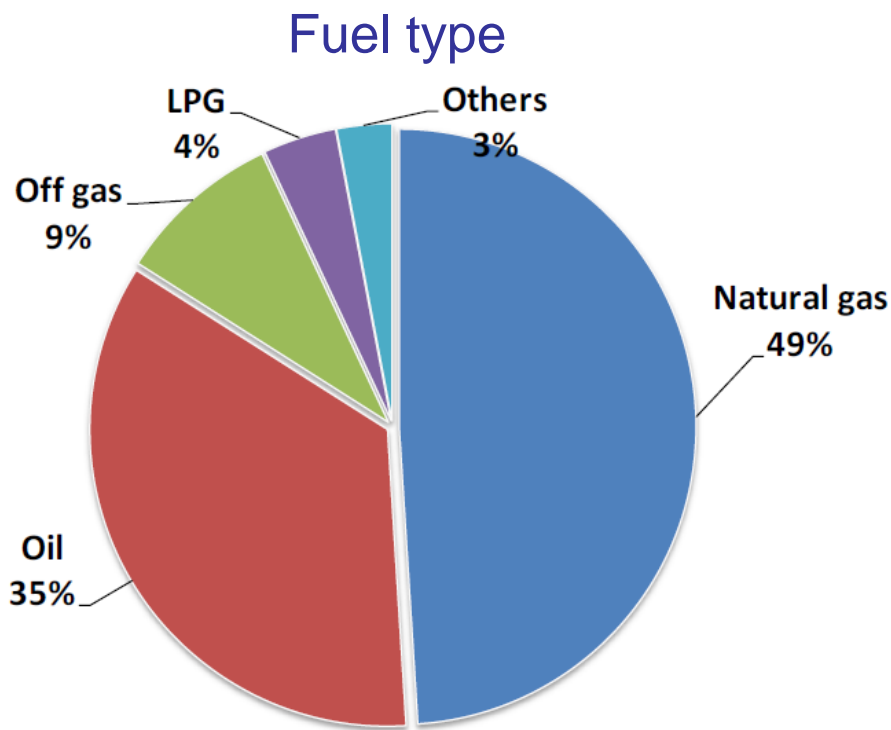
Commercial Segment



Source: The Advanced Cogeneration & Energy Utilization Center Japan

Japan's CHP market situation by Fuel type & System type

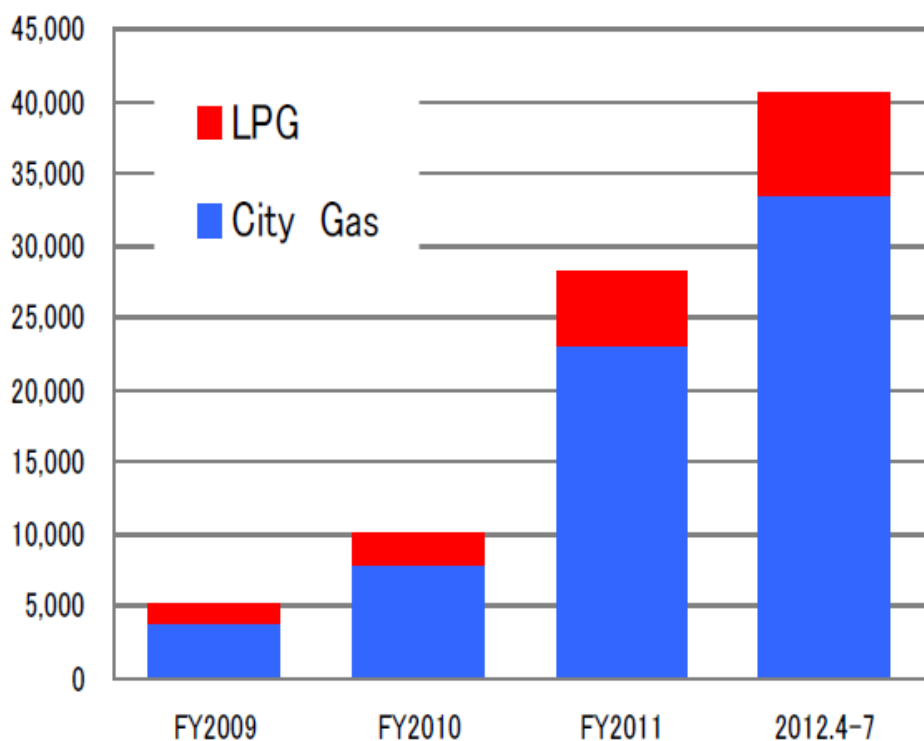
- ◆ Natural gas & oil represent more than 80% of CHP fuel.
- ◆ Gas turbines are predominant in industrial applications , while gas engines are the most widespread in commercial applications.



Source: The Advanced Cogeneration & Energy Utilization Center Japan

Japan's CHP market situation of Fuel-Cell micro CHP

- ◆ Fuel-Cell micro CHP named “Ene Farm” was launched to the residential market in 2009.
- ◆ It has been accelerating the pace of introduction and development.
- ◆ METI(Ministry of Economy ,Trade and Industry) support the diffusion of Fuel-Cell through national subsidy of more than 4 billion \$ in 2012.



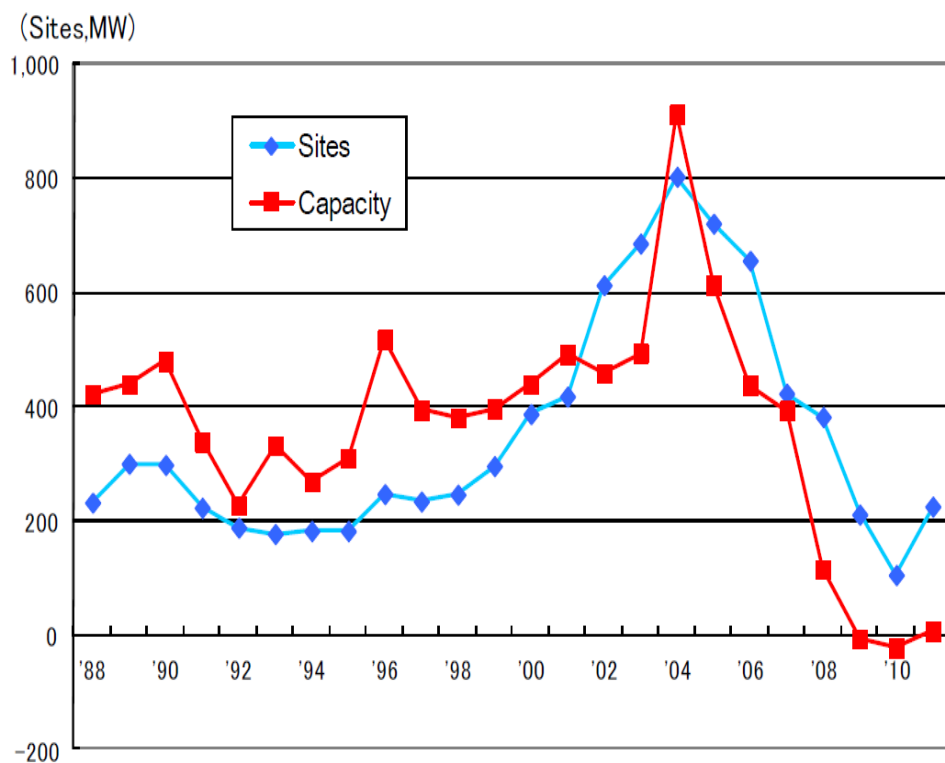
Items	ENEOS (SOFC)	Panasonic (PEFC)	Toshiba (PEFC)		Aisin (SOFC)
Fuel	LPG/City gas	City gas	LPG	City gas	City gas
Power output	700W	750W	700W		700W
Generation efficiency (LHV)	45%	40%	37.5%-	38.5%-	46.5%
Thermal efficiency (LHV)	42%	50%	55.5%-		43.5% (overall efficiency 90%)
Generator's Dimensions (mm) Weight (kg)	563W × 900H × 302D 90kg	315W × 1883H × 480D 100kg	780W × 1000H × 300D 94kg		600W × 935H × 335D 94kg
Water storage unit's dimensions (mm), tank size (liter), weight (kg)	740W × 1760H × 310D 90L 94kg	750W × 1883H × 480D 200L 125kg	750W × 1760H × 440D 200L 100kg		740W × 1760H × 310D 90L 94kg

Appearance

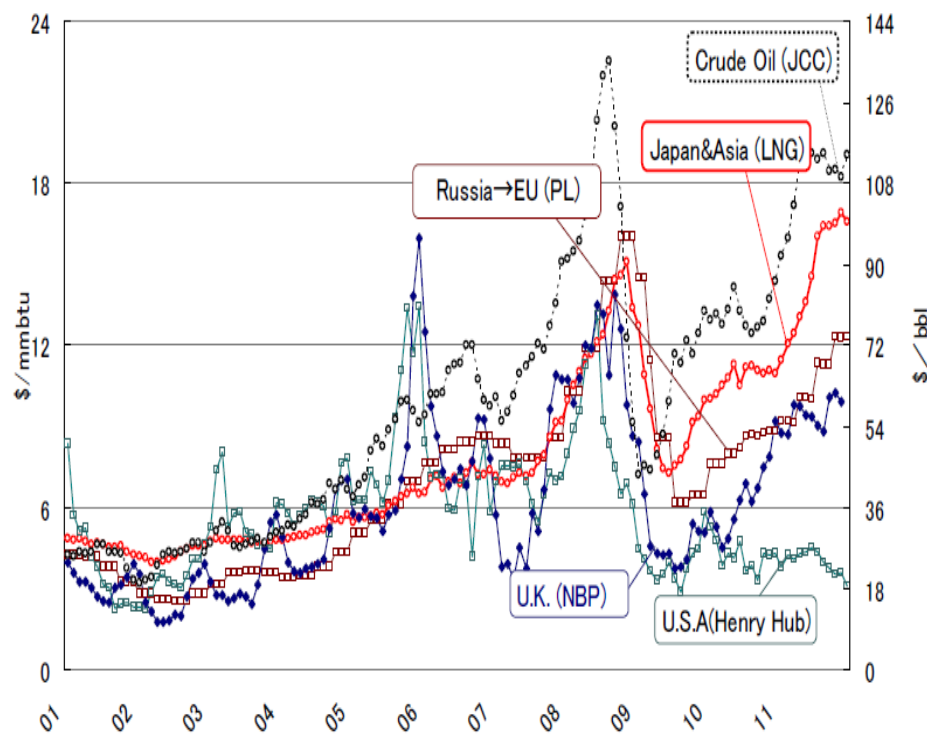


Japan's CHP market dynamic state

- ◆ CHP capacity growth has slowed since late 2000's.
- ◆ New CHP capacity additions have been below 200MW since 2008.
- ◆ Relatively high LNG price and low electricity prices has reduced the competitiveness of gas-fired CHP at this moment.
- ◆ On the other hand, recent electricity prices are increasing due to the change of power portfolio of electricity companies.



Source: The Advanced Cogeneration & Energy Utilization Center Japan



Source: WGI Trade Statistic of Japan



3 . The Recent Changes in terms of Market's Sense of Value

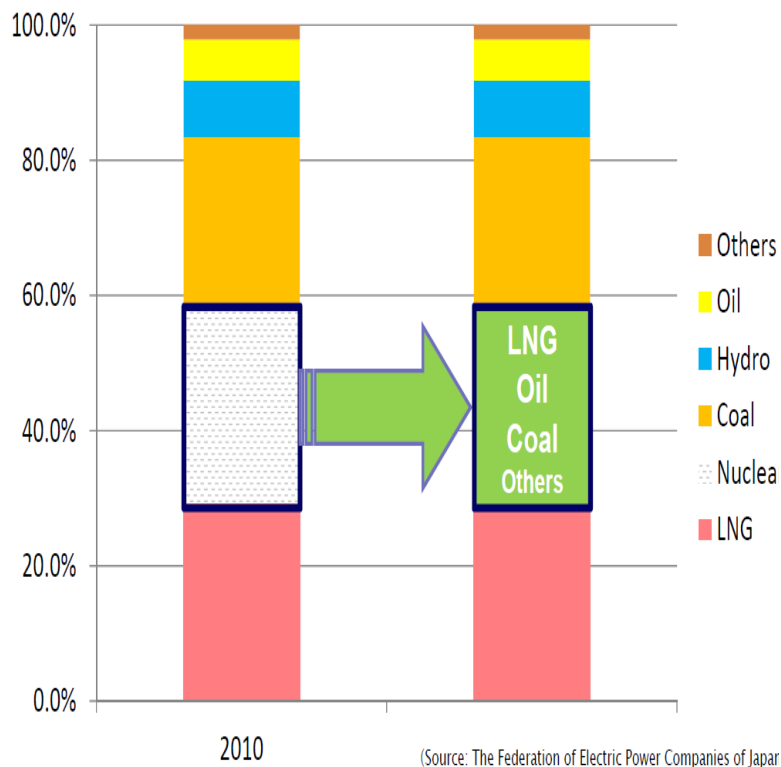
The change in sense of value related to energy

- ◆ Since the Great East Japan Earthquake, there has been significant change in the value related to energy .
- ◆ The major change in the value is “Centralized electric power supply system is not always perfect”. Because not only NUC but also many thermal power plants are damaged by Tsunami, severe electricity shortage occurred in 2011.
- ◆ Therefore, **sense of BLCP(Business & Life Continuity Plan)** are arising against security of electricity supply in various market segment.

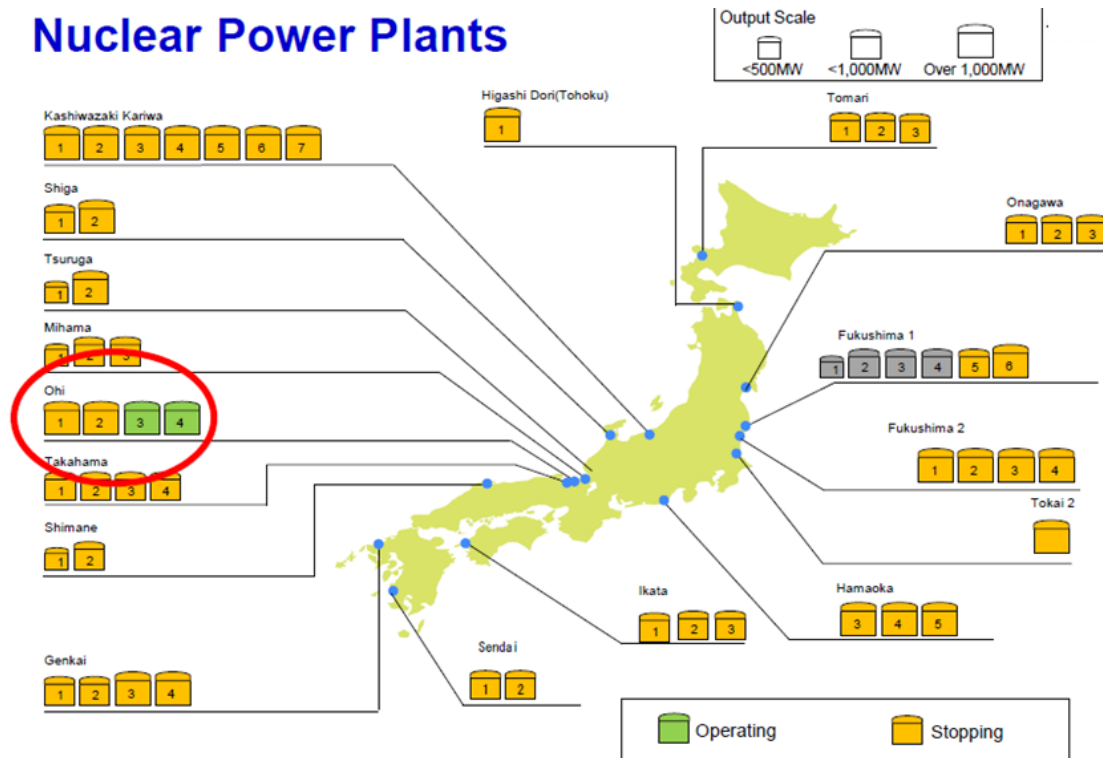


Electricity shortage & increasing price

- ◆ Electricity shortage and increasing price are caused by the stop of NUC.
- ◆ The average increasing rate is 20% in commercial and industrial segment.
- ◆ In peak demand season, Japanese government issue mandatory or voluntary electricity conservation order to avoid blackout currently.

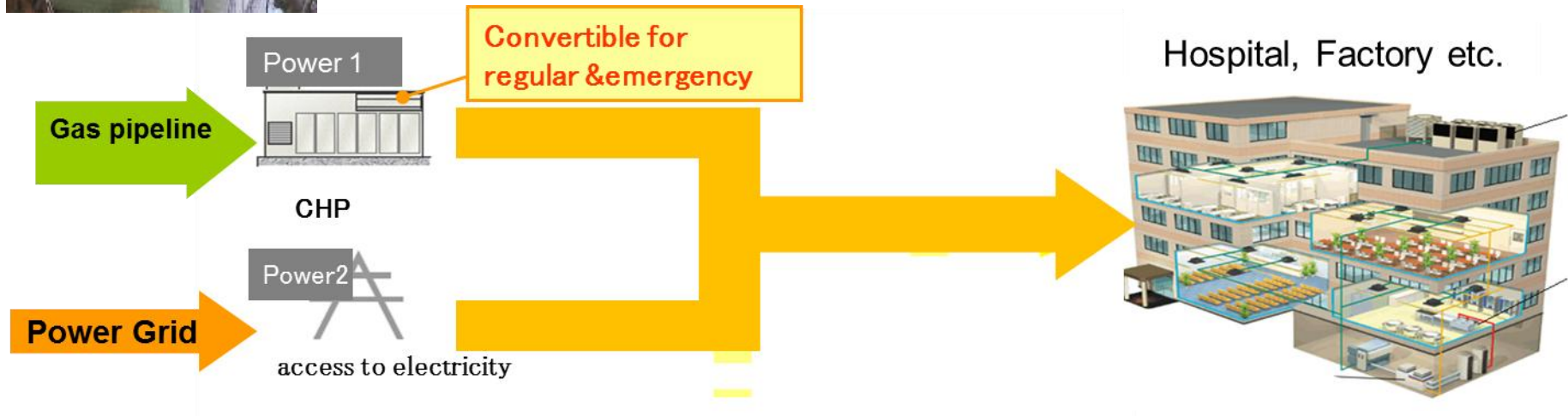


Nuclear Power Plants



Solution for the issues related to electricity through CHP

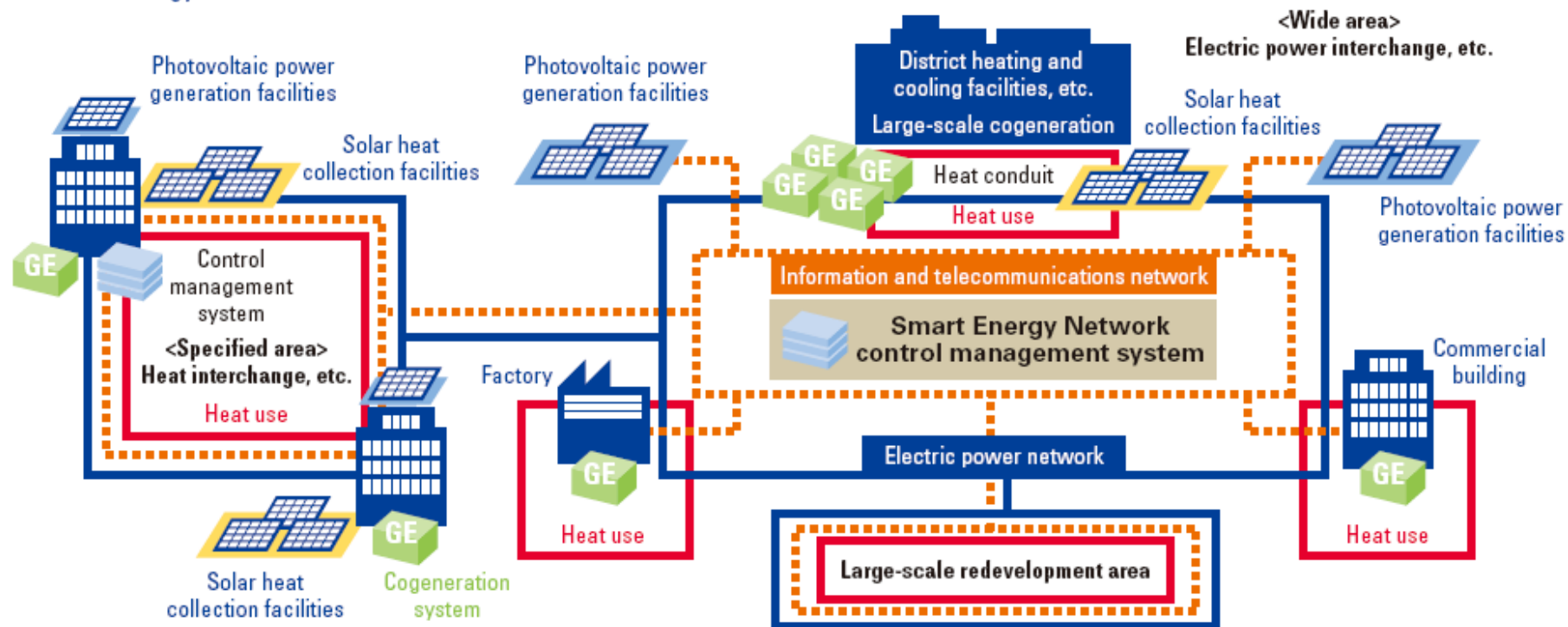
- ◆ Some CHP in the disaster area continued to supply electricity to the hospitals, evacuation center in the event of the earthquake.
- ◆ In terms of BLCP, We can propose CHP installation to the customer not only for energy saving but also power redundancy.



Solution for the issues related to electricity through Smart community equipped with CHP

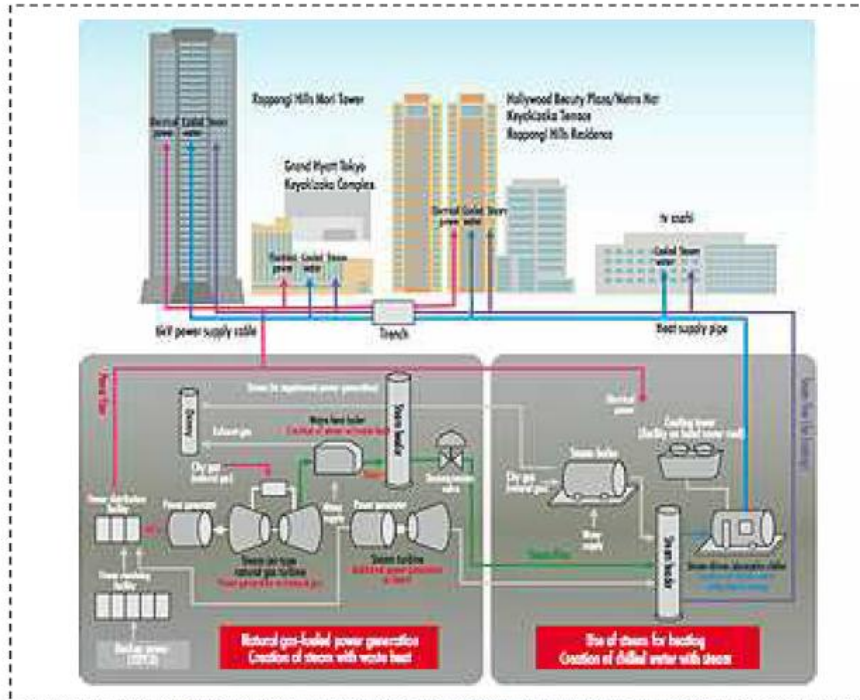
- ◆ Area-wide energy system for the efficient use of energy by networking multiple distributed energy sources, controlled by ICT.
- ◆ While promoting maximum usage of renewable energy, stable & reliable energy supply is secured under any contingency.
- ◆ Harmonization between distributed power sources and large, centralized power sources.

Smart Energy Network



Case Example 1

Stand-alone Energy Network



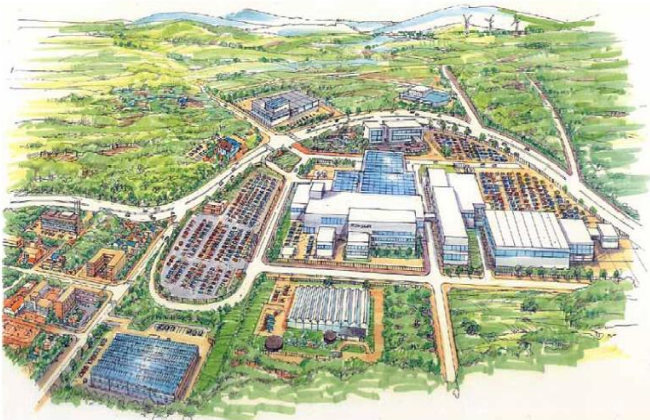
Roppongi Hills






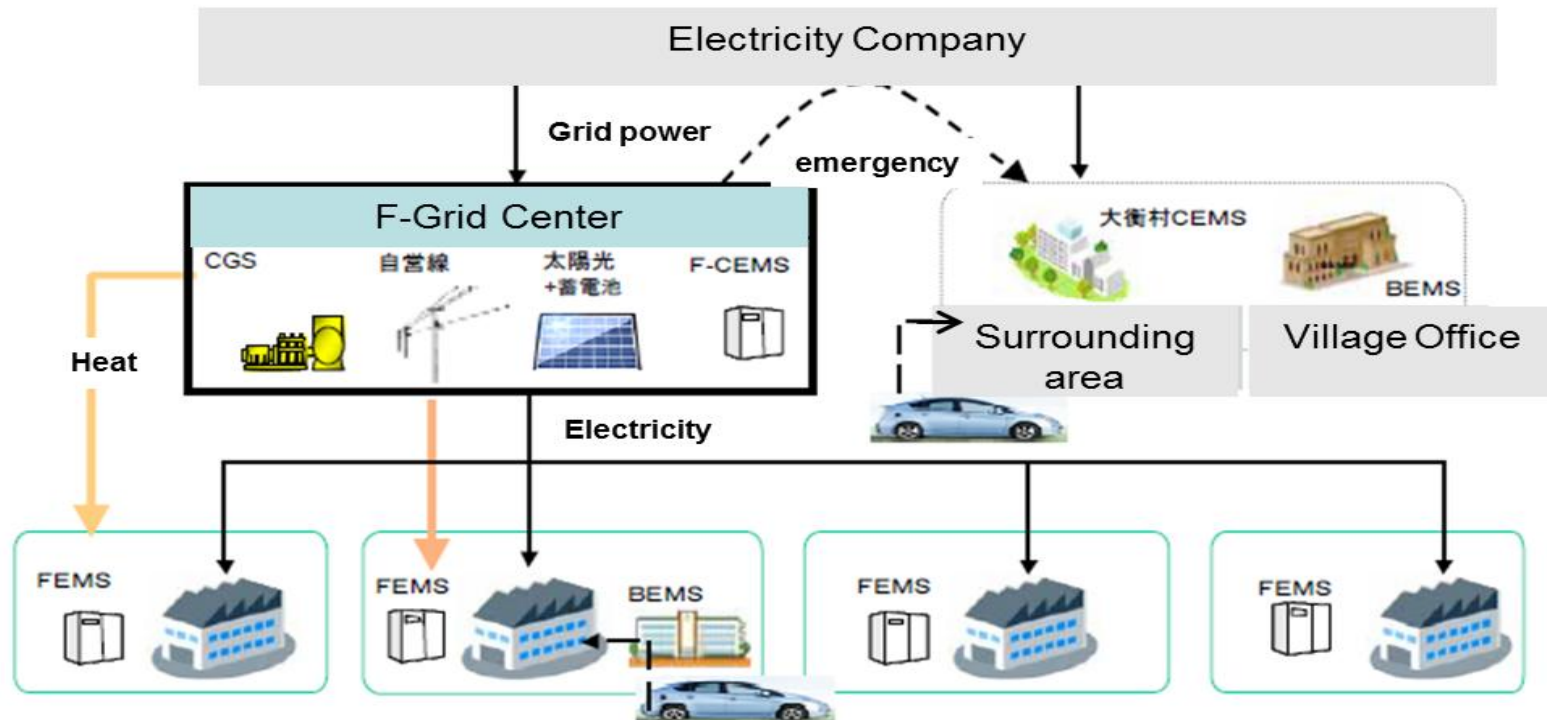
Source Roppongi Energy Service

Case Example 2

Factory Grid developed by TOYOTA



	Equipment	
Power Plant	CHP:7.8MW PV:700kW	 
Electricity storage	PHV:4.4kwh × 10 Battery:50kWh	 
Energy Management System	Community Energy Management Factory Energy Management Building Energy Management	
		





4 . CHP Policy Movement in Japan



Power portfolio options for 2030 presented by the previous administration

- ◆ Three scenarios with nuclear power at 0%, 15%, 20-25%, respectively
- ◆ Each scenario with CHP at a pre-set 15%

	Nuclear	Renew-ables	Thermal	CHP	C02 Emissions Reduction
FY2010 (benchmark)	26%	10%	60%	3%	-0.3%
Option 1	0%	35%	50%	15%	-16%
Option 2	15%	30%	40%	15%	-23%
Option 3	20-25%	25-30%	35%	15%	-25%

Source: Energy and Environment Council (29th June, 2012)

Policy changes by new administration

Cancel the former administration's policy "Zero operating nuclear power plants in the 2030s"



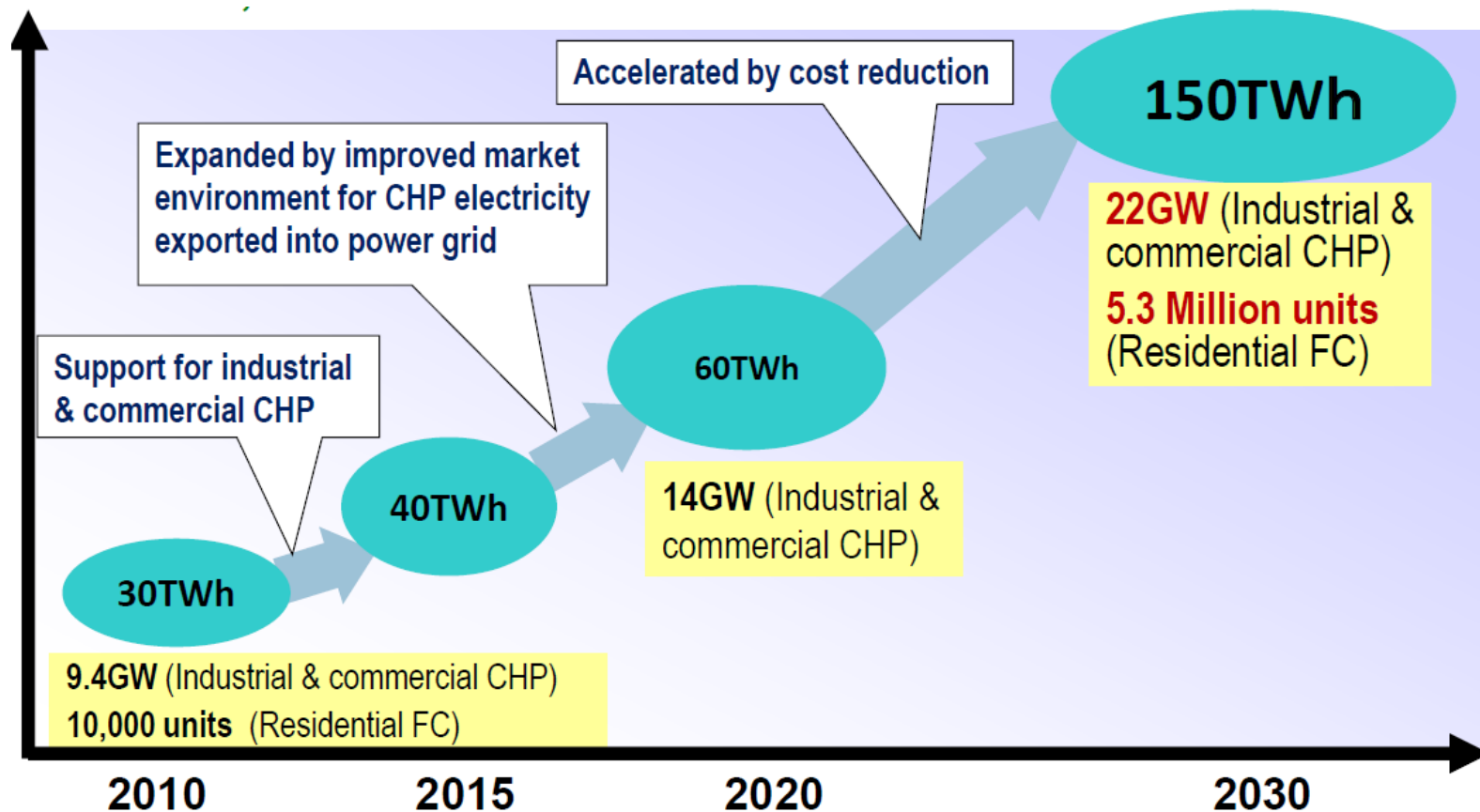
The Prime Minister Shinzo ABE



- Restart the nuclear power plants once their safety is confirmed
- Realize the best-mix of energy sources within 10 years

The roadmap for the diffusion of CHP toward 2030






- ◆ The previous administration presented a roadmap for the CHP diffusion by TWh.
- ◆ They estimated about 60billion \$ of accumulated investment is required to satisfy 15% of the domestic electricity demand by CHP in 2030.



source: prepared based on Energy and Environment Council's report on Sep. 14, 2012

Incentives for the diffusion of CHP

- ◆ In Japan, there's no legal framework related to the diffusion of CHP.
- ◆ We have support scheme only for CAPEX of CHP ,not for OPEX like FIT.

	Japan	Belgium	German	UK
Legal Framework		CHP promotion law (regionally issued)	<ul style="list-style-type: none">• CHP law• Renewable energy heat law	Energy Act 2008
Feed in Tariff				 (micro-CHP)
Certificate schemes		 (Flanders)		
Capital grant			 (micro-CHP)	

*The above schemes are for fossil fuel based CHP, and other support schemes do exist for renewable CHP.

Recent activities for CHP promotion by METI

Enhanced Support System

- ◆ Establishment of “Cogeneration Promotion Office” in METI(Agency for Natural Resources and Energy)
- ◆ Assignment of personnel in charge of CHP in each regional bureau of Economy , Trade and Industry

Reform of Electric Power Market

- ◆ Creation of a “Distributed Model Green Electricity Selling Market”(since June 18, 2012)
- ◆ Ensure appropriate contract for the supplementary supply from the grid between CHP user and the electricity company

*Supplementary supply means the backup when CHP is stopped due to maintenance or some trouble.



5. Conclusion

Conclusion

- ◆ CHP system is one of the promising options for energy saving under such circumstances of high demand of LNG.
- ◆ The value proposition of BLCP is one of the universal appeal for further diffusion of CHP in Japan .
- ◆ The OPEX is one of the most important barriers against the expansion of CHP market due to high price of LNG.
- ◆ Therefore further support scheme is required such as FIT, CHP certificates etc.. To realize the implementation of various incentives for CHP, it is preferable to establish some legal framework like “CHP Directive”.