

Approach to Thermal Power Generation

June 2nd, 2014

TAKASHI NII

Thermal Power Sect., Power Generation Div.
The Chugoku Electric Power Co., Inc.

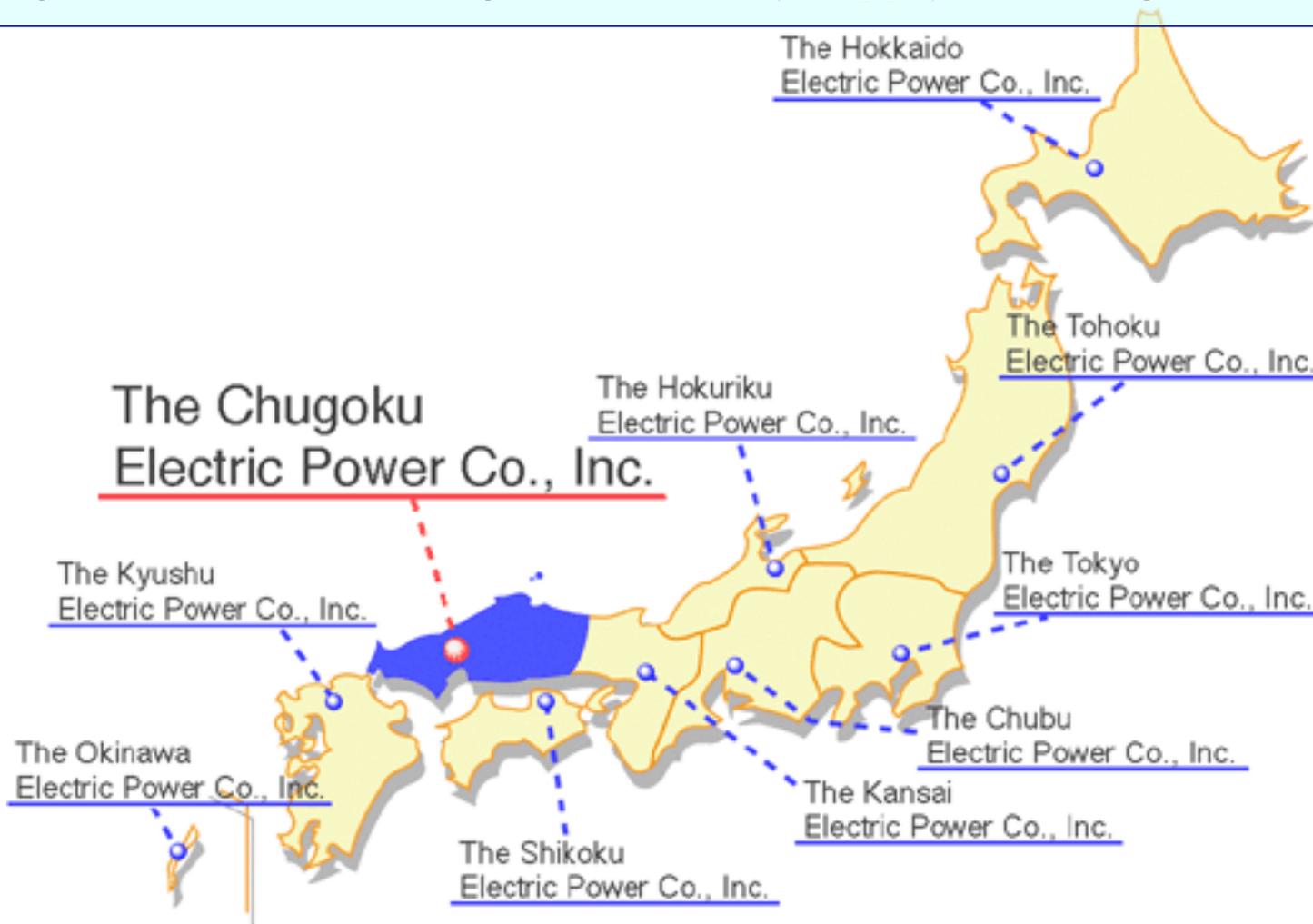
Company Profile

The Chugoku Electric Power Co., Inc. As of March 31, 2013

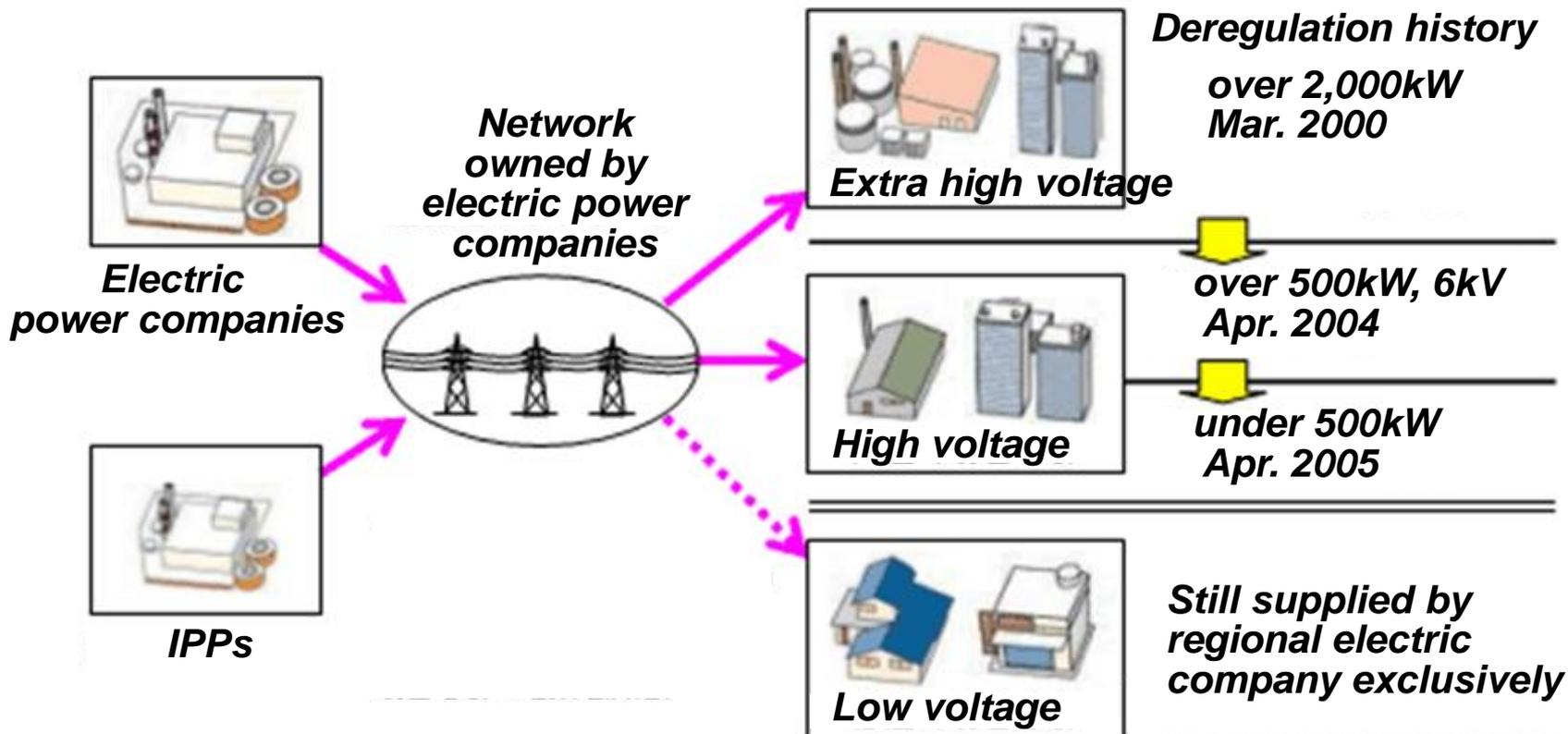
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Location (Head Office)	4-33 Komachi, Naka-ku, Hiroshima 730-8701 Japan	
Date of Establishment	May 1, 1951	
Paid-in Capital	185,527 million JPY	
Number of Shares Issued	371 million	
Service Area	32,282 km ²	
Population Served	7.5 million	
Number of Stockholders	138,475	
Electricity Sales	58,647 millions of kWh	
Customers by Type (unit) (Excluding by Liberalized sector)	Residential (lighting) : 4,749,492 Industrial and commercial : 473,580 Total : 5,223,072	
Operating Revenues	Consolidated basis : 1,199,727 million JPY Non-Consolidated basis : 1,131,926 million JPY	
Number of Employees (Total on-site staff)	Consolidated basis : 14,243 Non-Consolidated basis : 8,973	
Generating Capacity of Own Facilities	Hydroelectric (97 locations) : 2,906 MW Thermal (12 locations) : 7,801 MW Nuclear (1 location) : 1,280 MW New energy sources (1 location) : 3 MW Total (111 locations) : 11,989 MW	

- *There are 10 electric power companies in Japan which are responsible for supplying power on a regional basis.*
- *Chugoku EPCO is in charge of electricity supply in the region marked below.*



- *Electric power companies in Japan including Chugoku EPCO implement once-through service, generation, transmission and distribution.*
- *Power sales retail is partially deregulated. Approximately 36 % of the customers who located in Chugoku EPCO area are supposed to choose electricity company by themselves.*



Power plants owned and operated by Chugoku EPCO

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- Chugoku EPCO has power plants with total capacity of 11,989MW consisting of thermal 7,801MW, nuclear 1,280MW, hydro 2,905MW and PV 3MW.

Main power plant list

LNG: Liquefied Natural Gas

	Power plant		Output (MW)	COD	Note
Thermal	Misumi	#1	1,000	1998.6	Coal
	Yanai	#1	700	1992.12	LNG
		#2	700	1996.1	LNG
	Shin-Onoda	#1	500	1986.4	Coal
		#2	500	1987.1	Coal
	Tamashima	#1	350	1971.3	Oil, LNG
		#2	350	1972.4	Oil
		#3	500	1974.6	Oil
Nuclear	Shimane	#1	460	1974.3	
		#2	820	1989.2	
Hydro	Matanogawa		1,200	1986.10	Pumped storage
	Shin-Nariwagawa		303	1968.11	Pumped storage
	Nabara		620	1976.7	Pumped storage
PV	Fukuyama		3	2011.12	

Chugoku EPCO's activity in Poland

Chugoku EPCO's activity in Poland

■ Chugoku EPCO has conducted various projects listed as below with assistance from Japanese government.

Year	Project	Counterpart
① Mar. 2008	CO2 credit (JI project)	JSW Borynia
② Sep. 2009		KW, Szczyglowice, Sosnica
③ May. 2010	MOU conclusion	PGE, Tauron
④ Oct. 2010 - Mar. 2011	Technical consulting for existing power plant and	PGE, Energa
⑤ Jul. 2011 - Mar. 2013		Tauron
⑥ Aug. 2012 - Feb. 2013	Feasibility study for new construction project	PGE
⑦ Jul. 2011 - Mar. 2012		PSE, Energa



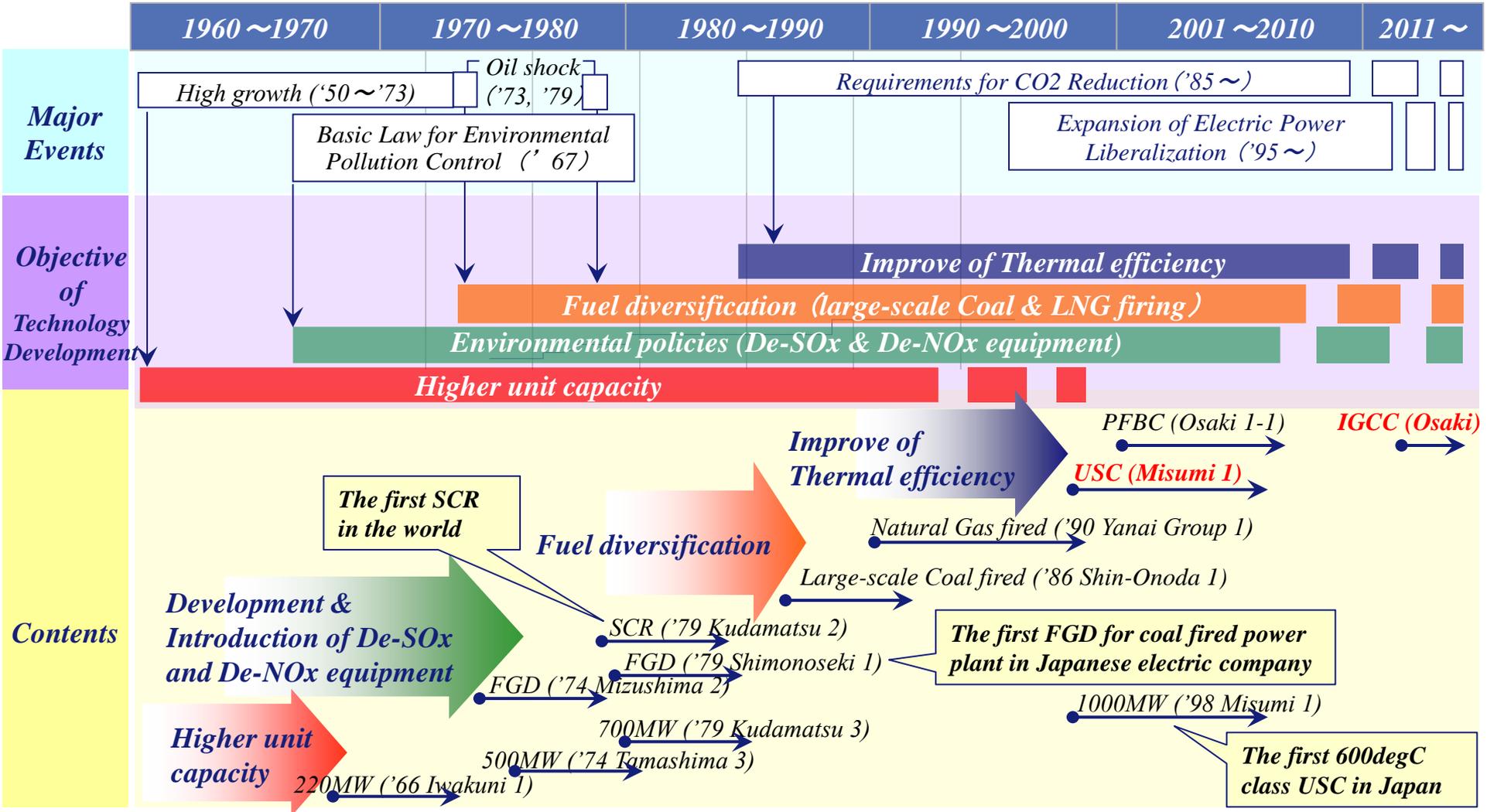
Feasibility study conducted with Tauron

Output	USC thermal power plant 1,000MW x1
Fuel	Polish hard coal
Efficiency	45.1% (Steam condition 600/620 degC, 25MPa)

***Approach to thermal power generation
by Chugoku EPCO***

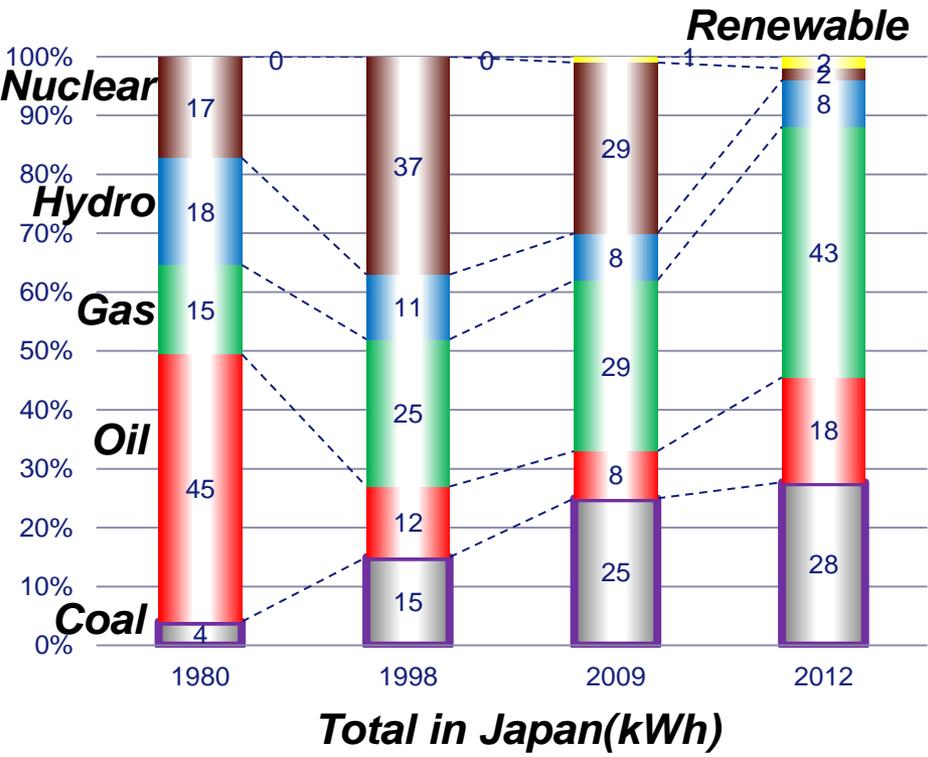
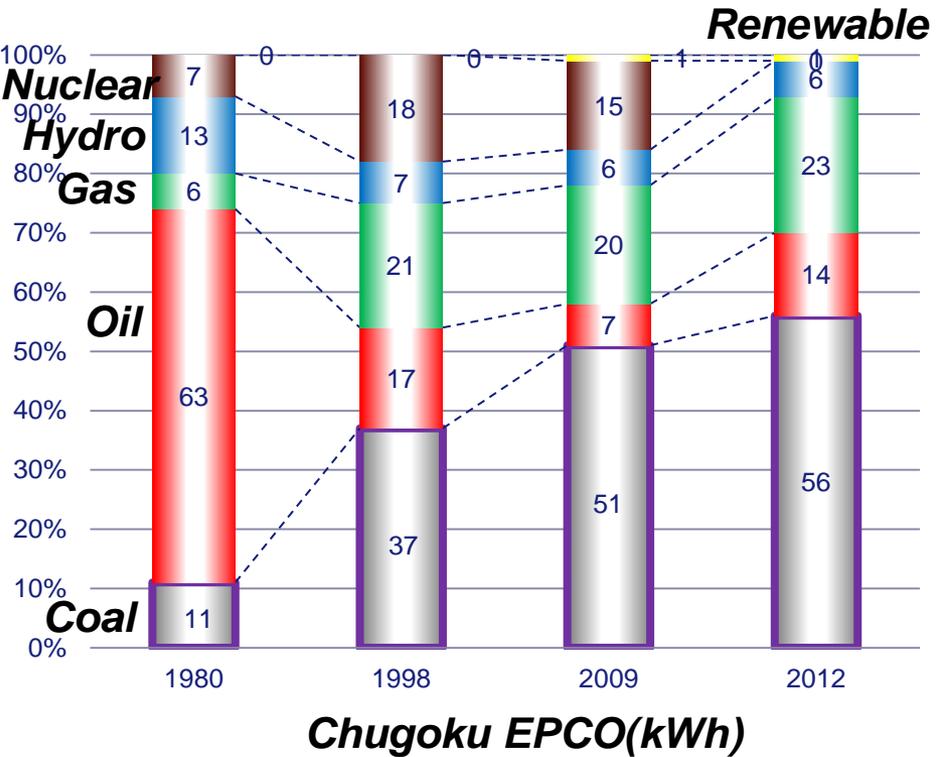
Thermal power technology development

■ Chugoku EPCO has been developing thermal power technologies with respect to capacity, environment, fuel diversification and plant thermal efficiency to meet the needs of each ages.



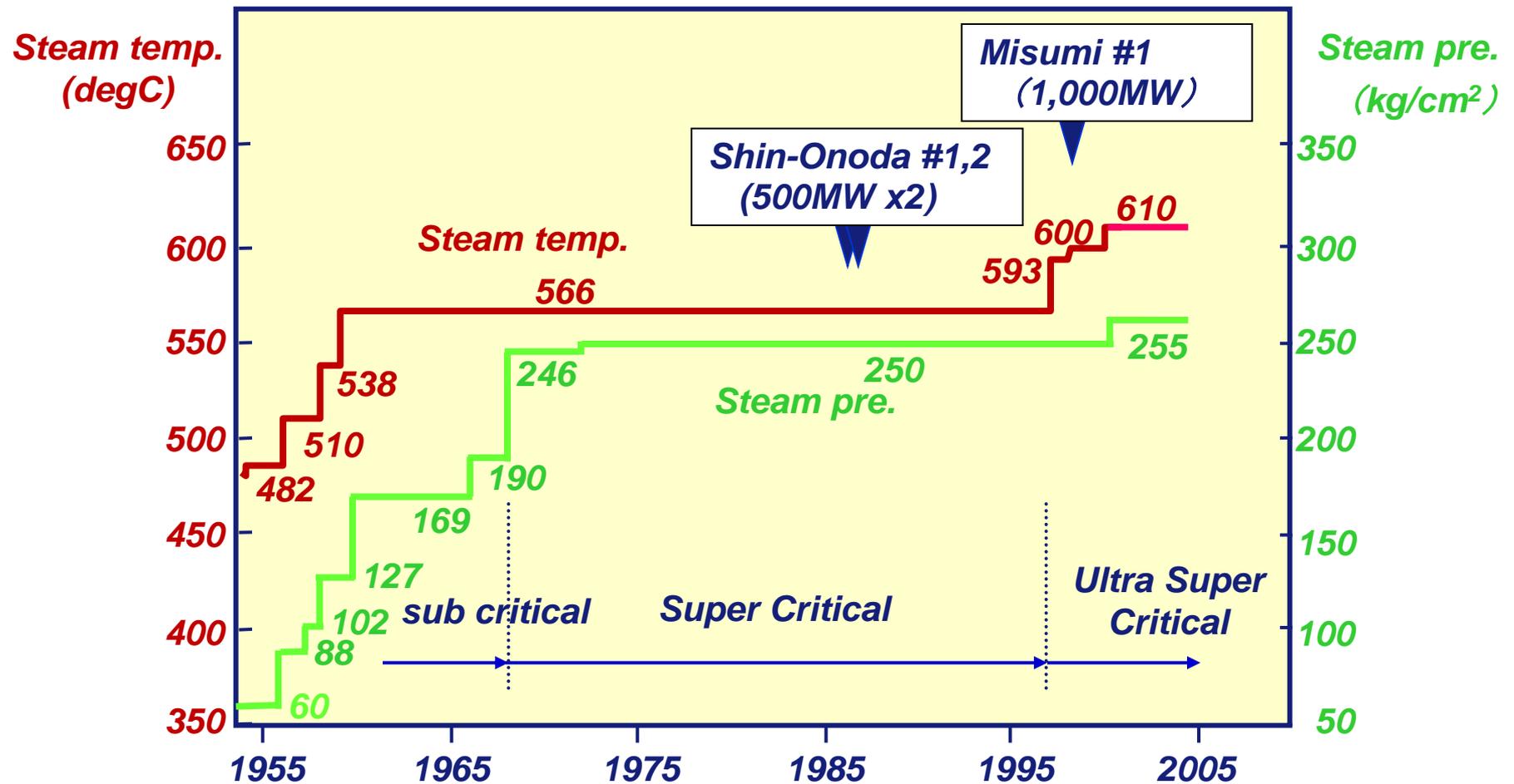
Composition of power generation (kWh)

- Chugoku EPCO is highly dependent on coal fuel relative to other Japanese electric power companies.(more than 50% recently)
- After huge earthquake in 2011, the percentage of thermal power is increasing due to shut-down of nuclear power plants.
- Coal fuel definitely continues to play a significant role in the future as well.



Transition of steam condition

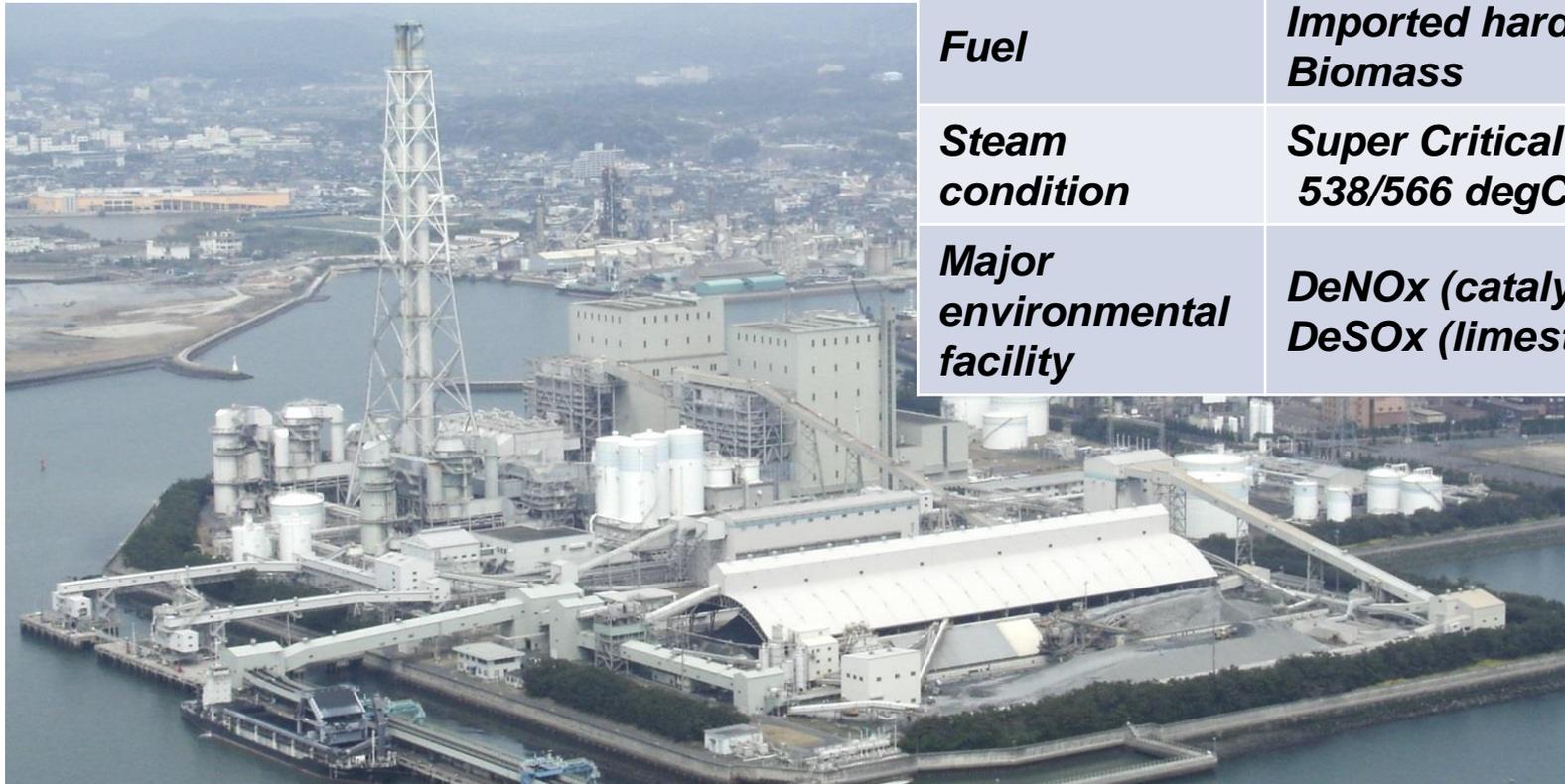
- Japanese electric power companies have been eager to install high thermal efficient technology to improve thermal efficiency.
- Chugoku EPCO firstly adopted 600 degC-class USC to 1,000MW power plant in Japan.



Shin-Onoda Power Plant (500MW, Super Critical) 12

- **Appropriate O&M at Shin-Onoda power station for 28 years since COD maintains its performance at high thermal efficiency (41%), plant availability (over 90%) and environmental protection capability.**

Overview	
Output	500MW x2
COD	#1 Apr. 1986, #2 Jan. 1987
Fuel	Imported hard Coal + Biomass
Steam condition	Super Critical 538/566 degC, 24.1MPa
Major environmental facility	DeNOx (catalyst), ESP, DeSOx (limestone/gypsum)



Misumi Power Plant (1,000 MW, USC)

- *Misumi power plant is the first 1,000MW class USC unit in Japan which has been continuing nearly full load operation for 16 years from COD except for periodical inspection terms.*
- *A long term O&M experience has realized performance kept at high thermal efficiency (43%), plant availability (over 90%) and environmental protection capability.*

Overview

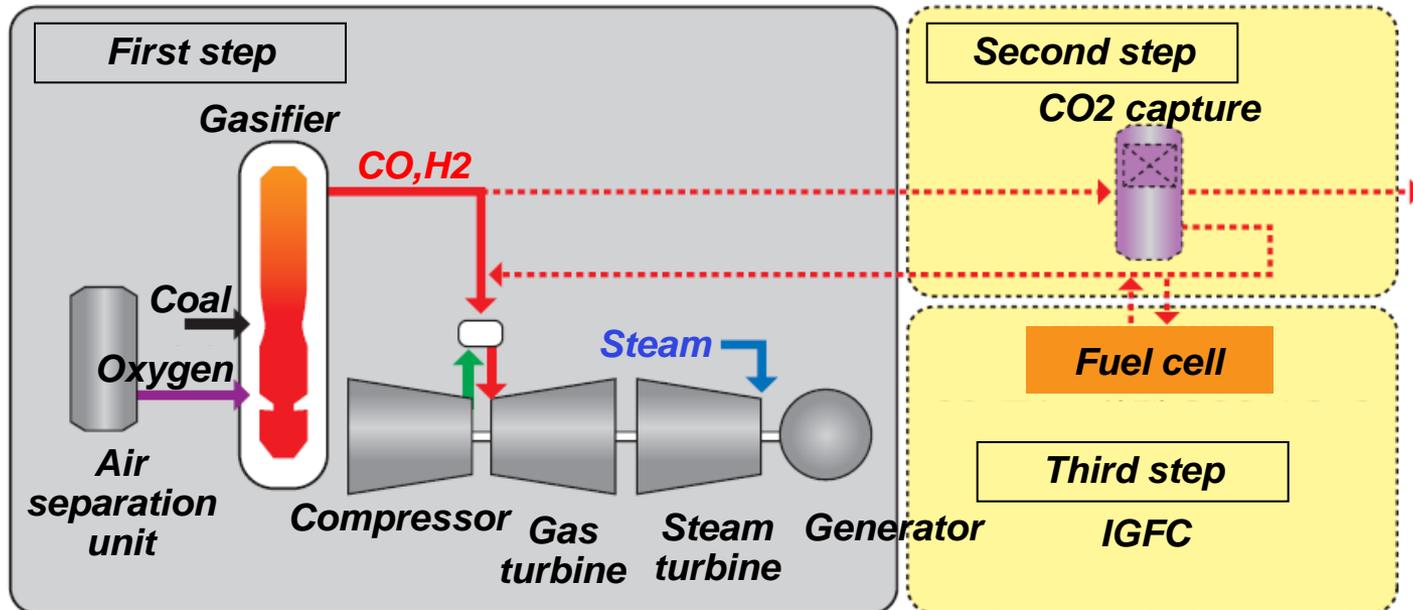
Output	1,000MW
COD	June, 1998
Fuel	Imported hard Coal + Biomass
Steam condition	USC 600/600degC, 24.5MPa
Environmental measures	DeNOx (catalyst), Low-low temperature ESP, DeSOx (limestone/gypsum)



- We are constructing a large-scaled IGCC demonstration test plant to verify coexistence of coal efficient utilization and environment-friendly performance.

Overview

Output	166MW
schedule	Commencement of work in Mar. 2013, Verification test in Mar. 2017
Scheme	Assistance from Ministry of Economy, Trade and Industry(METI) and New Energy and Industrial Technology Development Organization (NEDO)
Owner	Osaki CoolGen Corporation (Chugoku EPCO 50% J-POWER 50%)



IGCC: Integrated coal Gasification Combined Cycle

IGFC: Integrated coal Gasification Fuel Cell

Image after completion of construction



***Human Resource Development (HRD)
of power plant engineer***

- Chugoku EPCO implements power plant O&M management in cooperation with contracted company including our subsidiaries.
- Our company mainly carries out “main equipment operation” and “maintenance planning”. On the other hand “operation of environmental equipment” and “maintenance works” are outsourced to other companies.
- We are making a serious effort to develop technical aspect of engineers. They are supposed to take periodical training as well as education through daily O&M assignment (OJT).

Example of training program for freshman

	1 st year	2 nd year	3 rd year	4 th year
Assignment		Operation		Maintenance
Daily education (OJT)	Basic system of power plant, role and startup/shutdown of each equipment, patrol method	Outline of automatic plant control	Plant startup/shutdown Emergency operation (trouble)	Maintenance work Planning Order Witness Validation Budget control Safety/Quality management
Periodical training*	Freshmen training			

*conducted by subsidiary company

- Chugoku EPCO has subsidiary company named “PET” which offers O&M training service and engineering consulting service regarding thermal power.

Company profile

Service contents

- ◆ Technical Training for overseas and domestic trainee utilizing our decommissioned real power plant.
- ◆ Evaluation and installation of DeNOx equipment.
- ◆ Lifetime evaluation of high pressure pipe.
- ◆ IT solution for power plant management.

Established

Apr. 2002

URL

http://www.energia-pet.co.jp/pet_index_e.htm



O&M training course provided by PET

- PET contributes to develop engineering skills of trainees come from overseas as well as Japan.**

Category	Training course example
Power Generation	<i>Power Generation equipment basic training</i>
	<i>Boiler water quality control basic training</i>
	<i>Turbine governor characteristic test training</i>
	<i>Operation simulator training</i>
Mechanical	<i>Non-destructive test (NDT) training</i>
	<i>Remaining life diagnosis technique training</i>
	<i>Vibration basic training</i>
	<i>Vibration analysis training</i>
	<i>Small pump training</i>
Electrical	<i>Sequence control basic training</i>
	<i>Sequencer training</i>
	<i>HV / LV switchgear basic training</i>
	<i>Motor protection circuit training</i>
	<i>Motor insulation diagnosis training</i>
Control	<i>Automatic control basic training</i>
	<i>Automatic control training</i>
	<i>Industrial measurement training</i>
	<i>Flue gas analyzer maintenance training</i>

Approx. 50 trainees come from abroad every year.



In the last place ,,,

Chugoku EPCO has been adopting state-of-the-art thermal power technologies especially for coal over a period of decades, acting pioneering challenge among Japanese utilities and fulfilling a role appropriate to the needs of the each times.

In addition to a improvement of plant thermal efficiency, we have been making an active effort for further development regarding environmentally-friendly power generation technologies.

We continue to tackle positive approach for development of clean coal technology in order to contribute effective utilization of coal and climate change issue.

Serdecznie dziękuję za uwagę!

