

Hitachi Coal Fired Power Plant Technology

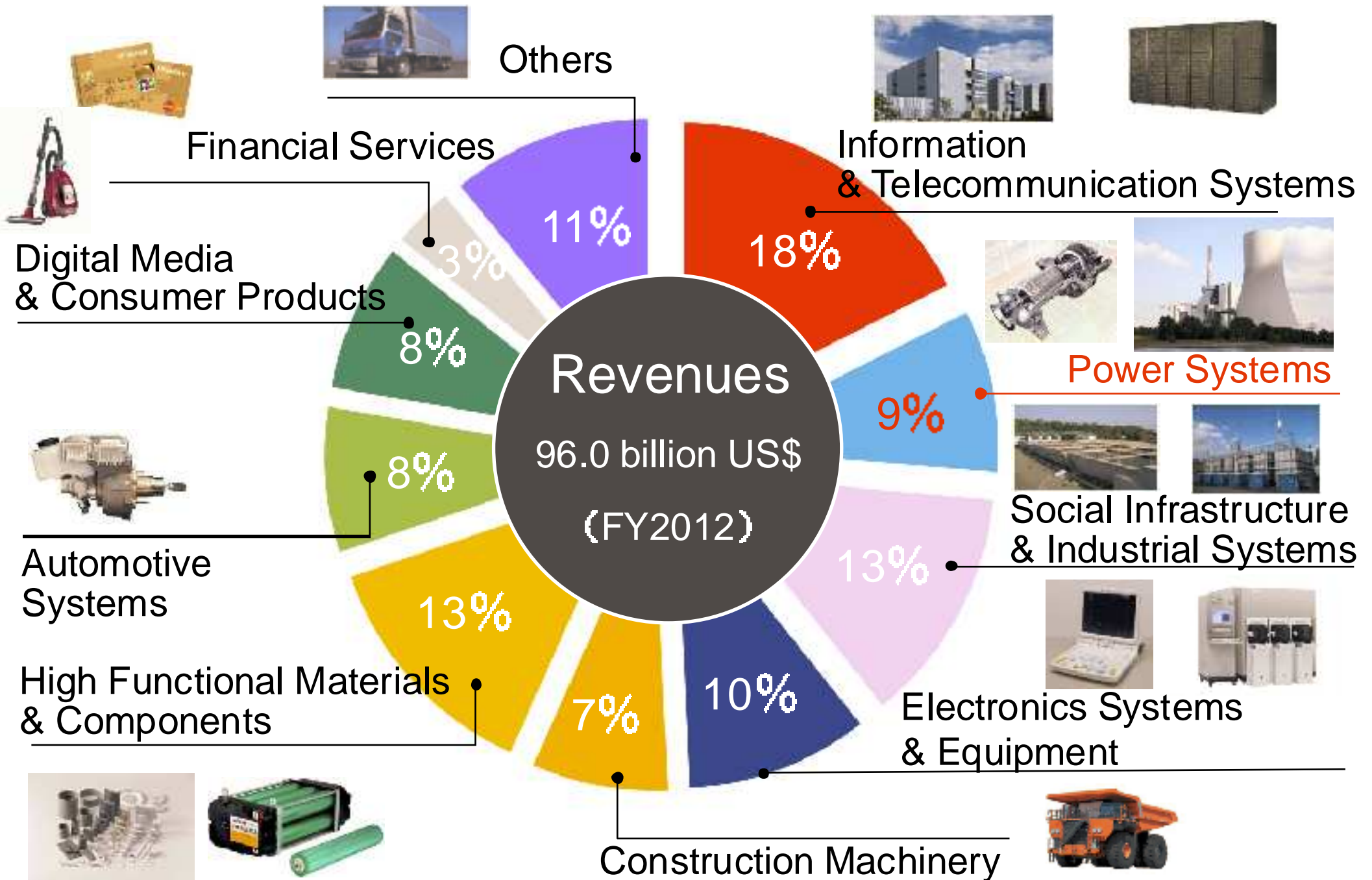
October 14, 2013

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Engineering Headquarters
Power Systems Company,
Hitachi, Ltd.

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2. USC (Ultra Super Critical) Technology
3. Retrofit
4. Air Quality Control System Technology

1. Hitachi Power Systems Company



Thermal Power Business

Coal-fired Thermal Power Plants



Major Equipment of Coal-fired Thermal Power Plants

Gas Turbines



Steam Turbines



Boilers



Air Quality Control System

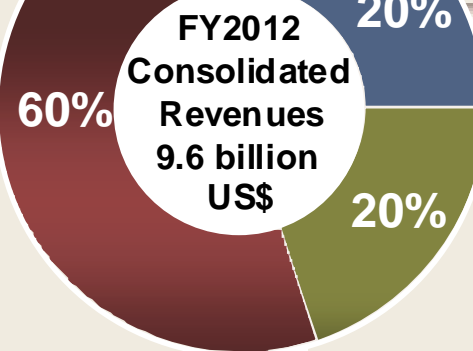


Nuclear Power Business

Boiling Water Reactor Nuclear Power Plants (ABWR-ESBWR)



Preventive Maintenance, Nuclear Fuel Cycle, etc.



Transmission & Distribution, Renewable Energy and Other Businesses

Particle beam therapy systems



Wind Power Generation Systems



Transmission & Distribution (T&D) Systems



Photovoltaic Power Generation Systems



Hydroelectric Power Generation Systems, Drive Systems, Smart Grids, Power Semiconductors, etc.

Integrated supply of BTG + AQCS ⇒ Optimize entire plants

Boilers (B)	Turbines (T)	Generators (G)	AQCS				
			DeNOx		Precipitators	DeSOx	CCS
			Systems	Catalysts			
○	○	○	○	○	○	○	○

■ Steam Turbines and Generators (TG)



Turbines and Generators



Low-pressure Turbines

■ Boilers (B)



■ Air Quality Control System

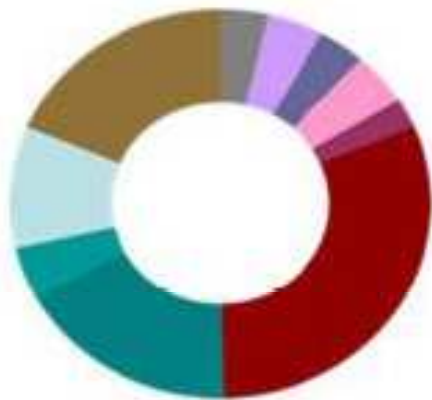


DeSOx (Spray Type)



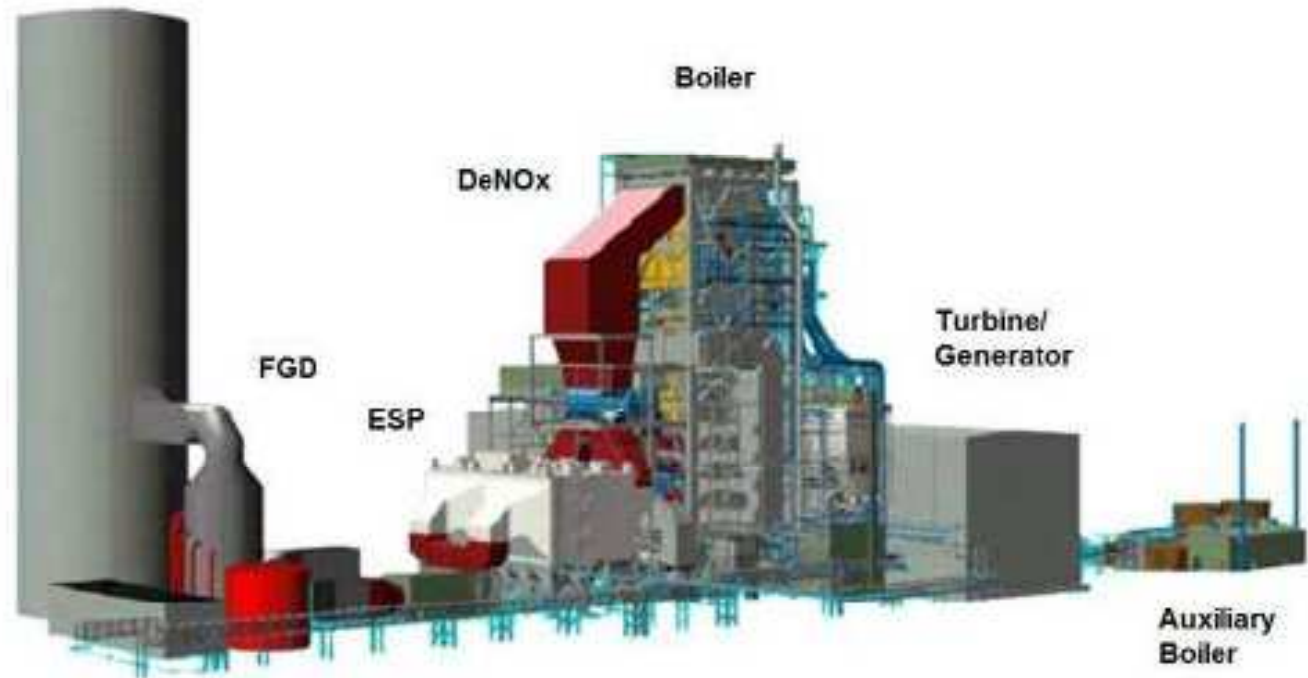
DeNOx Catalyst



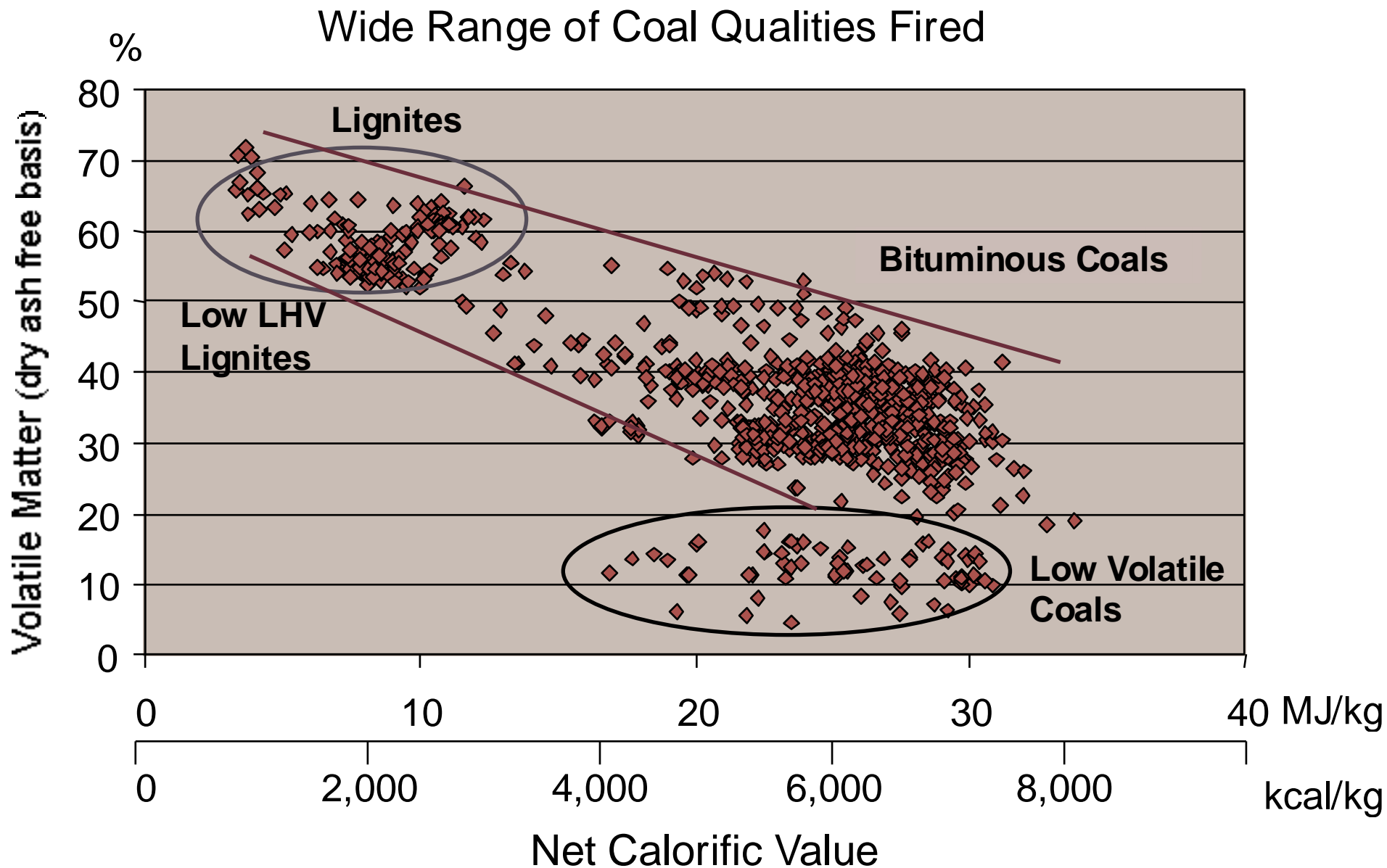


- Boiler
- Turbine/Generator
- DeNOx
- FGD
- Engineering
- BOP
- I & C System
- Civil works
- Infrastructure
- BOP others

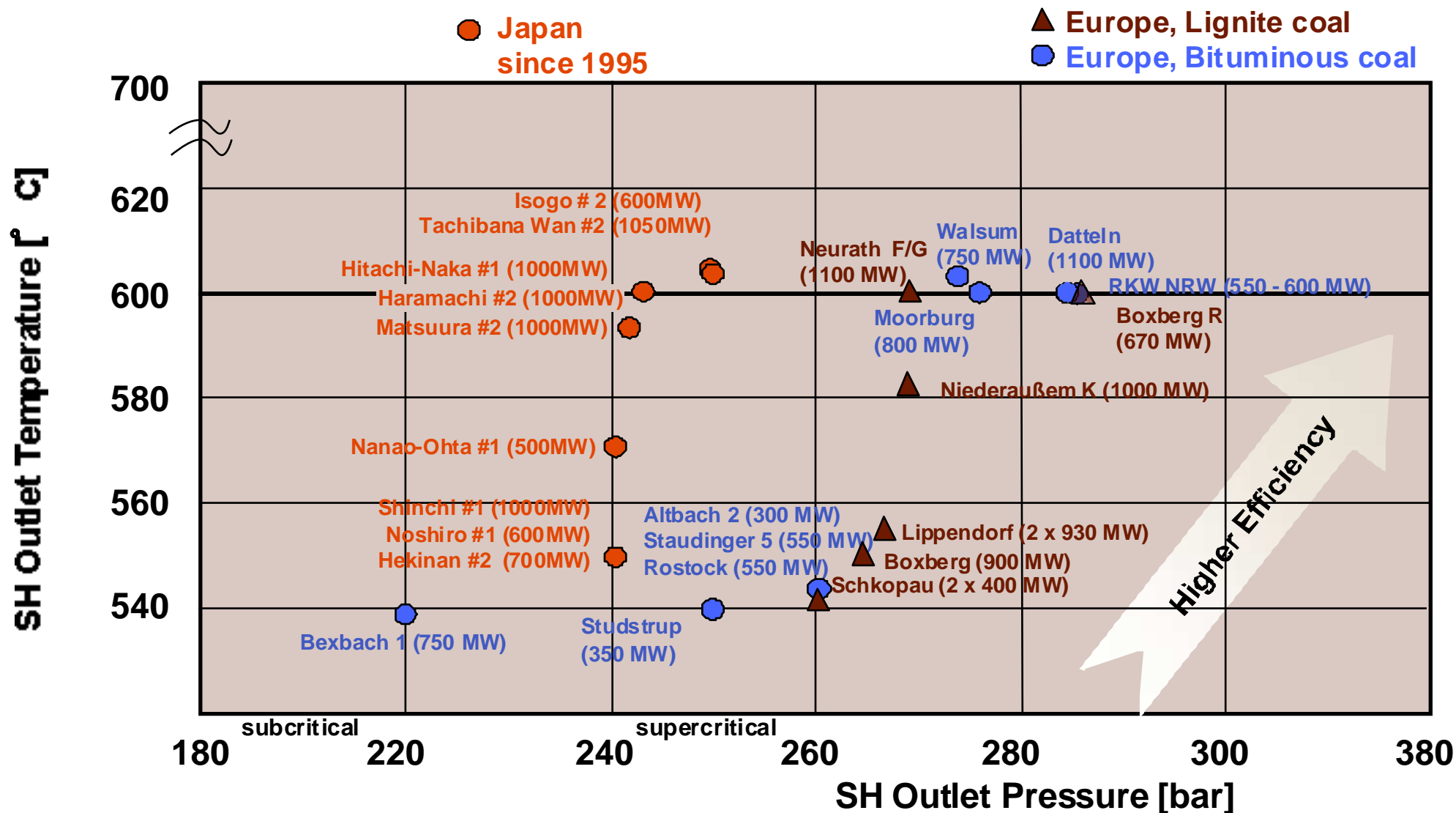
More than 65% of a high efficiency power station can be supplied by group members.



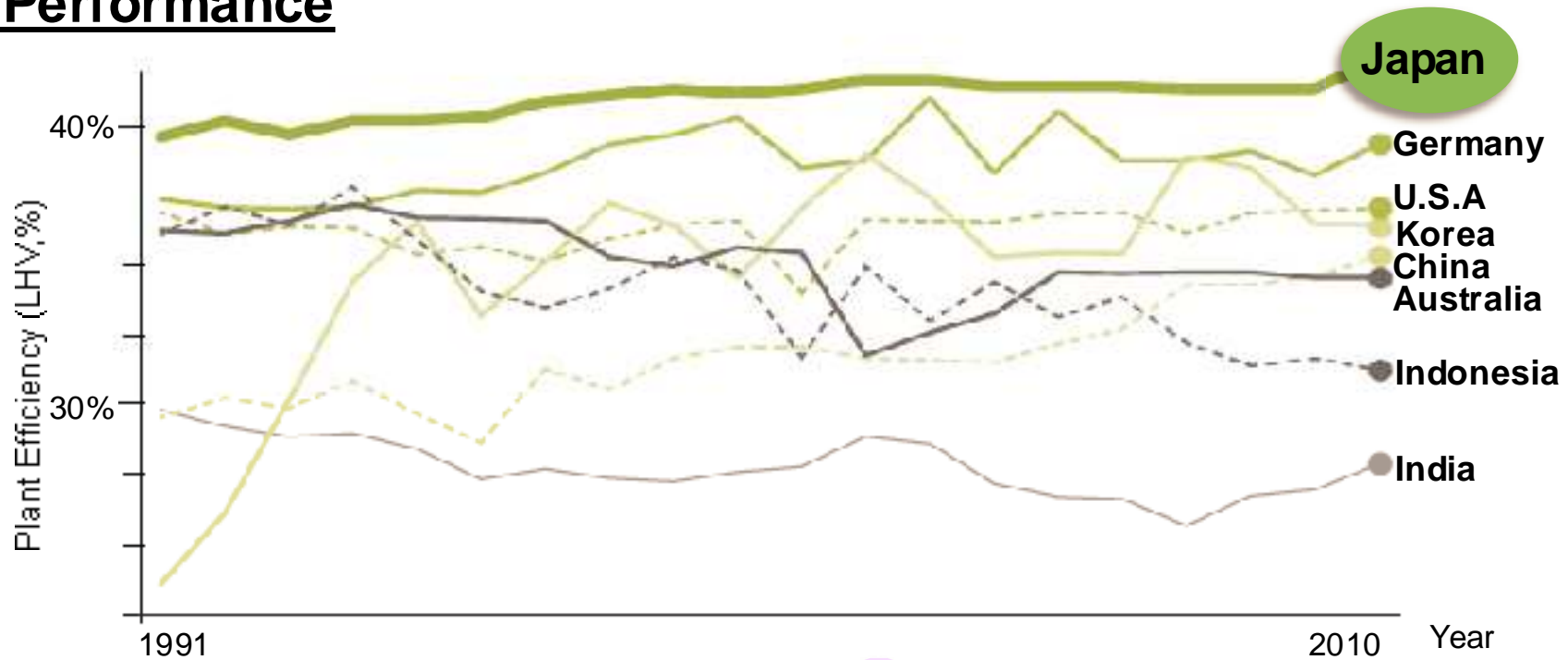
2. USC (Ultra Super Critical) Technology



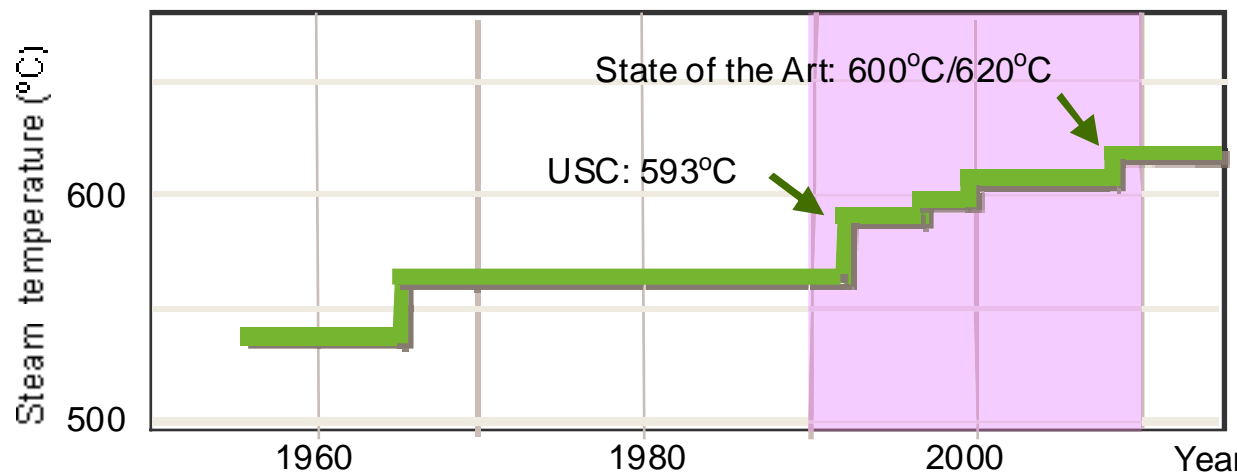
- The efficiency of the coal fired power plant has improved by making the steam condition a high temperature.



Plant Performance

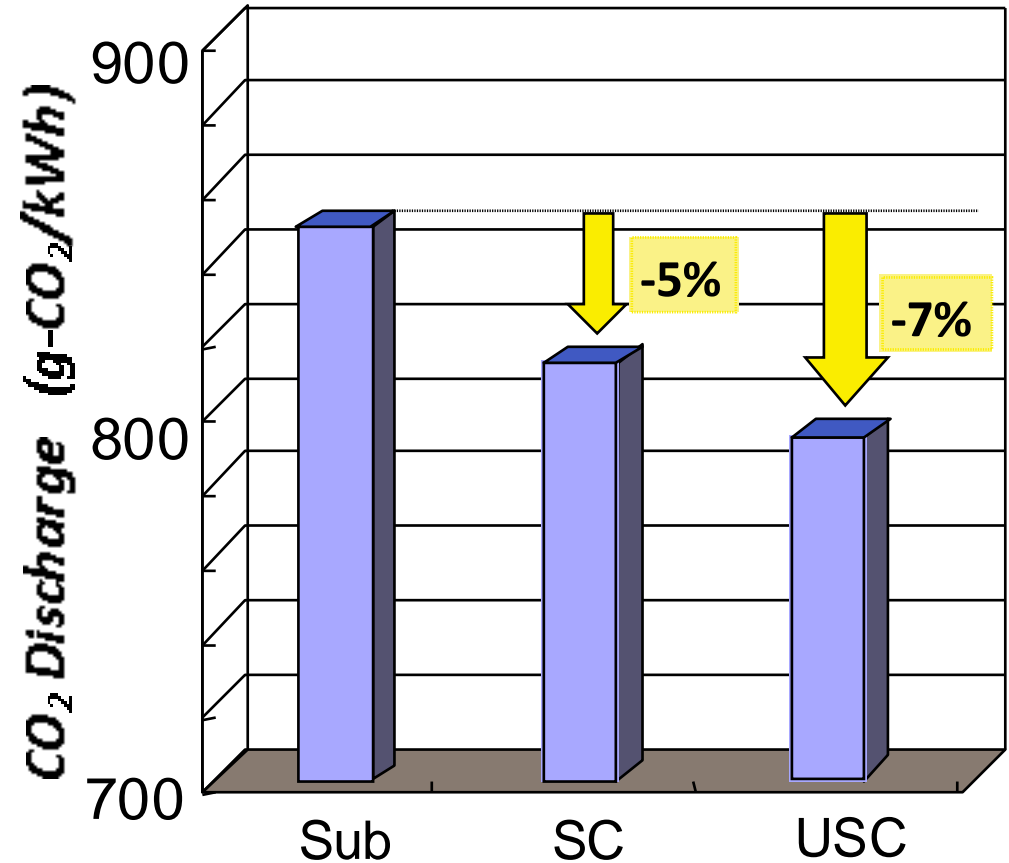
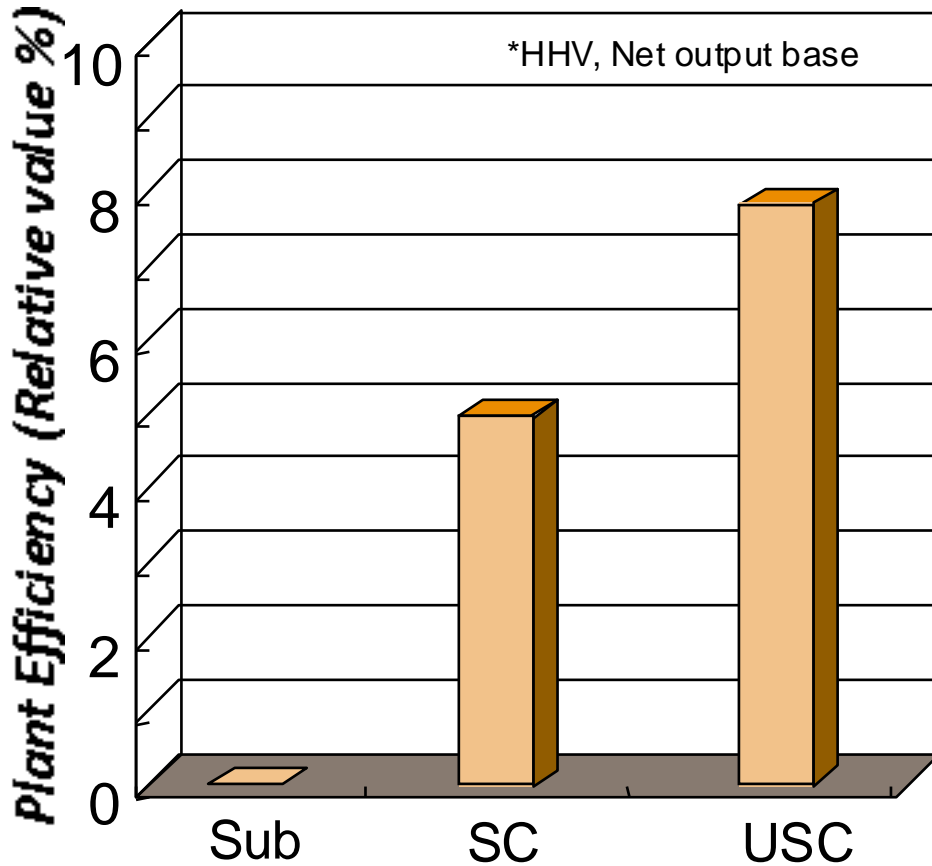


Steam Conditions Improvement



Source: Energy balances of OECD/
Non-OECD countries-2012

Higher Thermal Efficiency, Lower CO₂ Emission



	Pressure (MPa)	Temperature (°C)
Sub: Sub-Critical	16.7	538/538
SC: Super Critical	24.1	566/566
USC: Ultra Super Critical	25.0	600/600

【Assumption Ourselves】

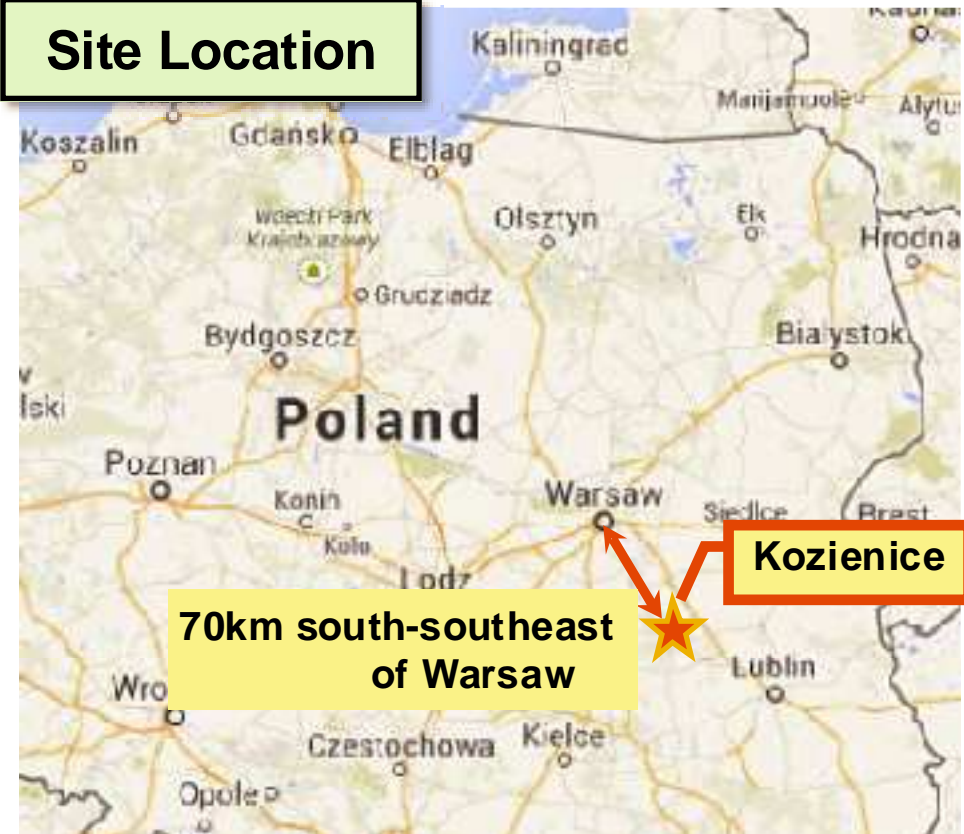
Latest USC Coal Fired Power Plant (EPC) in Poland

Site: Kozenice Unit 11

Owner: ENEA Wytwarzanie S.A.

Commercial Operation: 2017

Site Location



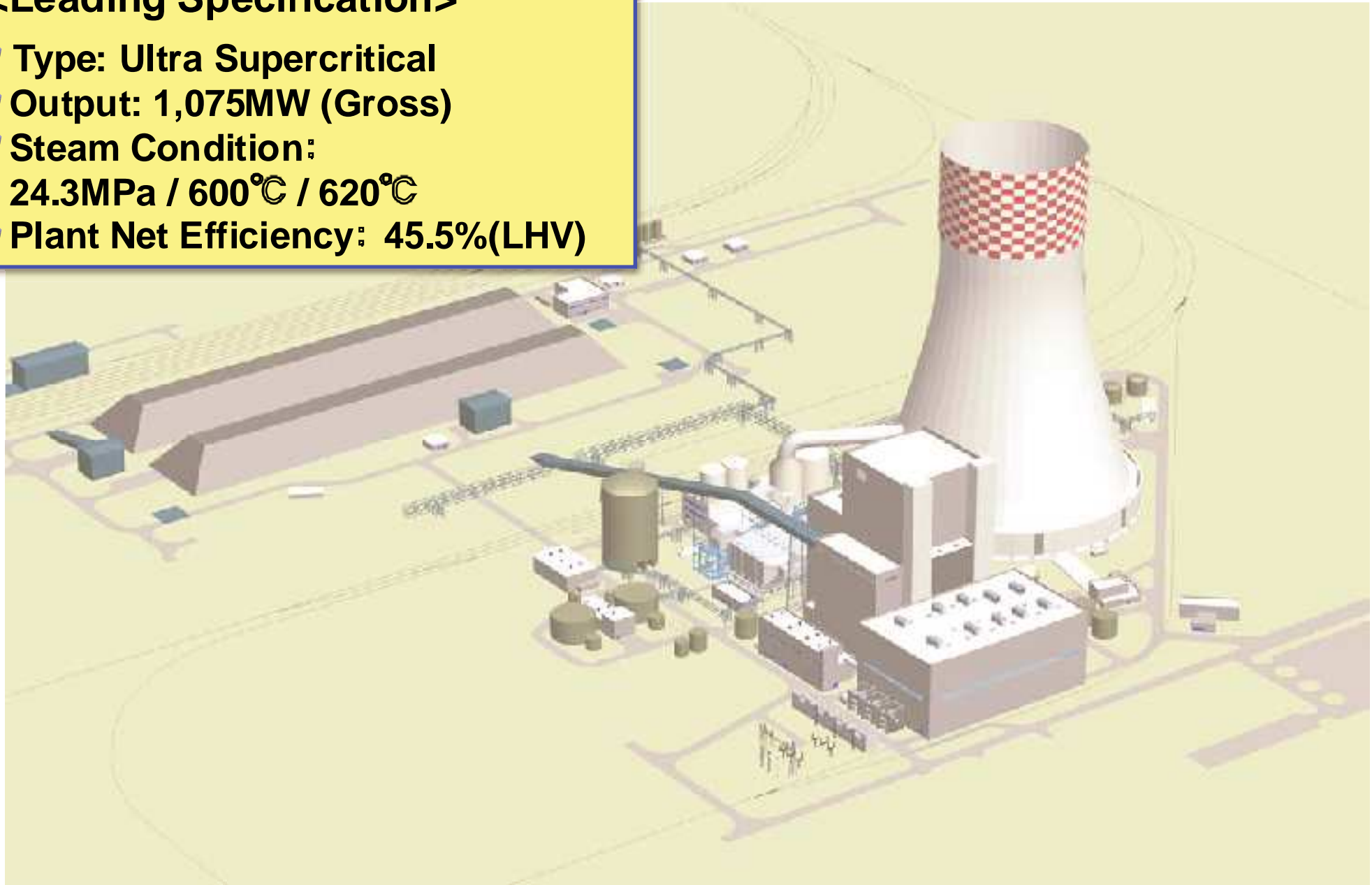
Contract signing on September 21th, 2012



Construction status as of September 2013

<Leading Specification>

- Type: Ultra Supercritical
- Output: 1,075MW (Gross)
- Steam Condition:
24.3MPa / 600°C / 620°C
- Plant Net Efficiency: 45.5%(LHV)



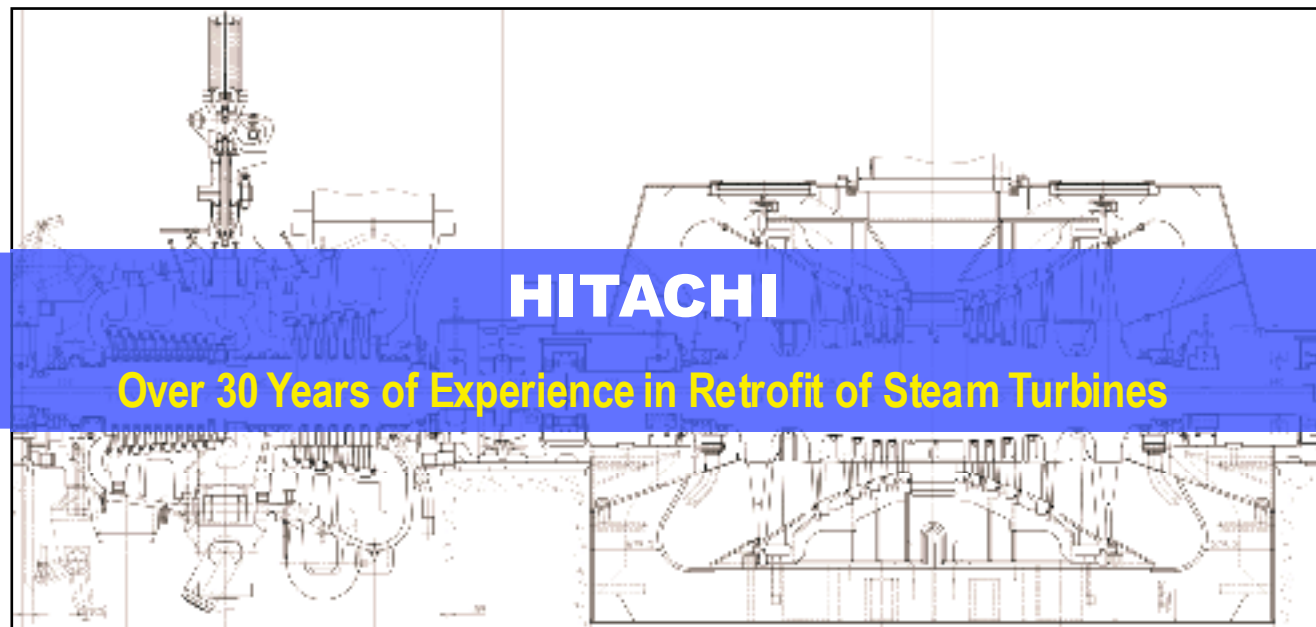
3. Retrofit

● Needs of Retrofit

- Modernization, Refurbishing and Life Extension for Aging Power-plant.
- Improve Reliability & Efficiency to Reduce the Operating Cost and Environmental Emissions.

● Objectives of Retrofit

- Utilization of Latest Steam Path Technology
 - to extend **Plant Life**
 - to improve **Reliability**
 - to improve **Plant Efficiency**



- Hitachi has successfully up-graded more than **120 Units** (Including Approx. **40 Units** of Other OEM's Turbine)



● Australia / Liddel 500MW / LP-Turbine Retrofit (Other OEM's ST)



Renewal Parts

LP Rotors
Moving Blades
Diaphragms
Inner Casings
Seal Parts



*AFTER
RETROFIT*

**Efficiency
Improvement**

4.8% (Relative)

**Carbon dioxide (CO2)
emission reduction**

120,000 ton / Year

4. Air Quality Control System Technology



SCR : Selective Catalytic Reduction
 ESP : Electrostatic Precipitator
 FGD : Flue Gas Desulfurization

AQCS Performance

Items	Boiler outlet	AQCS outlet	Performance
SO ₂ Emission Level (mg/Nm ³ , dry, vol 6%O ₂)	~2,800	< 150(*)	FGD performance: SO₂ removal efficiency = 95%
NO _x Emission Level (mg/Nm ³ , dry, vol 6%O ₂)	< 200(**)	< 150 (< 200: Lignite)(*)	**: When RS burner is applied.
Dust Emission Level (mg/Nm ³ , dry, vol 6%O ₂)	~55,000	< 10(***)	ESP performance: Dust removal efficiency = 99,94%

*: EU emission standard (Directive 2010/75/EC)

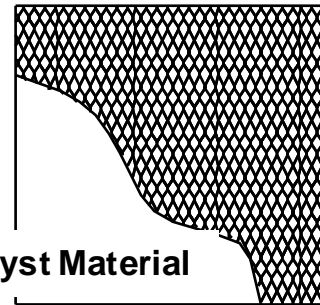
***: 10mg/Nm³ at stack, 30mg/Nm³ at ESP outlet

Feature of SCR Catalyst (Plate Type)

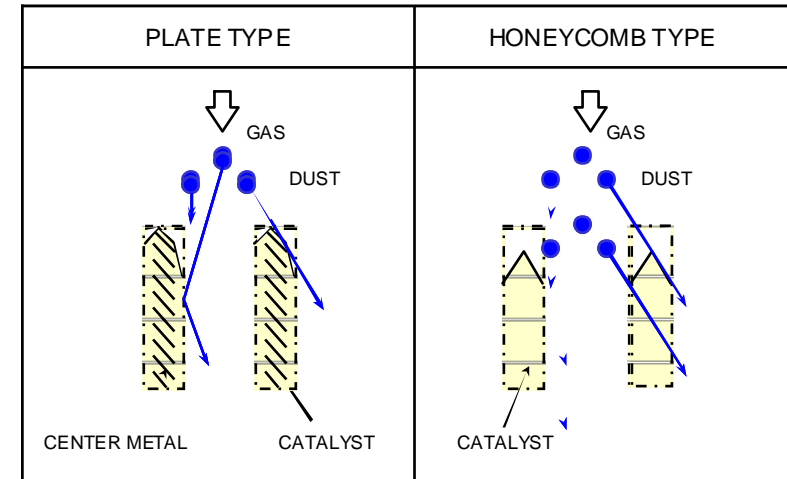
Catalyst Element



Meshed Center Metal



Catalyst Material



Catalyst Unit

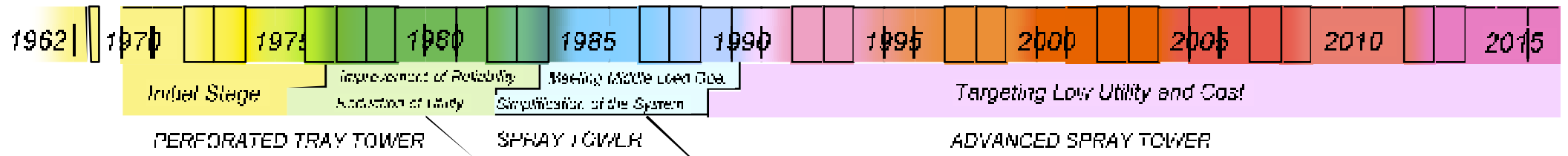


Features: Erosion Resistance, Plugging Resistance, Low Pressure Drop

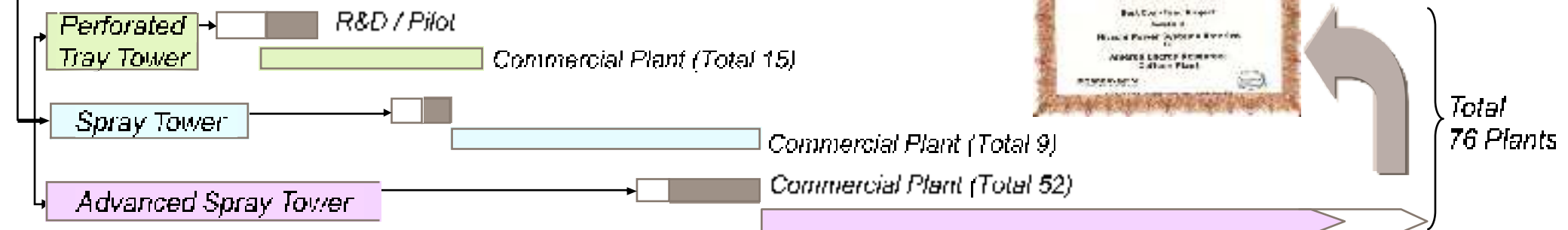
	PLATE TYPE	HONEYCOMB TYPE	REMARKS
ACTIVITY	●	●	
EROSION RESISTANCE AGAINST DUST	●	▲	CENTER METAL PLATE
PLUGGING RESISTANCE	●	▲	FEW CORNERS
PRESSURE DROP	●	▲	PRESSURE DROP
HANDLING	●	▲	COMPACT
CATALYST VOLUME FOR INITIAL LOADING	▲	●	SPECIFIC SURFACE
FOR LONG TERM OPERATION	●	▲	LONG LIFE CATALYST STACKING

● : EXCELLENT
● : ADVANTAGEOUS
▲ : AVERAGE

FGD Development and Supply



LIMESTONE GYPSUM FGD SYSTEM



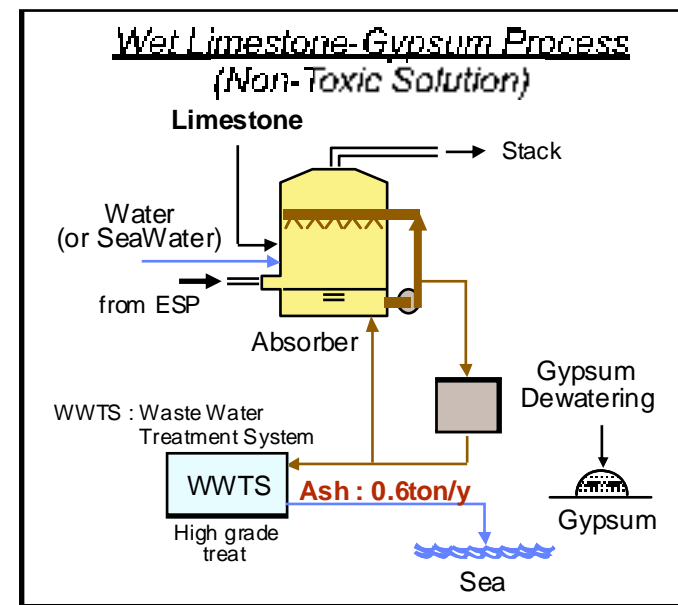
Supply Experience



Tachibanawan No. 2
1,050MW (Japan)



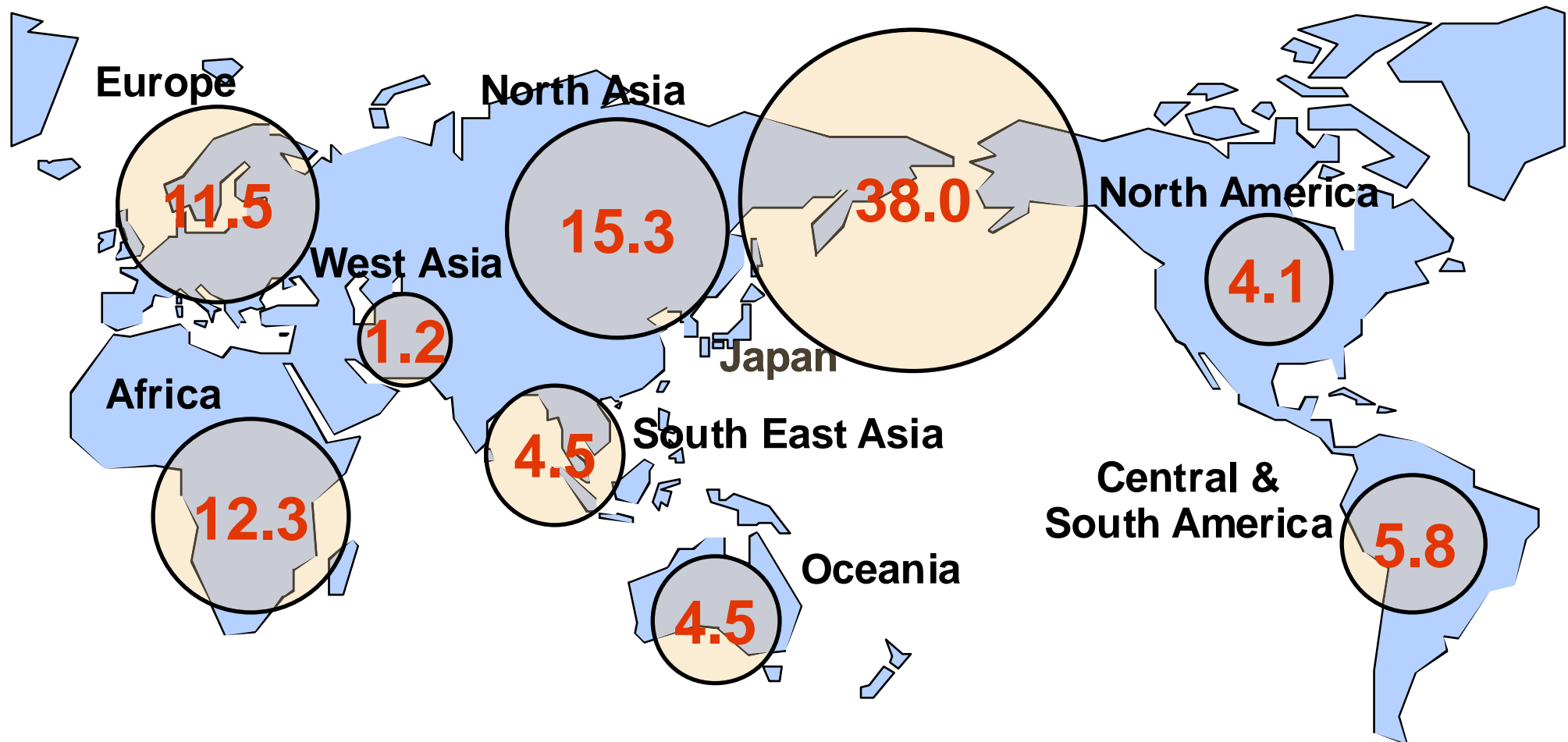
Koziernice II Project
800MW (Poland)



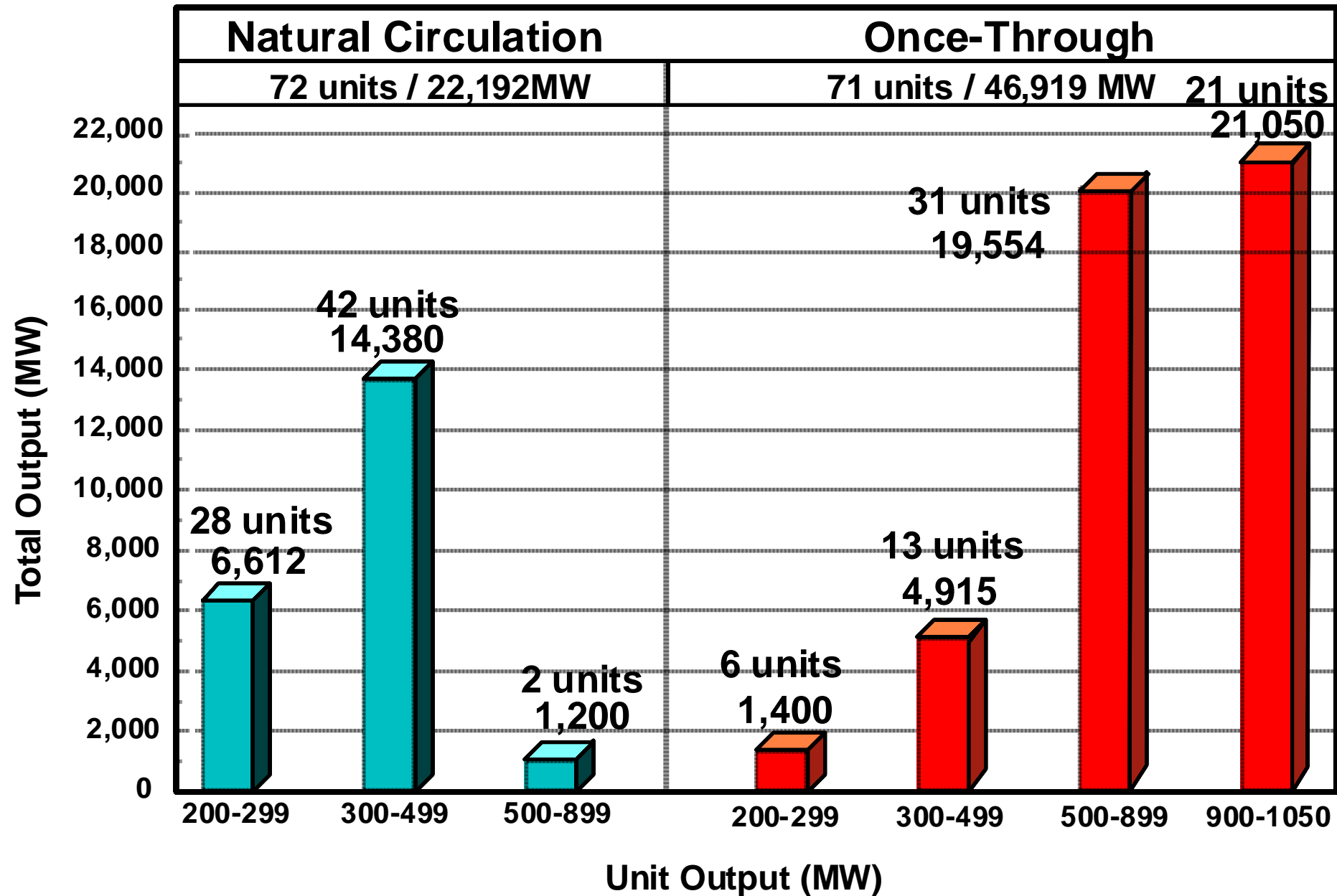
HITACHI
Inspire the Next

Experiences

Total Installed Capacity: 98.7 GW



Boiler Supply Record – Over 200MW



■ P.S. Neurath F&G (BoA II)

Output :	2 x 1,100MW
Main Steam flow :	2 x 2,959 t/h
Superheater Steam :	600°C / 272 bar
Reheater Steam :	605°C / 57 bar
Plant in Operation :	2012
Fuel :	German Lignite

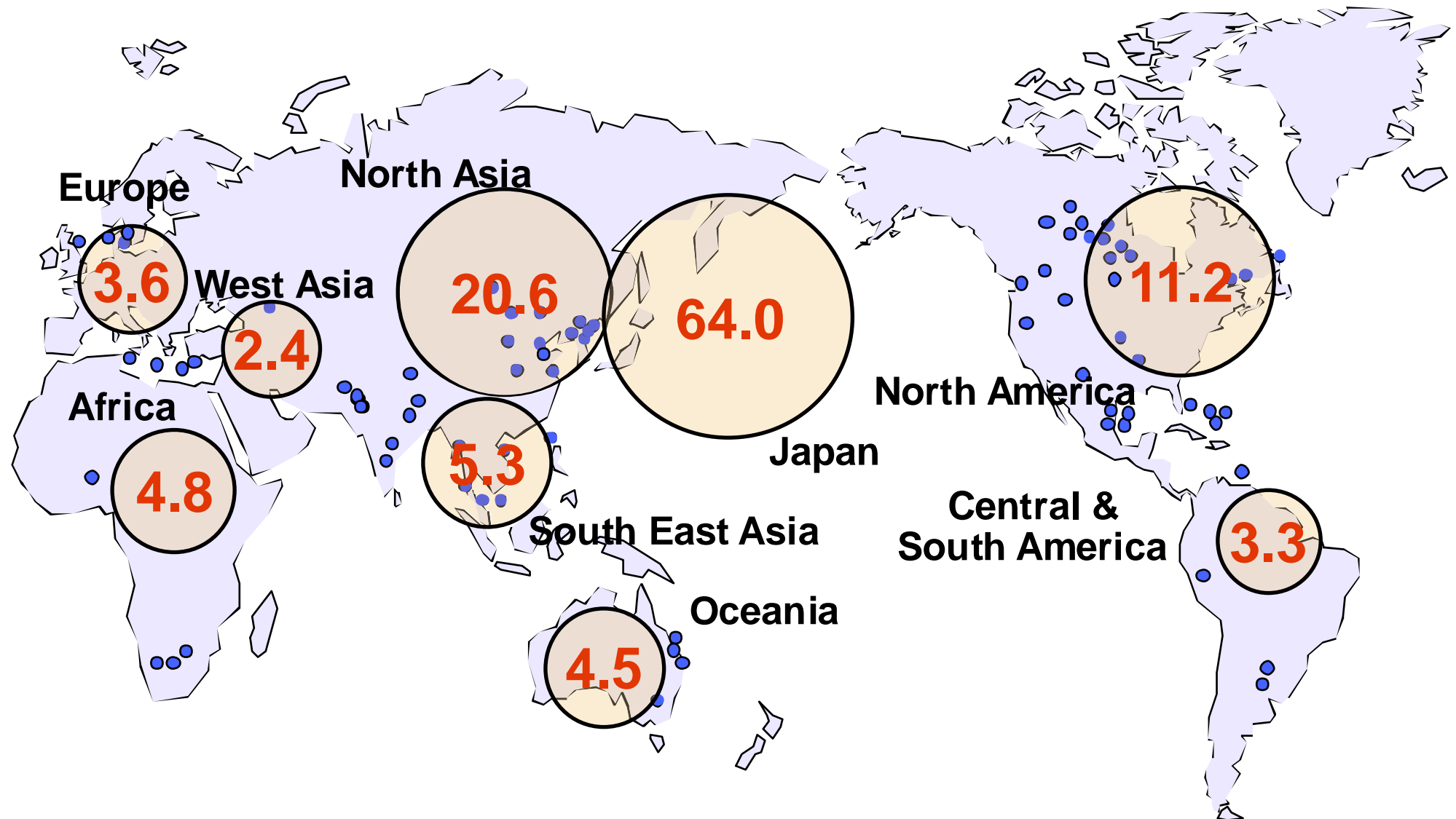
■ P.S. Boxberg R

Output :	1 x 670MW
Main Steam flow :	1 x 1,760 t/h
Superheater Steam :	600°C / 315 bar
Reheater Steam :	610°C / 72 bar
Commissioning :	2012
Fuel :	German Lignite



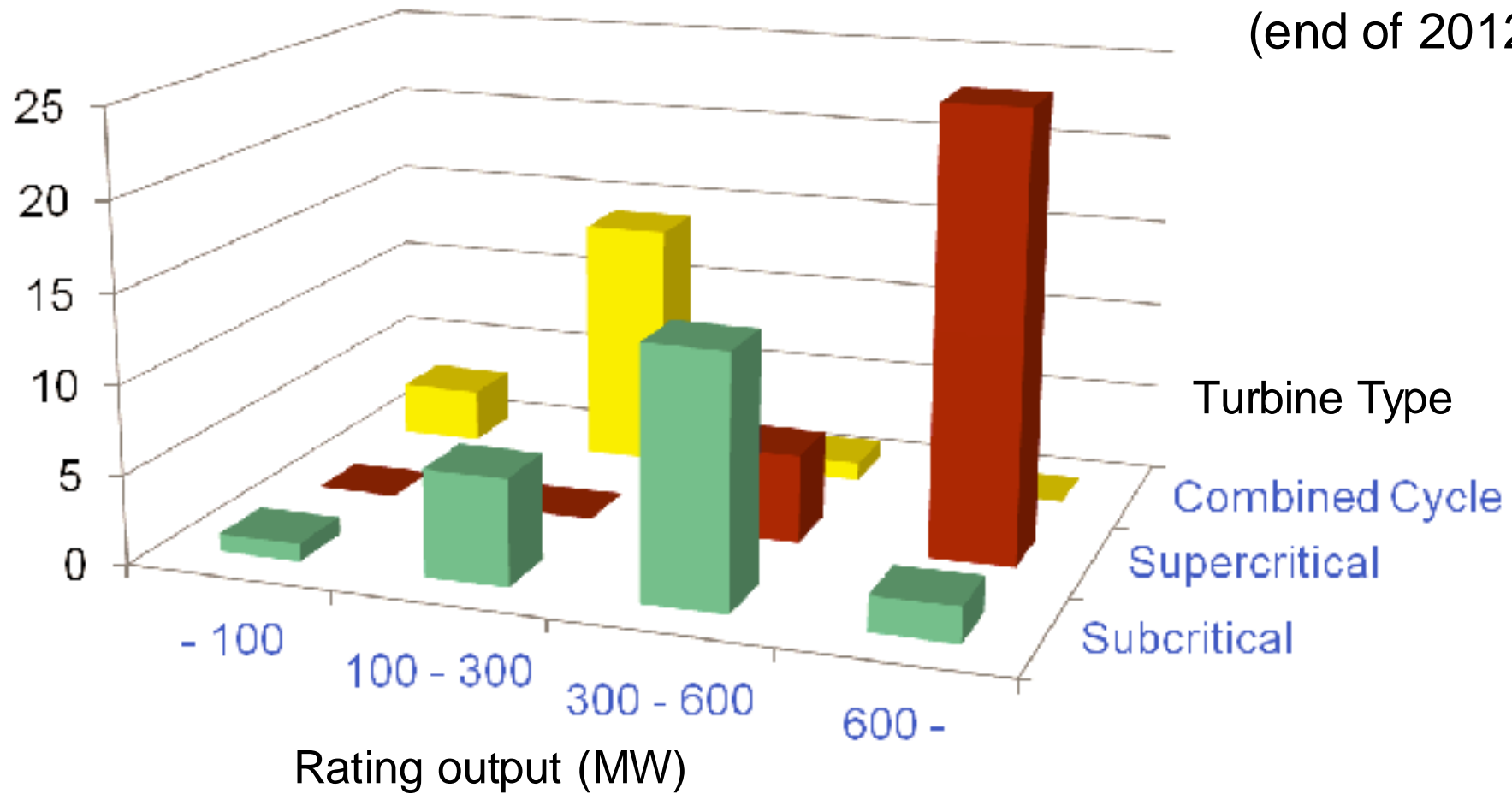
Steam Turbine Supply Record

Total Installed Capacity: 120 GW



Steam Turbine Generator under Contract since 2002

Total 71 Sets
(end of 2012)



- **STEAG-EVN (Germany)**
Walsum No.10

Generator Output :	790 MW
Frequency:	50Hz
Steam Conditions :	26.4MPa / 600°C / 620°C
Commercial Operation :	2013



- **Electrabel (Germany)**
Wilhelmshaven
- **Electrabel (Holland)**
Centrale-Rotteldam

Generator Output :	790 MW
Frequency:	50Hz
Steam Conditions :	25.0MPa / 600°C / 620°C
Commercial Operation :	2013



■ MidAmerican Energy Company (USA) Council Bluffs No.4

Generator Output :	870 MW
Frequency:	60Hz
Steam Conditions :	25.3MPa / 566°C / 593°C
Commercial Operation :	2007



■ Tokyo Electric Power Co., Ltd (Japan) Hitachi Naka Unit 1

Generator Output :	1,000 MW
Frequency:	50Hz
Steam Conditions :	24.5MPa / 600°C / 600°C
Commercial Operation :	2003



SCR (DeNOx) Supply Record

BHK Catalyst Manufacturing Facility in Japan (Akitsu Works)



BHK Catalyst Manufacturing Facility in China (BHHE)



USA, AES/
Somerset No.1
675MW, Coal



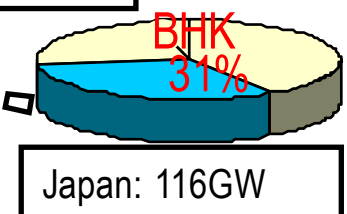
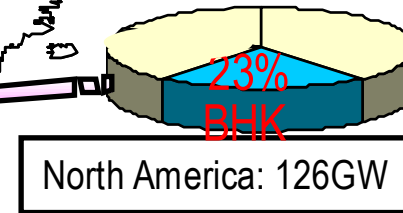
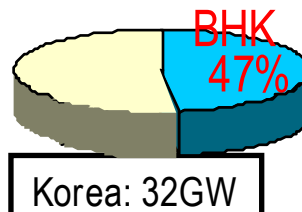
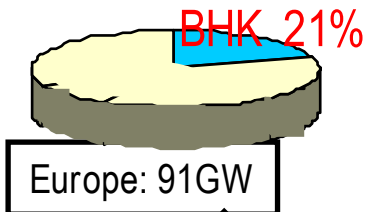
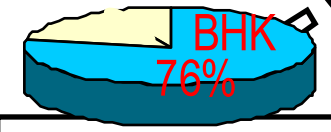
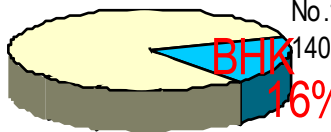
USA, LA DWP/
Haynes No.1 230MW,
LNG



Germany,
Mehrum No.3
700MW, Coal



Poland, PGNiG
Siekierkie
No.10, 11, 14, 15
140MW x 4, Coal



Japan, TEPCO/
Hitachi Naka No.1
1000MW, Coal



Japan, TEPCO/
Sodegaura No.1
1200MW, LNG

Total: 743GW Supply Experience in the world
⇒ World Share 24% (No.1 in the World) (Dec 2012)

FGD (DeSOx) Supply in Europe

