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Case studies on adoption of advanced coal-fired power technology in emerging economies

"Cleaner and more efficient coal technologies in Russia"
Expert meeting
10 December 2012, World Trade Center, Moscow

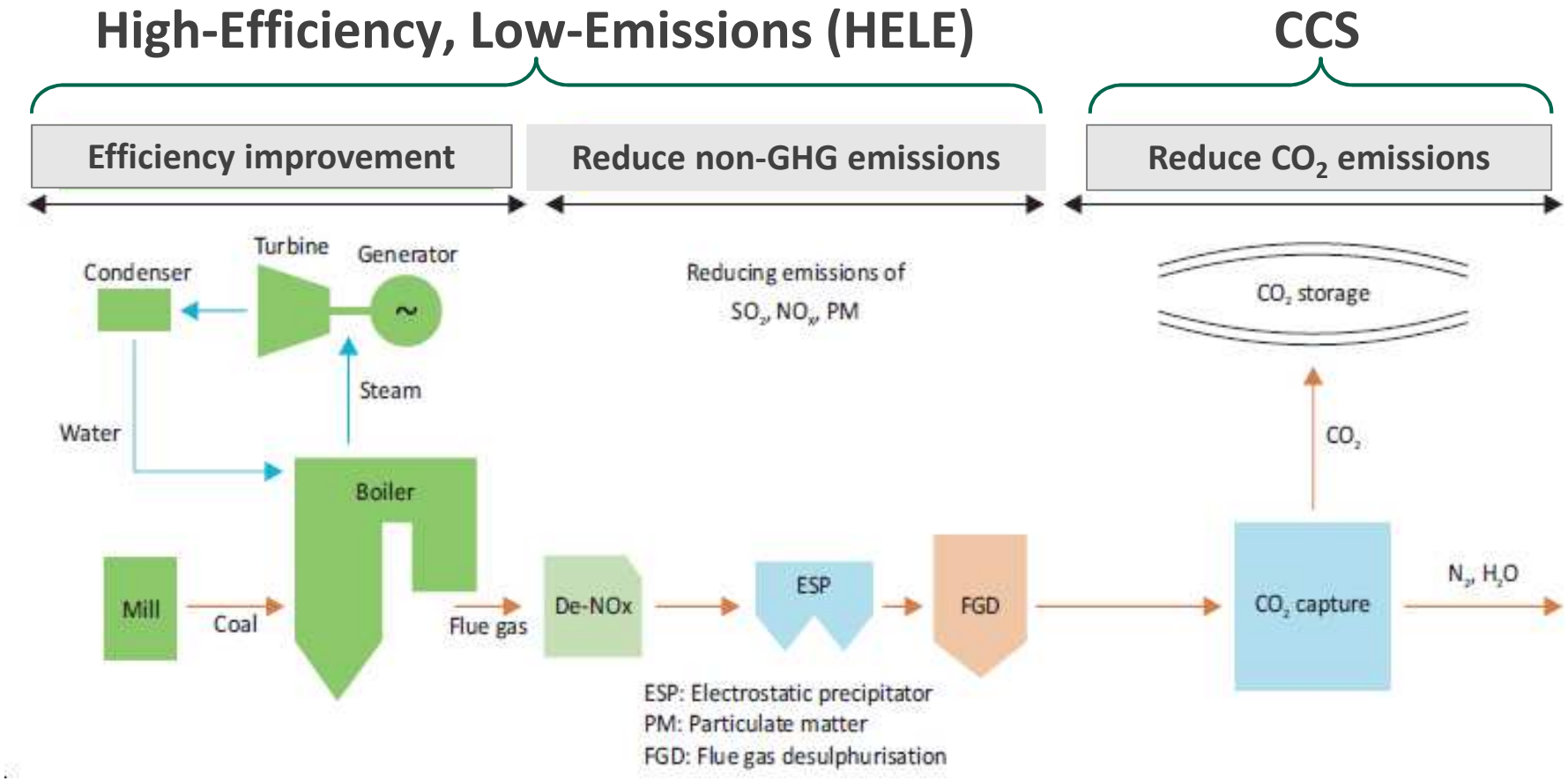




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The IEA recommends High-Efficiency, Low-Emissions (HELE) technologies

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Efficiency improvement reduces specific fuel consumption and also reduces specific pollutant emissions.

Source: IEA, Workshop on Advanced-USC Coal-fired Power Plants
Vienna, Austria, 19-20 September 2012

Hitachi covers all High-Efficiency, Low-Emissions coal-fired power technologies

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Integrated supply of BTG + AQCS ⇒ Optimize entire plants

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

■Steam turbines and power generators (TG)

Highly efficient and reliable

Achieved world's highest level efficiency with the new No. 2 unit of Isogo Thermal Power Plant for Electric Power Development Co., Ltd.

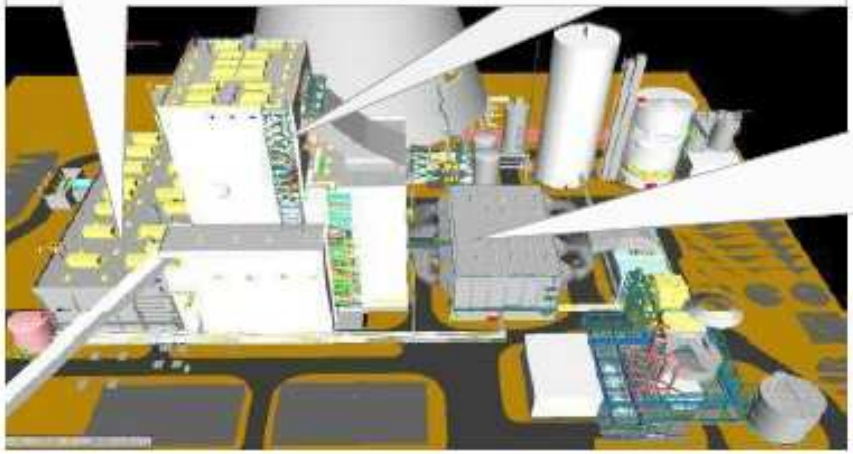


Turbines and generators



Low-pressure turbines

*Steam condition: 25MPa 600℃/620℃

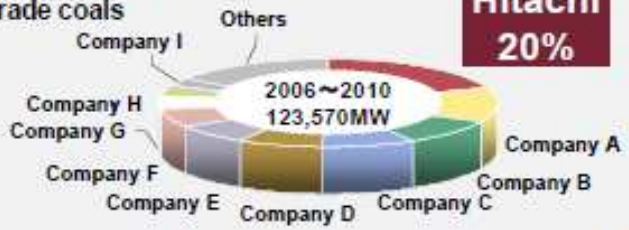


■Boilers (B)

Highly efficient combustion:
Low Nox/CO_2 emissions, high economical efficiency
Compatible with various coal types :
Applicable to low grade coals



Top share
Hitachi 20%



Source: McCoy Reports 2010 (Excluding China and India)

■AQCS

Integrated system (DeNOx reactor, precipitator, desulfurizer)
High-performance DeNOx catalyst: In-house development and production system



DeNOx systems



DeNOx catalyst

DeNOx Catalyst Share

Top share
Hitachi 26%



Source: Hitachi estimate

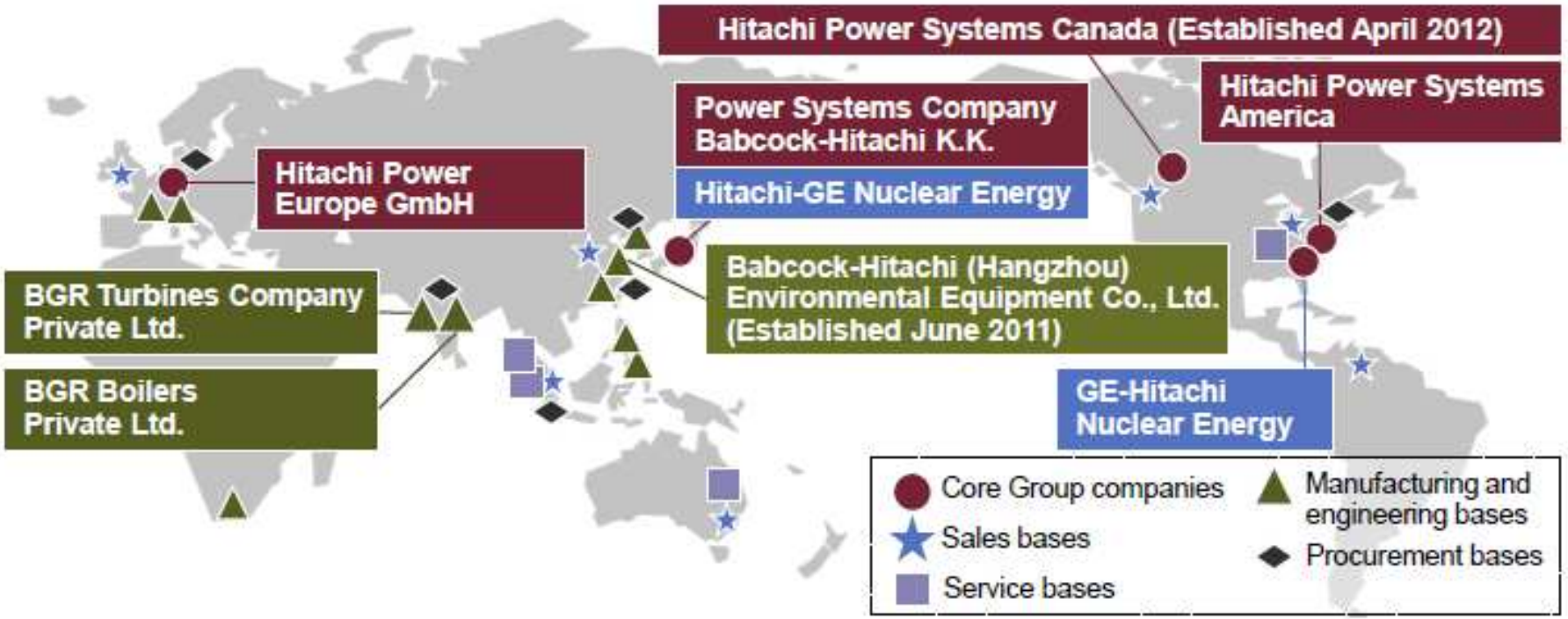
Source: Hitachi IR Day 2011

Hitachi built global business structure for growing power markets

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Provide solutions to target markets by expanding and enhancing global bases

- Expand and enhance sales functions of overseas bases
  (India, South Africa, Dubai, etc.)
- Make integrated proposals from power generation to transmission & distribution
- Expand and enhance overseas procurement,
  overseas production and overseas engineering



Source: Hitachi IR Day 2012

Hitachi has experiences of building coal-fired power plants in many regions

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Expand business through three core bases (Japan, Europe and the Americas) and India

■ Constructing highly efficient coal-fired thermal power plants: 30 plants (26.4 GW)* under construction

Europe, South Africa

- Neurath (Under commissioning) B [1100MW × 2]



- Moorburg (Under construction) B [820MW × 2]



- Wilhelmshaven (Under construction) BTG [790MW]



- Rotterdam (Under construction) BTG [790MW]



- Medupi-1~6 (Under construction) B [800MW × 6]



- Kusile-1~6 (Under construction) B [800MW × 6]



Asia

- TEPCO/Hitachinaka No. 2 unit (Under construction) BTG [1,000MW]



- South Korea/Yonghung Thermal Power Plant No.5 and No.6 unit (Under construction) TG [870MW × 2]



- South Korea/Dangjin Thermal Power Plant No. 9 and No.10 unit (Preparing for construction) B[1,000MW × 2]

Recent orders

- South Korea/ Taean Thermal Power Plant, Units No. 9 and No. 10 units [1,050MW × 2]BTG
- India/ NTPC [660MW × 6]B
- India/ NTPC [800MW × 4] (First refusal right)TG

<H-25 gas turbines>
6 orders from China, India, etc.

Americas

- Duke Energy (Under commissioning) B [900MW]



Recent orders

- U.S./ KCP&L AQCS × 2

<H-25 gas turbines>
4 orders from Canada, etc.

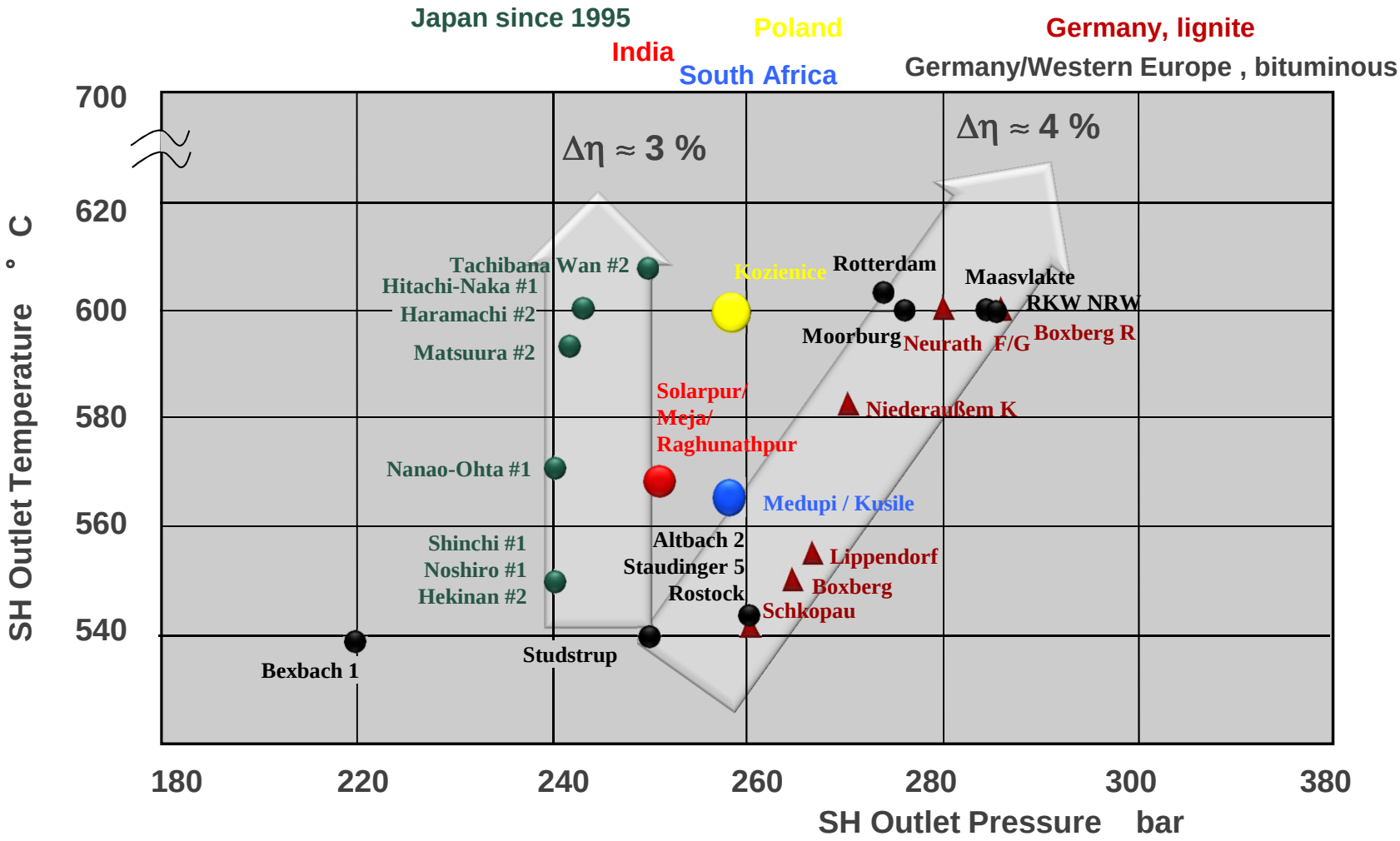
B: Boilers, TG: Steam Turbine and Generator AQCS: Air Quality Control System *: Including plants preparing for construction or under commissioning

Source: Hitachi IR Day 2012

Development of process parameters
Recent high efficient steam generators

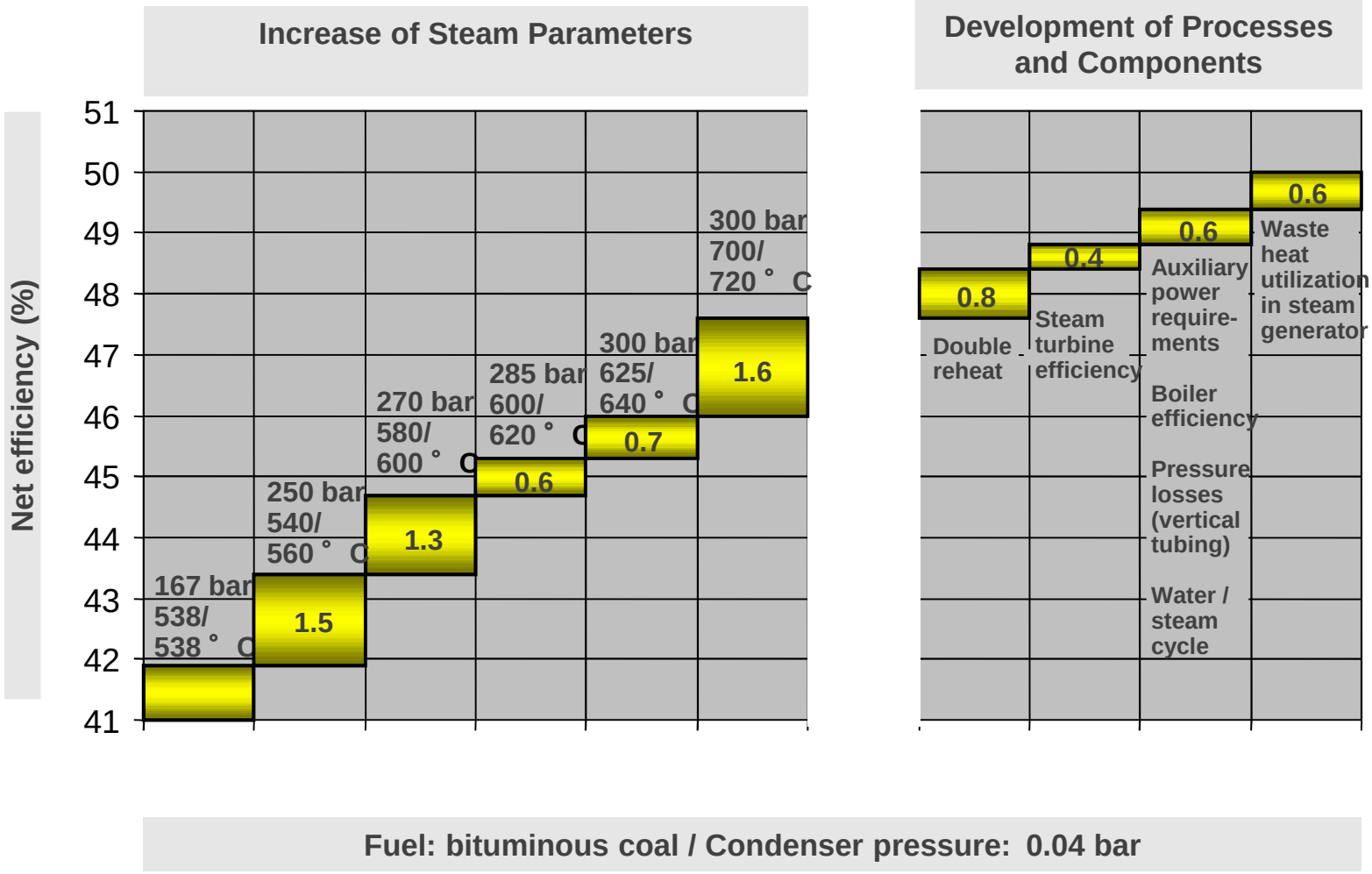
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Actual running power plants projects in Germany and western Europe marking the worldwide most modern state of the art



Measures for Increasing the Efficiency of the Water / Steam - Cycle

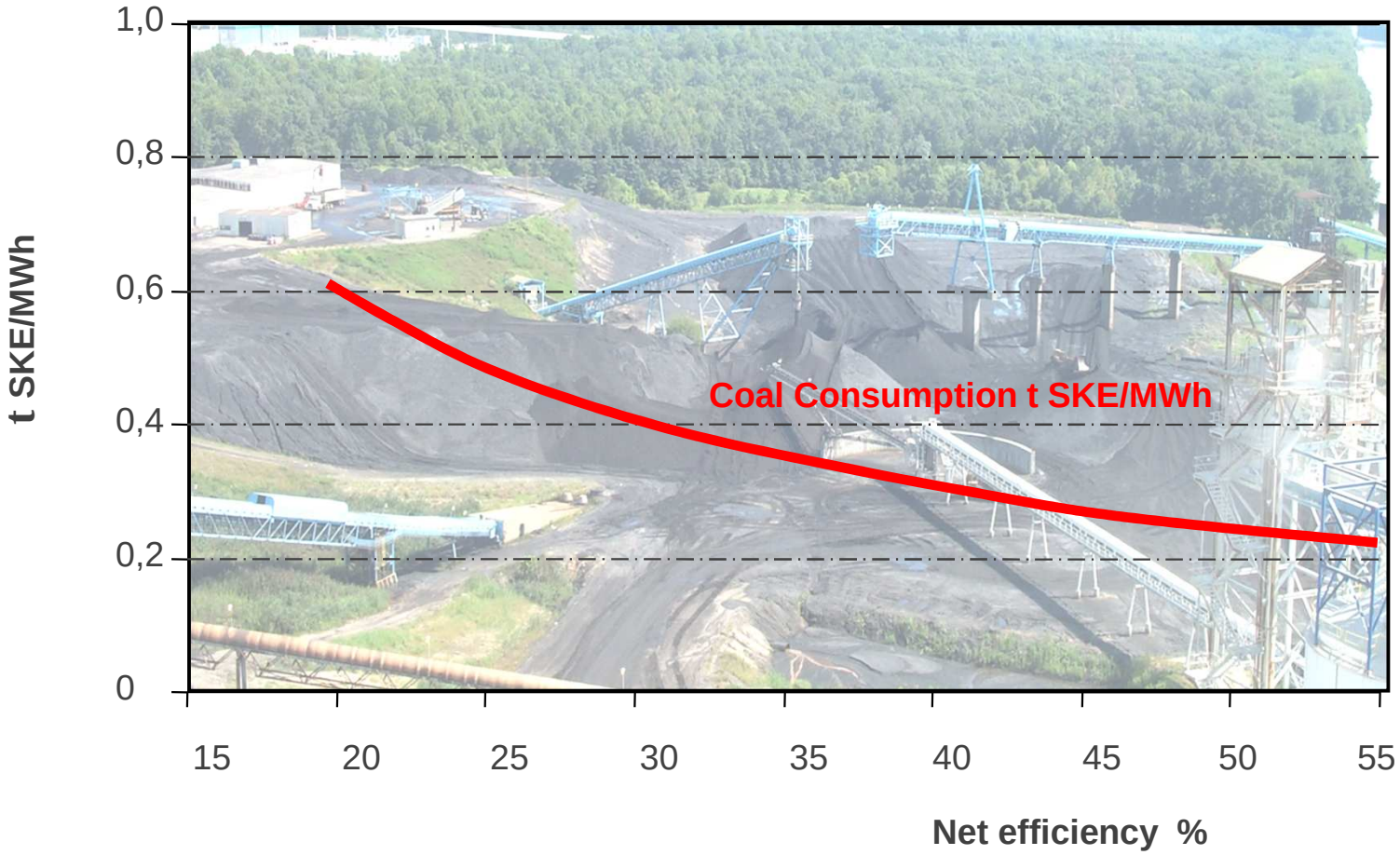
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Fuel: bituminous coal / Condenser pressure: 0.04 bar

Coal Consumption vs. Efficiency of Power Production

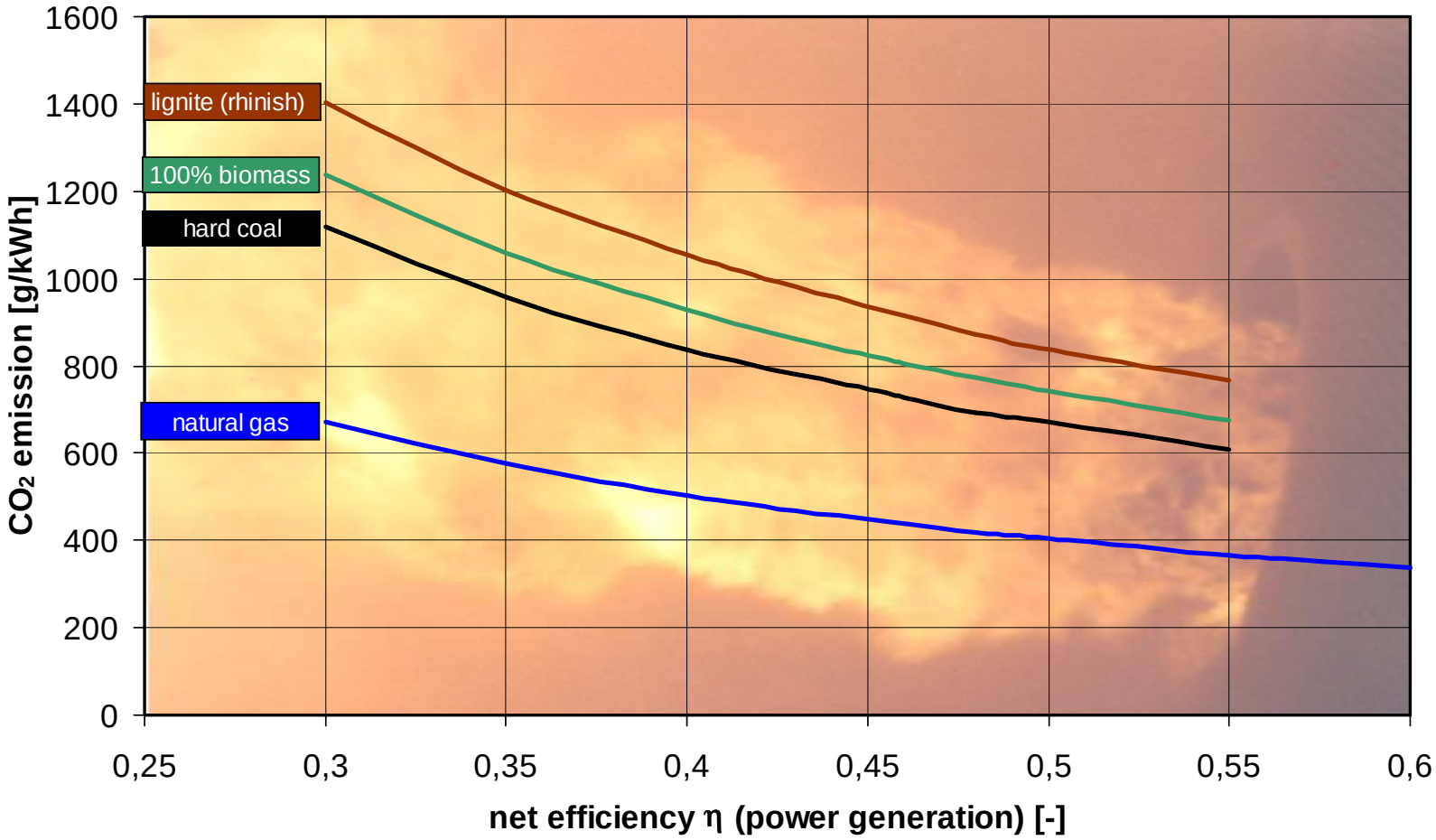
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Source: Wege zum emissionsfreien fossilen Kraftwerk (COORETEC)

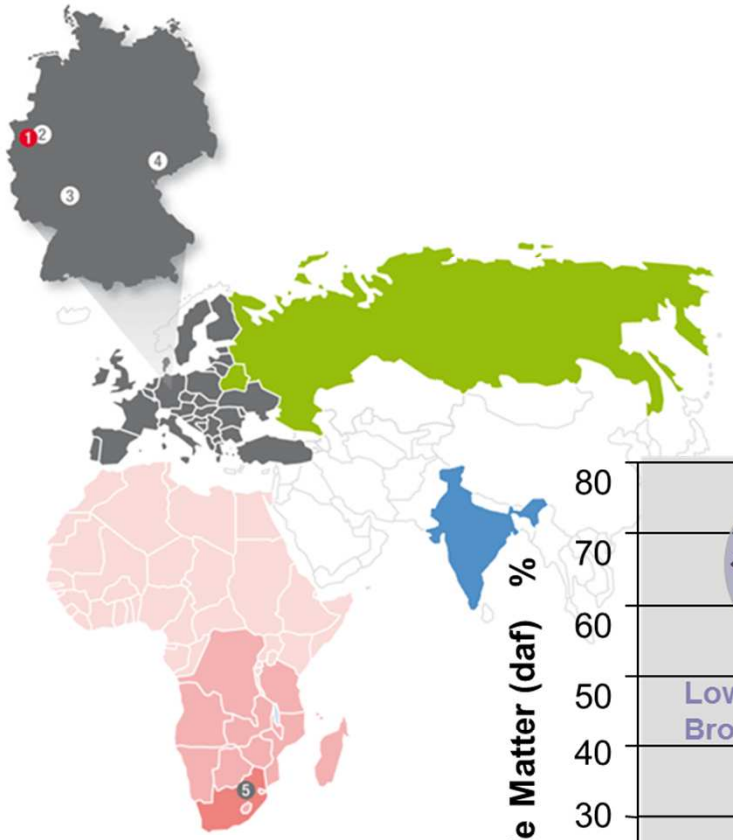
CO_2 Emissions of Power Plants Fired with Different Fuels

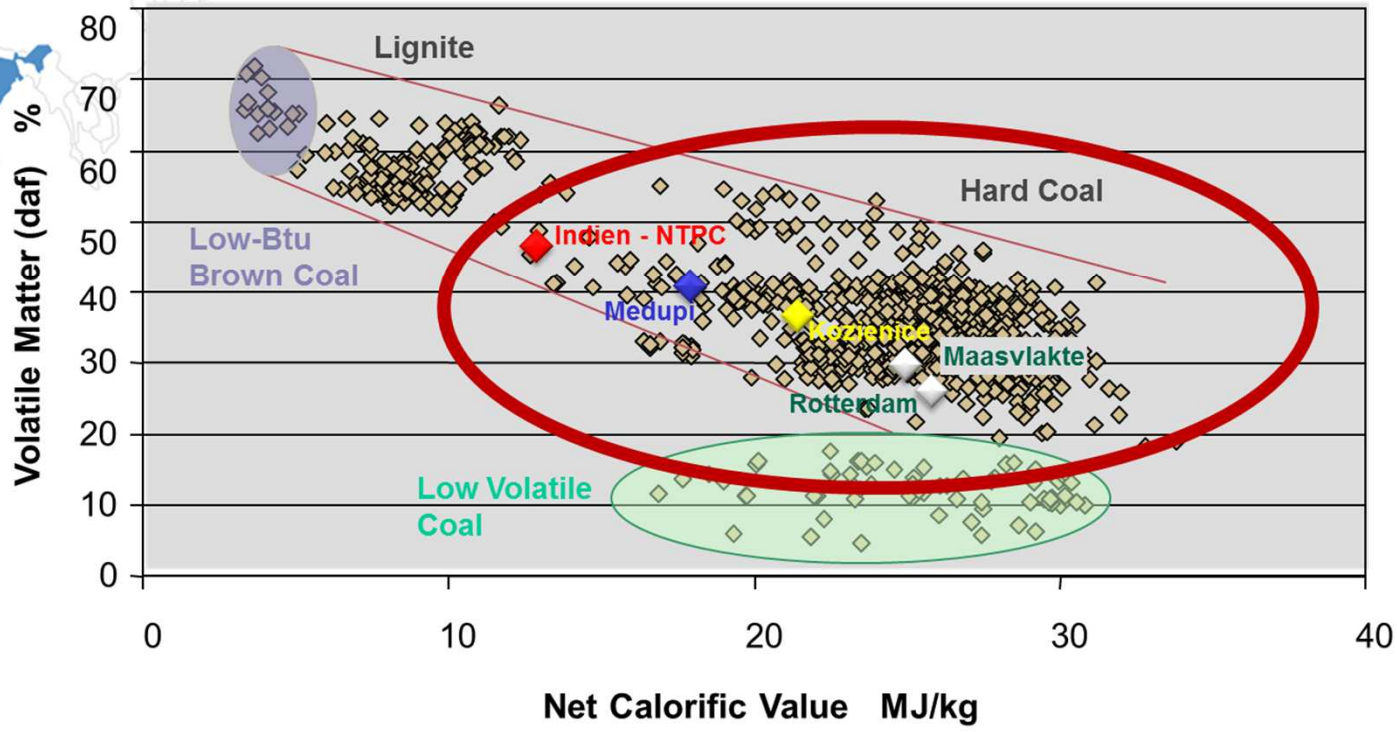
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HPE know-how for a world wide range of coal qualities

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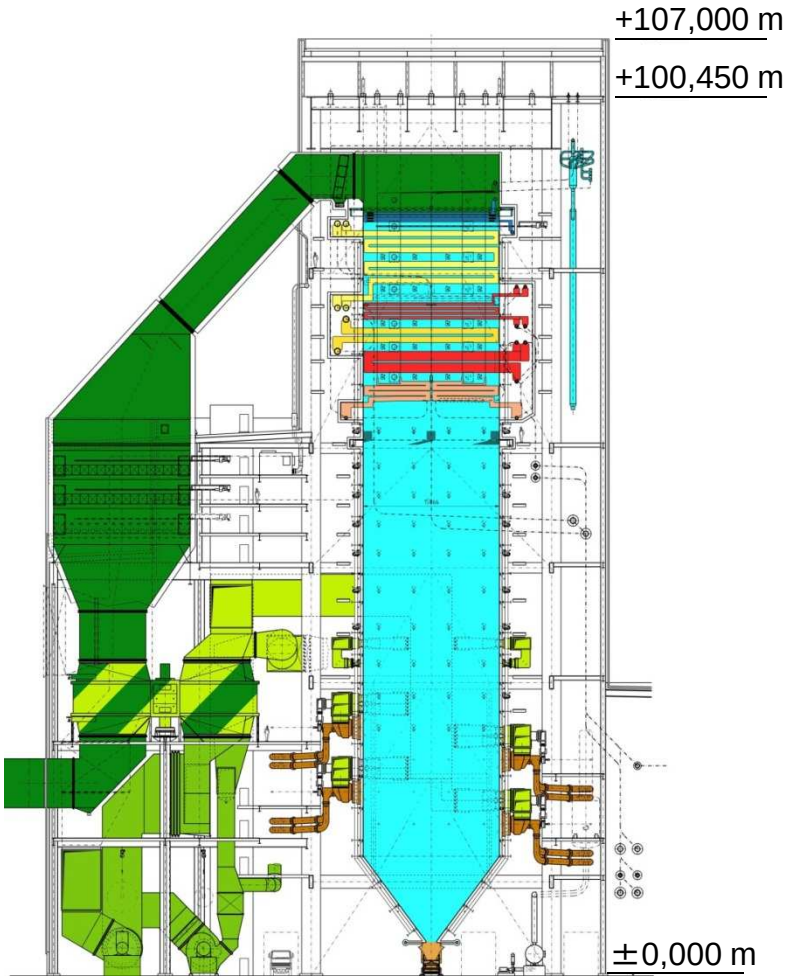


P.S. Rotterdam (790 MW)
Supercritical Steam Parameters

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- 1 x 790 MWel / 1 x 2143 t/h
- Start Commissioning 2013
- Bituminous Coal
  Hu = 24,9 MJ/kg
  A = 14,7 %
  W = 8,1 %
- Design parameters:
  SH: 603 °C / 290 bar a
  RH: 621 °C / 75 bar a



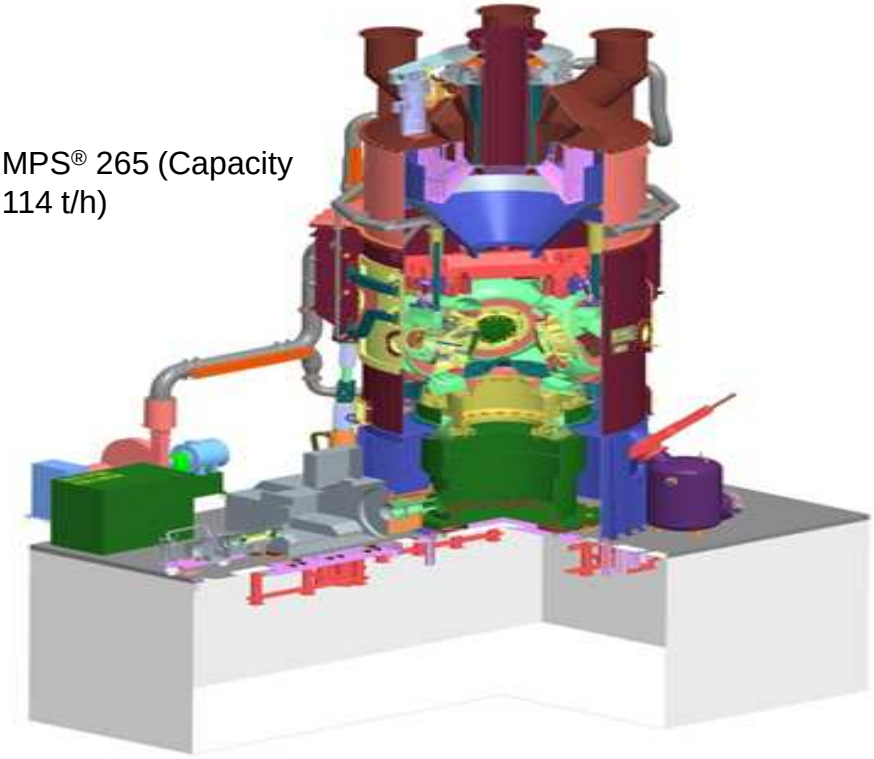


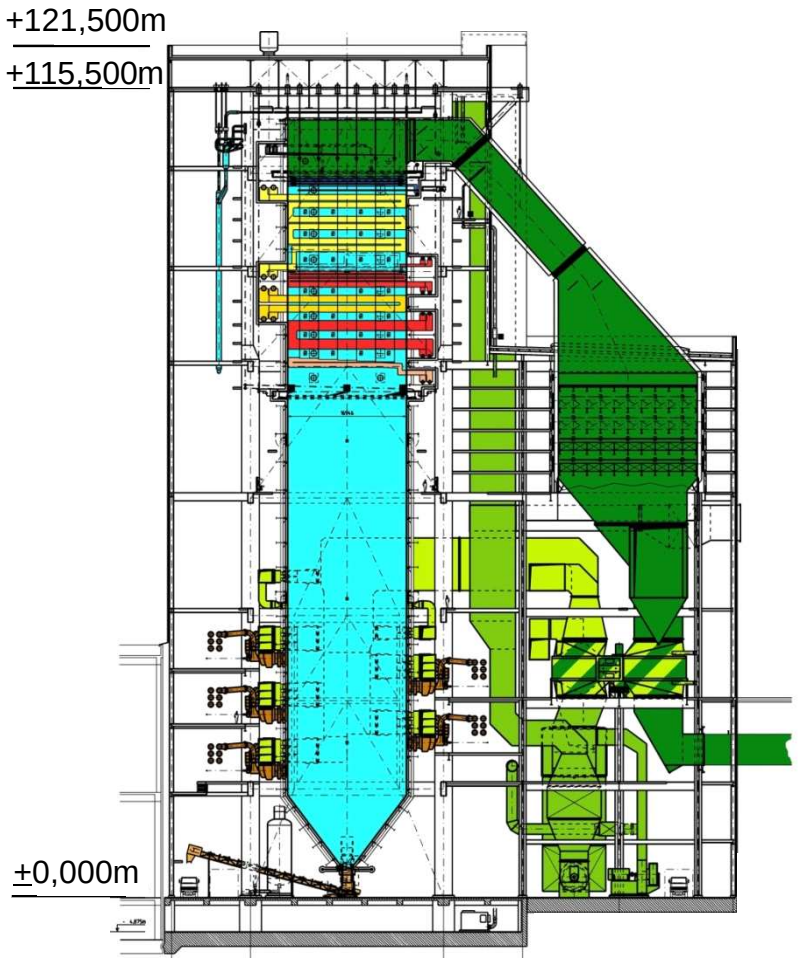
P.S. Maasvlakte (1100 MW)
Supercritical Steam Parameters

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- 1 x 1100 MWel / 1 x 2939 t/h
- Start Commissioning 2013
- Bituminous Coal
  Hu = 24,9 MJ/kg
  A = 14,3 %
  W = 8,2 %

MPS® 265 (Capacity 114 t/h)





Outline of technology in Korean Project

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The Largest Thermal Power Generation Equipment in terms of Power Generation Capacity in South Korea

Two boilers and two steam turbines and generators for use in the No. 9 and No. 10 units of the Taean Thermal Power Plant. The boilers are 1,050MW-class for ultra-supercritical (USC) coal-fired thermal power generation and the steam turbines and generators are to be developed independently by Hitachi.

Installation Plan at Korea Western Power's Taean Thermal Power Plant



Boiler	Type：Once-Through Benson
	Main Steam Flow： 3145t/h
	Steam Conditions：25.9MPa, 603℃/613℃
Steam Turbine	Type : Tandem Compound Four Flow Last Stage Blade : 50"Ti
	Steam Conditions：25MPa, 600℃/610℃
	Output：1050MW
Generator	Type : Hydrogen cooled, cylindrical rotor type
	Capacity：1254MVA
	Terminal Voltage：27kV
	Power Factor : 0.90(lagging), 0.95(leading)

Case studies on adoption of advanced coal-fired power technology

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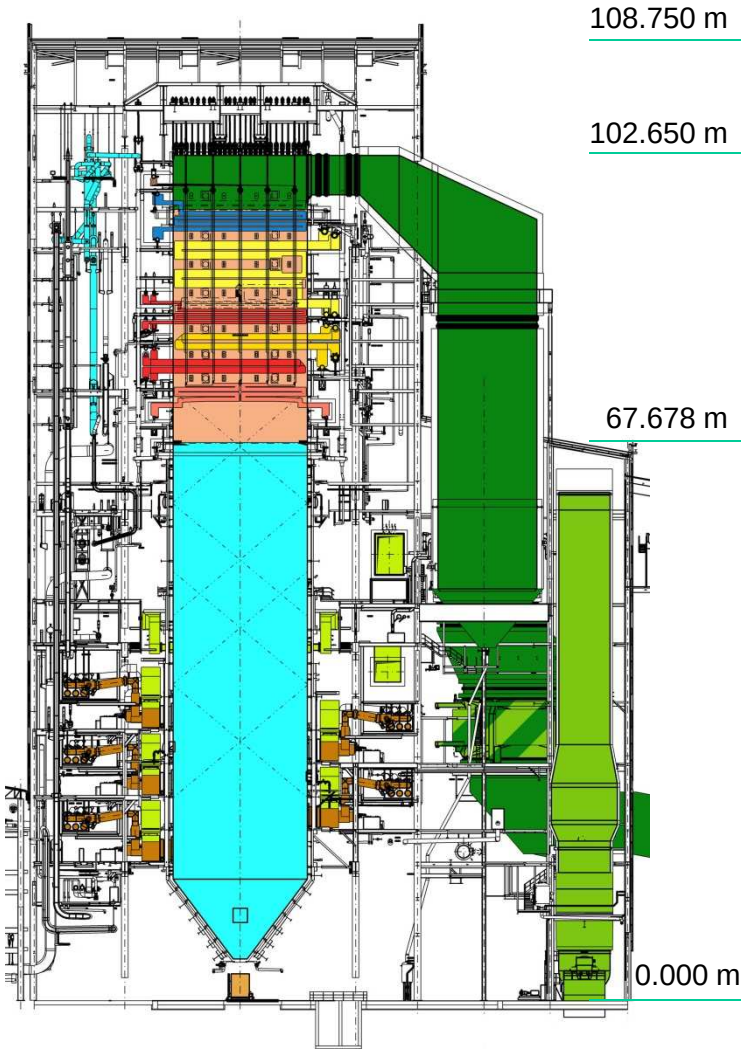
- Construction of Super Critical boilers in South Africa (800MW x 12 unit (B))
- Construction of Boilers and Turbines by partnering with local manufactures in India (660MW x 6 unit (B),
- EPC project for a Super Critical coal-fired power plant in Poland (1000MW x 1 unit (B,T,G & AQCS)

P.S. Medupi
Supercritical steam parameters

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- 6 x 794 MWel / 2290 t/h
- Start Commissioning 1st Unit 2013
- Bituminous Coal
  Hu = 17,8 MJ/kg
  A = 32,3 %
  W = 10,6 %
- Design parameters:
  SH: 564 ºC / 258 bar
  RH: 572 ºC / 53.2 bar

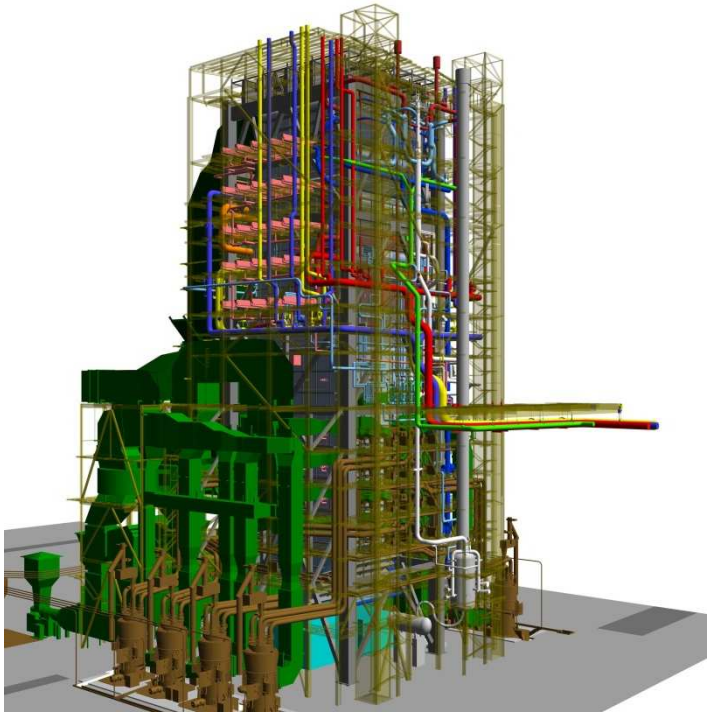


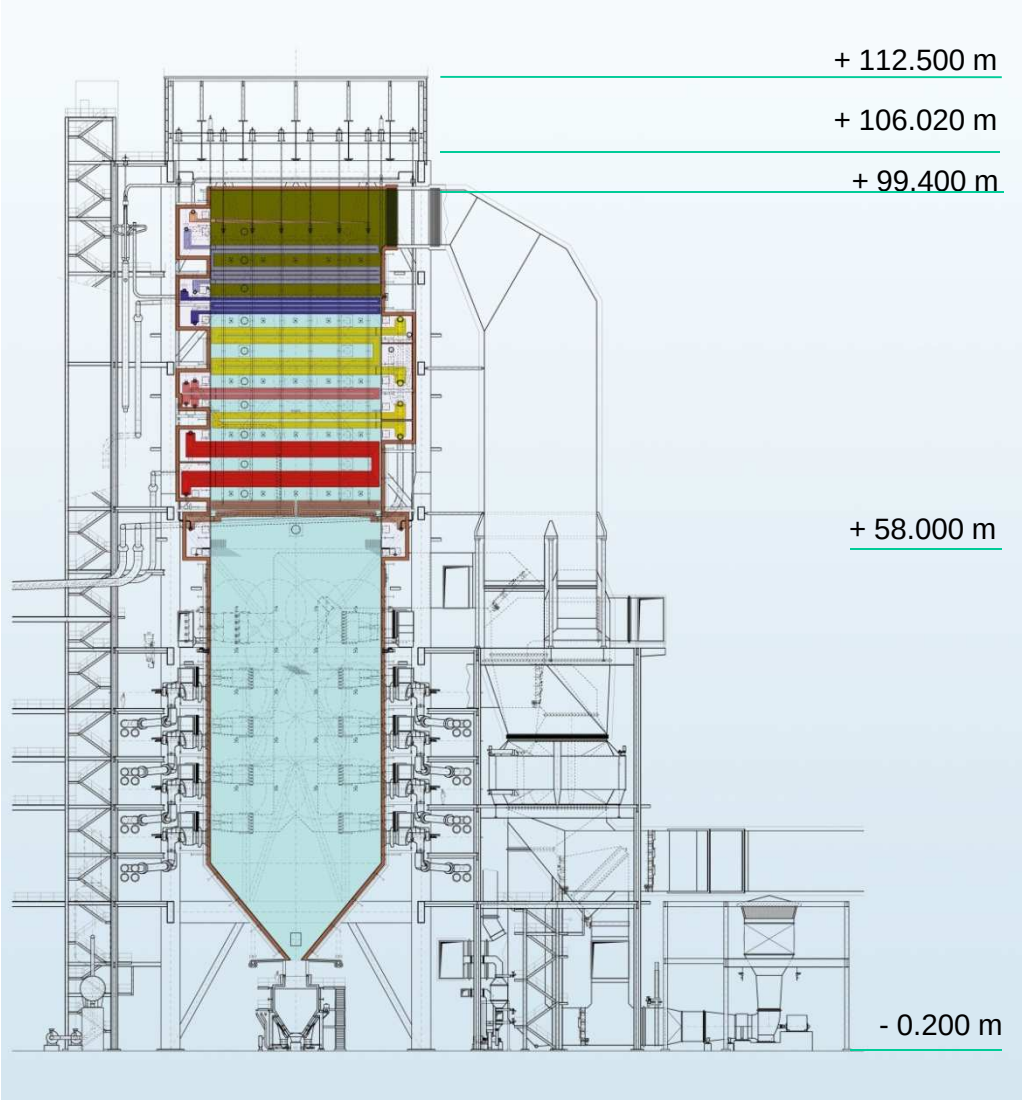


Indien NTPC
Supercritical steam parameters

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- 6 x 660 MWel / 6 x 2120 t/h
- Start Commissioning 2016
- Bituminous Coal
  Hu =12,7 MJ/kg
  A = 41,4 %
  W= 14,0 %
- Design parameters
  SH 568 C / 251 bar,
  RH 596 C / 52 bar

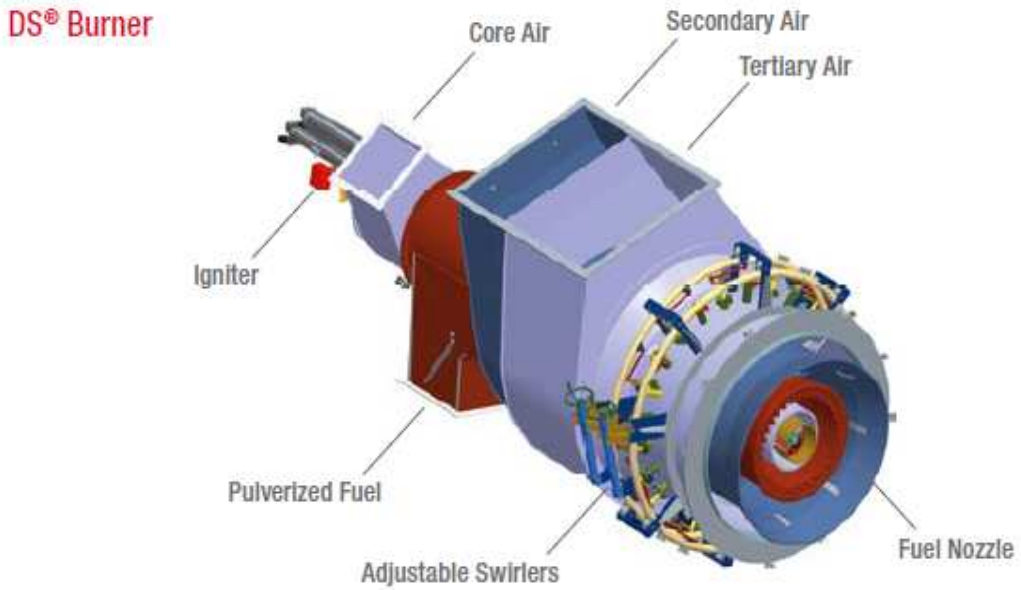


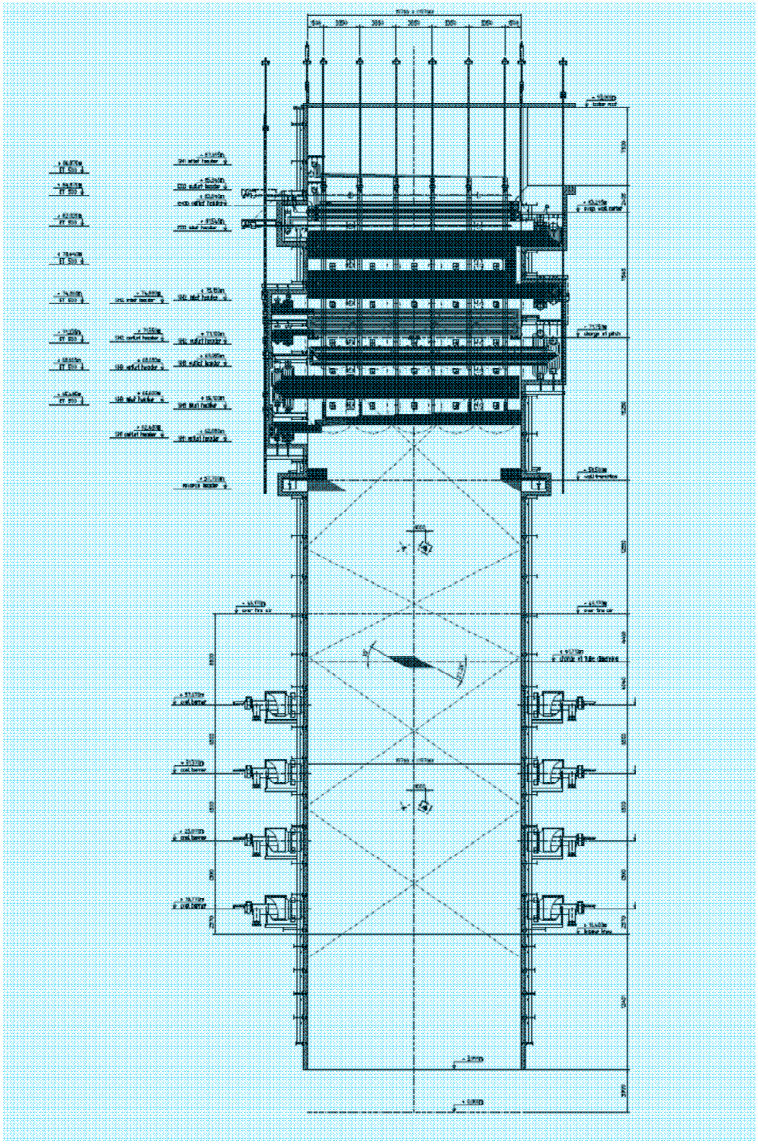


Kozienice
Supercritical steam parameters

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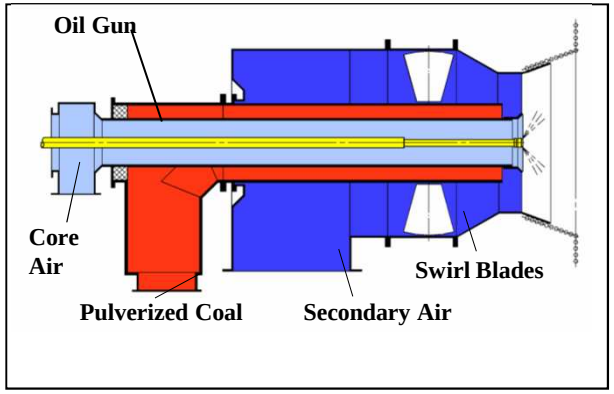
- 1 x 1000 MWel / 1 x 2016 t/h
- Start Commissioning 2016
- Bituminous Coal
  Hu =21,5 MJ/kg
  A = 22,0 %
  W = 11,3 %
- Design parameters
  SH 603 C / 267 bar,
  RH 621 C / 65,7 bar



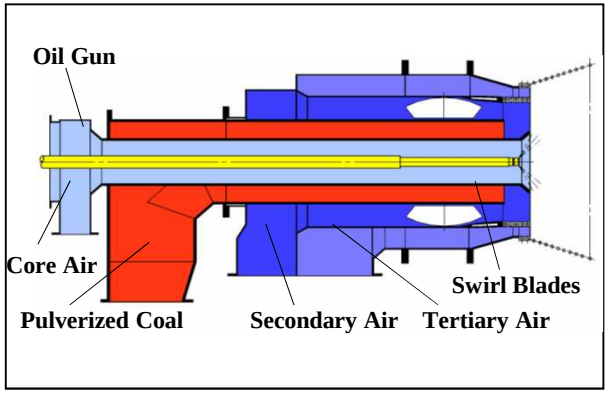


DS® Burner Development

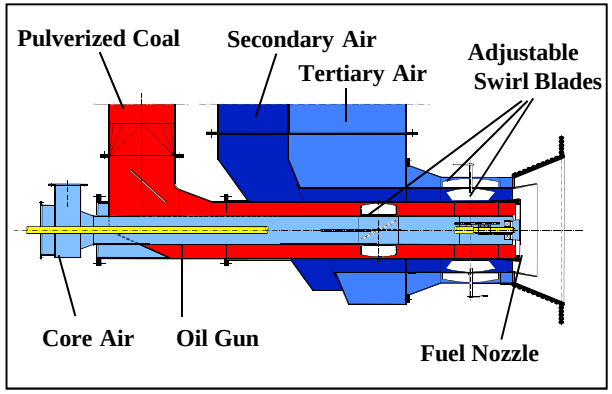
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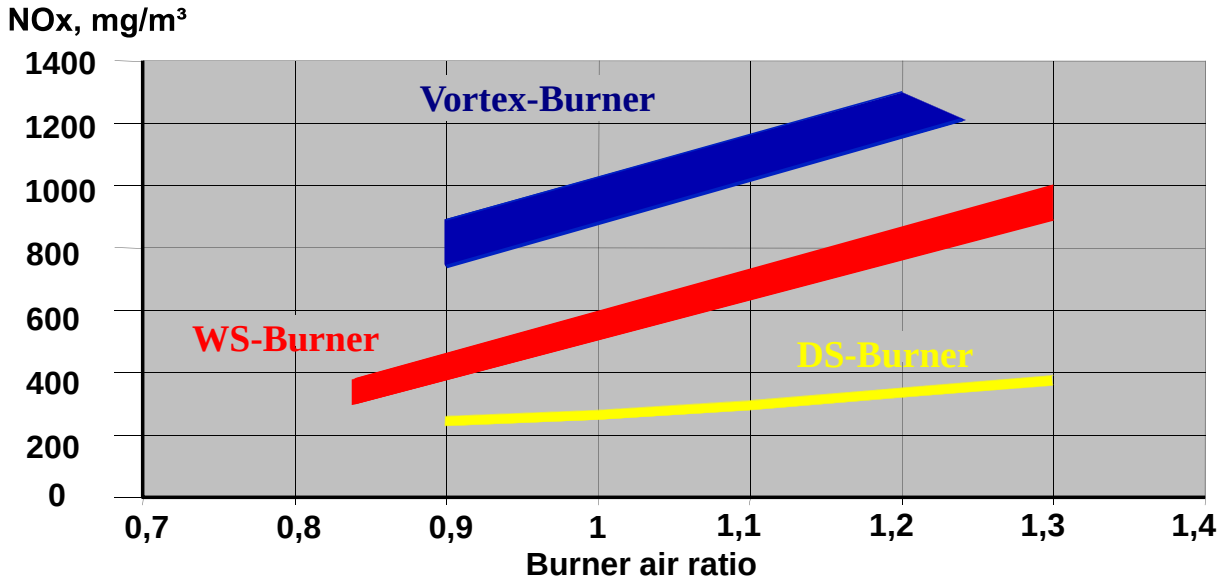
Vortex Burner before 1976



Vortex Burner developed in 1978

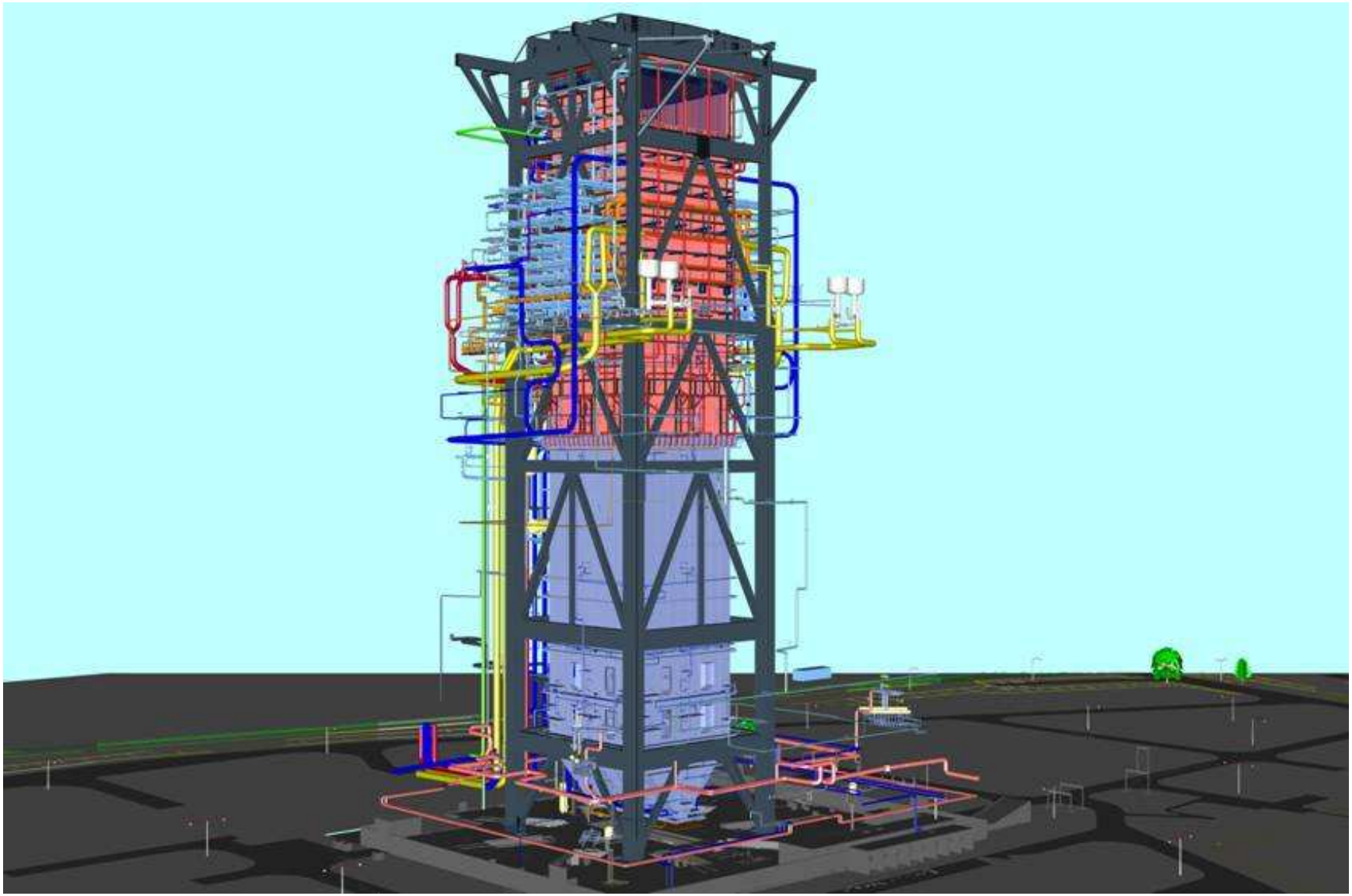


DS® Burner today



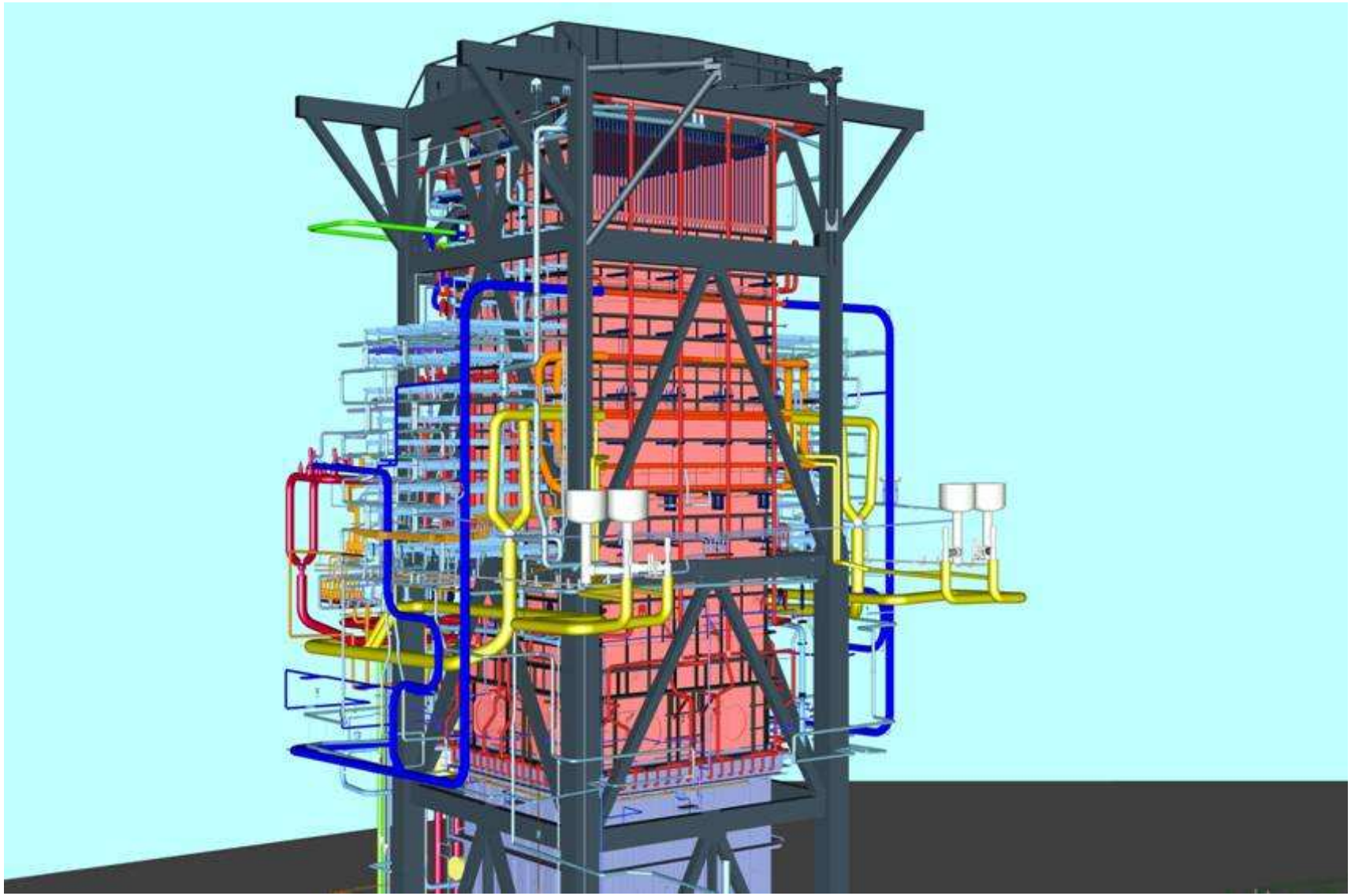
Advanced Coal-Fired Power Technology
Supercritical Tower Type Steam Generator

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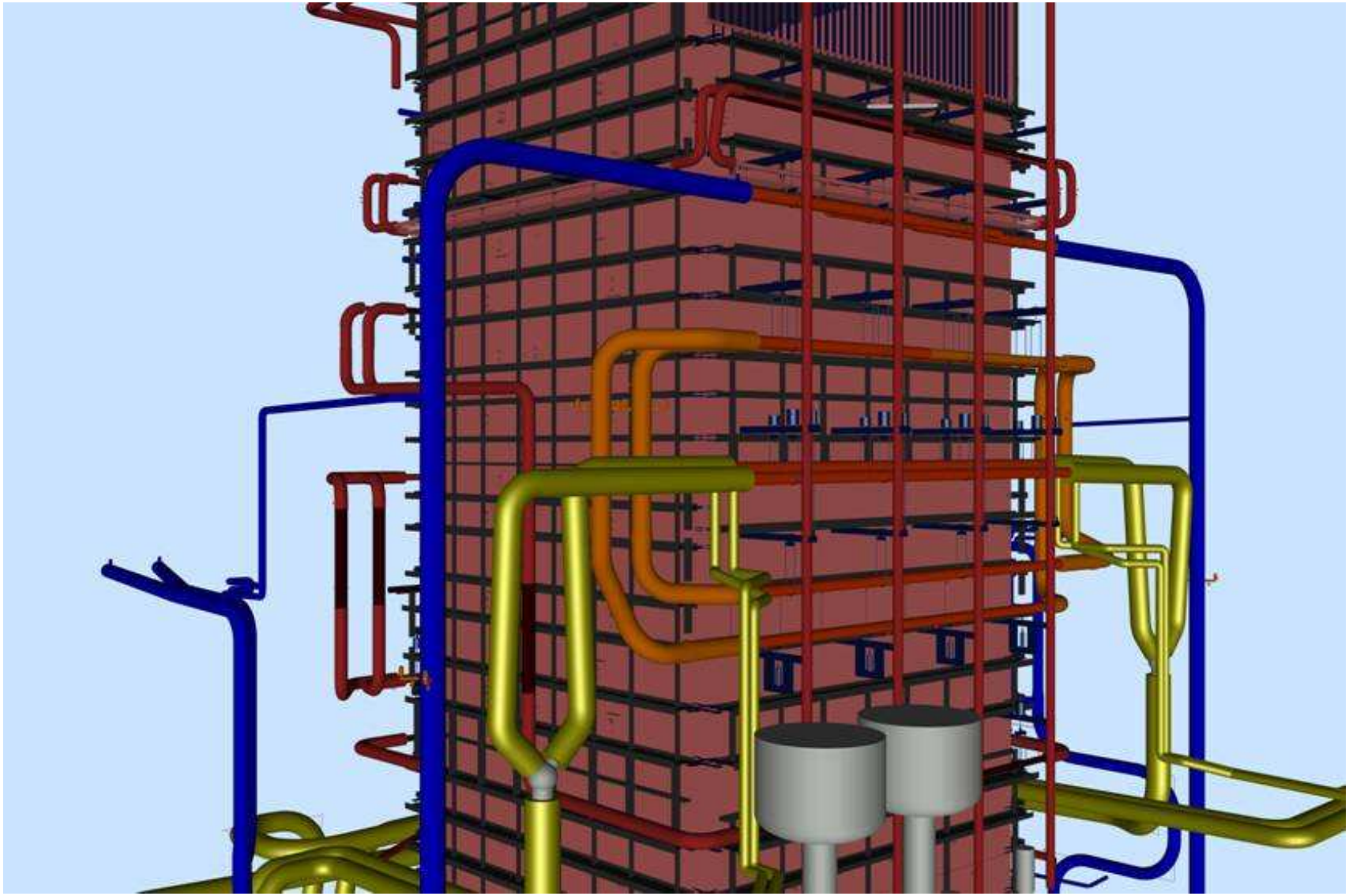
Advanced Coal-Fired Power Technology
Supercritical Tower Type Steam Generator

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Advanced Coal-Fired Power Technology
Supercritical Tower Type Steam Generator

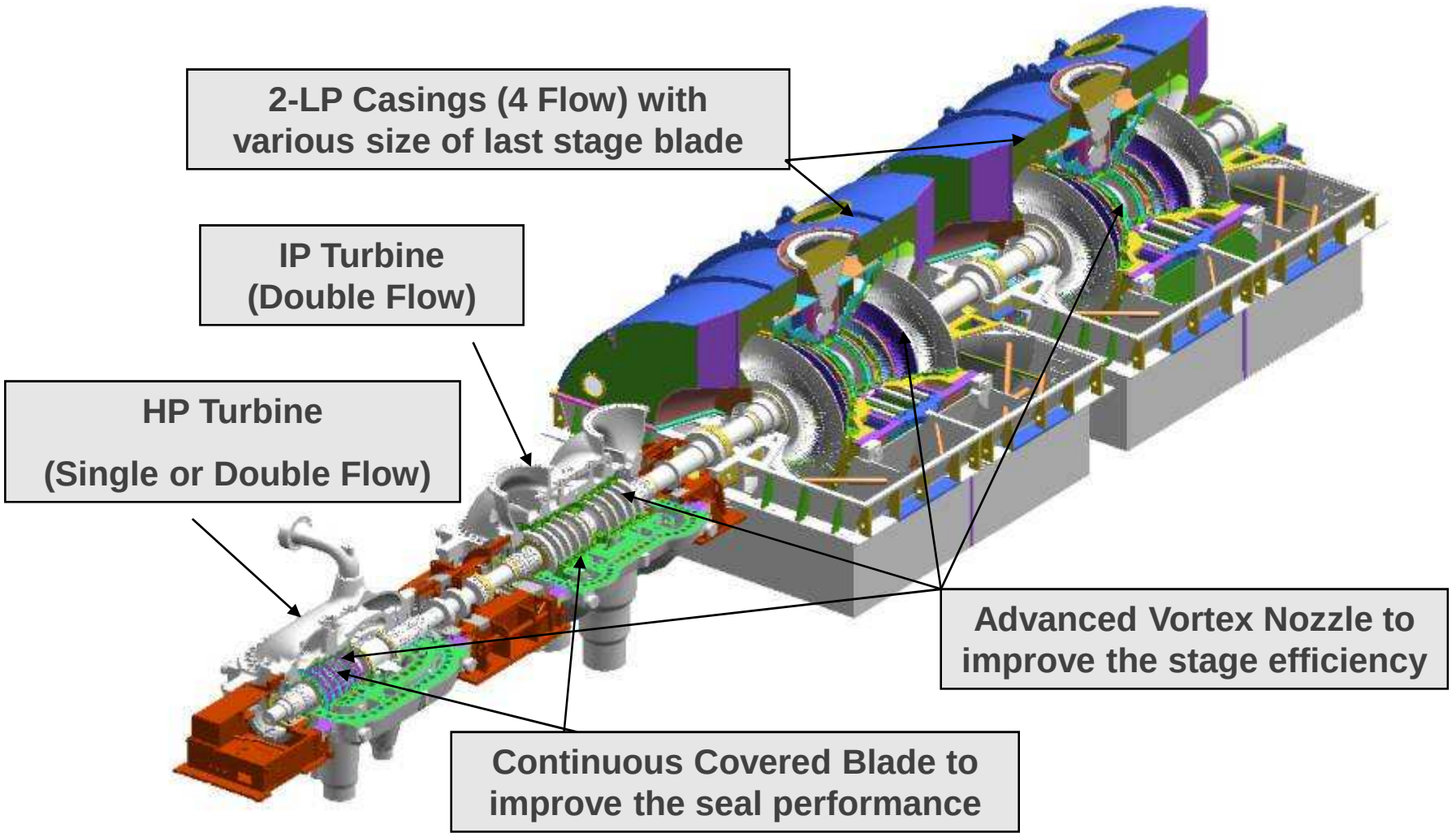
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Technology of steam turbine in Poland

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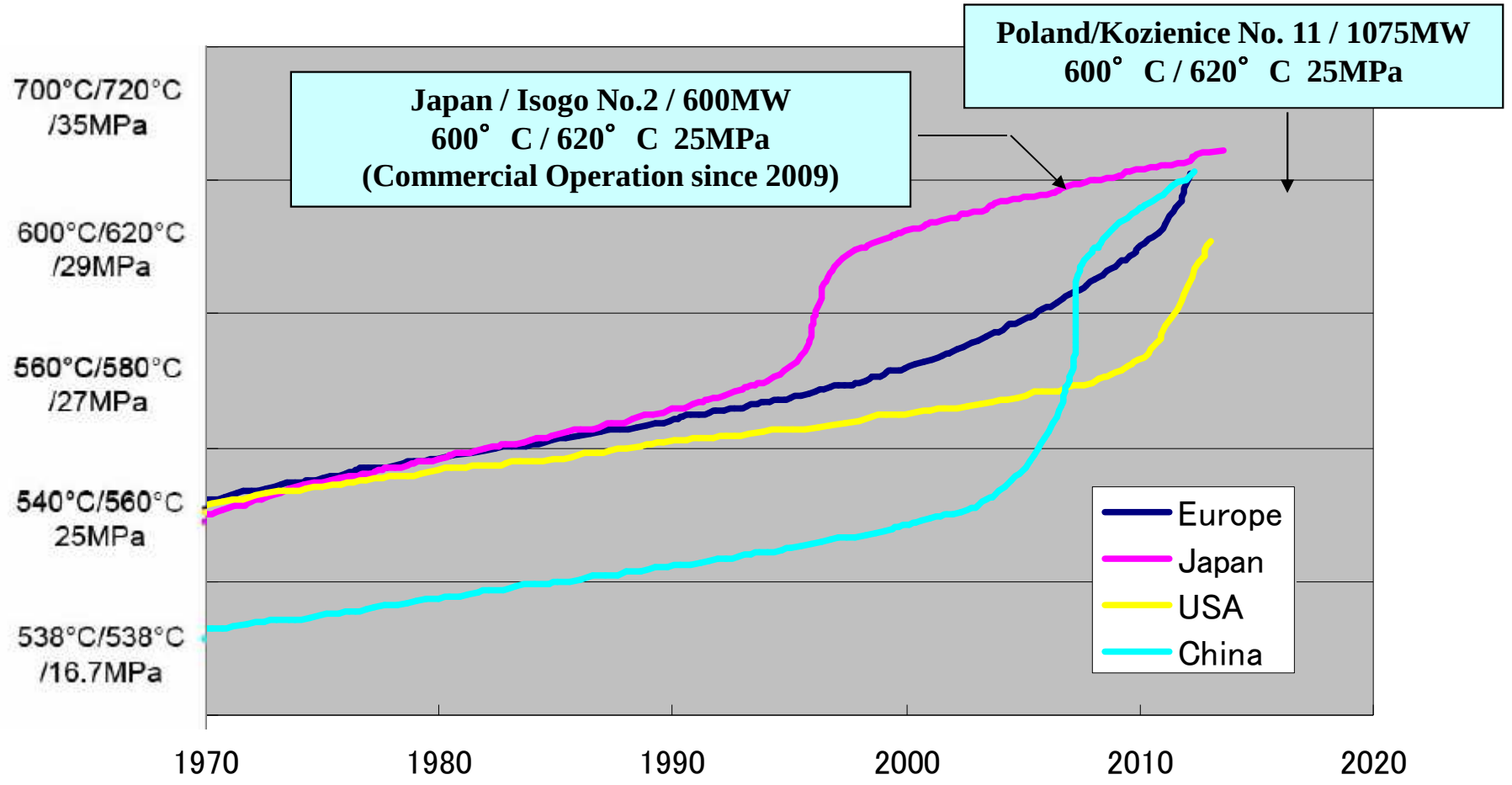
800-1300MW Class Steam Turbine for Polish Power Plant



Technology of steam turbine in India and Poland

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Super Critical Pressure Steam Turbine Technology



Summary

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- Hitachi can provide all technologies for advanced coal-fired power generation.
- Hitachi has experiences of making an optimum design for coal-fired power plants considering local conditions.
- Hitachi is open for technical collaboration with competent local companies.
- Hitachi would like to contribute to implementing cleaner and more efficient coal technologies in Russia.

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Case studies on adoption of advanced coal fired power technology in emerging economies

Cleaner and more efficient coal technologies in Russia
Expert meeting
10 December 2012, World Trade Center Moscow

Большое спасибо!

Thank you for your attention

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