



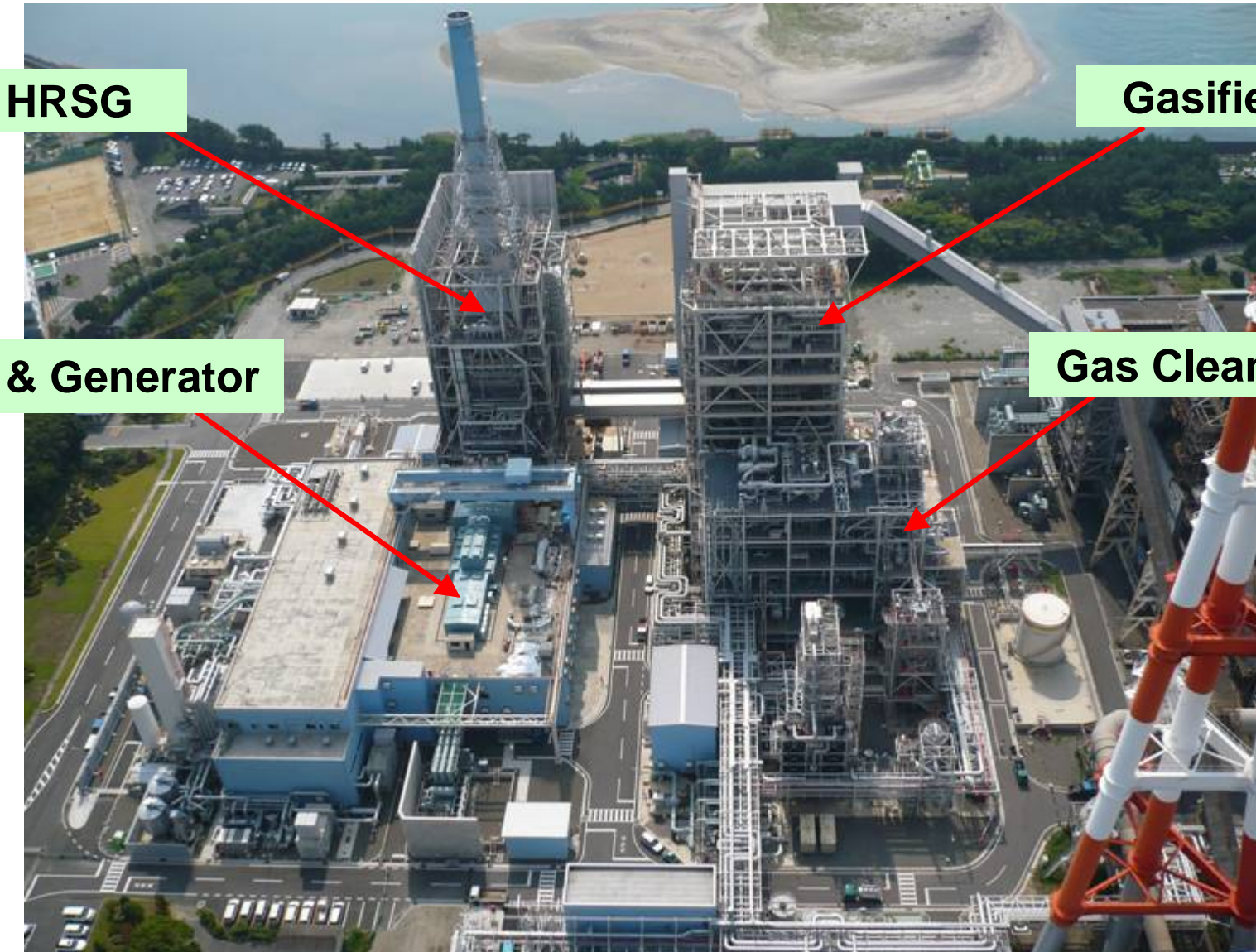
Second Year Operation Results of CCP's Nakoso 250MW Air-blown IGCC Demonstration Plant

October 6, 2009

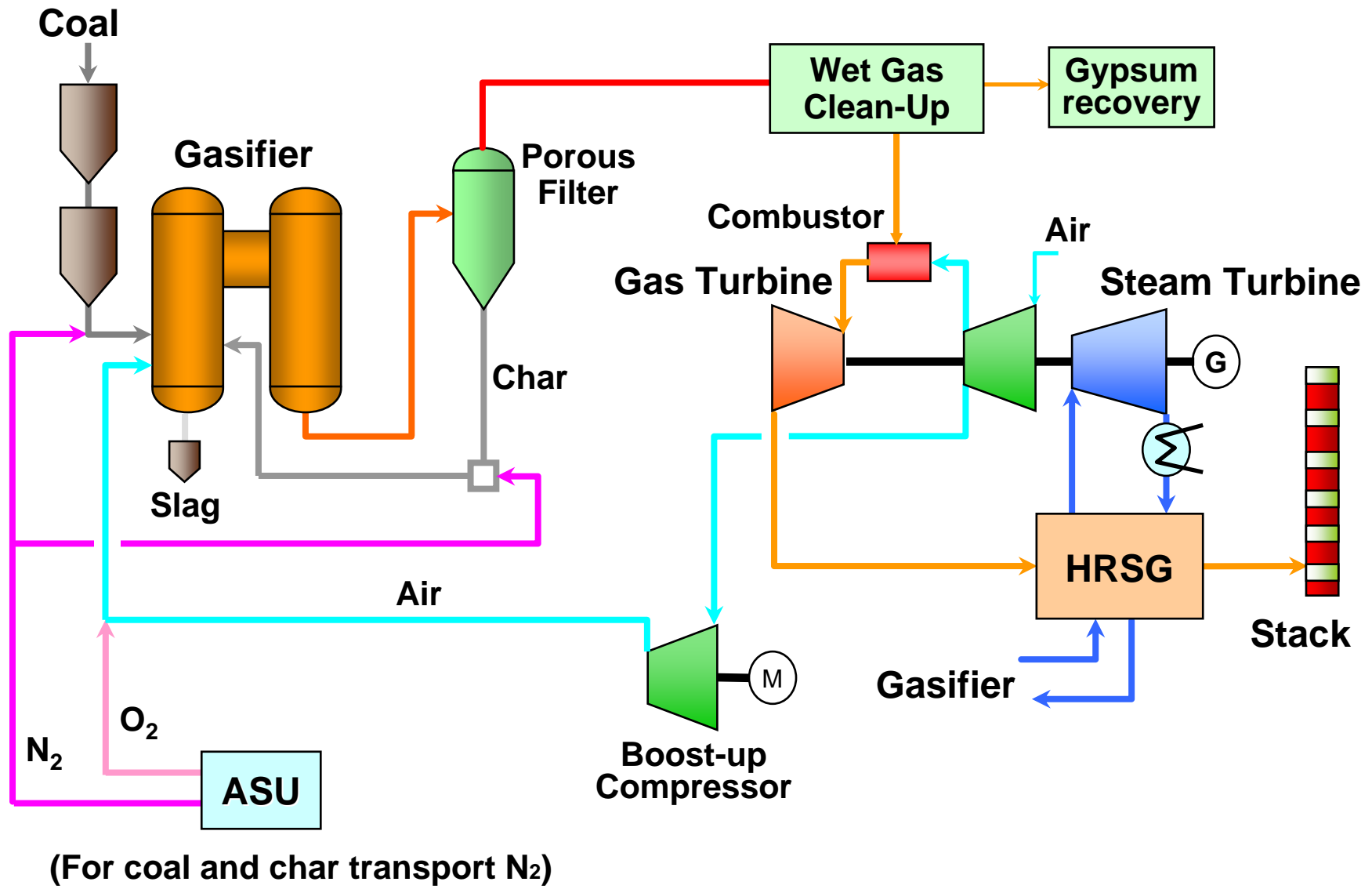
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Clean Coal Power R&D Co., Ltd.



View of IGCC Demonstration Plant



Schematic Diagram of IGCC



Main Feature of Air-blown IGCC



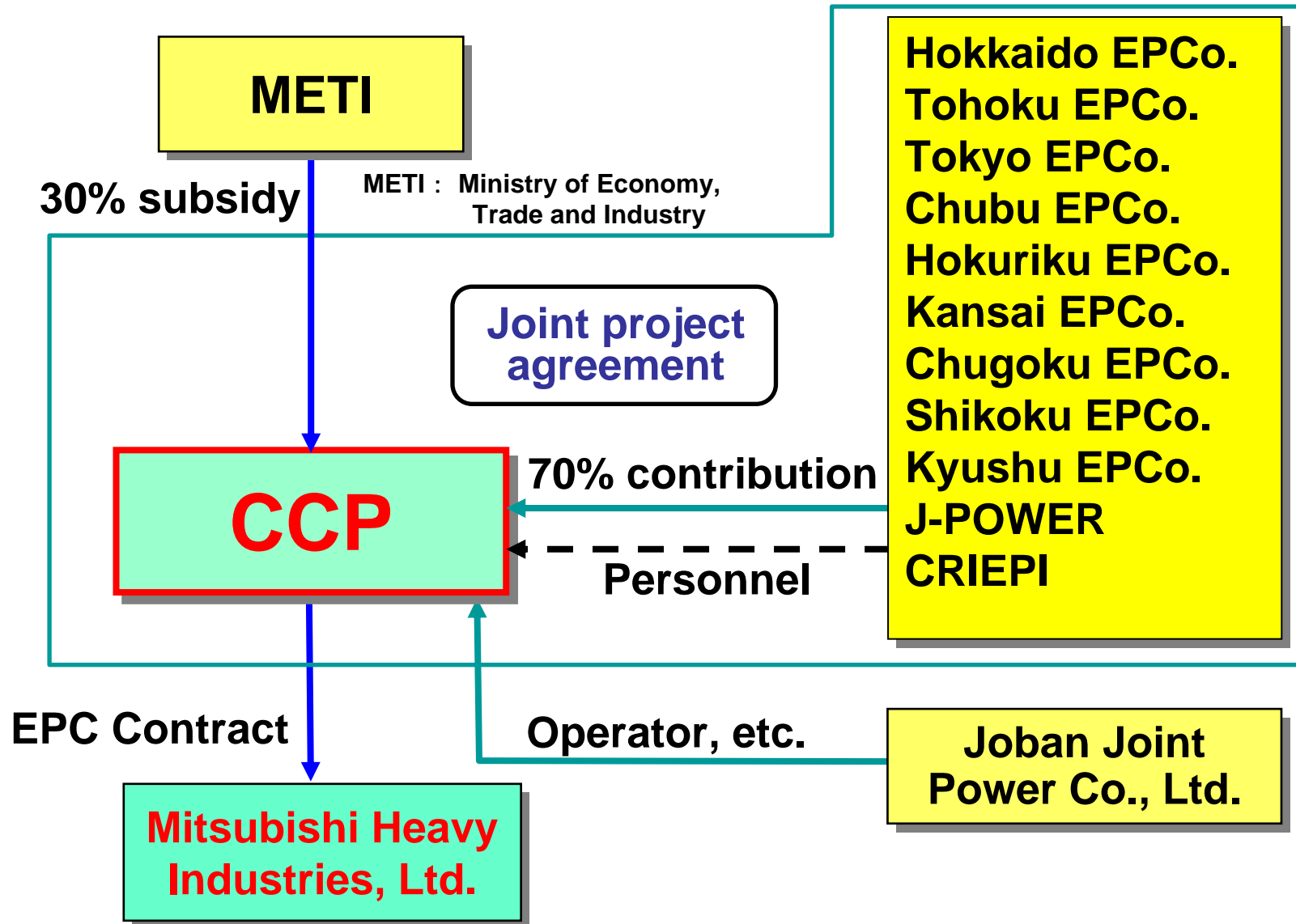
- **Net thermal efficiency is higher than other IGCC designs.**
- **Carbon conversion rate is more than 99.9%.**
- **Gasifier design requires no refractory maintenance.**
- **Operation is very stable .**

Specification of IGCC Demonstration Plant



Capacity	250 MW gross		
Coal Consumption	approx. 1,700 metric t/day		
System	Gasifier	Air-blown & Dry Feed	
	Gas Treatment	Wet (MDEA) + Gypsum Recovery	
	Gas Turbine	2,200 °F-class (50Hz)	
Efficiency (Target Values)	Gross	48% (LHV)	46% (HHV)
	Net	42.5% (LHV)	40.5% (HHV)
Flue Gas Properties (Target Values)	SOx	8 ppm	(16%O₂ basis)
	NOx	5 ppm	
	Particulate	4 mg/m³N	

Project Scheme



Status of Targets & Accomplishments



	Target	First year	Second year	Third year
Safe and Stable Operation	250MW	250MW		
Long Term Continuous Operation	>2000hr	2039hr (1568+471hr)		
Net Thermal Efficiency	>42.5% (LHV basis)	42.4%	42.9%	
Carbon Conversion Rate	>99.9%	>99.9%		
Environmental Performance	SOx <8ppm NOx <5ppm Dust <4mg/m ³ N	1.0ppm 3.4ppm <0.1mg/m ³ N		
Coals	Bituminous Sub-bituminous	Chinese	Chinese, PRB & Indonesian	expand coal flexibility
Start-up Time	<18hr	20hr	15hr	
Minimum Load	50%	50%		
Load Change Rate	3%/min	1.2%/min	(no try)	3%/min
Durability & Maintainability	Evaluate during 5000hr test		(in progress now)	5000hr evaluation



- **Operation optimization tests**
- **Coal flexibility tests**
- **5,000 hour durability test**
(in progress now)

Optimization Test Results (1)



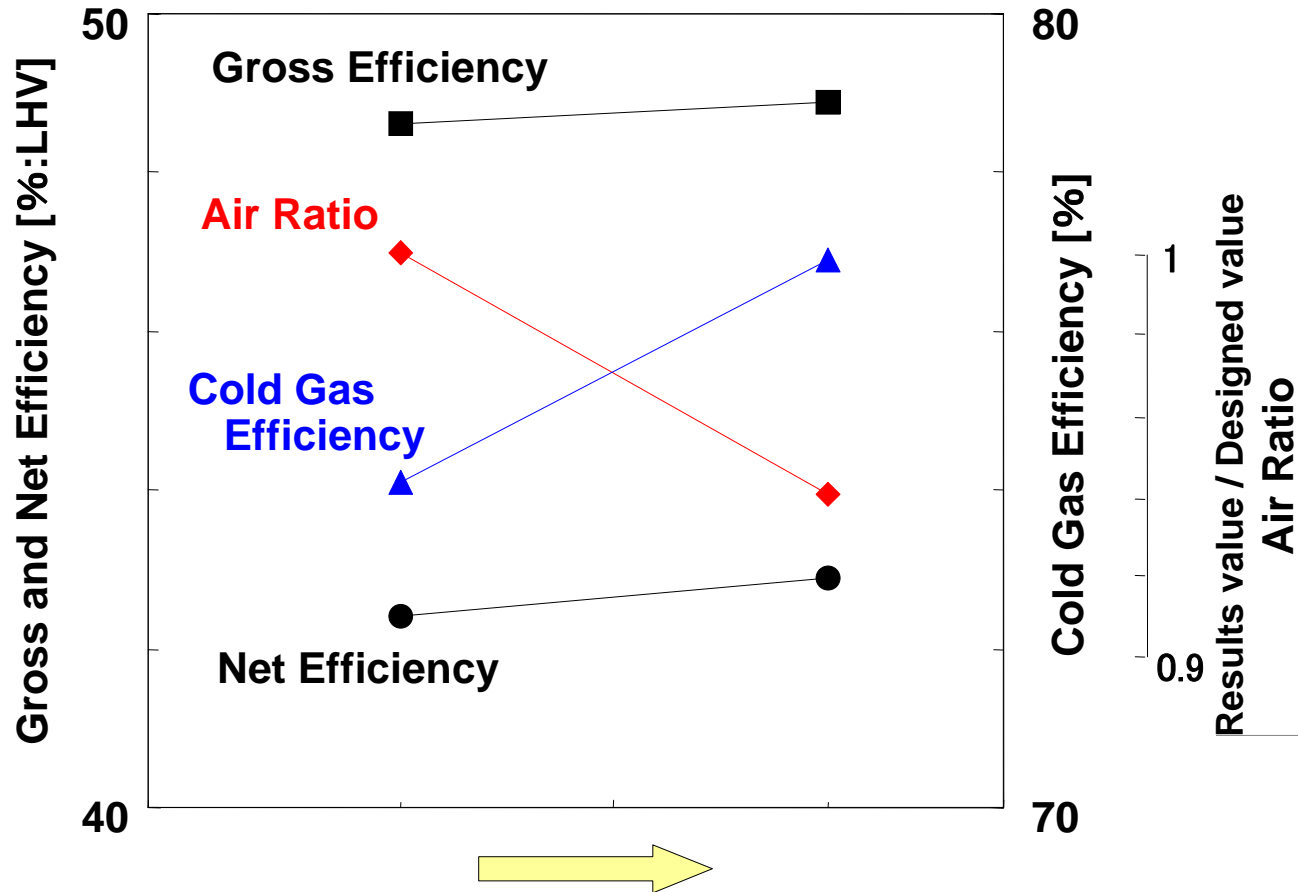
	Design values	Results
Atmospheric Temperature	15 °C (59 degF)	9.9 °C (50 degF)
Gross Output	250 MW	248.8 MW
Gas Turbine Output	128.9 MW	130.4 MW
Steam Turbine Output	121.1 MW	118.4 MW
Net Efficiency (LHV)	42.5 %	42.9 %※
Cold Gas Efficiency of Gasifier	73 %	77 %
Carbon Conversion Efficiency	>99.9 %	>99.9 %
Syngas LHV	4.8 MJ/m ³ N	5.6 MJ/m ³ N
Composition CO	28.0 %	31.9 %
CO₂	3.8 %	2.7 %
H₂	10.4 %	10.0 %
CH₄	0.3 %	1.4 %
N₂ & Others	57.5 %	54.0 %
Environmental Performance (16% O₂ Corrected)	<Target values>	
SO_x	8 ppm	0.5 ppm
NO_x	5 ppm	3.9 ppm
Particulate	4 mg/m ³ N	<0.1 mg/m ³ N

※Correction value at 15°C

Optimization Test Results (2)



Improvement of Thermal Efficiency



Efficiency has been improved by lowering the air ratio and so on

Coal Flexibility Test Results (1)



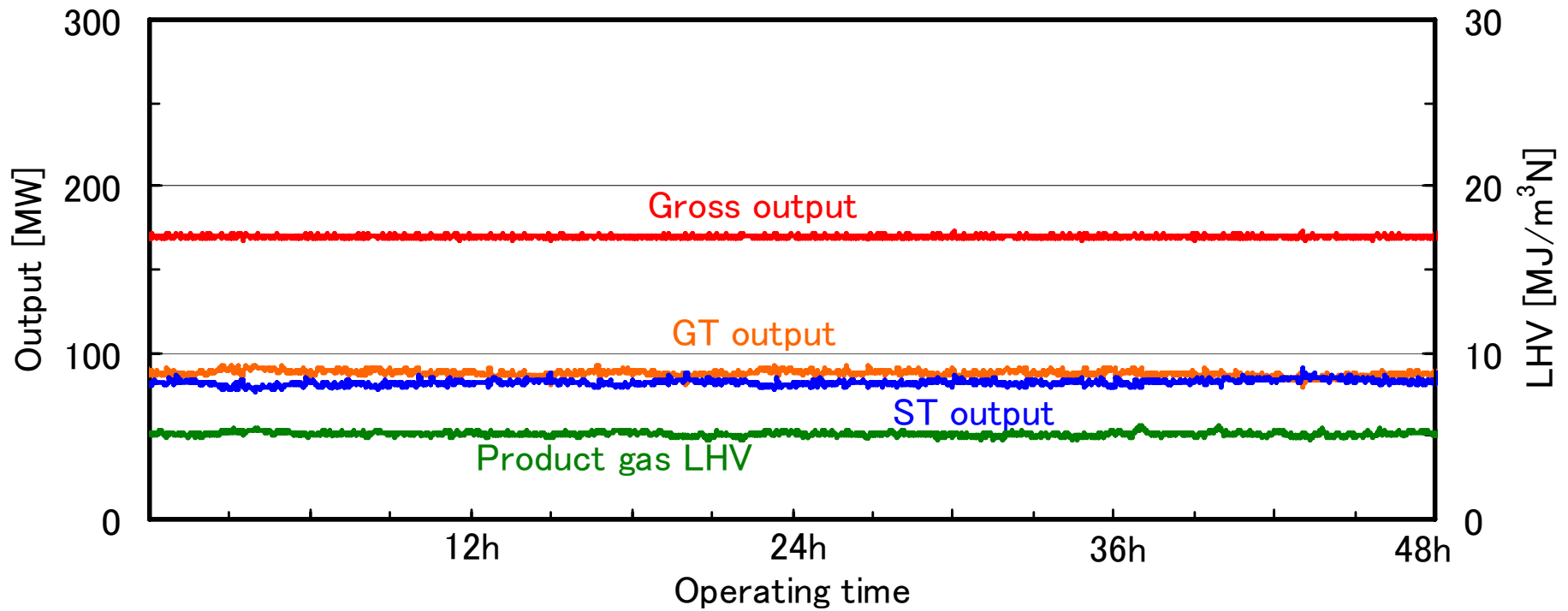
Properties of PRB coal & Indonesian coal

		Chinese	PRB	Indonesian
Proximate Analysis (Dry)				
Fixed Carbon	wt%	56.2	51.2	49.1
Volatile Matter	wt%	34.3	42.5	47.0
Ash	wt%	9.5	6.3	3.9
Total Sulfur	wt%	0.3	0.4	0.2
Moisture Content	wt%	16.3	29.3	25.3
HHV (Dry Base)	MJ/kg	29.3	28.6	28.8
Ash Analysis				
Fluidization Temp.	°C	<1300	<1200	<1200
	°F	<2370	<2190	<2190

Coal Flexibility Test Results (2)



Trend Data of Indonesian Coal Operation



Status of 5,000 Hour Durability Test



- **5,000 hour durability test commenced in June 2009.**
- **Problems with plant auxiliaries (not IGCC process) delayed test.**
- **The durability test was restarted on Sep.7, 2009 for the main part of the test.**
- **The durability test will be continued until March 2010.**

Operating Results



(As of September 30, 2009)

Operating Time	GT Operation by Syngas	4,621 hrs
	Gasifier Operation	4,717 hrs
Power Generation	Cumulative gross output	972GWh
Fuel Consumption	Cumulative coal consumption	318 kton (metric)



- ***Plans for the third year of operation;***
 - **5,000 hour durability test to continue until March 2010.**
 - **Additional coal flexibility tests**
 - **Additional operational optimization tests**

- ***After third year of operation;***
 - **Japanese government is performing feasibility study of a CCS project using our plant.**

