

Japanese Technology to upgrade low-quality CMM using filtration with activated carbon

October 30, 2007

Etsuo Shito,

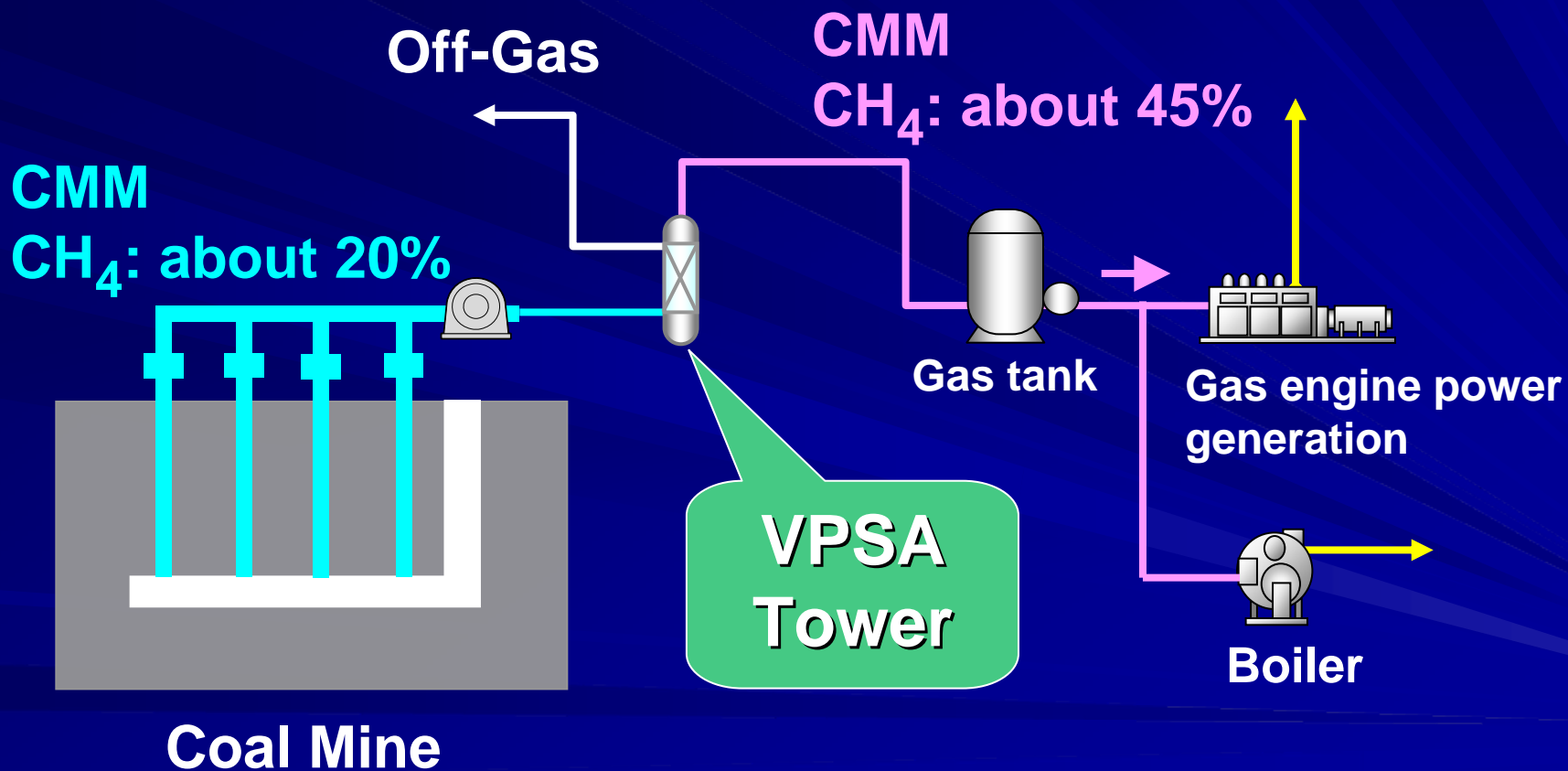
Gas & Power Investment Co., Ltd.



Objectives of Methane Concentration System

- Enhancement of recovery and utilization of low-concentration CMM currently emitted into the air
- Reduction of greenhouse gas

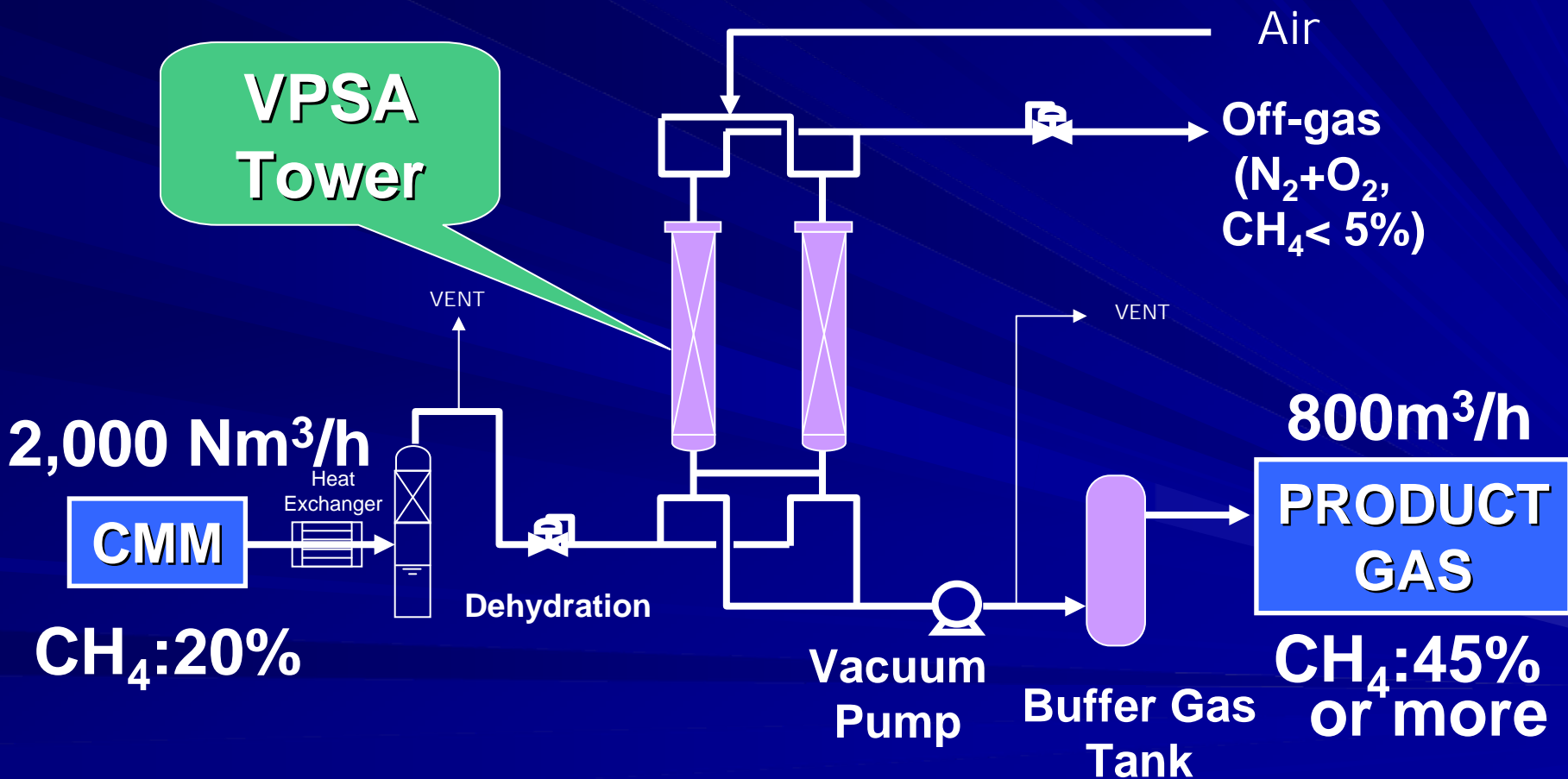
Outline of Methane Conc. System



Standard Specification of Methane Conc. System

- **Inlet CMM** **CH₄:20% or more**
2,000m³/h/unit
- **Product Gas CH₄:45% or more**
800m³/h/unit or more
- **Recovery rate** **90% or more**

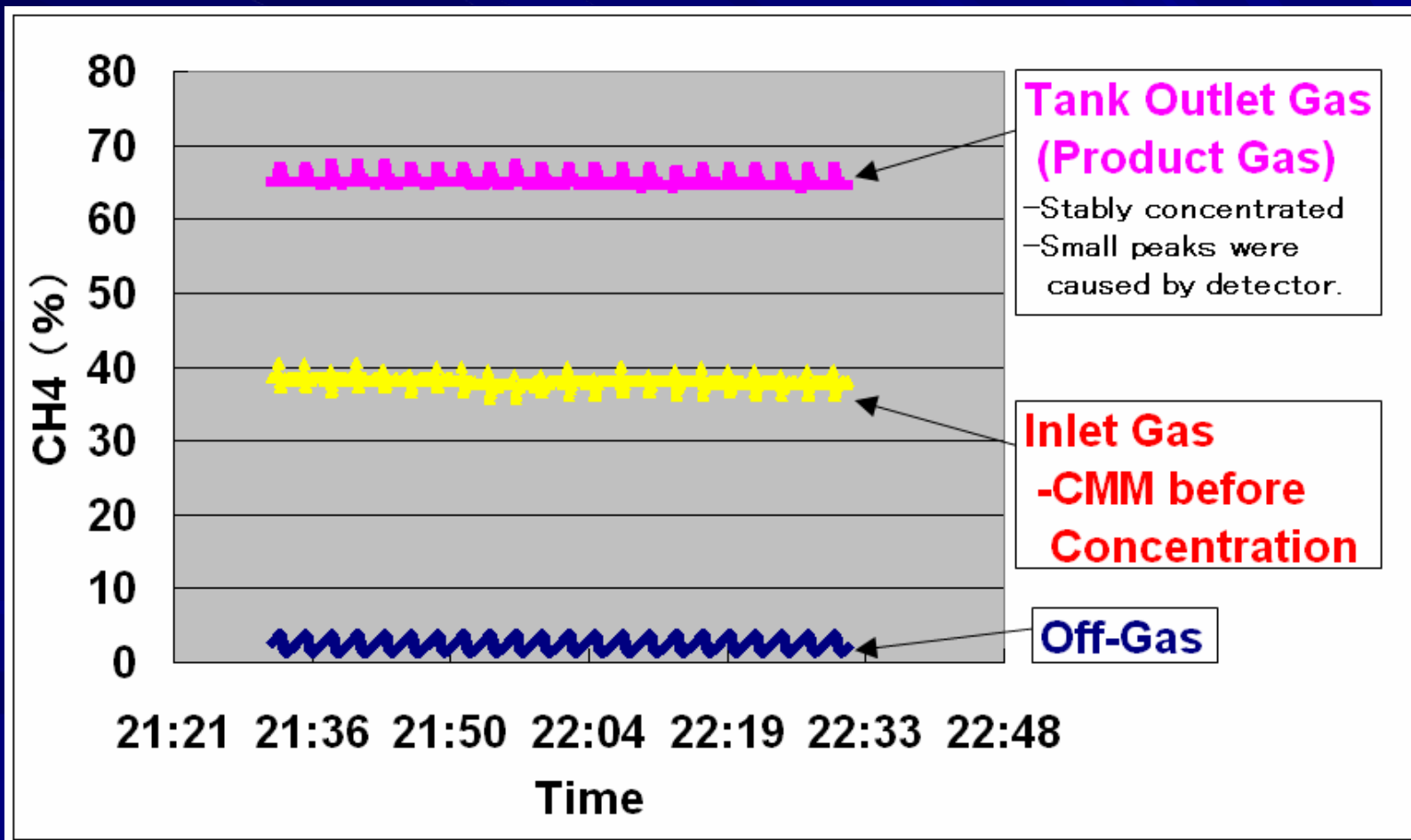
General Flow Diagram of Methane Conc. System



Bench Scale Unit of Methane Conc. System

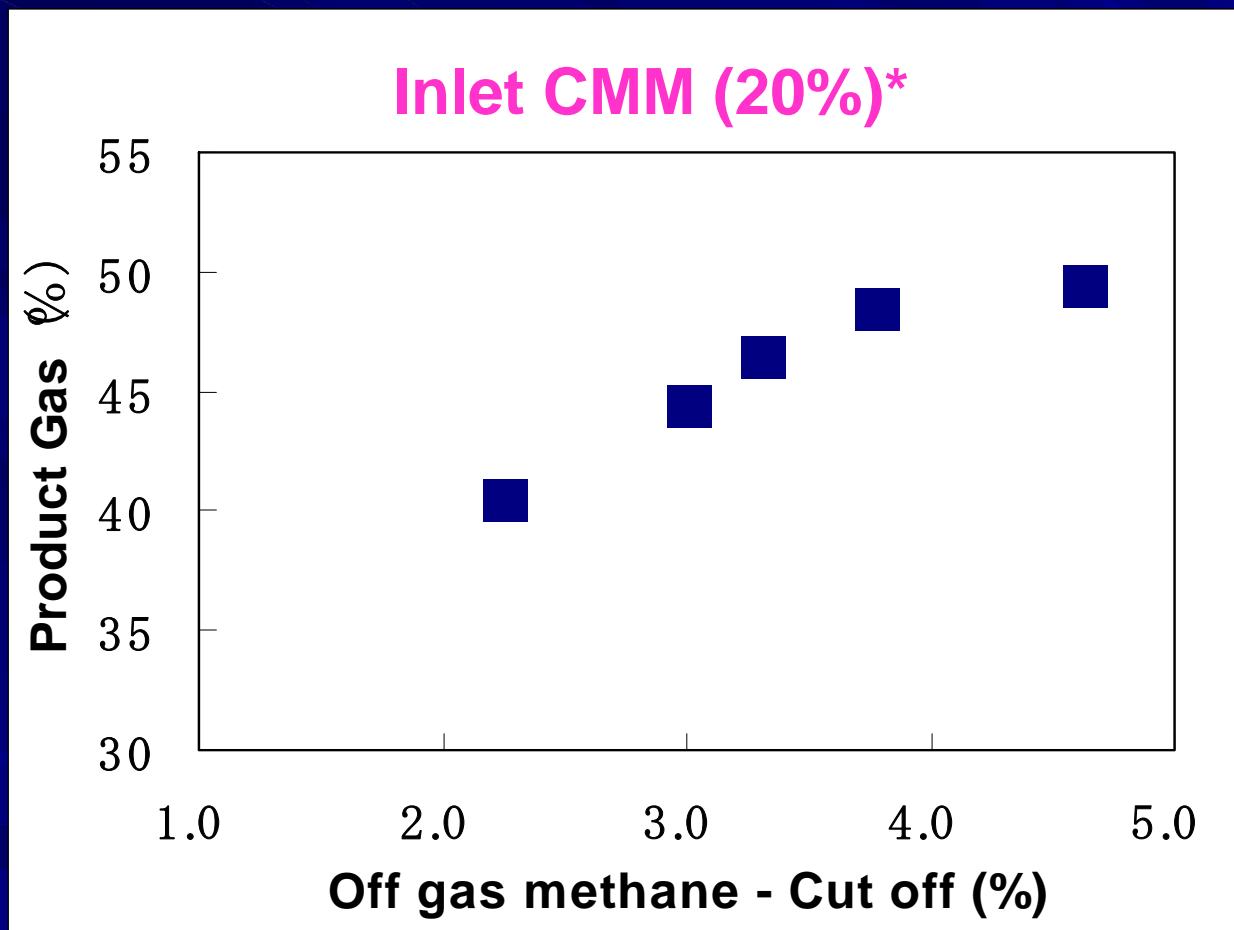


Example of Test Results at a coal mine in Japan



Example of Test Results

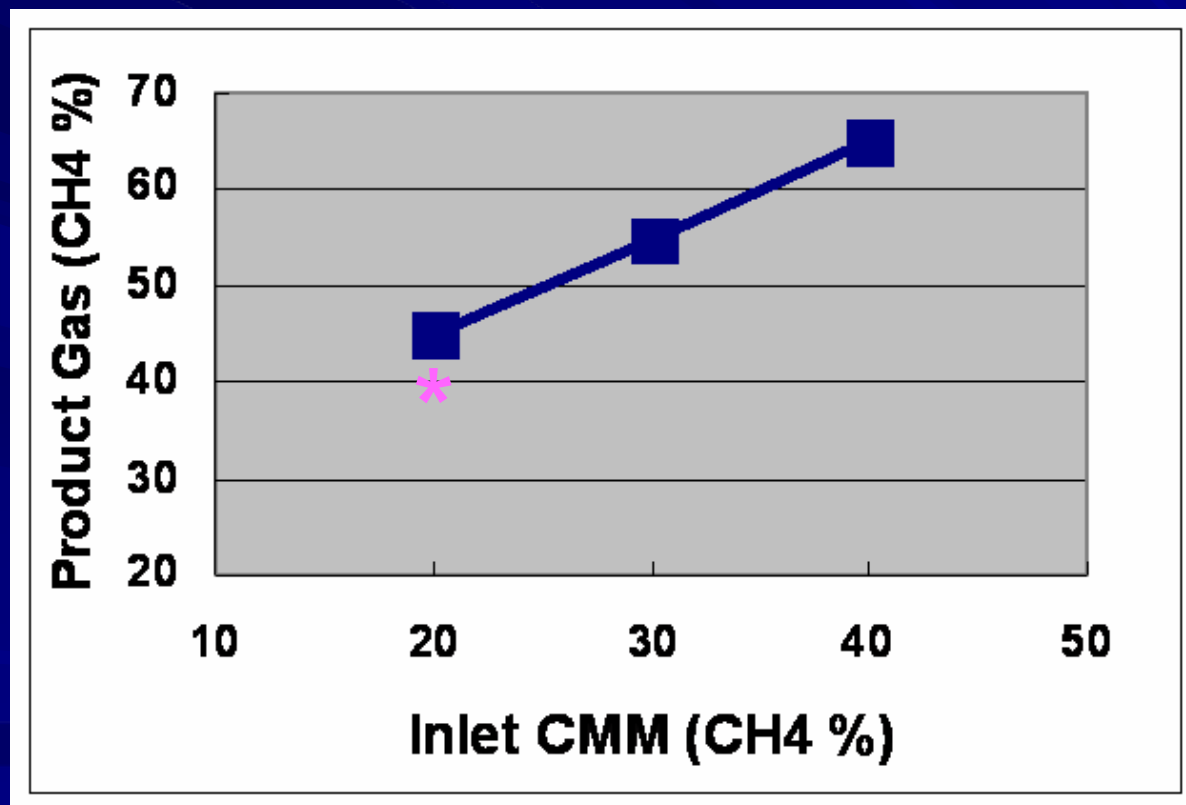
Off gas methane vs. Product Gas



*Inlet CMM(20%) was produced by diluting CMM with air.

Example of Test Results Inlet CMM vs. Product Gas

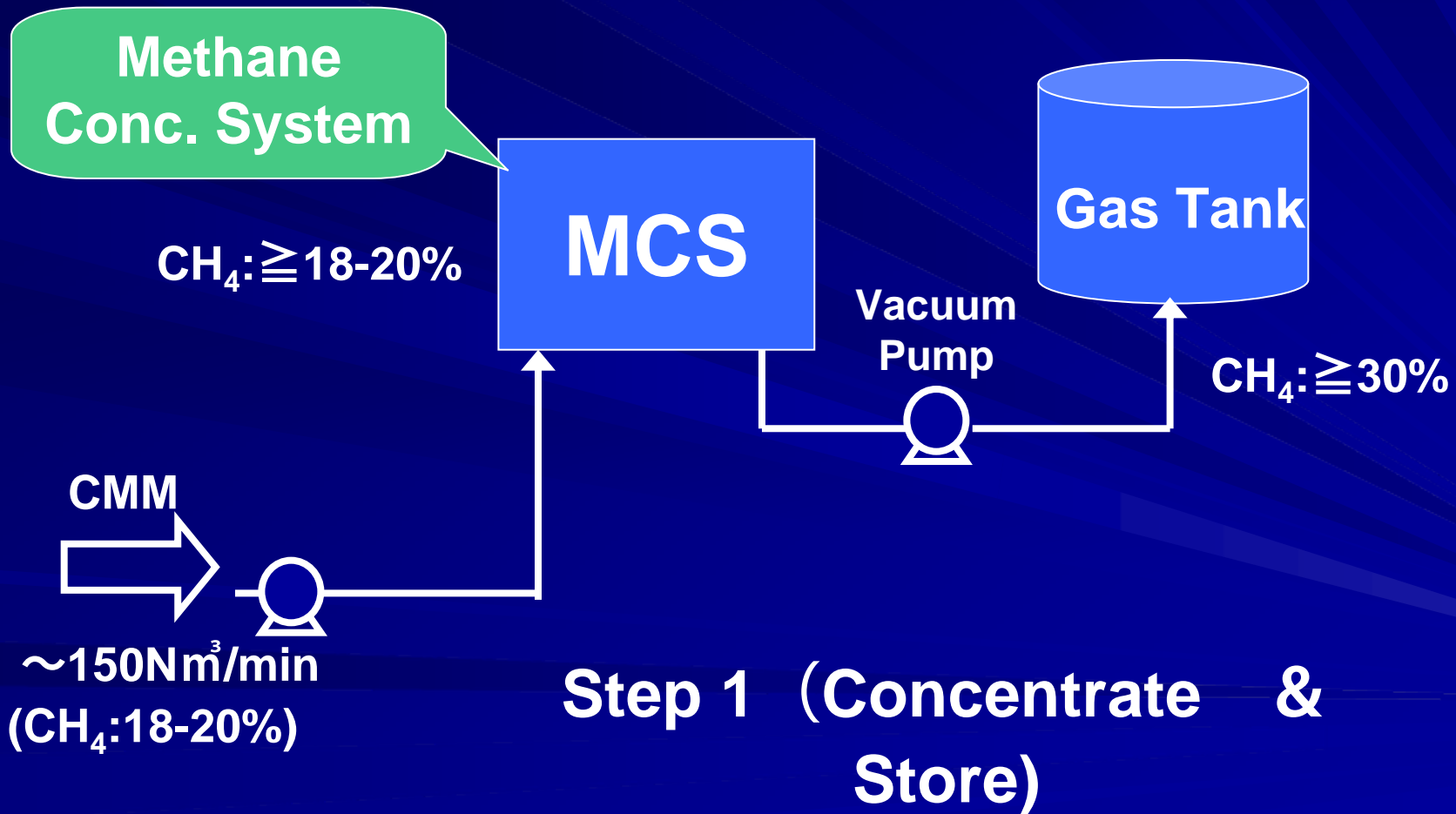
Product Gas = Inlet CMM + 25% or more



***Inlet CMM(20%) was produced by diluting CMM with air.**

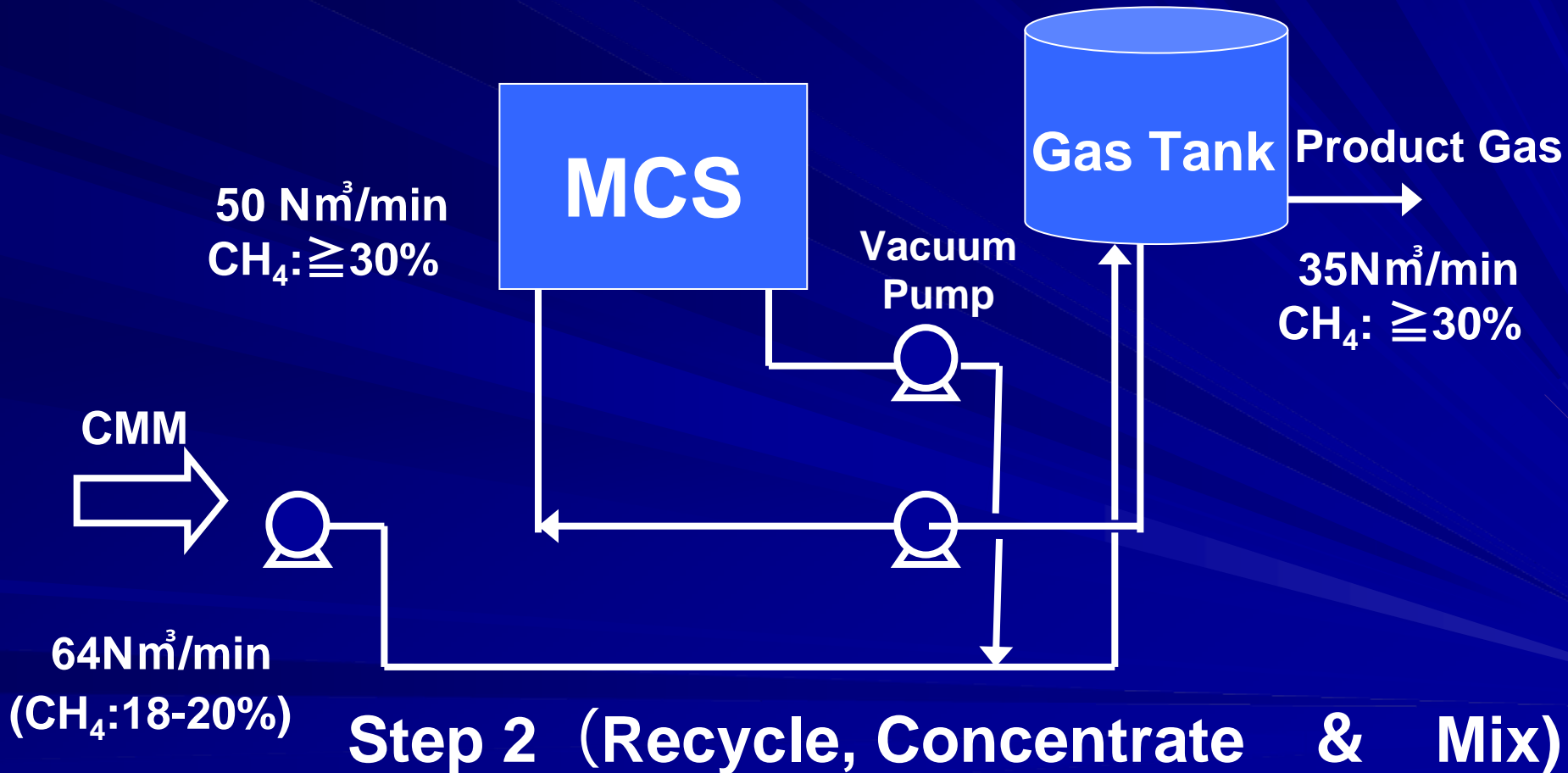
Application-1

For low methane CMM



Application-1

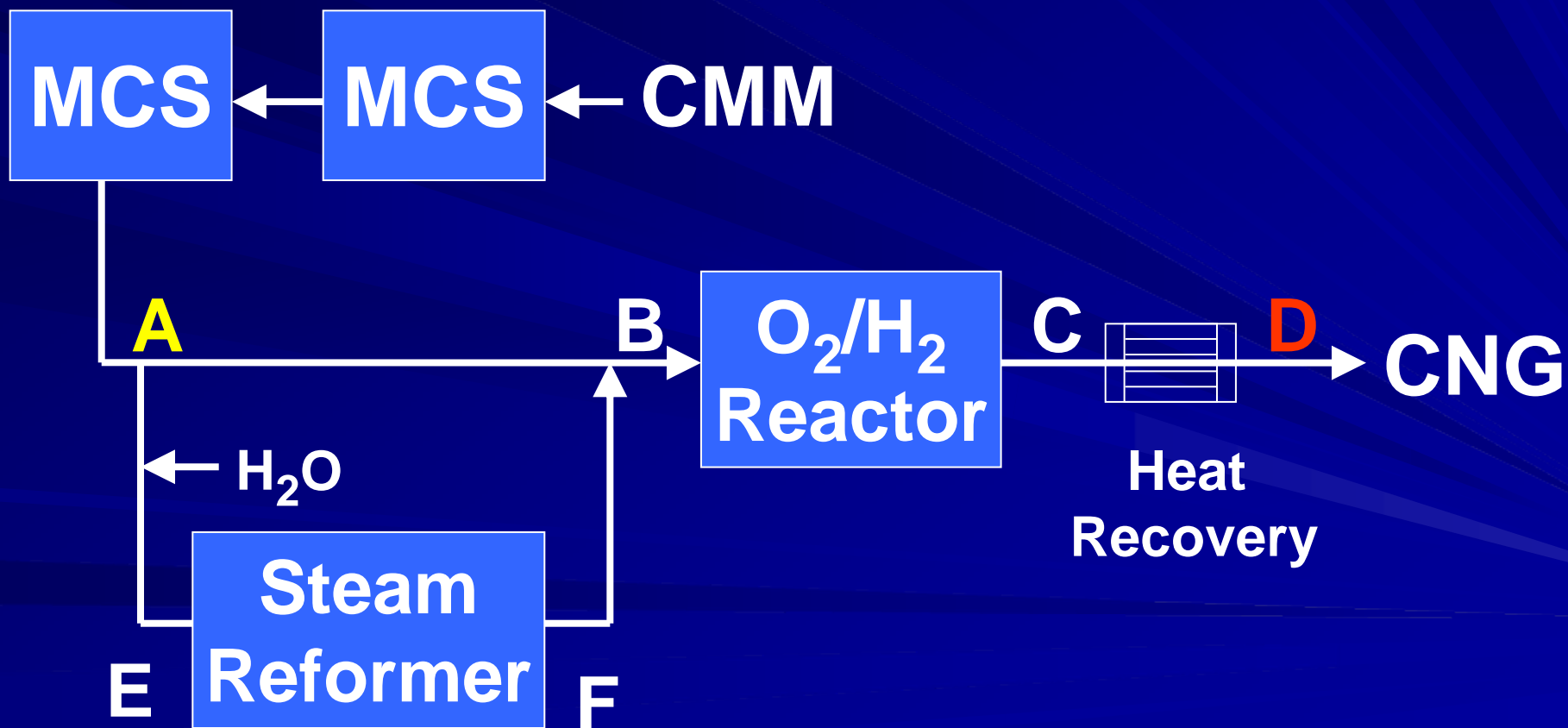
For low methane CMM



Application-2

Conversion to CNG from CMM

2 Steps



Change of gas composition



		Point	A	B	C	D	E	F	Dried D
CH₄	(%)	90.0	85.5	87.1	87.1	31.5	1.4	90.8	
N ₂	(%)	8.0	7.7	7.8	7.8	2.8	1.8	8.2	
O₂	(%)	2.0	1.9	0.0	0.0	0.7	0.0	★ 0.0	
H ₂	(%)		3.1	0.0	0.0		60.4		
CO	(%)		0.7	0.0	0.0		12.9		
CO ₂	(%)		0.3	1.0	1.0		5.6	1.0	
H ₂ O	(%)		0.9	4.1	4.1	65.0	17.9	---	
Flow-rate	(Nm ³ /h)	556	586	575	575	19	30	551	
Temp.	(°C)	25	60	286	100	25	700		
Heating Value	(kcal/m ³)							8,662	
WI								11,198	
MCP								34	

Advantage of Methane Conc. System

- Compact equipment
- Low operational cost
- Low initial cost
- High reliability
- Various applications

Master Plan for Marketing Methane Conc. System



2007				2008								
9	10	11	12	1	2	3	4	5	6	7	8	9



Conclusion

- For utilization of CMM with low-concentration methane and reduction of greenhouse gas,
We have developed a unique VPSA system for CMM enrichment with activated carbon.
- We are ready to discuss business opportunity.

Thank you very much !