



An Overview of the Chinese Programme on UCG

- ★ Li Yulan
- ★ Liang Xinxing
- ★ Liang Jie (Professor)

China University of Mining & Technology (Beijing) (CUMTB)
ucgrc@sohu.com



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1 Introduction

- ★ Coal takes about 70% of the primary energy resource construction in China
- ★ The serious environmental pollution
- ★ About 50% of the coal resource is left underground unmined
- ★ Clean coal technologies are needed
- ★ Underground coal gasification (UCG) meets this demand



1 Introduction

★ The UCG Research Centre of CUMTB has carried out research since 1984

- Shaft-UCG technology (no-shaft)
- CBM-UCG technology
- Producing H₂ technology by UCG
- Disposal method of CO₂



1 Introduction

★ Key studies

- Temperature field, Concentration field
- Heat Resistance
- Cavity growth
- Monitoring and controlling techniques



2 UCG model test

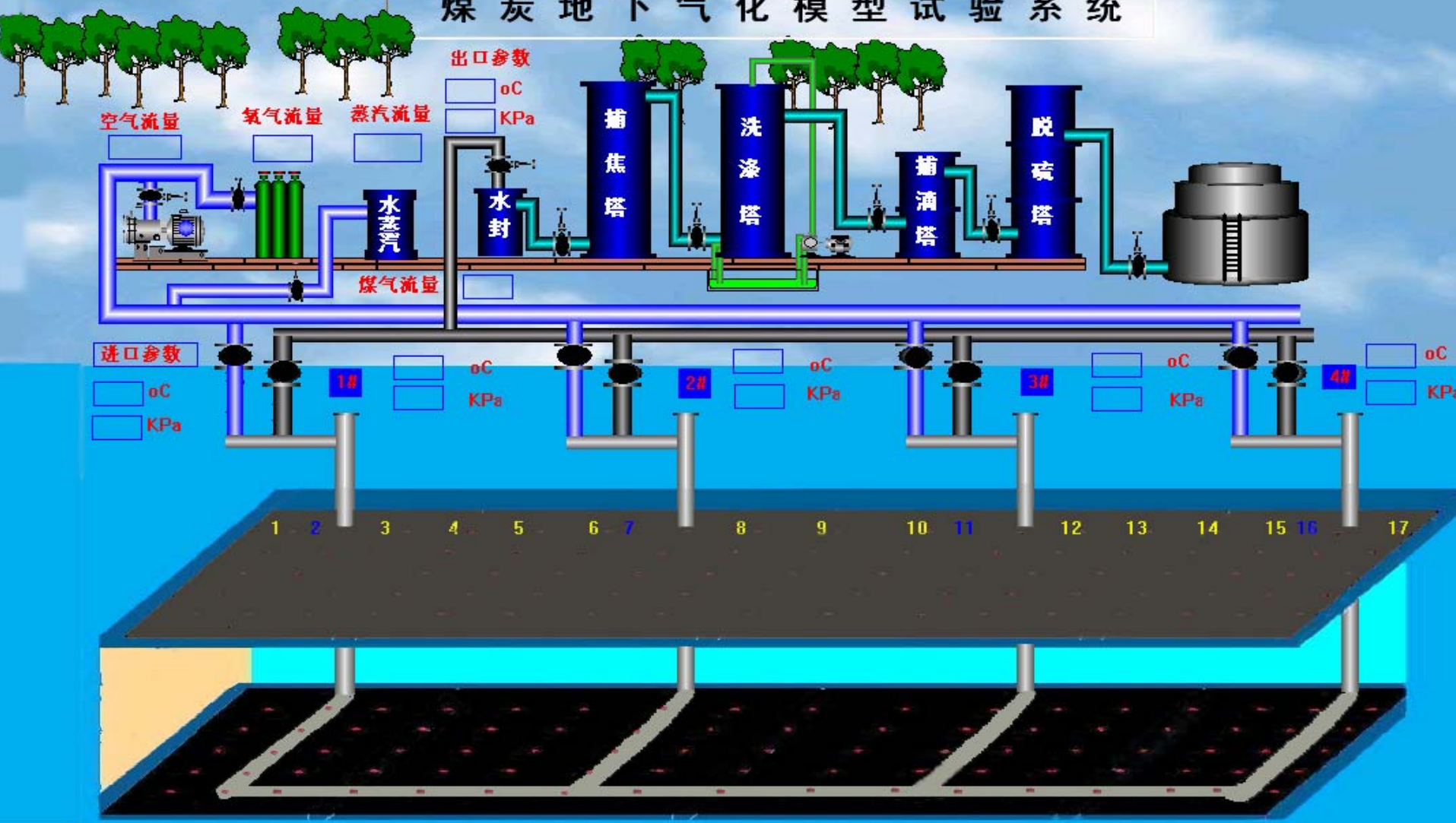
★ There are three functions :

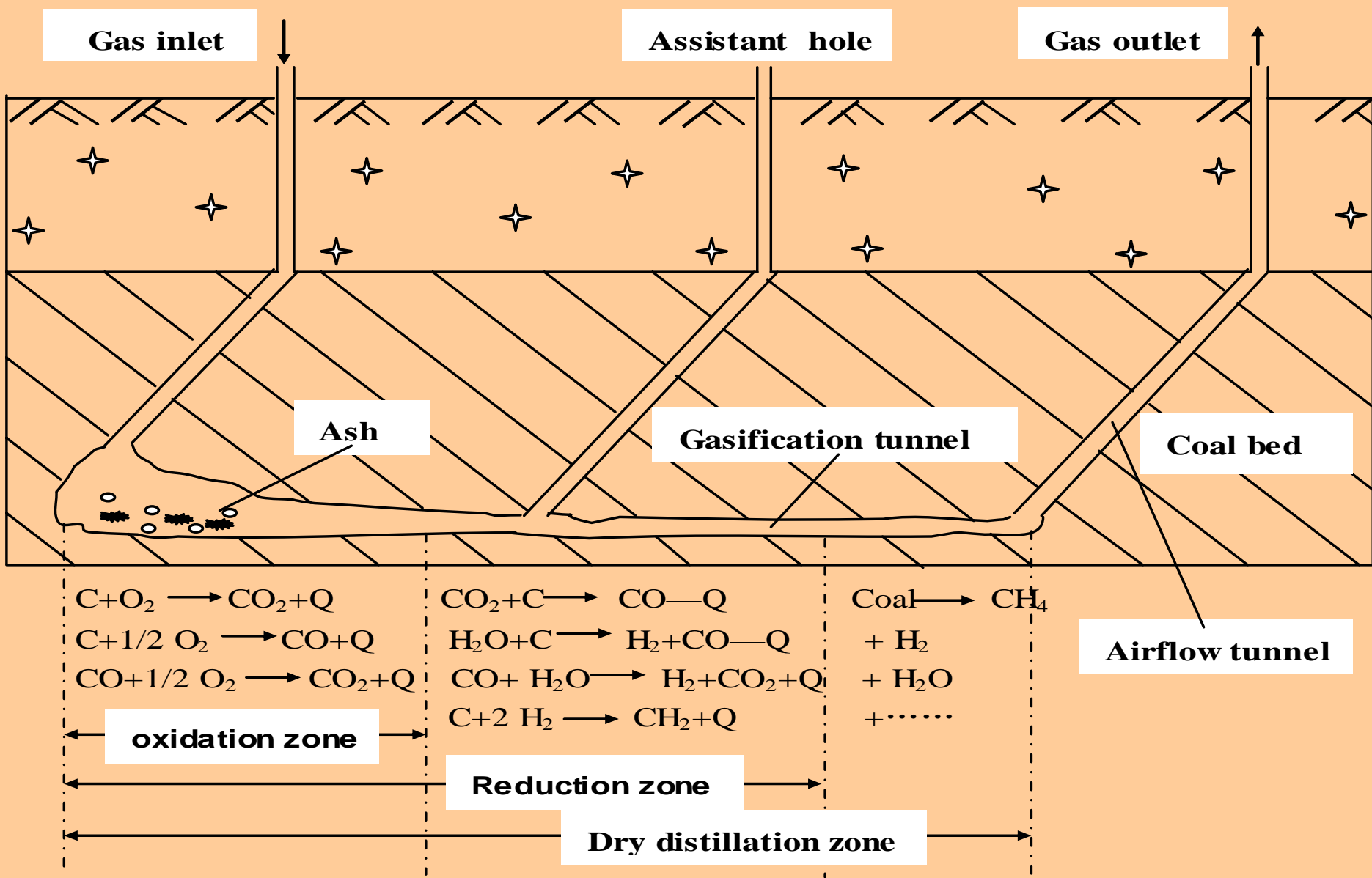
- (1) Simulate UCG process of different coal quality, coal seam obliquity, coal thickness and coal depth
- (2) Test at different UCG parameters (two-direction blast, assistant-hole blast, pressing-in and absorbing-out)
- (3) Test of different parameters of gasifier (blast, O_2 supplying and equipment for $H_2O_{(g)}$ generation)



Model rig of UCG (CUMTB)

煤炭地下气化模型试验系统





schematic diagram of UCG principle



2 UCG model test

Table 1 gas component, heat value and production rate

Coal kind	gas component %					Gas heat value	Production rate
	H ₂	CO	CH ₄	CO ₂	N ₂	MJ/ m ³	m ³ / kg
lignite	36~45	20~30	1~5	25~35	1~3	8.5~9.5	1.2~1.4
soft coal	33~42	25~35	4~10	20~25	2~3	9.6~11	1.8~2.3
hard coal	35~45	25~35	2~8	25~30	1~3	9.5~10	1.9~2.5



2 UCG model test

★ Theoretical research work

- 1) temperature field, concentration field
- 2) velocity field, velocity of gasification reaction
- 3) extending rule of cavity
- 4) stability of UCG process
- 5) technology of measuring and controlling
- 6) CO₂ eliminating and CO transferring to generate H₂

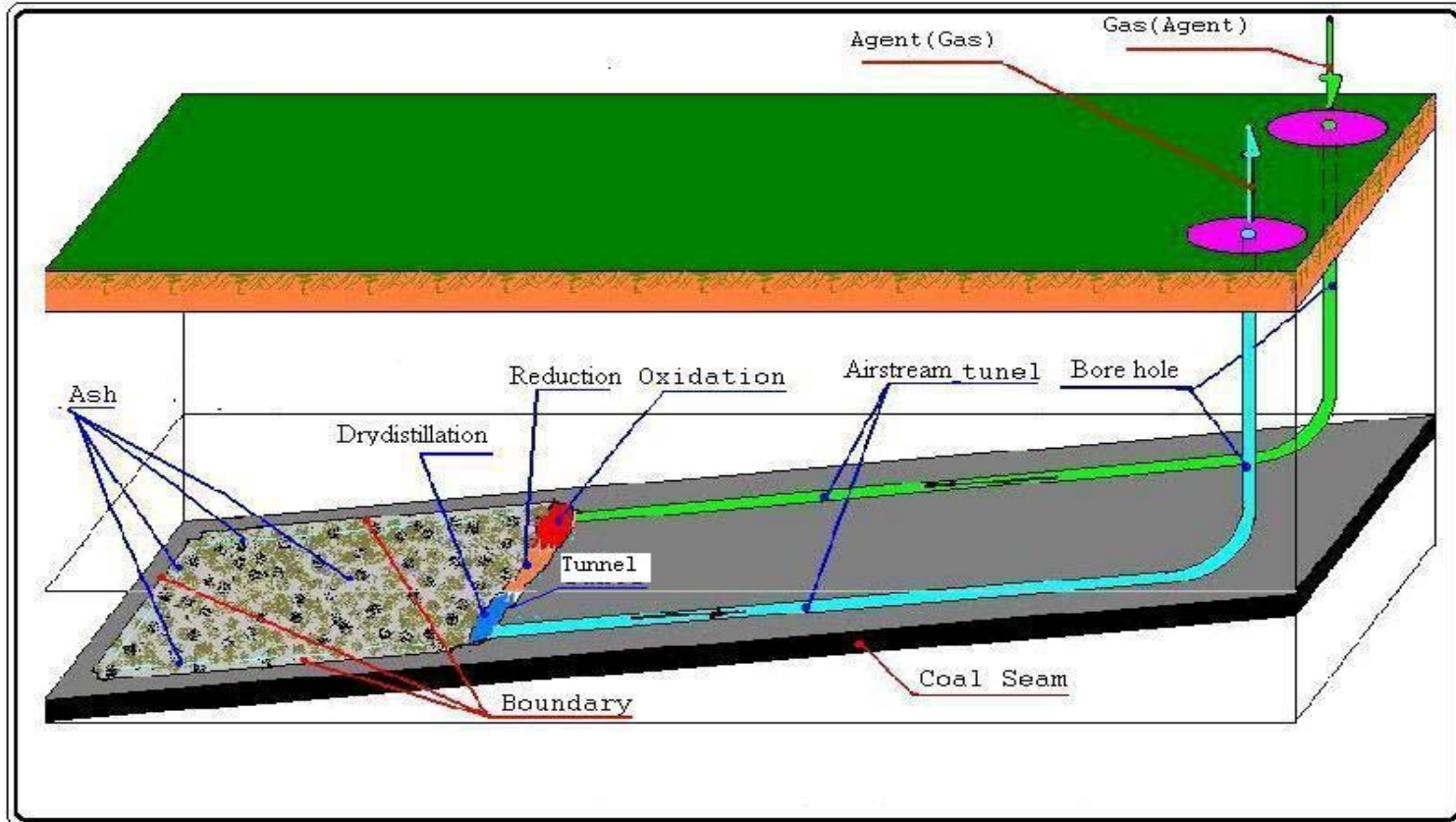
Monitoring and controlling system





Temperature field at different time of model test

3 UCG field trial



The sketch of the “long-tunnel, large-section, two-stage” UCG

Mine		Xinhe	Liuzhuang	Xinwen	Feicheng	Xiyang
Coal kind		Fat coal	Gas coal	Gas coal	Fat coal	Anthracite
Coal seam feature	Depth,m	80	100	100	80-100	190
	Thickness,m	3.5	2.5-3.5	1.8	1.3-1.8	6
	Obliquity,°	68-75	45-55	25	5-13	22-27
Gas heat value,MJ/m ³		11.83	12.24	5.21	5.09	11.91
gas component %	H ₂ %	58.29	47.14	54.79	17.4	54.30
	CO %	8.59	13.36	9.72	3.83	4.10
	CH ₄ %	9.28	12.38	8.75	6.22	12.20
	CO ₂ %	19.63	20.48	20.75	22.9	20.20
	N ₂ %	4.21	6.64	5.21	49.5	9.10
Time of ignition		1994.3	1996.5	2000.3	2001.9	2001.10

Table 2 Status of UCG station

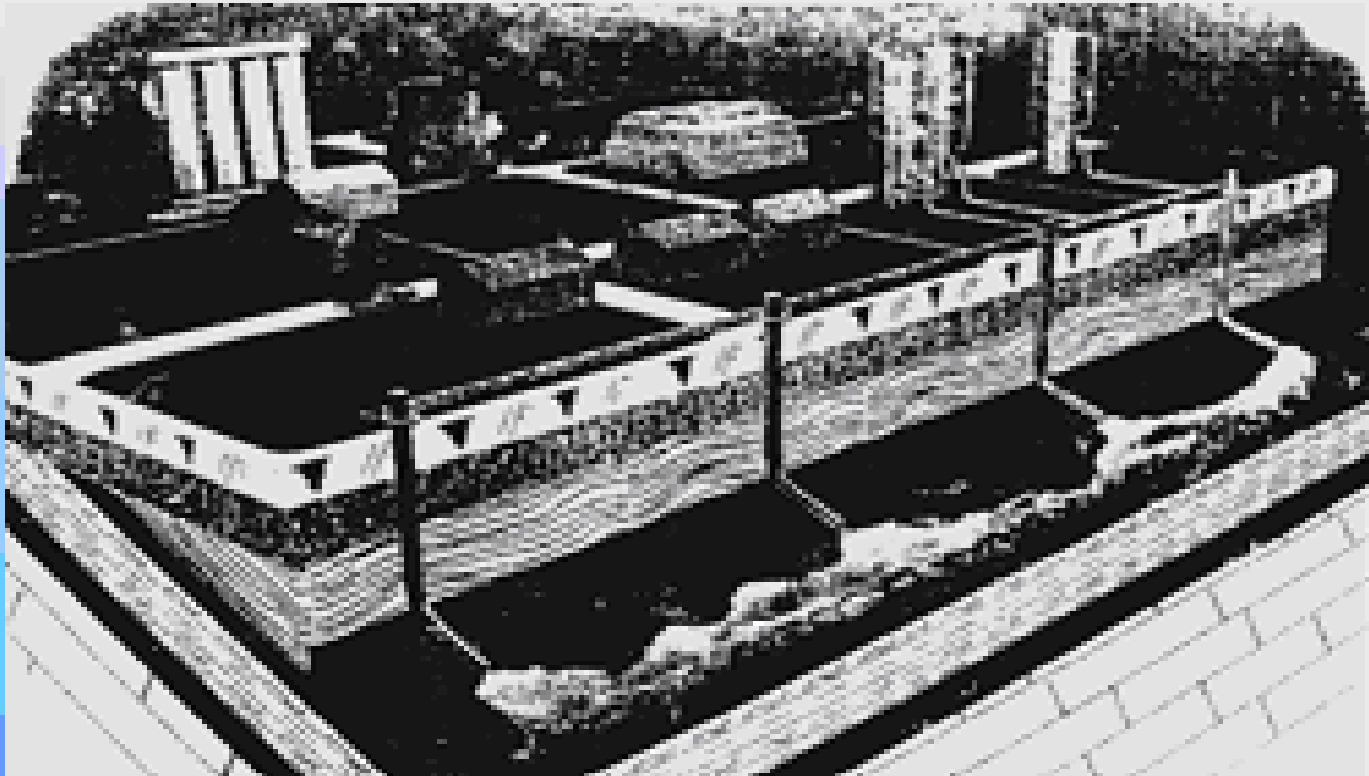


3 UCG field trial

★ UCG demonstration projects at Liuzhuang mine

- Structure of the gasifier
- Gas production and utilization
- Measuring the moving velocity of fire face

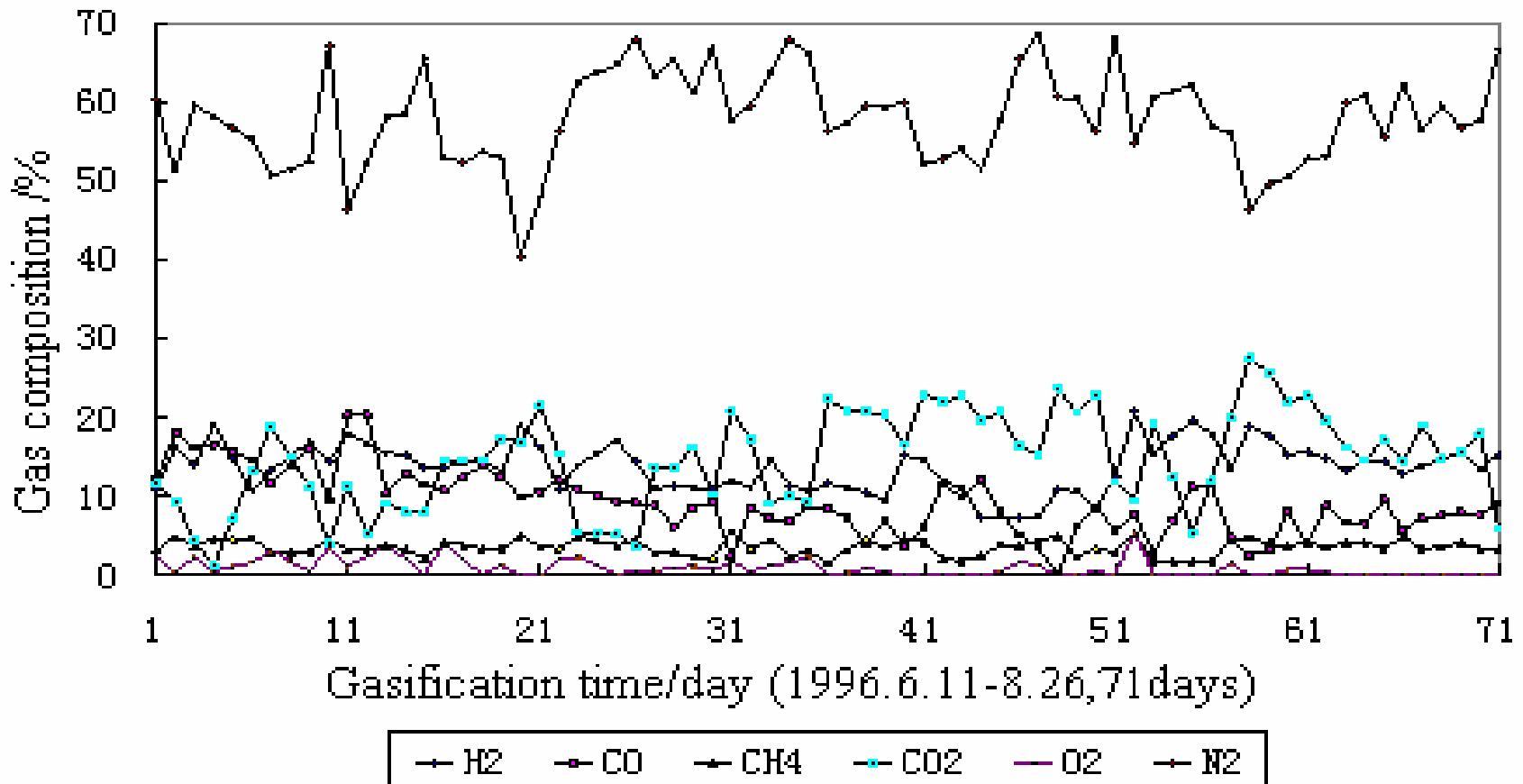
3.1 Structure of the gasifier



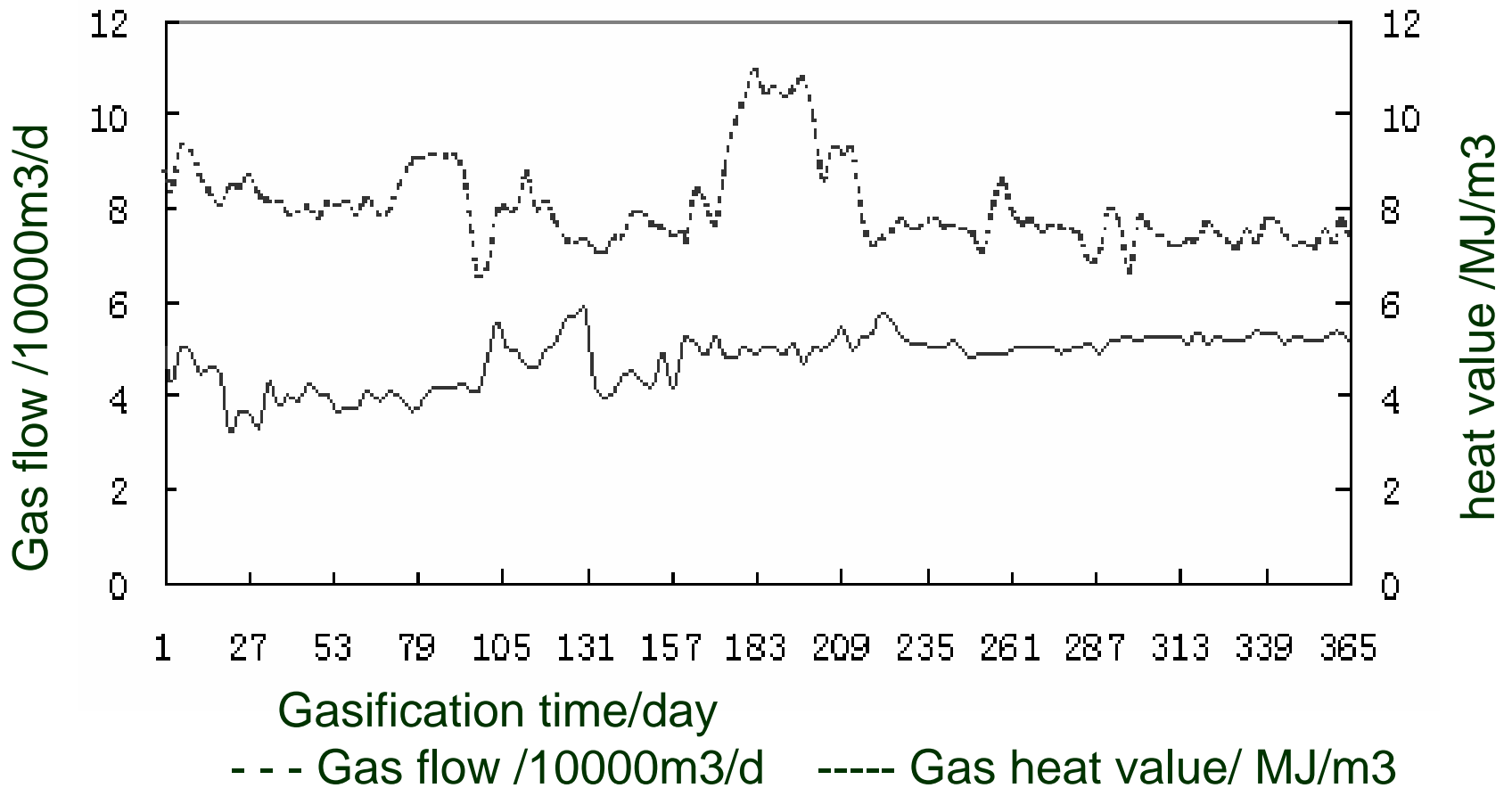
Liuzhuang UCG gasifier



3.2 Gas production and utilization



Gas composition of air gas



Heat value and gas flow of air gas

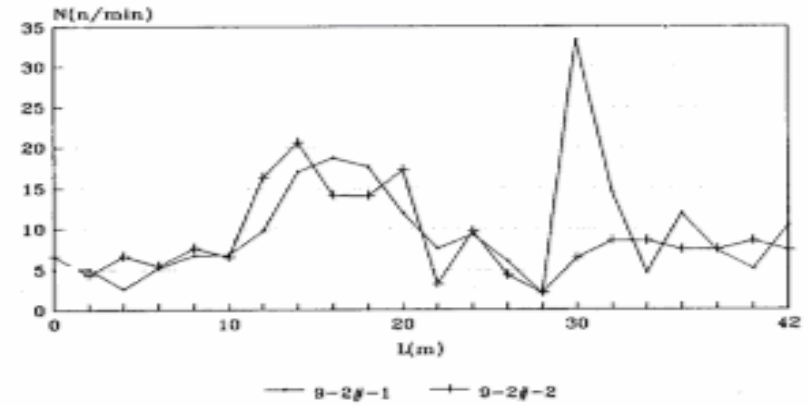
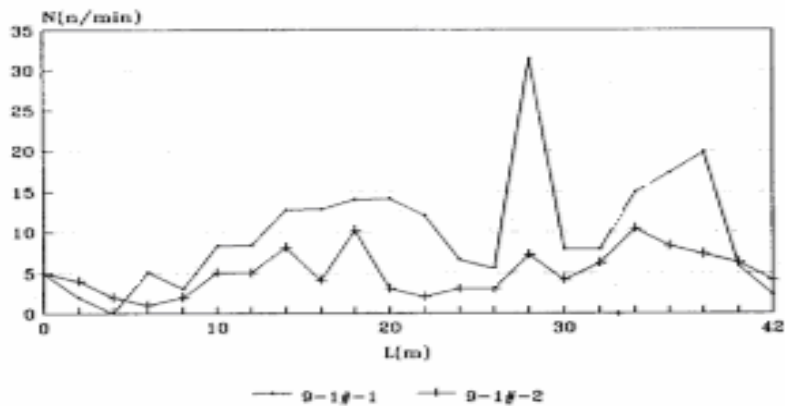


3.2 Gas production and utilization

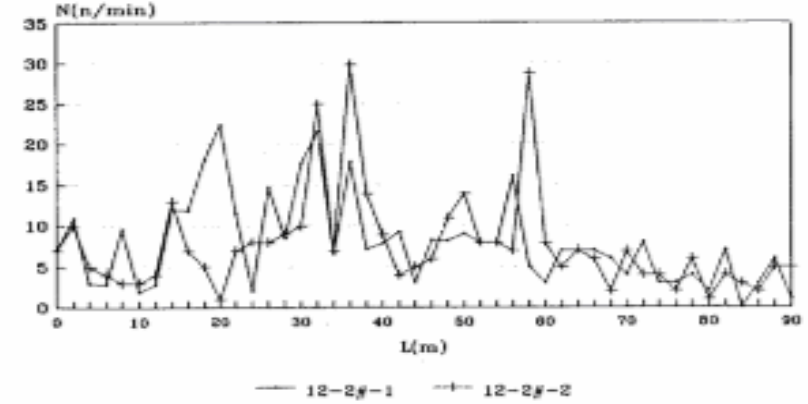
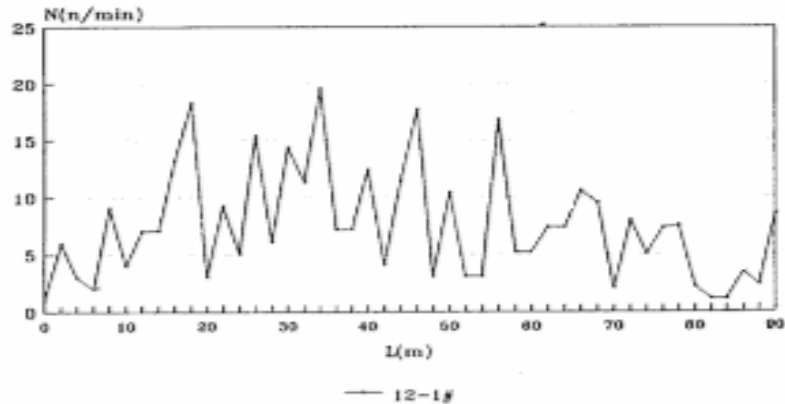
Table 3 Composition and heat value of water gas

H ₂ (%)	CO (%)	CH ₄ (%)	CO ₂ (%)	O ₂ (%)	N ₂ (%)	HV(MJ/m ³)	Flow(m ³ /h)
41.46	10.39	9.12	36.68	0.00	2.35	10.22	1500
45.05	8.18	7.53	34.38	0.00	4.86	9.77	1400
46.51	9.34	9.19	32.65	0.00	2.31	10.76	1500
52.92	10.37	9.50	19.55	0.00	7.62	11.84	1200
45.32	9.13	9.24	33.10	0.00	3.21	10.60	1400

3.3 Measuring the moving velocity of fire face



Radon variation (9^S)



Radon variation (12^S)

Change of Radon concentration along the gasification tunnel



4 Market prospect of UCG technology in China

- ★ the total amount of discovered coal was 10179×10^8 tons (1997)
- ★ The distribution of different coal kind (table 4)
- ★ the total amount of discovered and forecast coal with depth $\leq 2000\text{m}$ was 55697×10^8 tons
- ★ the forecast coal with depth $\geq 1000\text{m}$ takes up 59.5%

4 Market prospect of UCG technology in China

Table 4 Distribution of coal kind in the discovered coal resources amount (x10⁸t)

Coal kind	lignite	Lower-grade bituminous	Gas coal	Fat coal	Coking coal	Thin coal	Poor coal	anthracite	Others
Discovered	1291.32	4320.75	1317.31	382.99	682.92	424.47	559.17	1200.16	0.27
Percent (%)	12.68	42.45	12.94	3.76	6.71	4.17	5.49	11.79	

4 Market prospect of UCG technology in China

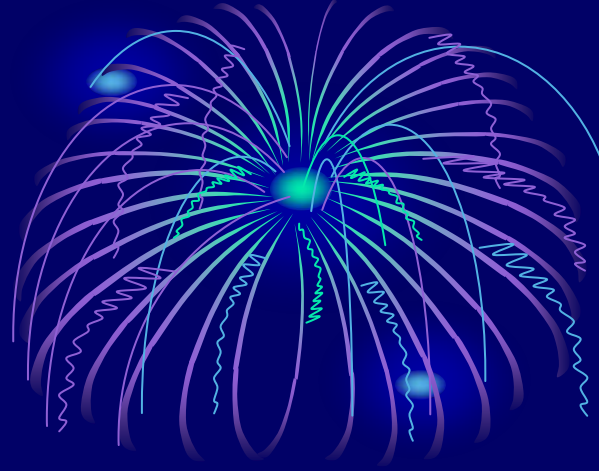
★ Conclusion

- The amount of lignite and low-grade bituminous takes up more than 55%
- The deep coal seam with depth more than 1000m takes up 59.5%
- UCG has the superiority for mining and utilizing deep coal and low quality coal



5 Closing

- UCG is important to China and other coal-based countries
- UCG makes contributions to the utilization of coal resource and environmental protection
- enhance cooperation with other countries



Thank you