



Analysis of implementation of GHG reduction policy in Shandong Cement Industry

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2008-7-15



Contents

- Brief sectoral introduction
- List of key mitigation options/technologies identified
- Analysis from technology to policy taking cogeneration as an example
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 - Identification of key promotion policy
 - Implementation of key promotion policy: stakeholders, barriers, costs, effects, etc.
- Discussion on next steps



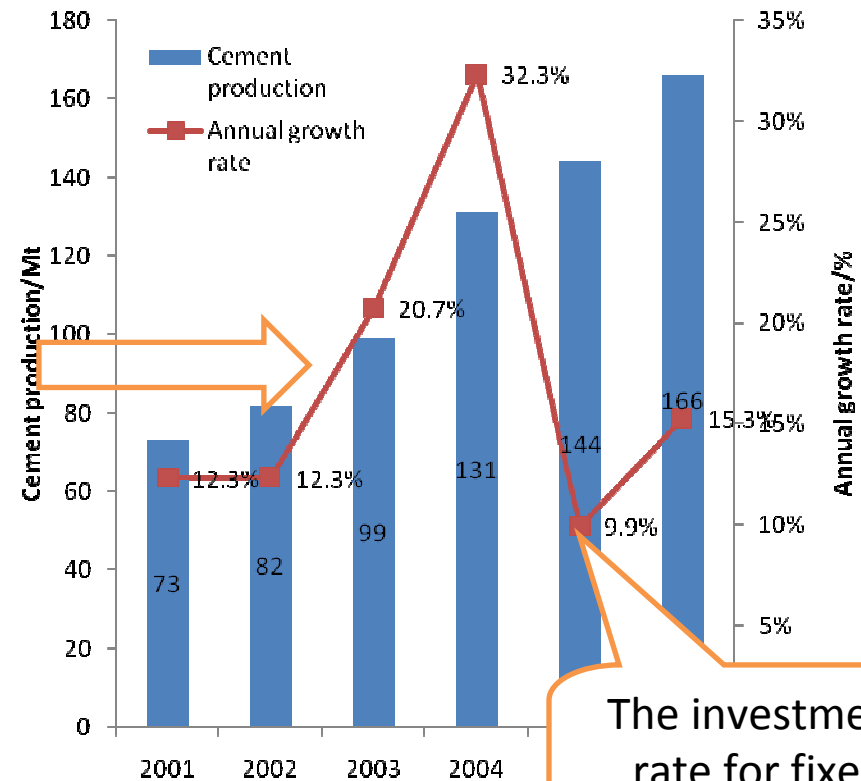
Development of production

The 2nd development peak

The cement production of Shandong doubled

◆ Feature:

- the development of Shaft kiln cement significantly shrank, replaced by rapid development of NSP.
- Just a few years, the province's NSP production lines have reached 50, the production capacity of clinker reached 43.1 million tons / year.



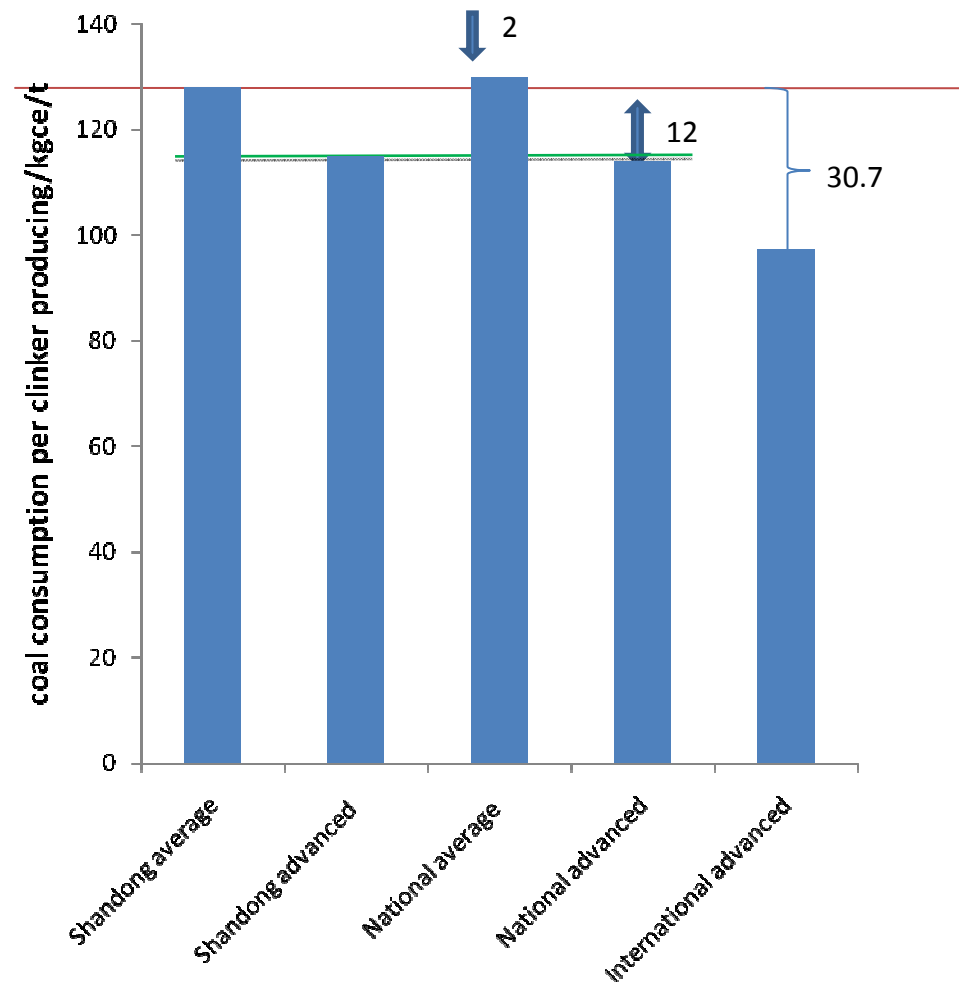
The investment rate for fixed assets decreased



Comparison of energy efficiency

	Coal consumption of clinker producing (kgce/t)
Shandong average (2007) a	128
Shandong advanced (2007) b	115
National average (2007) c	130
National advanced (2007) d	114
International advanced (2007) e	97.3

- a. China Building Material
- b. Shandong building material office
- c. Tianjin Cement Industry Design and Research Institute Ltd.
- d. BEST-LBNL , 2008
- e. Park , 1998





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Mitigation technologies- Abatement potential and corresponding cost information of mitigation options

No.	Mitigation Options	Marginal mitigation cost (US\$/tCO ₂)	Total emission reduction (MMt CO ₂)
1	Preventative Maintenance	-4.53	23.5
2	Use of Waste Derived Fuels	-3.75	21.5
3	Process Management and Control	-2.44	19.5
4	Kiln Shell Heat I		
5	High-efficiency Dri		
6	Active A		
7	Composite		
8	Conversion to Multi-stage Pre-heater kiln	3.79	49.1
9	Combustion System Improvement	4.14	34.8
10	High-efficiency roller mills	6.59	28.6
11	High-efficiency Powder Classifiers	9.67	10.2
12	Efficient Transport Systems	12.69	3.67

In Shandong's cement industry :

What is the technology and equipment status?



Production equipments status

	Production capacity (10 thousand ton/year)	Number of enterprises	Sum of production capacity (10 thousand ton/year)
Power grinding	<20	7	75
	20~60	41	1194
	60~100	3	215
	>100		
Shaft kiln	<20		
	20~60		
	60~100		
	>100		
NSP	<60		
	60~100		
	100~200		
	200~300		
	>300		

- Shandong's clinker production is only shaft kiln (55%) and NSP (45%).
- Main shaft kiln scale : 200 to 600 thousand tons / year
- Main NSP scale : 4000~5000 t/d
- Main roller mills scale: <600,000 tons / year

- In 2006 NSP proportion of Shandong ranked 24th in the country. It has a big gap between the level in Zhejiang Province (85%).



Explanation of equipment status

	To be eliminated	To be encouraged
Shaft kiln	*	
NSP (<1200t/d)	Naturally out of use as the scales are too small to modify with other technology economically.	
NSP(2000-4000t/d)	Still in operation normally, no cut-down policies for this scale	
NSP (>4000t/d)		*



Identification of key mitigation options

- ❑ Frequency control of motor drive system
- ❑ Process management and parameters control
- ❑ Multi-level kiln pre-heater
- ❑ Cogeneration
- ❑ High-efficiency roller mills



A simplified comparison matrix of the key mitigation options in Shandong's cement sector

Technologies	Costs	CO ₂ emission reduction effects	Penetration potential
Frequency control of motor drive	**	*	****
Process management and parameters control	*	**	*
Multi-level kiln pre-heater	***	****	***
Cogeneration	*****	*****	*****
High-efficiency roller mills	****	***	**

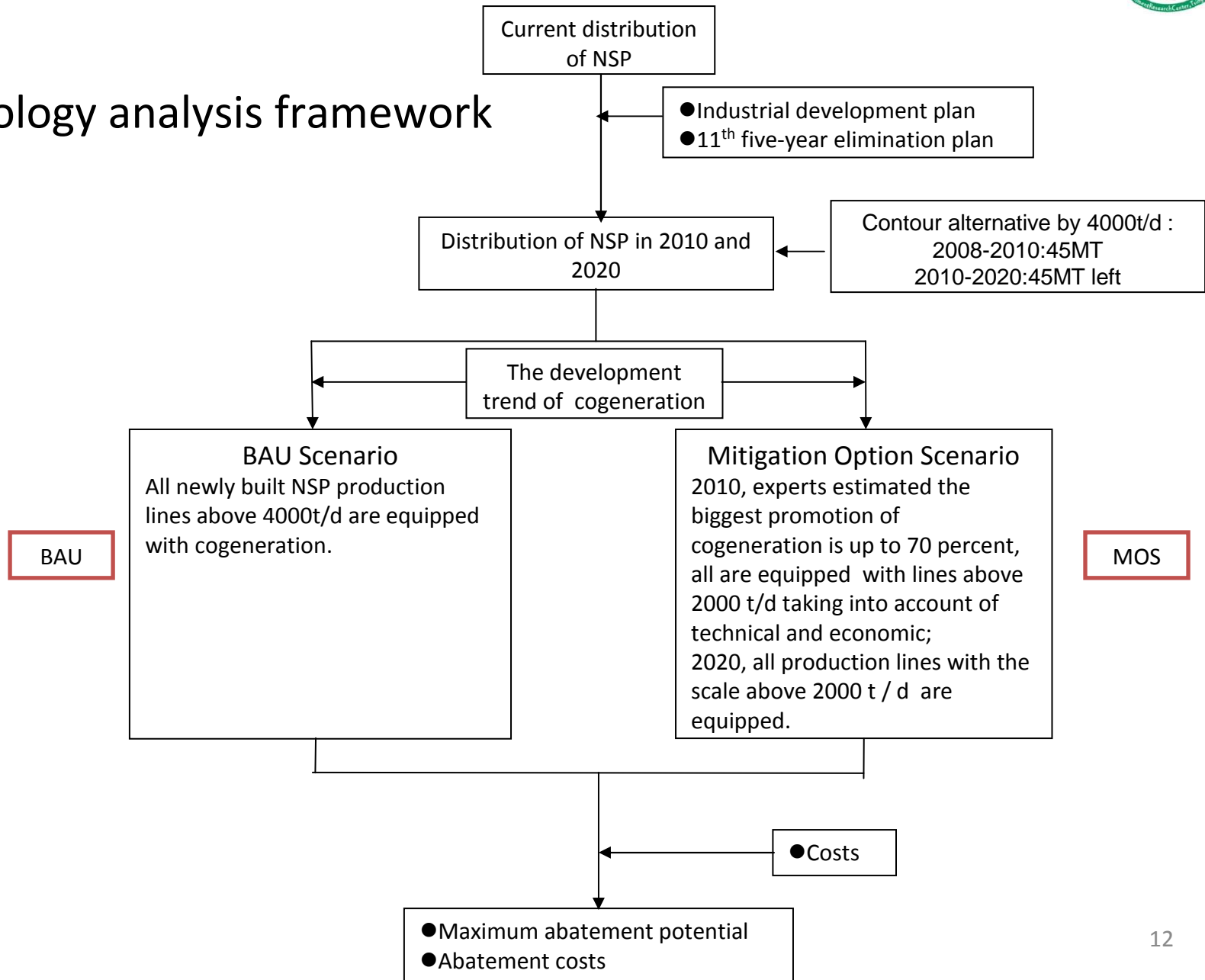


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Technology analysis framework





Current status and detailed settings in scenarios

	Shaft Kiln		NSP		
			< 1200t/d	2000-4000 t/d	>4000t/d
2007	90MT	Distribution of NSP	14	29	18
	↓	Number of NSP with cogeneration	0	2	3
2010	45MT	Distribution of NSP	14	29	45
BAU	↓	Number of NSP with cogeneration	0	2	30
MOS	↓	Number of NSP with cogeneration	0	17	45
2020	0	Distribution of NSP	14	29	72
BAU		Number of NSP with cogeneration	0	2	57
MOS		Number of NSP with cogeneration	0	29	72



Changes in energy and carbon intensities

		BAU	MOS
Energy Intensity of cement producing (kgce/t)	2007	108.25	108.25
	2010	103.19	98.97
	2020	98.12	92.78
Carbon Intensity of cement producing (kgCO2/t)	2007	280.82	280.82
	2010	266.09	253.82
	2020	251.36	235.82



Effects on energy and GHG reductions

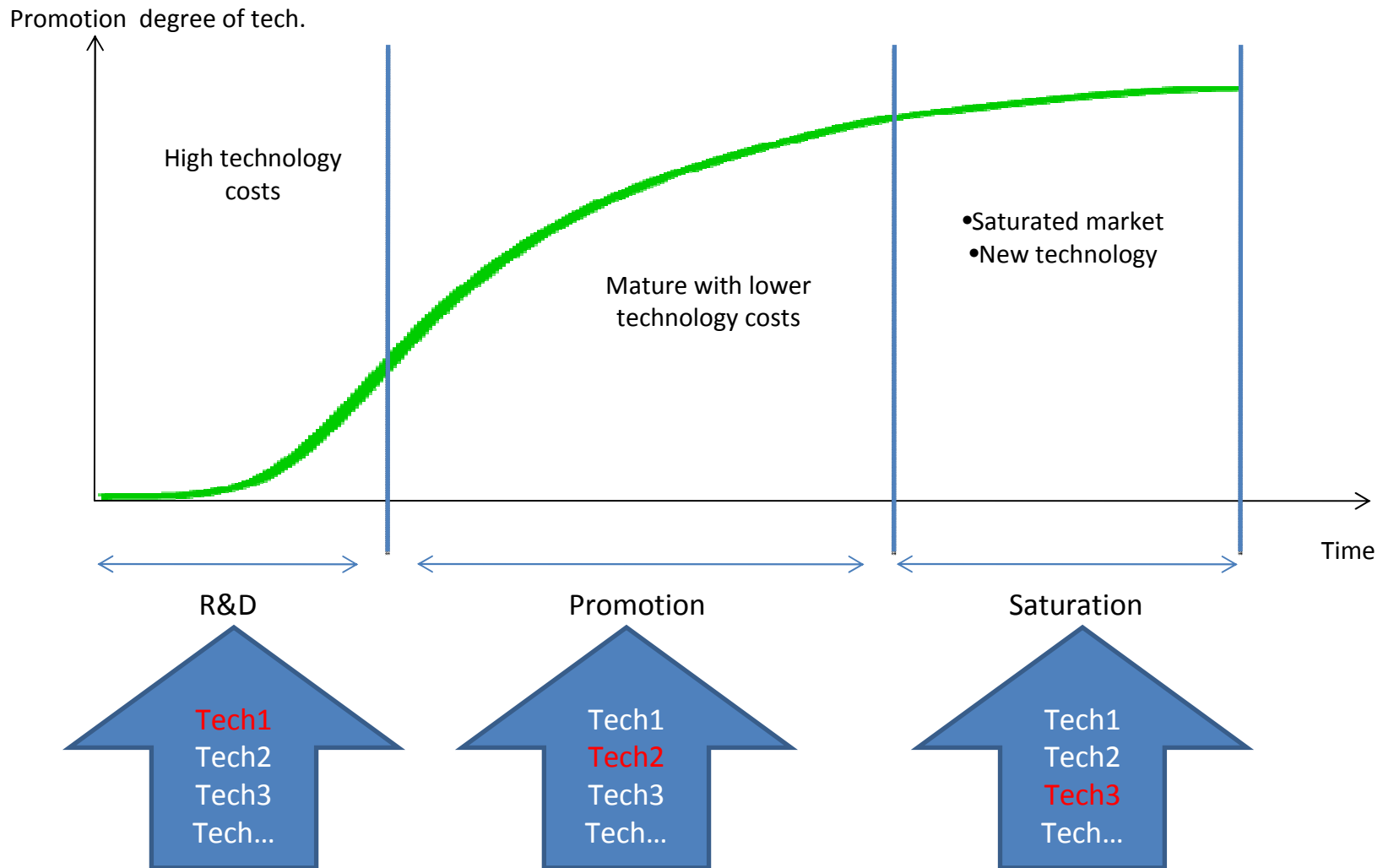
		Total reduction in electricity usage by cogeneration (GWh)	Maximum total reduction in electricity usage by cogeneration (GWh)	CO ₂ emission reduction by cogeneration* (MT)	Maximum CO ₂ emission reduction by cogeneration* (MT)
2010	BAU	2715.6	73%	2.87	
	MOS	4686.6	1971	4.96	2.09
2020	BAU	5080.8	49%	5.38	
	MOS	7577.4	2497	8.02	2.64

For cogeneration:
With the penetration degree up, less space is left for promotion

*Emission factor of north China power grid= 1.0585 tCO₂/MWh



Further analysis of technology





Barriers to adopt cogeneration

- ◆ **Market**-hard to get on the power grid and relative high fees. It mainly results from the interest conflict between departments and sectors. Cogeneration reduces the income of power companies.

- ◆ **Technical**-hard to get on the power grid. The electricity generated by cogeneration equipment can't be used directly by the cement plant itself, the amount of electricity must be firstly joined into the regional power grid. In the process there will be impact to the grid. Thus the grid companies took some limiting measures.



Barriers to adopt cogeneration

Financial-lack of financial support from governments and banks.

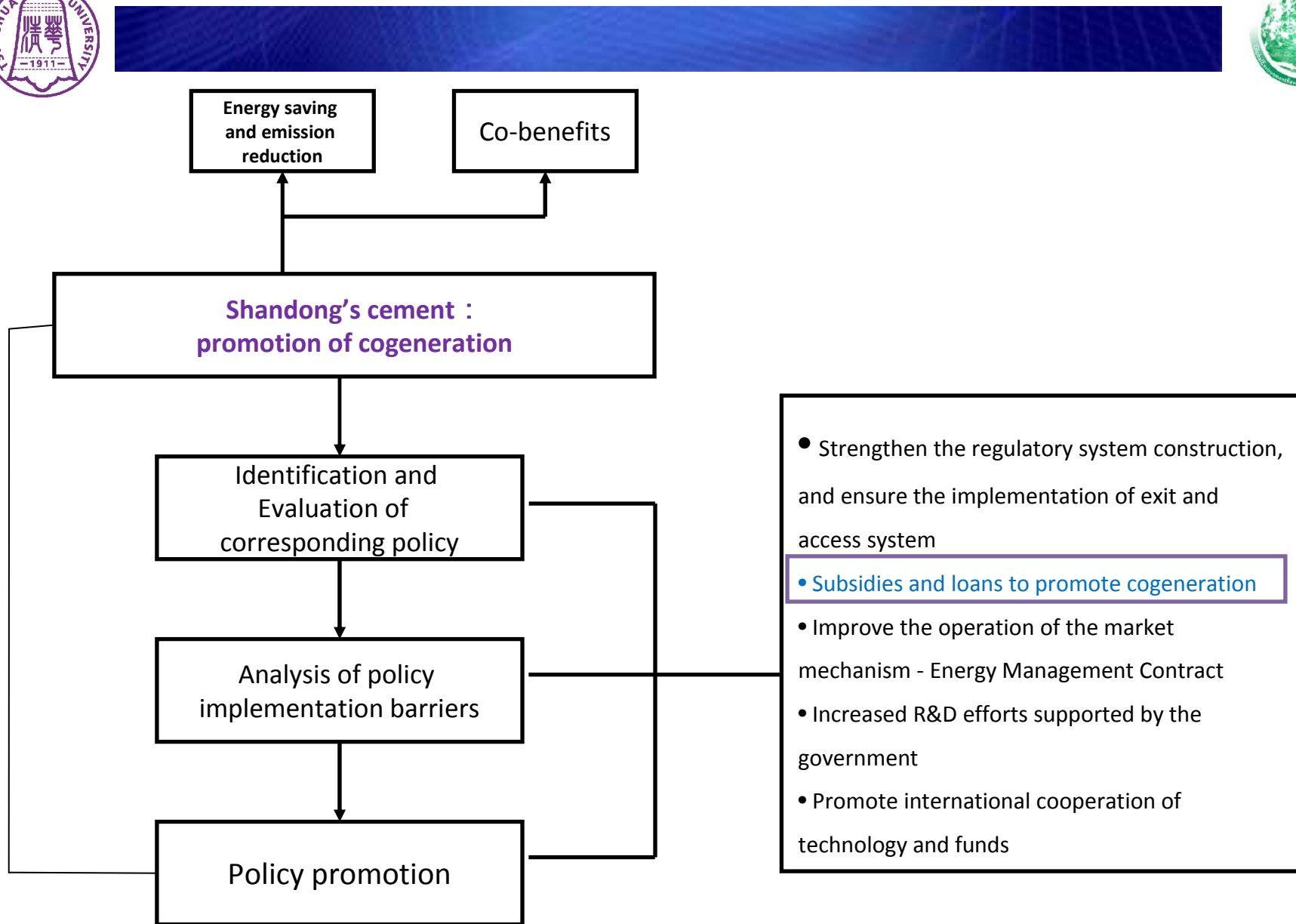
❑ The pre-investment for fixed assets is very high, almost occupying 15% of the total investment of a cement plant.

➤ Bank : no obvious cash flow

➤ Plant : although noticing the great benefit from cogeneration, the big pressures of finance and market competition ability make them choose to put the enlarging of producing ability and occupying the market share at the first.

❑ Some cement plants are too small to reach the threshold of loans.

❑ Some cement plants enlarge their scale mainly through bank loans, the debt rate is high, so it is hard to get loans again.





Policy on cogeneration carried out in Shandong Province



Category of policies		Cement
		cogeneration
Command and Control	政府令 法规 条例等	鼓励采用纯低温废气余热发点技术。新型干法窑系统废气余热要进行回收利用.到2010年,新型干法水泥采用余热发电生产线要达40%,山东省力争达到60%
	许可证	
	能耗标准	
	常规污染物排放标准	
	温室气体排放标准	
	其他标准和规范	
Economic measures	补贴	200元每节约一吨标煤
	价格杠杆	<div style="border: 1px solid black; padding: 5px; text-align: center;"> Large space for application </div>
	费税减免/增加	
	低息、贴息贷款	↓
	加速折旧	<div style="display: flex; align-items: center; justify-content: center;"> <div style="border: 1px solid black; padding: 5px; margin-right: 10px;">No actions</div> → ? Barriers </div>
	专项科研基金	
Market policy	排放交易	
	政府采购	
	公开招标	
Government-run Voluntary training or assistance		



Analysis of policy implementation barriers

- ❑ The process of gaining subsidy from government is very complex, there are many procedures including reporting to the economic commission, verification, waiting for approval.

- ❑ The development of cement industry, to a large extent, depends on the national and local industrial policies, which will bring about fluctuation to plant's profits. Thus the loans from banks will be affected.
 - Central bank has been increasing loan rates from 2007 in order to curb excess liquidity and lower loan growth.
 - Bank loan available ? Newly built lines equipped with cogeneration and 50% finance provided by bank loans, 36 billion yuan/year in need.



Feasibility of policy implementation -short investment recovery period

Example: 4000t/d NSP-9000kW

Contents	basis
Equipment depreciation	The investment recovery time is 8.6 years, including depreciation except 4% as residuals.
Maintenance costs	Maintenance costs account for 4% of the value of assets (referring to the original value).
Labor costs	Labor cost is 20,000 yuan per capita per year, 10 people are required for 9000kW.
Management fees	Management fees are 1% of the investment per year.

Investment recovery time-8.6 years

The price of self-generation is 0.36yuan/kWh, the net income is 0.30yuan/kWh.

Total investment: 8.48 million yuan/year



Efforts done for policy implementation barriers

Governmental efforts-subsidy

- ❑ Given based on the coal consumption reduction, the relative energy saving reward is 200 yuan per ton coal-saving.
- ❑ According to the local industrial plan-cogeneration proportion reaches the goal of 60% in 2010.

➤ 0.31 billion yuan from fiscal income, 0.17% of Shandong's fiscal expenses in 2006.



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Thank you!

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