



GHG reduction opportunities in China's cement sector

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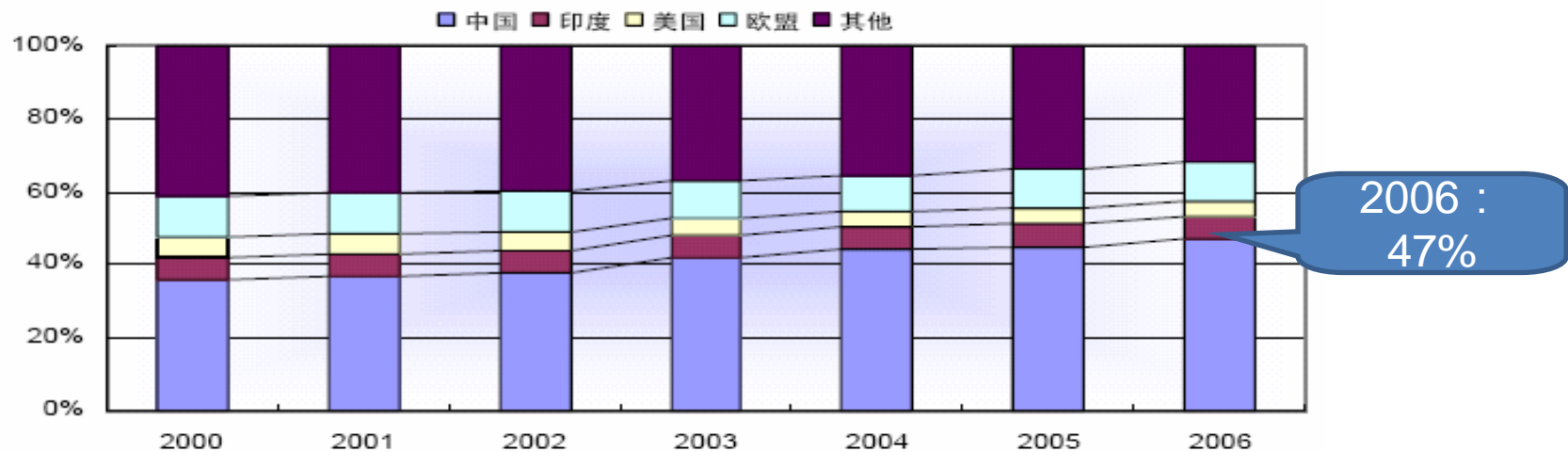
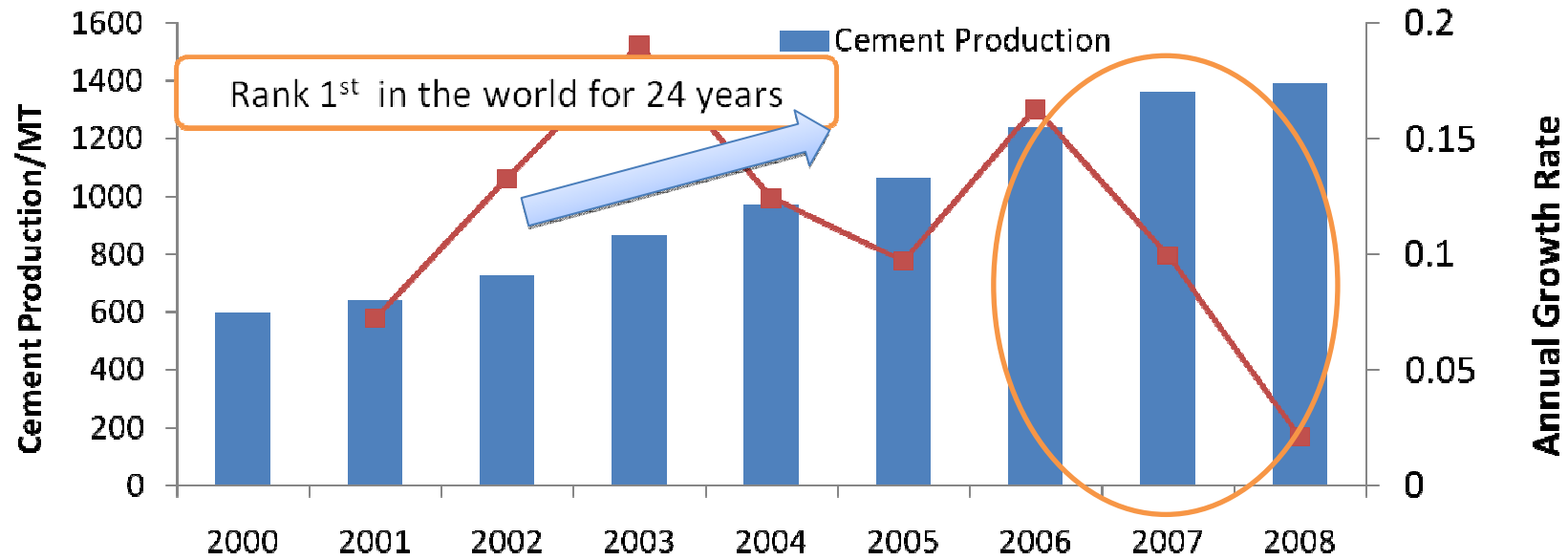


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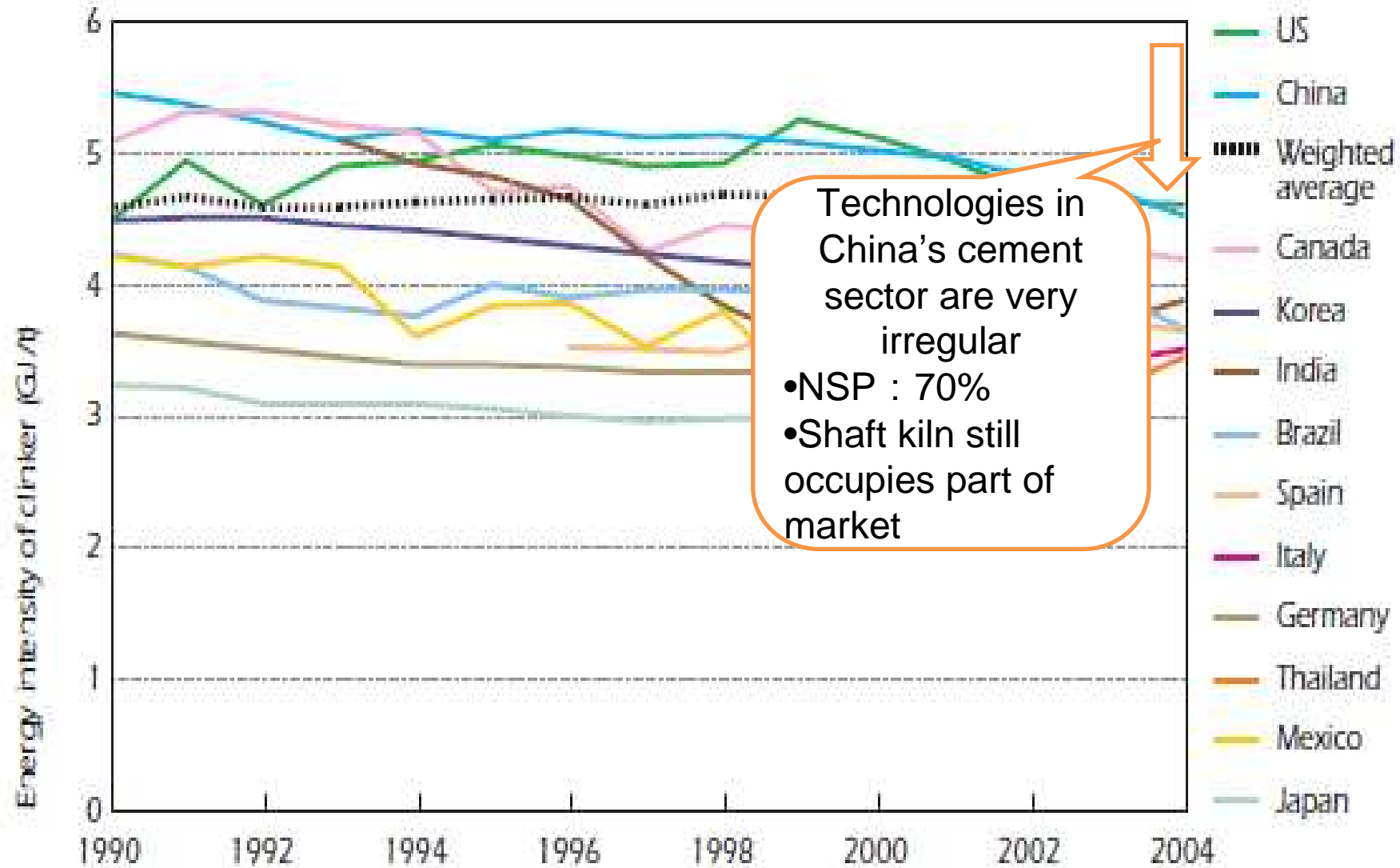


Cement production





Energy consumption per unit clinker



Sources: Coal Statistics, India; ERI, 2004; Soares and Tolmasquim, 2000; Worrell, et al., 2001; IBGE, 2006; CEMBUREAU, 2006; EEA, 2006; AITEC, 2005; USGS, 2006; PCA, 2005; NRCAN, 2006; Japan Cement Association, 2006; OFICEMEN, 2007; Siam Cement Company Ltd, 2005; INEGI, 2006; VDZ, 2006; Battelle 2002; LBNL, IEA and Tsinghua University estimates.



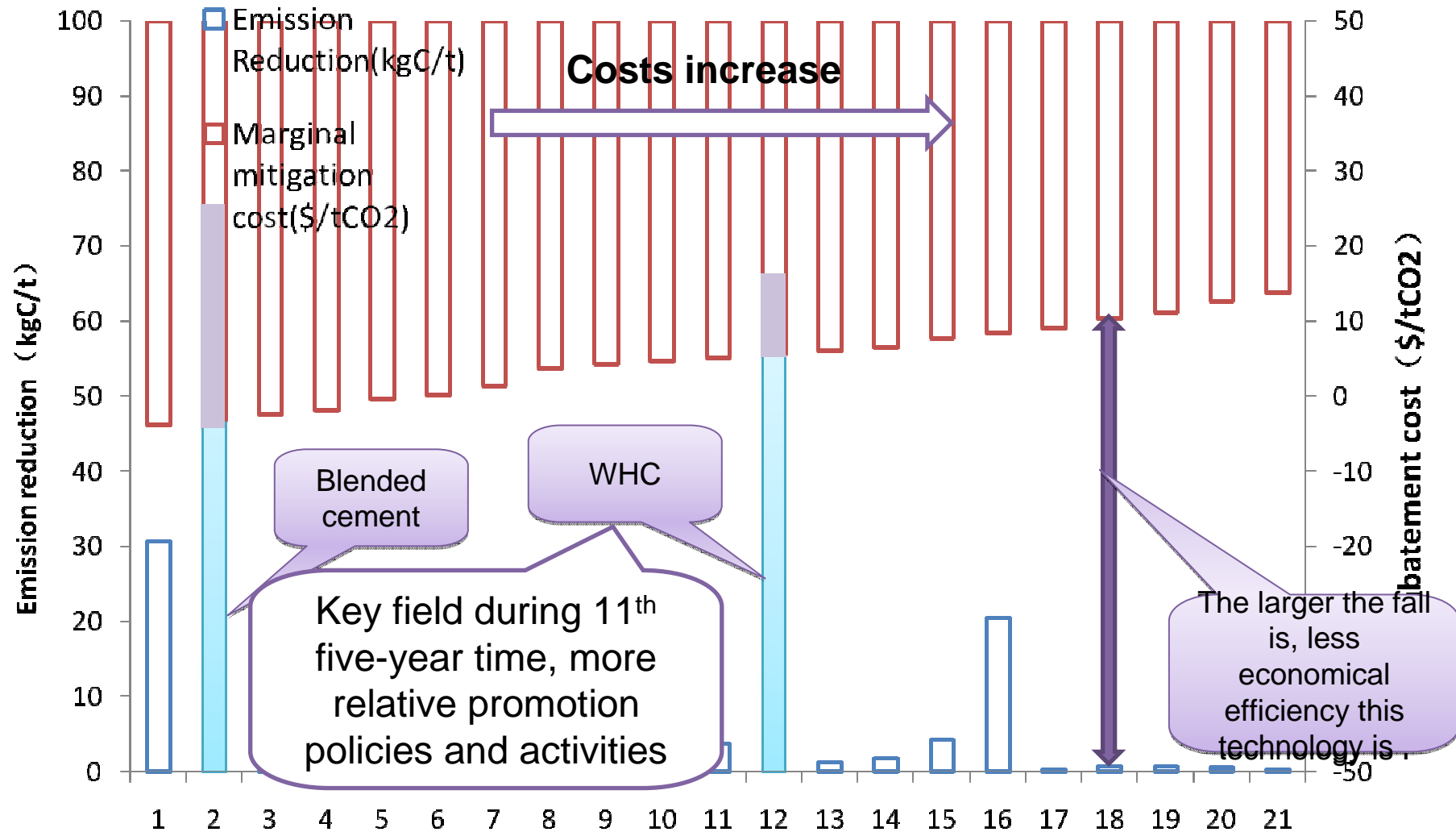
Technology list in cement sector



Raw materials preparation (wet process)	Raw materials preparation (dry process)
Mechanical transport systems	Mechanical transport system
	Raw meal blending system
	High efficiency roller mills
	High efficiency classifiers
Clinker production (wet process)	Clinker production (dry process)
Kiln combustion systems	Kiln combustion systems
Kiln shell heat loss reduction	Kiln shell heat loss reduction
Use of waste fuels	Use of waste fuels
Conversion to grate cooler	Conversion to grate cooler
Conversion to semi-wet process	Low pressure-drop cyclones
Optimize heat recovery(grate cooler)	Heat recovery for power generation
Conversion to precalciner kiln	Conversion to multi-stage preheating
	Conversion to pre-calciner kiln
	Conversion to PH/PC-kiln
	Optimize heat recovery(grate cooler)
Finish grinding	General measures
Improved grinding media	Variable speed drives
High-pressure roller press	High-efficiency motors
Roller press/Horomill	Process control systems
High efficiency classifiers	
Product changes	
Blended cement	



Identification of key mitigation technologies





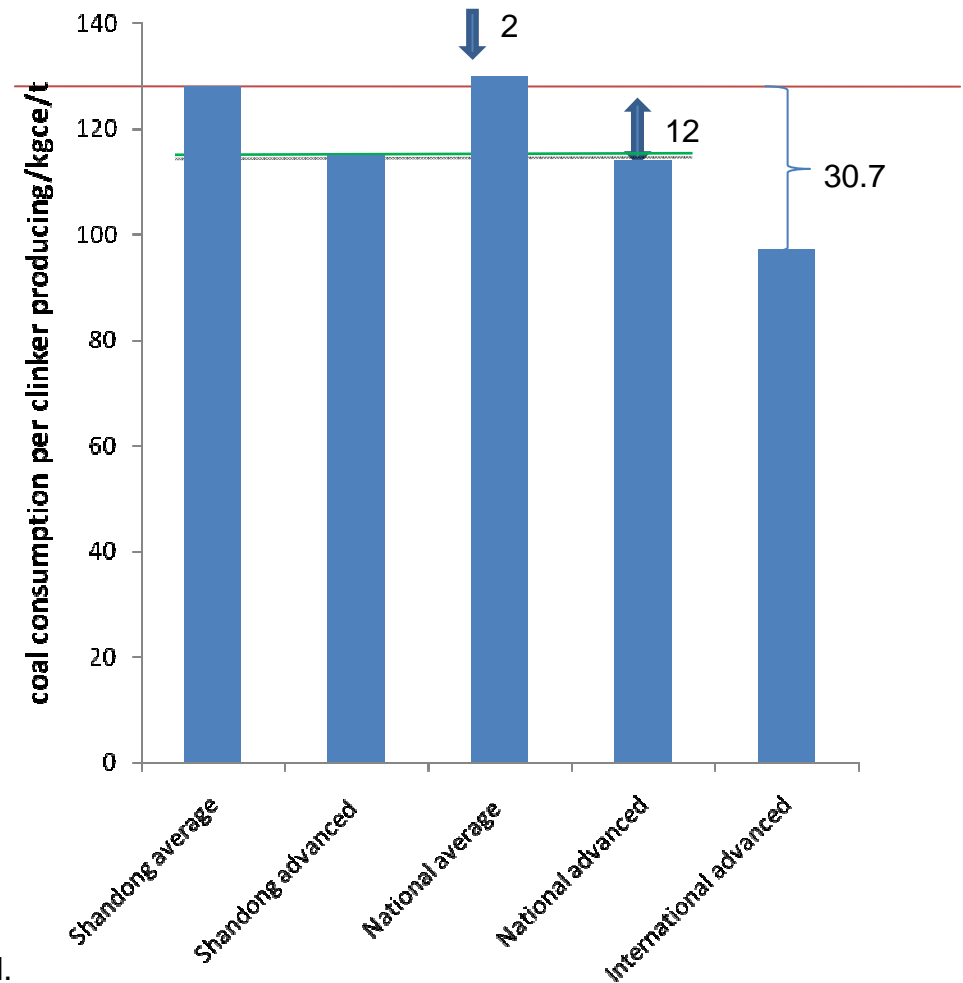
Why choose Shandong to do this analysis?

- **Significance in research at provincial level**
 - Many provinces have their own energy saving plan and implementation steps corresponding to national plan.
 - Resource capacity, environment of economy and policy are different among provinces, leading to the difference capacity for sectoral emission reduction. The significance of mitigation policy design just exists at provincial level taking the actual situation of provinces into consideration.
 - Cement production of Shandong have been ranking 1st in China for 19 years.
 - Proportion of NSP in Shandong exists 50%.
 - Cement production of Shandong have been negative growth since 2007, although the cement production of China keep increasing.
 - Shandong finished the elimination work for old kilns above quota in 2007 and 2008, about 30 million tons.
 - Proportion of WHC in Shandong 's cement industrial plan is 60% in 2010 , 20% higher than that in national plan--40%.



Energy efficiency of Shandong cement sector

	consumption of clinker producing
Shandong average (2007)	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



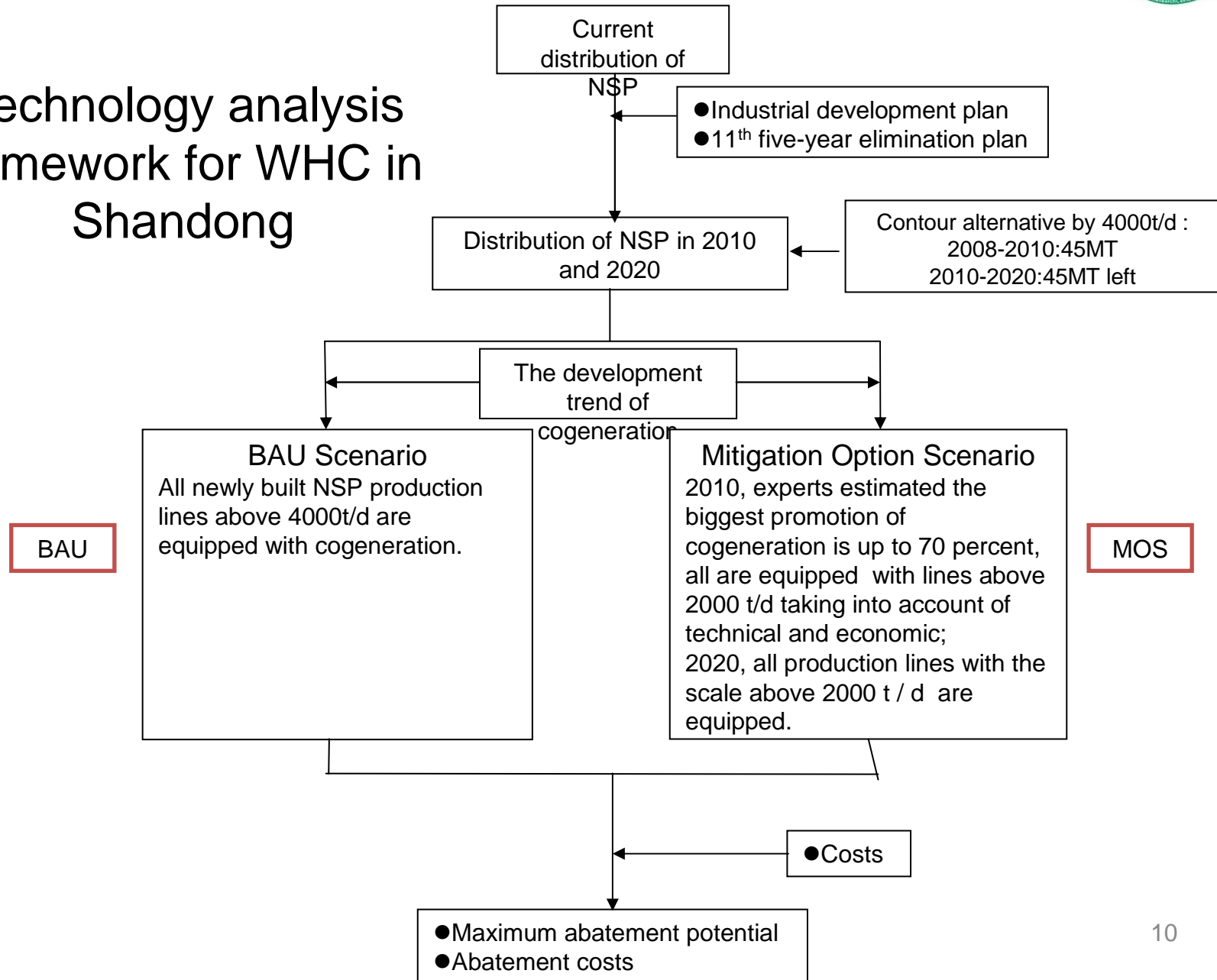
Production equipment status

	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 (50%) and NSP (50%).
- 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%).



Technology analysis framework for WHC in Shandong





Barriers for WHC promotion

Market barriers

- Hard for grid-connecting: For cement plants, the power from waste heat cogeneration must be connected to the grid first, and then buy from the grid to use, the process of grid-connecting will attack on the grid
- It may results in the interest conflict between departments and sectors. Cogeneration reduces the income of power companies.
- High fees: in the charging of grid-connecting, there is no inconsistent standards all over the country, but generally it is high. As the grid-connecting process would have an impact to the central grid, at present, in addition to China's Zhejiang Province, many provinces require power companies to pay an occupation fee for grid resources, ***the power sector of some districts even limit the power generated from waste heat cogeneration to be connected to the grid***, which brings obstacles to the promotion of waste heat cogeneration technology in no doubt.



Barriers for WHC promotion

Financial barriers

Lack of financial support from governments and banks-rapid development, strict management

- ❑ 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 asset liability ratio is so high that it will be very difficult for them to obtain loans from banks to invest energy efficiency projects.



Barriers for WHC promotion

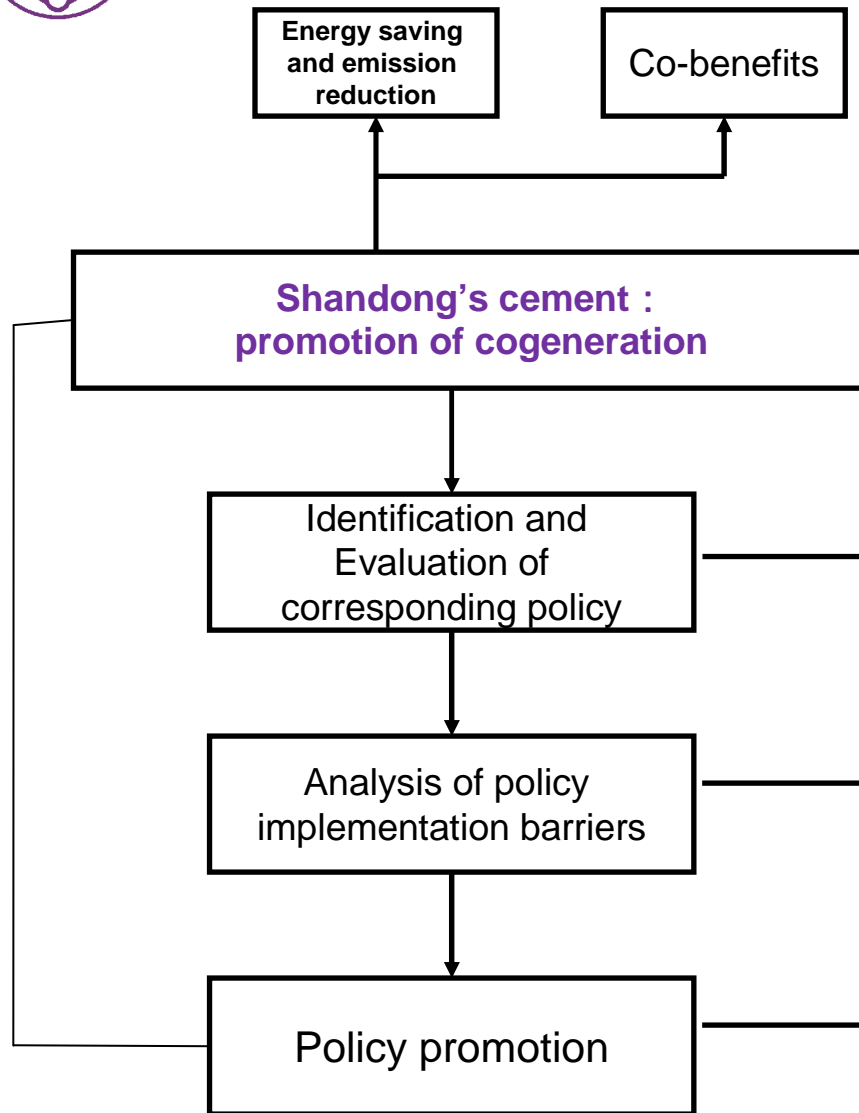
Financial barriers

◆ Take *tax* as an example

✓ Policy for value added tax: according to national tax law, power plant has to pay 17% of value added tax, and the calculation equation is ***value added tax = output tax – input tax***, but cement plants operating WHC don't have fuel costs, that is to say, there is 12% higher to pay.

✓ Other taxes: after the power generation, the plants have to pay 33% as the income tax, and 3% as sales tax, 5% as the urban construction tax and education surcharge, and so on.

✓ Hard to promote in western region: tax burden is so heavy, and power price in western region is relatively low, so the return rate of WHC in the west is low, therefore WHC is difficult to be operated in western region.



Key promotion policy for WHC in Shandong

- Strengthen the regulatory system construction, and ensure the implementation of exit and access system
- Subsidies and loans to accelerate production from behind to promote cogeneration
- Improve the operation of the market mechanism - Energy Management Contract
- Increased R&D efforts supported by the government
- Promote international cooperation of technology and funds



Technical barriers for implementation of promotion policy

- WHC is just encouraged but not mandatory required in relative laws, such as ***Clean production promotion law, Energy saving law***
- The process of gaining subsidy from government is very complex, there are many procedures including reporting to the economic commission, verification, waiting for approval.
- Although WHC has been developing for more than 30 years, it really becomes popular in the market during recent years.
- It is estimated that there still be 400 lines to be equipped with WHC after 2008, if we calculate based on the cost of 5000t/d production line, that is 60 million yuan per line, more than 24 billion yuan is needed to support the development of WHC in the future.



Social barriers for implementation of promotion policy

◆ expanding the capacity to absorb the surplus labor force

- The labor productivity of NSP increased 5-6 times than shaft kilns
- the structure adjustment of cement industry makes the total demand for labor decline
- Take Anhui Conch Group as an example

Year	In-service personnel	Professional staff					Education	
		Production staff	Sales	Technicians	Finance staff	Executives	The number of people receiving medium and high education	The number of people with a college education
2004	13296	9526	9526	2416	296	548	4122	3558
2005	14677	10369	10369	2812	341	590	4634	3776
2006	16685	12008	565	3109	294	643	4799	3674 ¹⁶

◆ Labor quality in demand

- For enterprises of different sizes, the education level of labor force in large-scale enterprises is generally higher than that in small-scale enterprises



Efforts done for policy implementation barriers

Subsidy-governmental efforts

□ More than 3 billion yuan from Shandong's fiscal income are put into energy saving and emission reduction in 2008, 2 times more than 2007, including

- 439 million yuan for energy saving
- 2650 million yuan for environmental protection

□ 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.

➤ ***310 million yuan in need from fiscal income, 0.17% of Shandong's fiscal expenses in 2006.***



Broader...



Implementation of mitigation policies in cement sector

- ◆ *Cement industrial development policy*
- ◆ *Cement industrial specific development plan*

◆ Continue to promote structural adjustment

- the cement industry is supposed to seriously implement the document related to the restructuring issued by the State Council, as well as the spirit of the document issued by the NDRC and the relevant ministries.
- The local government of the new projects should help enterprises implement the equal out work of backward production capacity.

◆ Increase the phasing out of backward

- NDRC promulgated a formal announcement of backward cement enterprises (line) list to be closed in 2007
- increase the enforcement of *differential price, environmental protection measures and law*
- *stop* a variety of tax incentives including the *duty-free policy* for comprehensive utilization of resources
- *The elimination of outdated production capacity should be systematically carried out so as to avoid market fluctuations in prices and the emergence of gap*



Broader...



Implementation of mitigation policies in cement sector

◆ Support large-scale enterprises (group) to accelerate development

- Concentration ratio of top 10 companies: 2.99% in 1996 to 13.68% in 2005

◆ Develop circular economy

- Develop waste heat cogeneration projects and projects with co-processing, industrial waste, garbage utilization technology in cement production.

◆ New standard called *General Portland Cement put into practice* (June,2008)

- Enlarge the scope of products enjoying preferential policy
- Only three kinds of wastes can be added: slag, fly ash and pozzolanic materials



International cooperation

- ◆ Finance assistance-loans from foreign banks
 - Phasing out of backward capacity
 - Promoting NSP
- ◆ Technology assistance
 - Wastes as alternative fuels
 - Grinding technology(for blended cement):Better mill in the USA
- ◆ Capacity and institution building
 - Wastes collection and classification institution
 - Relative policies and regulations
 - Product and process standard
- ◆ Training and education
 - Operate and use energy-saving and emission-reduction technologies and equipment
 - Mass education



Thank you!

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