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Comparative Assessment of Alternative Electricity- generating Systems in China: Under the Background of Electricity Deficiency

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Assessment of electricity-
generating systems choices

1



Survey:

No.1: Can you guess the detailed contents of this presentation from its title, 'Comparative Assessment of Alternative Electricity-generating Systems in China: Under the Background of Electricity Deficiency'.

No.1 Simply, it is about assessment of the choices among different power stations, such as coal-fired, hydro, nuclear, wind, Solar PV and so on.

No.2: Are you familiar with the features of the power stations referred above, such as cost, environmental friendly or not and so on.

No.2 If true, maybe you can understand my presentation well, even you can take place of my position today or tell me whether I make some mistakes or what's the biggest debate on this issue.



Background: Energy Deficiency in China from the year of 2003

	Growth rate of GDP in 2003 (%)	Estimated growth rate of GDP in 2004 (%)	Estimated generation capacity shortage (10MW)
Tianjin	14.5	11.5	50
Hebei	11.6	9	50-150
Shanxi	13.2	9	250
Inner Mongolia	16.3	13	80
Shanghai	13.5		404
Jiangsu	13.5		855
Zhejiang	14		430-630
Anhui	9.2	9.5	70-80
Jiangxi	10.5	11	50

many regions have not enough electricity and must limit or stop electricity supply

Energy Crisis?



Voices: What type of new generating projects is better?
Now, or a long term?



I think wind is best, because it is so clean



I think nuclear power station is incredibly good,
It has big capacity, low GHGs emission, safe performance



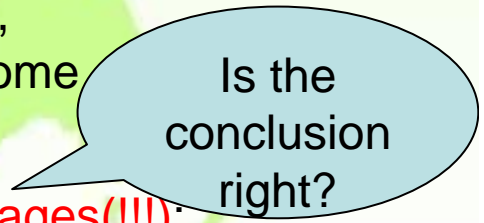
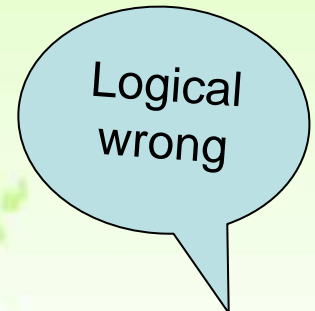
Natural gas: (1) Environment friendly comparing **with coal-fired station**

(2) More stable and flexible comparing **with hydro or wind**

(3) Benefit the adjustment of power structure, **now coal is dominated.**

(4) Decrease the pressure to the construction of grid, **comparing with traditional source.** __A report from some Chinese media.

Conclusion: Natural gas generation has **Four advantages(!!!):**





What's the problem? ?

Need a comprehensive comparison of features of different power stations

Just this presentation focused

The comprehensive comparison contained 5 aspects



Five aspects of comparison:

- **Cost and related elements**
- **Available and stability of resource**
- **Capacity of station**
- **Pollution issue**
- **Climate Change impact**



(1) Cost and related elements

least-little-moderate-much(high)-most(higher)

Cost and related elements	investment	building period	fuel price	generation cost	risk of cost change
Coal-fired	little	little	much	little	much
Nuclear	high	most	moderate	high	much
natural gas	moderate	least	high	higher	much
Hydro	much	most		little	little
Wind	much	moderate		much	little
solar PV	much	moderate		much	little



(2) Available and stability of resource

China's coal resource is rich, But the problem of transport and grid construction will probably be constraint.

Oil and natural gas reserve is little. Energy security issue

Renewable energy plants such as wind, hydro, solar can't be transported economically, so applied locally, and transmit the power by grid.



(3) Capacity of station

Nuclear and fossil fired power plants are net energy producers and are capable of supplying large amounts of electricity. Among renewable energy technologies, **hydro and geothermal power** plants are superior because of their higher energy density. ---From the international experience and **net energy analysis**.

From the practice of China, whatever generation systems, the **gap** with the international advanced technology is considerable huge. So China develop any systems, there still much space and advance technology as reference. Now in China, the capacity of thermal and nuclear is much bigger and renewable generation capacity is small, whatever unit or cluster capacity.



(4) Pollution issue

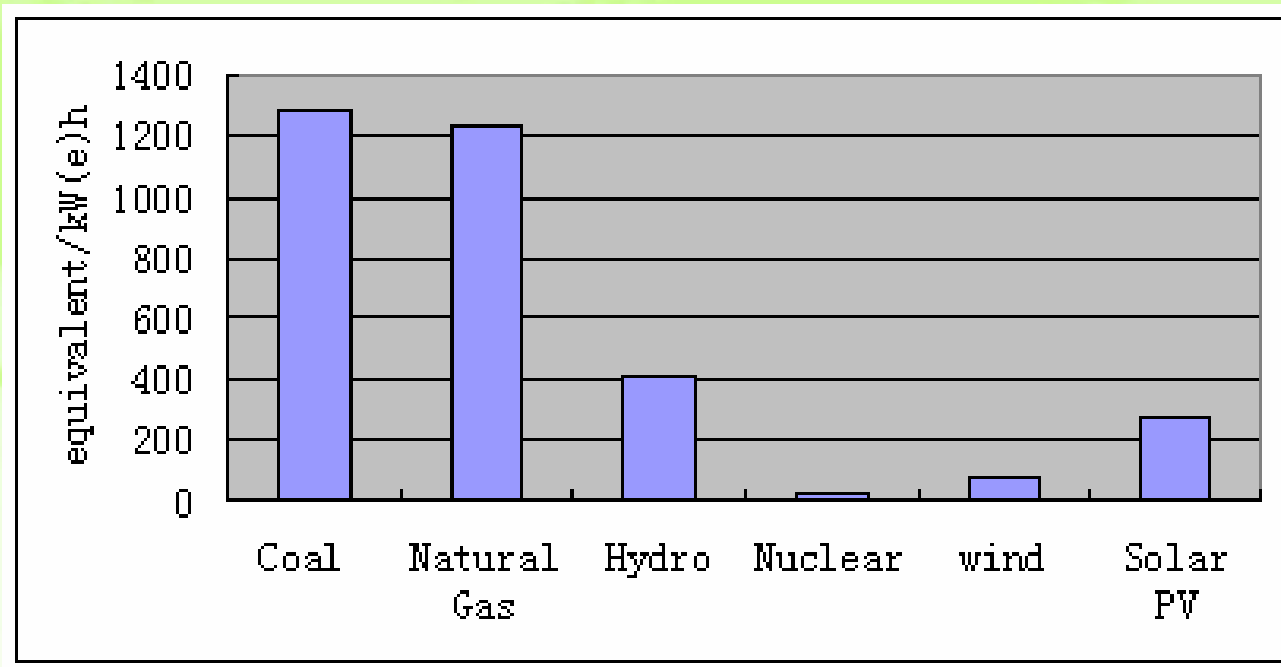
Emissions (kg/GWh)	Wind	Solar PV	Coal	Nuclear
SO ₂	10.9-23..5	300-380	704-709	33-50
NO _x	16.0-34.2	300-380	717-721	64-96
Dust	2.0-4.3	60-80	150	6-8

Full energy-chain analysis, including the fuel cycle and the construction of the plant.



(5) Climate Change impact

CO₂, CH₄, and so on.
GHGs

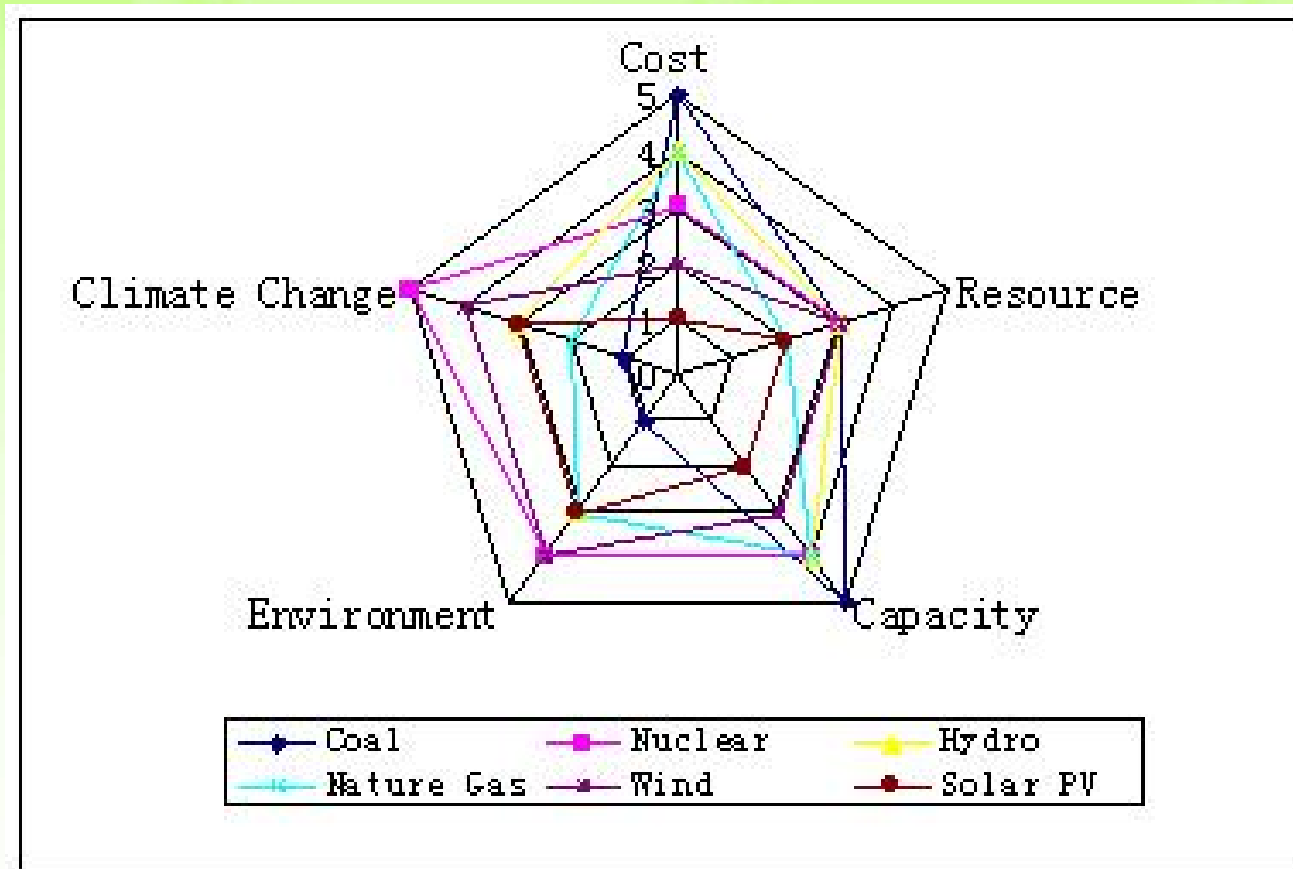


Full energy-chain analysis



Result

To make the result more clear, use 1-5 judgment to assess the score of every generating choice, displayed in the figure with **Radar Chart** below.



No optimal solution



Conclusion and policy implications

- (1) Thermal generation, including coal and natural gas, has low cost, flexibility and short building period.
- (2) Nuclear performance is excellent wholly and should be developed as a priority.
- (3) Hydro is satisfied, however it is necessary to expand the grid and maintain the whole generation and transmit of electricity.
- (4) Wind generation is the potentially dominated energy sources environmental friendly. But The cost in China must decrease and once the proportion is beyond 10%, the stability must be considered.
- (5) solar PV is not like that clean as imagination because of full energy chain analysis, thinking about the construction and waste management. But this can be solved through capturing and sequestration. It can be used as good form to improve life quality in the countryside and lonely area.



According to some study, the rate of growth of electricity consumption is the **Granger reason** to GDP growth in China. That means that in order to avoid any adverse effect of electricity shortages on economic development, it is important for the Chinese government to plan, and build enough generating capacity to satisfy the electricity demand of industry and other sectors.

References (omitted here for convenience)



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Thanks for your patience

Any Questions?