Steps To Avoid the Historic Boom/Bust Cycle in Power Sector

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Abstract: China's electric sector power is a vital part of the nation's economic and environmental well being. The power sector has been plagued with persistent swings from significant power surpluses to serious power shortages. This Boom/Bust cycle is not good for China's economic or environment health. One simulation showed that steady annual additions of no less than 30 GW, and no more than 38 GW, of new resources (demand reductions or supply increases) would reduce the risk of a Boom/Bust cycle. But regardless of specific numerical results, international experience shows that new planning, investment, and market and regulatory reform policies are needed to reduce the likelihood and severity of future shortages and surpluses.

Key Words: Power shortages; Boom/Bust cycle; Demand Side Management; Economic Cycle.

The Anatomy of China's Current Power Shortage

The monetary crisis in Asia caused China's economic growth in 1998 to slacken. In 1998, power demand growth grew only 2.6%. A power surplus began in 1999, and in 2000 the government stopped approving new coal fired power plant investment.

Meanwhile, in 1998, the Government implemented financial and currency policies to promote rapid development of fundamental and processing industries. The result as shown in Table 1 was rapid growth of economy and power demand. Table 1, however, also shows that generating capacity additions grew much more slowly than electricity demand.

Table 1 Electricity and Generating Capacity Growth

Year	Annual Electricity Growth	Annual Generation Capacity Growth
1999	6.9%	7.7%
2000	11.4%	7.0%
2001	8.6%	4.7%
2002	11.6%	6.8%
2003	15.4%	7.7%

Rapid growth in electricity demand, slow growth in new generating plants, and not enough investment in Demand-Side Management (DSM) combined with weak transmission and distribution capability to cause a power shortage in 22 provinces (municipals and autonomous regions). In some regions, shortages of capacity and energy have become a "bottleneck" for economic development.

In summary, China is now experiencing serious power shortages in many provinces. Yet, just a few years ago, in 2000, China had a power surplus which prompted the government to halt new investment in power plants. How, in just three years has China has gone from a surplus condition to a significant shortage?

Part of the current problem was due to the nearly explosive growth of the economy. Part of the problem is with a planning and investment process that could be more advanced and more market driven. Yet another part of the problem is underinvestment in DSM and other resources with short planning and construction lead times.

Clearly, power development and construction must be better coordinated with economic growth and China's other important environmental and social goals

Economic Cycle in China

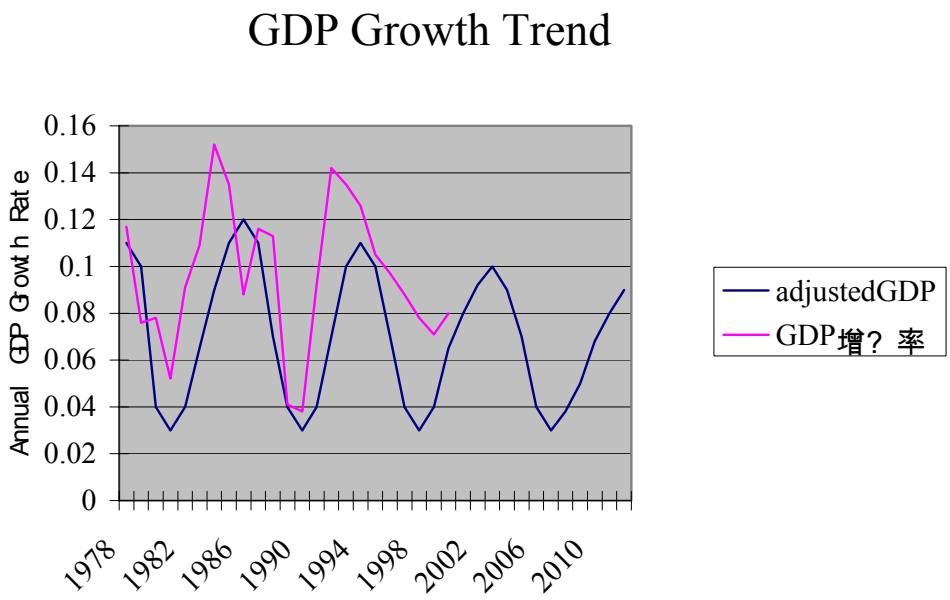
Looking back, it seems that China's economy is on one cycle and power plant construction is on another. The long construction periods for power plants planning and investment practices that have not accurately anticipated needs, has created a mismatch between economic cycles and the cycles of power plant construction. The interaction of these two cycles has produced periods of surplus and shortages.

The pattern of power plant construction seems to follow a similar sine wave path, but the lag of the construction period means we have been increasing construction when we should have been decreasing investment, and decreasing it when we should have

been increasing.

An analysis of China's economic history shows a sine curve with a periodic cycle around 9 years.[1] The peak years of economic growth were respectively in 1985, 1994, and 2003. The years of slowest economic growth were 1980 1989, and 1998. If this trend were to continue, 2012 and 2021 would be years of peak growth and slow years would be 2007 and 2016.

A simulation by Intelligent Engineering[2] shows that China annual additions of no less than 30 GW and no more than 38 GW of new resources (with corresponding additions to transmission capability) will minimize the risk of power supply shortages or surpluses.



Solutions

One solution would simply accept the 9 year economic cycle as a fact and adjust the power plant investment cycle to match it. But there are two reasons

[1] Hu Zhaoguang, China's Sustainable Electrification By Competition in the Power Sector, WEC 2001 Australia

[2] Hu Zhaoguang "Study on the baseline space of sustainable power development" Electric Power pp1-3, vol.37, No.4,2004

to look for even better solutions.

First, economic systems are complex and unpredictable. Economic growth is influenced by a wide variety of internal and external factors that are impossible to predict with sufficient accuracy to simply assume the nine year pattern will continue.

Second, China is rapidly reforming its power sector. Generation has already been separated from the grid. Regional power markets are being organized. Increasingly generation will be market driven. Because the reforms have not been fully designed, it is impossible to predict whether the power sector reforms will make the boom/bust cycle better or worse.

Thus, the question we address is what policies can China adopt that will reduce the probability and severity of future power shortages and surpluses?

Suggestions

Sustainable development of the power sector requires a balance of multiple objectives including adequate and reliable power supply, low cost, clean environment, and economic development.

To promote sustainable power sector development and avoid the damaging boom/bust cycles of the past, we suggest the following:

1. **Adopt Better Planning Methods, Such As IRP With Better Data Collection And Analysis To Identify Near, Mid, And Long-Term Needs And Resource Options**

   The electricity crisis in California showed that the government must continue to have an active role in power sector planning even after market-based power sector reform has been implemented. Thus, under China's market economic system, the government will continue to have a vital role in power sector planning and development. This planning process should be aimed at avoiding the historical boom/bust cycle while meeting China's energy needs in a least-cost manner. This planning process needs to take account of China's multiple objectives.

2. **The Planning Process Needs To Become More Sophisticated And Advanced.**

   a. **Better Data.** Advanced planning methods need large amounts of high quality and timely data on the supply and demand side. However, during the course of power market reform, new data problems have surfaced. For example, on the supply side, data on power capacity commissioned in

2003 could not be obtained until early 2004. When the data was obtained, its data quality was lacking. For example, the data obtained from different sources showed that the total new installed generation capacity in2004 varied from 35GW to 48GW. Information detailing the construction period and expected completion dates were incomplete or consistent.

On the demand-side, detailed end-use energy data such as the number and efficiency of new buildings, appliances, and factories is either not available or incomplete.

Forecasting energy needs and planning least-cost solutions are not possible without fundamental data of this type. Without accurate reliable data on demand and supply-side

b. **Better Analytical Methods**. China needs to adopt advanced planning methods capable of recognize the costs of boom/bust cycles and the value of avoiding these cycle with a diverse portfolio of options.

Some resources like DSM, wind, and CHP, have much shorter lead times and can more quickly respond to changing circumstances. But, the economic value of short lead times and flexibility is not recognized in current planning process.

China should adopt sophisticated IRP methods that can measure the take account of diversity, short-lead times, financial and operating risk, and environmental of different resources.

3. Power Sector Reform Needs To Better Incorporate Market Mechanisms To Balance Supply And Demand

Power sector reform is well underway in China. New markets are in the process of being developed. International experience shows that a vital element of any successful competitive generation market is the incorporation of "demand response" in the market. This means allowing demand-side and supply side to compete to balance demand and supply in the least-costly manner. Customers offers to reduce demand would compete against generator offers to produce power.

Incorporating demand response in generation markets will keep generation prices low and it can avoid the much more costly approach of administratively rationing power during a shortage condition.

4. Improve Use Of Existing Resources

A key goal of China's power sector reform is to create large regional markets that allow more efficient use of existing resources. Transmission grids would be strengthened and power would be allowed to flow more freely from low cost regions in the west to high cost regions in the east. The result would be more efficient use of existing resources and lower cost for all.

5. Improve Tariff Setting Methods To Produce More Efficient Pricing And To Encourage Grid Company Investment In DSM

Pricing at both the generation and consumer levels are irrational and inefficient. These inefficiencies are of particular importance due to the effect on DSM and utility incentives to encourage or distribution courage DSM.

a. **Generation Pricing,** Under current generation pricing practices each generating plant receives a single energy-based price for its output. The price covers capital and energy-related costs. The one part pricing approach is not consistent with international practices and is currently under review. The current generation pricing practices lead to several types of inefficiencies.

   First, dispatch of generation is inefficient. Plants should be dispatched on the basis of their marginal (running) costs, not their total cost which includes their historic, fixed costs (which are unavoidable and not affected by dispatch). In China today, however, plants with low running costs but high capital costs may be dispatched after plants with high running costs, but a lower total cost. This raises the total cost of electricity.

   Second, it provides the wrong price signals for investors in new plants to build plants that can be used to meet peak demand.

   Third, with current generation pricing practices there is little, if any, time-of-day difference in generation costs incurred by the grid company. This leads to the grid company favoring retail prices that do not vary by time-of-use (TOU). If TOU prices are imposed at the consumer level, the result is a serious mismatch between the grid company's TOU revenue and the underlying

generation costs

Correcting generation pricing methods can help reduce the boom/bust cycle buy encouraging more efficient investment and operating decisions.

b. **Consumer Pricing**. A transparent and rational power price system is an important element in the optimization of power resources and its prerequisite is to reflect the principle of fair burdens for consumers. There are many flaws in the current pricing system. On the customer side, capacity and energy prices do not reflect the capacity and energy costs. The classification of power prices and prices of voltage difference does not truly reflect the corresponding level of costs. The current TOU prices do not reflect the TOU costs. Differences in reliability among power suppliers are not reflected in the prices.

   Inefficient pricing leads to inefficient use that contributes to power shortages and surpluses

c. **Grid Company Incentives To Invest In DSM.** China has had some impressive experience with DSM and energy efficiency. Studies have shown that the adoption policies that government policies, including policies that encourage grid company investment in DSM can replace the need for 100 GW or more of new generating capacity by the year 2020. The California energy crisis showed that DSM is the fastest, lowest –cost and cleanest way to address power shortages.

   Under current tariff setting methods, the grid company's prices are allowed to include the cost of buying power to meet customer needs. However, existing tariff methods do not allow the grid company to include the cost of DSM even though DSM can meet customer needs at a lower cost than buying power. Changing this policy would allow DSM to be an effective option for reducing the likelihood and severity of power shortages.

Conclusion

The Boom/Bust cycle of China's electric power sector is not good for china's economy or environment. Decision making during a crisis is likely to impose significant long term economic and environmental costs. International experience shows that it is possible to reform the power sector and use advanced planning and

investment methods to maintain a better and more sustainable balance between supply and demand.