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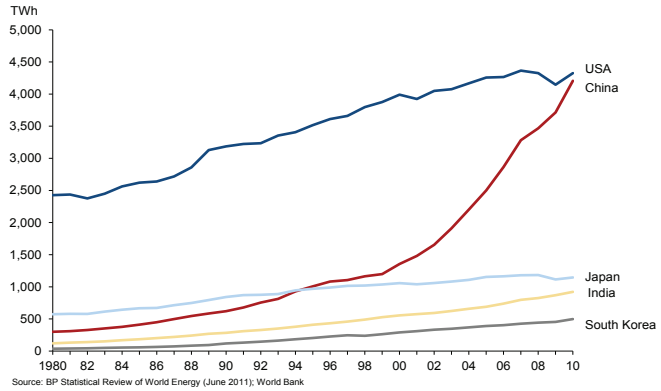
In this edition

In this country spotlight edition of Lantau Pique, we take a closer look at some key challenges facing China's power sector.

China's Size Hides Many Challenges

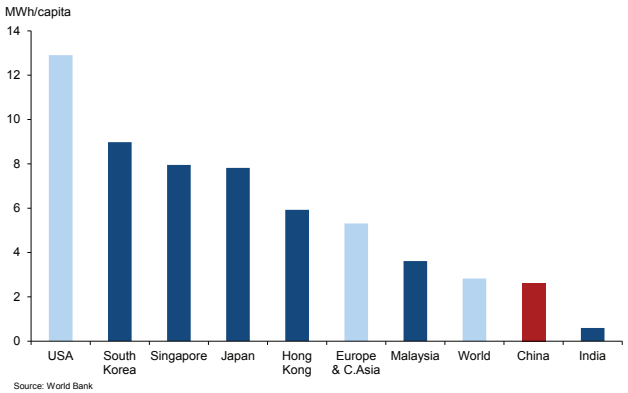
It is probably not possible to comment seriously about the future of China's power sector without first noting its remarkable size and rate of growth. China's electricity generation output has grown nearly 15-fold since 1980, from approximately 300 TWh to 4,200 TWh in 2010, an annual average growth rate over nine percent (Figure 1). And China's electricity generation capacity has grown from just 66 GW in 1980 to over 1,000 GW today, second only to the United States. China's growth sounds even more impressive when expressed in terms of "countries-per-year", as in: "China has built the power systems of South Korea or the United Kingdom over again for five years running". And with relatively low average energy intensity per capita, China's power sector has plenty of room to grow even more (Figure 2).

Figure 1: Electricity generation, selected countries (1990-2010)



Source: BP Statistical Review of World Energy (June 2011); World Bank

Figure 2: Electricity consumption per capita, selected countries and regions (2009)



Source: World Bank

Yet, growth and scale are two deceptive aspects of China's power sector. Initially, attracted by China's size and growth potential, outside investors are often disappointed by the limited opportunities and significant financial risks they see. It helps to understand what China's own power companies are going through, and to place China's power sector development in a broader historical and international context. A rigorous analytical framework helps, too.

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The Big Five

The five largest, state-owned, thermal generators (hereafter the 'Big Five') currently own approximately half of China's total generation capacity and built nearly two-thirds of China's new generation capacity from 2005 to 2010. Each is amongst the world's largest utilities. Unfortunately, their large size has been matched by their poor financial performance. Between 2008 and 2010, the Big Five lost over RMB 60 billion from their thermal generation operations. A similar story played out in 2011.[1] These losses have been an inconvenient result of China's efforts to liberalise its coal pricing mechanism in order to improve the availability of coal resources, while maintaining a strictly regulated electricity tariff system.

Despite poor financial returns, the Big Five still invested about RMB 200 billion on average each year from 2006 to 2010 on new generation capacities, comparing to the national spending in electricity industry of an average of RMB 646 billion each year in the same period—approximately two percent of China's annual GDP (Figure 3). Facing a gap between revenue and cost, they relied heavily on debt to fund this growth, reaching a level of debt of between 80 and 90 percent (Figure 4).[2] The Big Five have been able to access such substantial amounts of debt because of their close relationship to the government.[3] Backed by the government or not, the enormous debt burden has a profound and potentially limiting impact on the sector. Financing expenses for the Big Five in the first seven months of 2011 grew 33 percent year-on-year to RMB 53 billion.[4] A mere 25 basis point increase in the annual cost of power sector debt would increase annual financing costs to the Big Five by RMB 5.5 billion—roughly 25 percent of their total reported pre-tax profits in 2010.

With limited room to use more debt to cover the revenue gap, the Big Five face the prospect of massive on-going power sector investments as China's electricity demand continues to grow robustly on the back of strong economic growth and rising income. Something needs to change.

Figure 3: Annual investment in generation capacity and network

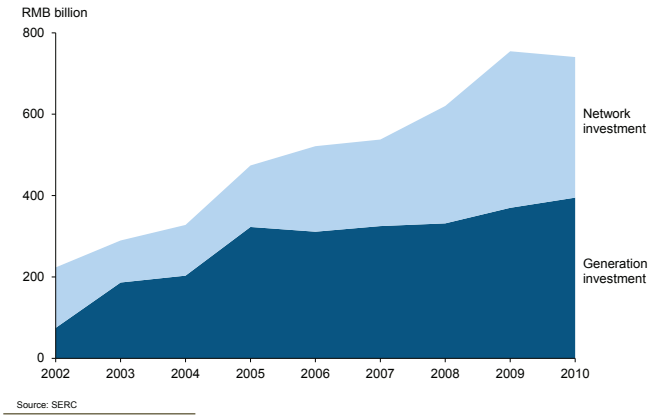
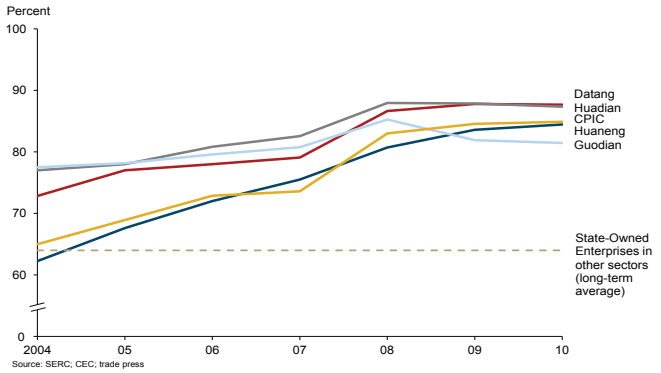


Figure 4: Proportion of debt to assets



China is not alone. Many governments in Asia do not support cost-reflective power prices to consumers. As a consequence, many utilities in the region—from China's Big Five to Korea's KEPCO, from Malaysia's TNB to Indonesia's PLN—have been unable to consistently align investment and operational costs with tariffs. Volatile and high fuel prices have made doing so even more difficult. And the challenge is becoming even greater still on account of pressures for improved environmental performance.

Prolonged mismatches between prices and costs can result in lower prices to end-users (or to a subset of end-users) in the short-term, but usually at the risk of accumulating problems in the longer-term. Blackouts in Korea, expensive gas curtailments in Malaysia, and government rejection of a tariff increase intended to pay for legally required (and previously government-approved) emission control equipment and low carbon fuel supplies in Hong Kong—each reflects the denial of costs required to generate, transmit and deliver secure, reliable and adequate power to end-users. Ultimately, an inconsistently or poorly regulated power sector is unlikely to be a consistently high achieving power sector, though problems can go undetected for years.

Eventually unsustainable situations must give way to real change. After 30 years of significant and relatively stable growth, the US power sector hit hard times in the 1970s and early 1980s as it introduced nuclear power into its generation mix just as demand growth began to slow and costs began to rise (Figure 5). The new nuclear power station capacity was not only more expensive than had been expected, but the new capacity was not needed to the extent previously anticipated given the slower growth environment. Further hit by rising fuel prices, most utilities sought significant price increases, probably expecting that, in a period of clearly rising costs, their requested increases would be seen as fair and reasonable especially after decades of stable or even declining prices. They were wrong. In a flash, thirty years of industry goodwill vanished as governments and consumer groups found traction arguing against monopoly utilities – a sobering lesson for anyone who believes that incumbent utilities can actually conserve goodwill for use during bad times.

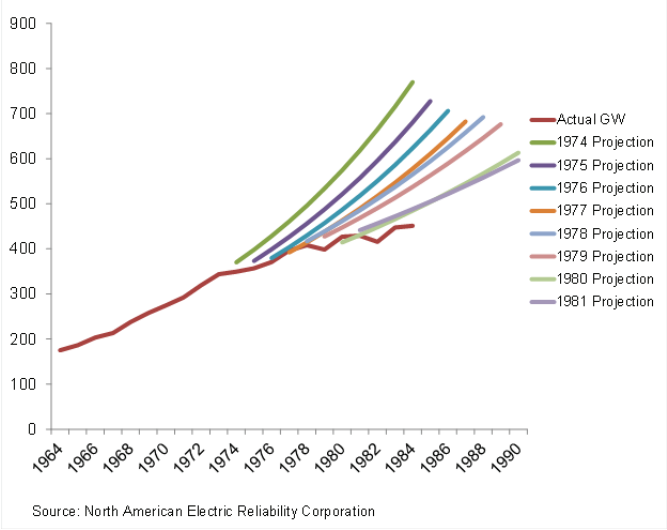
[1] Source: China Electricity Council (August 2011)

[2] This level is much higher than the level of debt (approximately 64%) held by State-Owned Enterprises (SOEs) in other sectors.

[3] As evidenced by Fitch's re-affirmation of Huaneng's BB+/stable rating in November 2011 based upon their expectations that the Government will take adequate steps to support Chinese independent power producers.

[4] Source: China Electricity Council (August 2011)

Figure 5: Unexpected Slow Down in Growth After 1974 in the United States Power Sector



Source: North American Electric Reliability Corporation

These industry dynamics had serious ramifications. Several US utilities flirted or went through bankruptcy largely as a result of unrecoverable cost over-runs related to the construction of the US nuclear power fleet. Major industry reforms followed, including reforms that launched the Independent Power Producer (IPP) sector. Change follows stress. Armed with a sufficiently broad historical and economic perspective, one cannot help but wonder whether this simple reality will be as applicable in China and in Asia, generally, as it was in the United States.

China's Regulatory Challenge

In any industry characterised by large fixed capital investments with long lifetimes, industry investors are necessarily exposed to significant financial risk for decades. Once they make their financial commitment, investors can do little but hope the rules of the game do not change in unanticipated ways. Some countries provide more protection than others against this risk of "hold-up"—the ability to exploit the weakened negotiating position of an investor *after* the investor has made an irreversible (typically very large) financial commitment. Strong regulatory protections and durable and robust commercial contracts (power purchase agreements) are two of the most effective ways countries protect power sector investors from hold up risk. At the moment, China offers neither of these.

In the presence of significant hold-up risk, a power sector investor should not want to invest. If forced to do so anyway, the resulting investment climate is likely to be riddled with value distorting rent-seeking behaviours, poor financial controls, reduced transparency and, potentially, corruption. The stakes are too high and the natural economic resistance too great.

China's Big Five may well be directed to build power stations, but given their poor financial performance and limited capacity to take on additional debt, it is folly to believe that all is well beneath the surface. Reliable power systems are complex. They do not spring from the directives of policymakers, no matter how enlightened, but through the consistent workings, over decades, of complex economic and commercial systems that reward stakeholders for taking the positions necessary to anticipate problems and then propose, justify and commit the resources needed to overcome them.

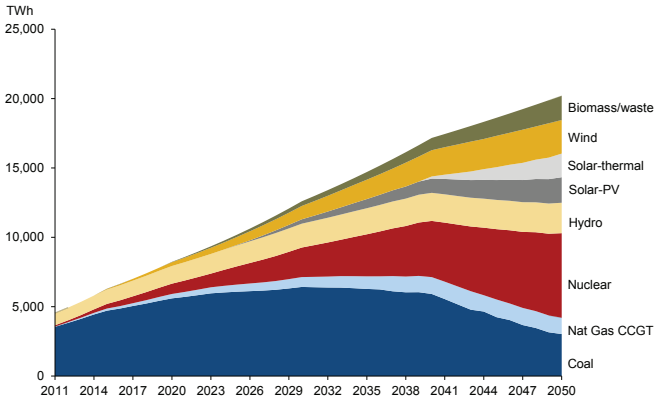
TLG's China Power Sector Model (CPSM)

After watching these factors and their impact on the local, regional and global economy for some time, we decided the time was ripe to develop the CPSM in order to evaluate various long-term power sector development scenarios. The CPSM co-optimizes long-term new entry and short-term dispatch decisions to minimize the cost of generation while meeting demand within various operational and physical constraints. The CPSM can model a large number of scenarios of policies, generation technology deployments and market conditions.

If we assume that fuel prices remain constant at 2011 levels in nominal terms[5], coal-fired generation will continue to be China's major source of total and incremental generation for the next twenty-five years (Figure 6). Large-scale hydro development also increases initially, but soon reaches projected natural resource limits. In the longer-term, the share of coal eventually shrinks as the cost-effectiveness and availability of non-coal generation technologies improve.

Like most other forecasts, our model results show that if currently projected cost, availability and performance assumptions continue to be credible, China's nuclear power industry will expand significantly. Until now, the main constraint has been China's ability to scale-up development and construction of new facilities. McKinsey and others have projected favourable economics for nuclear power in China for some time.[6] On the other hand, should the economics of nuclear generation not prove to be as favourable, China's carbon emissions could increase even further, potentially negating efforts elsewhere in the world to de-carbonise, as China may need to fall back to invest in more coal-fired capacity to support its economic growth.

Figure 6: Projected annual generation mix of technologies

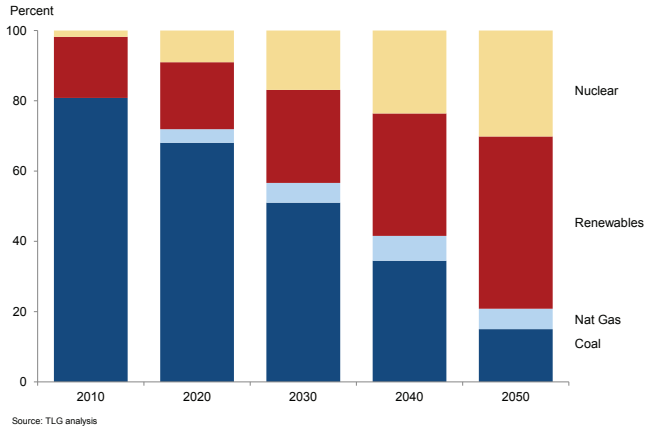


Source: TLG analysis

[5] Other assumptions such as efficiency gains for fossil fuel technologies and project cost especially for the non-conventional renewable energy technologies also play critical roles.

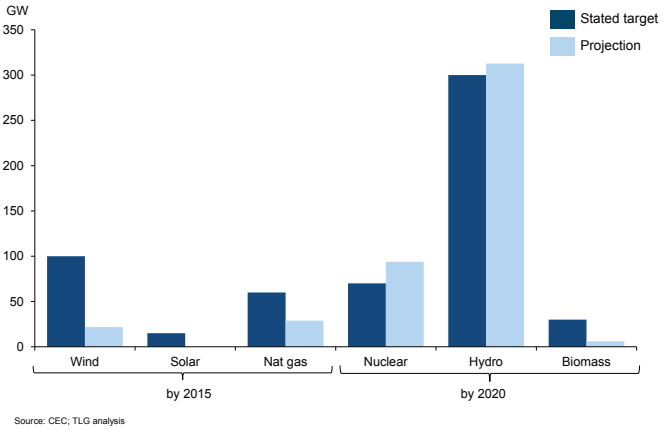
[6] See, for example, 'China's green opportunity', McKinsey Quarterly (May 2009)

Figure 7: Generation share by type



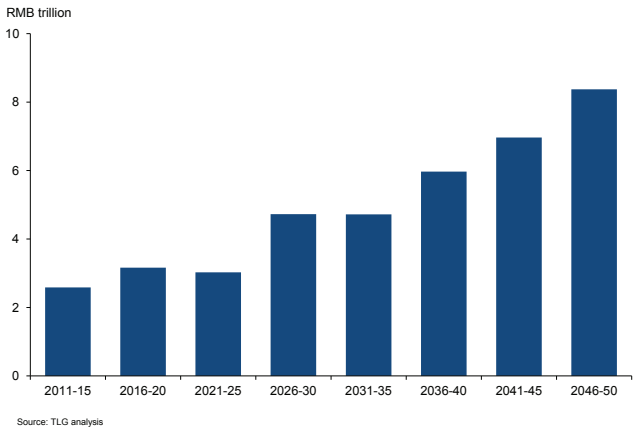
We then compared our projections of future generation capacity to those available from China's power sector, such as the targets in 12th Five-year Plan (Figure 8) and found China's current targets for 2020 to be economically sensible with respect to nuclear and hydro. However, targets for wind, solar, biomass and natural gas generation do not appear realistic without extensive subsidies or strong policy support.

Figure 8: Comparison of stated targets vs. CPSM projections for 2015/20



We estimate the cost of meeting China's forecasted growth to be nearly RMB 6.0 trillion over the next decade alone (Figure 9), a value broadly consistent with the estimate of RMB 5.7 trillion by the China Electricity Council (CEC)[7].

Figure 9: Projected capital requirements for new generation capacity



Financing Growth

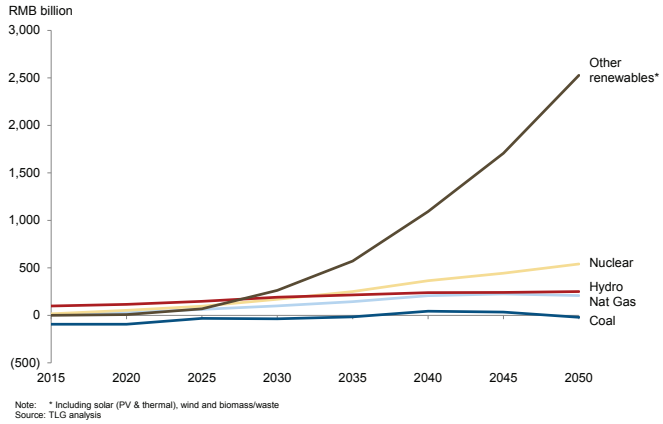
If the Big Five continue to receive even the most recently increased on-grid price for generation by technology group, then they will still not recover the full commercial cost of new required investment in coal-fired generation. An overnight realignment of tariffs for new coal plants and the commercial costs of building and operating those plants would require a further increase in tariffs today of approximately 15 percent (to cover all costs including a reasonable return on equity). Combining modest assumptions regarding inflation, technological improvement, future fuel costs and that just the right amount of new capacity is built each year results in a potentially growing tariff gap, increasing to as much as 40 percent by 2020.

The risk inherent in power tariff management in China is a serious one for China's power sector and government. Even after the recent tariff increase, China's Big Five will struggle to find commercial merit in building new coal-fired power stations in China (Figure 10). But without coal-fired generation investment, China's power sector cannot meet China's growing power demand. The prospect is high of continuous, significant tariff increases just to keep the industry on what any investor in a commercially oriented power sector would consider the equivalent of financial life support.

Ultimately, the risk associated with future tariff scenarios will come down to what happens in global fuel markets and what happens to China's ongoing financial contribution to the power sector by the Chinese banking sector. If coal prices trend constant in nominal terms (declining in real terms), the tariff gap may be able to be bridged more slowly over time, a bit each year. If coal prices increase at all in nominal terms (with or even at some fraction of the rate of inflation), then the future tariff increases needed to close the tariff gap can be significant indeed. In no case do the Big Five earn a return on the carrying cost of their substantial past shortfalls.

[7] Source: China Electricity Council, 'Estimates of investment in the power industry' (2011-02-21)

Figure 10: Average annual pre-tax profitability of new investment over five year periods



Note: * Including solar (PV & thermal), wind and biomass/waste
Source: TLG analysis

Option 1: The Closed Investment Model

In the closed investment model, the Big Five continue to invest extensively in the power sector, and continue to be responsible for the majority of capital investment. Outside investors have limited opportunities (and limited interest) given the hold-up risk challenge.

Consumer prices can be managed aggressively by keeping the Big Five on what could be called "life support" in the sense that legacy investment currently fails to recover its full cost, but cannot be withdrawn once built. On life support, the Big Five would gain *ad hoc* tariff increases only to the extent required to keep them operationally viable, perhaps with the periodic potential windfall gain should fuel prices fall or the broader political climate allow.

In effect, the Big Five would be 'held up', and would have limited (if any) opportunity to earn a material profit on the investments they have already made. This legacy hold-up model is only sustainable as long as Big Five believe that the on-grid prices for *new* investments will at least support those investments.

The hold-up (life support) model is not unique to China. The IPP sectors in Malaysia and Korea have generally enjoyed commercially viable returns, whereas their off-taker (TNB or KEPCO, respectively) bears the vast majority of the financial risk related to tariff policy. In both countries, commercial arrangements within the power industry are structured so that if fuel costs increase, it is not the IPP that bears the financial risk, but the incumbent.

Option 2: The Open Investment Model

In the open investment model, the Big Five cease to be the primary engine of power sector investment. Instead, new arrangements are put in place to facilitate and support investment by domestic and international investors.

Power purchase contracts are established for new power projects. The power purchase contracts are protected from hold-up risk by full pass through of costs and associated assurances and guarantees. As a result, domestic and international investors become much more willing to invest in China's power sector, creating a new source of capital with which to finance the sector's investment and growth requirements.

Tariff pressure is moderated by the fact that legacy assets owned by the Big Five are subject to traditional on-grid tariff pricing mechanisms, while new investment is covered by new contract arrangements. The end user sees the weighted average of these, providing the regulator with a mechanism to transform from state guaranteed financing and control to a more liberalised arrangement over time, freeing capital to move into other sectors in the Chinese economy. The Big Five may or may not earn higher returns, as their outcomes depend primarily on the on-grid prices earned on legacy (uncontracted) assets.

The open investment model provides a transition pathway for managing value from legacy assets to new investment by solving the hold-up risk, which is the main risk that constrains access to commercial capital as opposed to state-guaranteed capital.

The open investment model does not solve one of the most difficult issues specifically facing the Big Five – namely the prospect that they may never see a full return on investments made to date – but it does provide a mechanism to stop the continuing erosion of their financial condition and to move forward more decisively on broader reforms aimed at improving overall industry efficiency. The main requirement of a successful open investment model is that it must address the hold up risk problem.

Conclusion

Growth and scale are interesting aspects of China's power sector, but they have been deceptive measures of the attractiveness of China as a power sector investment environment. Costs are not recovered under China's on-grid price system. Instead, the Big Five have been forced to take on unsustainably high levels of debt, creating a much more financially fragile industry. Yet, significant investment continues to be required.

If fuel prices remain high or interest rates increase, China's current magical power sector math will stop working sooner, rather than later. The existing arrangements could be extended—keeping the sector on a version of financial life support. Alternatively, the time seems increasingly ripe for China to consider separating its treatment of legacy power sector investments from its treatment of new power sector investments and opening up investment into a more liberalised power sector. New mechanisms and contractual instruments could be used to recapitalise the power sector, creating a much more robust investment climate to support more efficient and timely growth in the future.