

# TLG on

## Understanding the Link Between China's Economy and Energy Use: Growth, Consumption, Renewables and Challenges

Lester L (2017) Understanding the Link Between China's Economy and Energy Use: Growth, Consumption, Renewables and Challenges, *TLG on* 4(3), The Lantau Group (HK) Limited

TLG on is The Lantau Group's in-house journal addressing current energy issues, and their policy and economic implications, facing the Asia Pacific region.

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On 27 April, 2017, The Lantau Group, in collaboration with Renmin University of China, held a public seminar on China's energy economy. Participants discussed four main themes: the link between energy use and economic growth, how geography and demographics affect energy use, the implications for renewable energy from the latest energy policy reforms, and China's continuing experience with curtailment of wind and solar energy.

Open to all and free to attend, the seminar formed part of The Lantau Group's continuing engagement in public policy as it aims to raise understanding of key energy issues and commercial risks, while enhancing policy effectiveness.

The seminar featured presentations from leading Chinese academics and The Lantau Group's own consultants. A fifty-strong audience drawn from government, academia, energy-sector companies, and related NGOs attended.

### Key Points

- China's energy demand reflects a complex mix of factors, not just GDP growth. China's economy has shown a clear reduction in overall energy intensity, and power demand growth rates have slowed markedly relative to GDP growth. Nonetheless, electricity meters can reveal a huge amount of additional information on the performance of individual sectors, providing an alternative route to GDP estimation.
- China's power sector possesses a huge surplus in generating capacity, far beyond what is needed to meet peak demand. As a result, thermal power plants in provinces such as Sichuan and Yunnan have capacity factors as low as 25%, while curtailment rates of wind and solar power in Gansu and Xinjiang have reached around 40 percent. In the short term, curtailment is creating significant financial stress for power project owners. Improved inter-provincial transmission connection and planning, prioritised dispatch of renewable energy, more pumped storage hydropower plants, retirement of older capacity, and enhanced market mechanisms may all help.
- China's power sector is undergoing a period of reform that started in March 2015 and the full consequences of which have yet to be realised. Over-capacity is not the only problem: underdeveloped ancillary services and a lack of system flexibility are also raising costs. Reform should open up both the generation and retail ends to greater competition, with transmission and distribution charges unbundled and regulated. Implementation may be challenging, particularly given the many prerequisites for success identified elsewhere.

District heating demand has been growing as incomes rise but power demand growth has been slowing. China now has significant generation overcapacity.

New data is only as good as its transparent and timely availability, and analytical results still depend on correctly understanding underlying assumptions of elasticity.

## Different Stories for Different Sectors

The relationship between district heating demand (which mainly serves residential customers) and GDP continues to be driven by the ability of a rising middle class to pursue a more comfortable life. With increasing demand for heating evident in more southern regions, there are questions around the economics, efficiency and flexibility of current systems. Richer customers want comfort, convenience and customisation; traditional systems and thinking need to be updated.

The impact of rising GDP on the power sector is much more complex, in part because its growth and demand is buffeted and shaped by the many strands of China's huge and varied economy. According to official statistics, growth in power demand has fallen much further than growth in GDP. In 2015 power demand growth was approximately one percent, down from almost 15 percent as recently as 2010. Capacity expansion has, in contrast, increased at a roughly steady 10 percent each year over the same period. By some measures, overcapacity had reached 84 percent by 2016: coal capacity alone was greater than total peak demand. While exact numbers for reserve margins and dispatch factors depend on assumptions (for instance whether gross nameplate capacity or net available capacity is used) the argument here is less about precise numbers and more about the sheer disproportionate scale and ubiquity of the oversupply.

Against this backdrop, a new round of power sector reform was launched in March 2015, the effects of which have yet to be fully realised. At the heart of these efforts is 'Decree No. 9: Several Guiding Principles of Furthering the Reform of the Electricity Market', which sets out the liberalisation of both the wholesale and retail markets. As part of this, transmission and distribution (T&D) would also be unbundled, with the grid companies likely no longer able to arbitrage off the wholesale-retail price difference.

## Whither with Growth

A source of uncertainty for power sector participants and policymakers alike is understanding whether the slowdown in power demand growth in 2012-16 represents a cyclical or structural shift. If official phrases such as 'new normal' suggest that slower growth rates are here to stay as part of a structural shift in a broadly maturing market, there is also evidence that places the recent 'economic winter' in the context of China's continuing economic cycle. For the bullish, data since August 2016 point to a recovery.

The more than four hundred million smart meters that China has so far installed allow officials to understand exactly who is using electricity, how it is being used, and when. New data can be provided on the health of the property market as electricity meters report zero-usage and so give a window onto the differences between rates of ownership and occupancy. For industrial sectors, 'electricity economics' can help elucidate whether or not changes in the amount of raw materials used represent improved efficiency or declining production; in other words 'electricity economics' can aid estimations of industry health, and of the sustainability (and rate) of macro-economic trends.

New approaches still need to tackle two old problems. The first is data transparency and accuracy; the second is the robustness of simplifying assumptions for an economy as vast, complex and geographically heterogeneous as China's.

- Data publication is controlled by the National Development and Reform Commission,

which currently releases aggregated information only. Questions over timeliness and transparency are likely to remain.

- Making the leap from energy use to economic activity relies on an assumed elasticity. Understanding and deciding on suitable values is a constant source of contention. China has made great progress reducing its energy intensity, so it's clear that the relationship has been changing; what is less certain is what it will be.

Currently, these new 'electricity economics' suggest overall GDP growth rates much higher than the official 6.5 percent, meaning the current surplus of generation capacity is of less importance: it will be soaked up soon enough. But if China's 'new normal' implies a structural shift towards a less power-driven economy (even with the advent of new electricity demand sources such as electric vehicles) then the capacity overhang may prove more vexing.

## Consequential Surplus

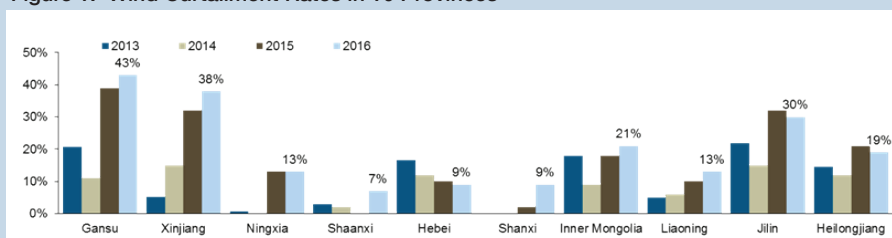
China's over-capacity is not just the result of an imbalance between supply and demand: it is also a function of the province-level focus of planning combined with a geographic mismatch between centres of demand and supply. At its simplest, China's energy resources, both coal and renewable, are located in its northern and western provinces, but the major demand centres are found around Beijing, along the east coast and in the south. Yet while planners have focused on both ensuring that individual provinces meet targets for renewable capacity and continue to gain social and economic benefits from the coal industry, there has been a lesser focus on building inter-provincial connections that can accommodate cross-country power transfers or on treating China as a single energy system.

The result is seen in:

- hugely over-supplied local markets, even in traditional demand centres that could have acted as power importers;
- an underdeveloped ancillary services market with a general lack of flexibility and too few peaking plants;
- capacity factors for China's coal-fired power stations that are on average below 50 percent, but which have come as low as 25 percent in hydro rich provinces; and
- provincial curtailment rates for wind power that have been seen to hit as high as 43 percent (see Figure 1).

Oversupply and poor flexibility have led to low capacity factors and high rates of curtailment. Gansu's curtailment rate of 43 percent means that for every 100kWh produced, only 57kWh are actually dispatched and used.

Figure 1: Wind Curtailment Rates in 10 Provinces



Source: NEA

The Government is responding. There have been a number of new policies announced including guaranteed hours and priority dispatch for renewable energy, the rolling out of an ancillary services market and a power market where dispatch quotas can be traded. Yet while new dispatch rules and enhanced market mechanisms can help, there are likely no quick fixes for either China's general overcapacity or its renewable energy curtailment.

## Reformed Solutions

On their own, the reforms announced will likely deliver incremental efficiency improvements to China's power sector, but are unlikely to be transformative in the short term. Prioritised dispatch for renewables should reduce wind and solar curtailment, and proper market trading mechanisms for thermal dispatch quotas should lead to the most economically efficient plants enjoying higher capacity factors, and the least efficient being rationalised out of the market.

Such is the overcapacity that finding somewhere to send the power will remain difficult in the short to medium term, even with improved inter-provincial transmission. Implementation is also key. Mandatory green certificates may yet be delayed, the roll out of an ancillary services market is thought to be 'difficult' and local governments still have significant control over price and dispatch.

The reforms China is pursuing are major, but so are the challenges that are amplified by inconsistent data and imbalanced supply and demand across provinces.

## The Presenters

Moderator: Chen Zhan-Ming (陈占明), Associate Professor, Renmin University

Hu Jingqiu (胡竞秋), Research Associate, Renmin University

Hu Zhaoguang (胡兆光), Chief Specialist Power Markets, China Electricity Council

Zhang Liutong (张柳潼), Senior Manager, The Lantau Group

Zhang Sufang (张素芳), Professor, North China Electric Power University

All presentations were given in chinese, and may be downloaded from [www.lantaugroup.com/files/ppt\\_renmin.pdf](http://www.lantaugroup.com/files/ppt_renmin.pdf)

## About the Organiser and Author

Leo specialises in Asia's political energy economy, and brings a decade of international energy experience, having worked in the UK, India, Thailand and Saudi Arabia. Leo holds degrees from the Universities of Oxford (MA) and Reading (PhD), and is a Global Research Fellow at the Institute of Asia and Pacific Studies. He has numerous publications and was editor of *Energy Relations and Policymaking in Asia*, published by Palgrave Macmillan in 2016. He is a CFA charter holder and a certified Financial Risk Manager.

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