

<b>Institution:</b> University of Cambridge		
<b>Unit of Assessment:</b> UoA 17 Business and Management Studies		
<b>Title of case study:</b> Improving electricity sector governance in the UK and China to benefit consumers and society		
<b>Period when the underpinning research was undertaken:</b> 2011 to date		
<b>Details of staff conducting the underpinning research from the submitting unit:</b>		
<b>Name(s):</b>  Michael Pollitt	<b>Role(s) (e.g. job title):</b>  Professor of Business Economics	<b>Period(s) employed by submitting HEI:</b> October 2001 to date
<b>Period when the claimed impact occurred:</b> 2015 to date		
<b>Is this case study continued from a case study submitted in 2014?</b> N		
<p><b>1. Summary of the impact</b> (indicative maximum 100 words)</p> <p>Research by Cambridge's Energy Policy Research Group (EPRG) has played an important role in energy market reform in the UK and China. The Group's study, led by Professor Michael Pollitt, underpinned the announcement by National Grid in 2017 to create an independent system operator legally unbundled from their transmission asset business. The research also proposed and supported adjustments to National Grid's (NG) transmission arrangements, in particular the rationalisation of their procurement of electricity security of supply products. These developments bring benefits to consumers through improved energy market function, allow for greater accountability, and provide savings of up to GBP8,000,000,000 per year. The group has extended these insights to China, informing its power sector reform, both at regional and national levels.</p>		
<p><b>2. Underpinning research</b> (indicative maximum 500 words)</p> <p>This research began with a historical analysis of independent system operators in the energy sector, written for the GB water regulator, Ofwat, in the context of their desire to separate retail and network operations. A key focus of the work examined the boundary between transmission level system operation of the electricity sector and the transmission asset ownership. In [R1] Pollitt discussed U.S. experience with multiple transmission asset ownership combined with wide area transmission system operation in electricity. It proposed that this arrangement includes an independent system operator (ISO) responsible for coordination and market facilitation, separate from generation, transmission, distribution and retail entities. Further, the paper argued that this experience of separation of the true monopoly of system coordination from the contestable market in building and operating transmission lines (or non-line alternatives), should be taken seriously in other jurisdictions, including the UK.</p> <p>A related research paper [R2], written for the GB energy regulator, Ofgem, subsequently discussed how the electricity transmission arrangements in GB needed to change in the light of increasing conflicts between competing and un-coordinated arrangements for the facilitation of transmission capacity for a high renewables electricity system. Making a point close to that in the paper written for Ofwat, it argued that an ISO was likely to provide the best long run solution to resolving the current conflicts of interest inherent in the role of NG as system operator for GB, onshore transmission asset owner monopolist in England and a competitor in UK offshore transmission auctions.</p>		

The need for an ISO and the related update to existing transmission arrangements were not the only challenges faced by the electricity market structure in GB. With the increased need for electricity storage as part of a broader transformation of electricity supply in GB, it appeared that the system operator's (NG) provision of electricity quality products was no longer adequate or efficient. Research paper [R3], written as part of an EPSRC project on future business models for electricity storage, focused precisely on that issue. It discussed how frequency response (FR) markets could be rationalised into a single auction, rather than involving the multiple FR products that National Grid currently procures.

These insights and developments from the UK and other international markets were suitably adapted and extended to inform China's power sector reform in the context of the recent round of electricity reform, which began following publication of the March 2015 No.9 document by the State Council. Research paper [R4], written as part of an ESRC Global Challenges Research Fund Award, discussed the applicability of international experience of power market liberalisation – summarised in 14 different lessons – in the Chinese context. Research paper [R5] written as part of an ESRC Impact Acceleration Award, summarises much of Lewis Dale (Regulation and Strategy Manager from NG) and Pollitt's advice to Chinese stakeholders on the mechanics of industrial electricity price formation in the UK. The paper breaks down each of the price elements – wholesale, retail, network and levies and taxes are determined (and by whom) in a 'competitive' power market.

"*Reforming the Chinese Electricity Supply Sector: Lessons from Global Experience*" [R6], draws on the outputs of a three-year research programme based on the interactions of Chinese and British power market professionals, facilitated by the British Embassy in Beijing. The book seeks to provide lessons for China's reforms from international experience, combining a detailed review of reform lessons from around the world, a specific application to China and a particular focus on how exactly the industrial price of electricity is determined in a liberalized power system. Pollitt has engaged with Chinese academics at a range of institutions during frequent visits to China and is currently organising a special issue of a journal written by Chinese scholars about power market reform in China.

### 3. References to the research (indicative maximum of six references)

**R1.** Pollitt, M.G. (2012) "Lessons from the history of independent system operators in the energy sector." *Energy Policy*, 47: 32-48 (DOI: 10.1016/j.enpol.2012.04.007).

**R2.** Strbac, G., Pollitt, M., Konstantinidis, C.V., Konstantelos, I., Moreno, R., Newbery, D. and Green, R. (2014) "Electricity transmission arrangements in Great Britain: time for change?" *Energy Policy*, 73: 298-311 (DOI: 10.1016/j.enpol.2014.04.009).

**R3.** Greve, T., Teng, F., Pollitt, M. and Strbac, G. (2018), 'A system operator's utility function for the frequency response market', *Applied Energy*, 231 (1 December): 562-569.

**R4.** Pollitt, M.G., Yang, C-H. and Chen, H. (2017), 'Electricity Reforms: International Experiences and China's Decision' *Financial Minds*, Vol. 2 Issue 4, July 2017, National Academy of Economic Strategy, Chinese Academy of Social Sciences. [In Chinese]. Published in English as: Pollitt, M., Yang, C.-H. and Chen, H. (2017), *Reforming the Chinese electricity supply sector: lessons from international experience*, EPRG Working Paper No.1704. Cambridge: University of Cambridge.

**R5.** Pollitt, M. and Dale, L. (2019), 'Restructuring the Chinese Electricity Supply Sector – How industrial electricity prices are determined in a liberalized power market: lessons from Great Britain', *Financial Minds*, Vol.4 No.4 pp.81-120, July 2019, National Academy of Economic Strategy, Chinese Academy of Social Sciences. [In Chinese]. Published in English as: Pollitt, M.

and Dale, L. (2018), *Restructuring the Chinese Electricity Supply Sector – How industrial electricity prices are determined in a liberalized power market: lessons from Great Britain*, EPRG Working Paper, No.1839.

**R6.** Pollitt, M.G. (2020) *Reforming the Chinese Electricity Supply Sector: Lessons from Global Experience* (Palgrave). ISBN 978-3-030-39462-2.

Research outputs published in peer-reviewed journals and supported by competitively won grants:

EPSRC Business, Economics, Planning and Policy for Energy Storage in Low-Carbon Futures (EP/LO14386/1), GBP1,017,000.

#### **4. Details of the impact** (indicative maximum 750 words)

The EPRG at the University of Cambridge actively engages in the dissemination of its research and uptake by relevant stakeholders through its Energy Policy Forum, which runs events such as seminars and conferences and stakeholder visits and dinners. The group has been ranked number eight among Global Top Energy and Resource Policy Think Tanks in 2018 and 2019 in a report by the University of Pennsylvania.

##### The Creation of an Independent System Operator in the UK Energy Market

In the UK energy market, the role of National Grid (NG) is highly significant. NG was a founder member of the EPRG's Energy Policy Forum in 2005. Since that time Pollitt and his team at the University of Cambridge have been a 'critical friend' to the organisation and have examined their monopoly role in the GB electricity system [R2]. NG value the close relationship that EPRG has with the GB electricity regulator, Ofgem, which has also led to Pollitt writing policy documents for them (drawing on [R1] and published as [R2]). According to NG's Regulation and Strategy manager, the relationship with EPRG has proved valuable in broadening its perspectives including Pollitt's research highlighting the benefits of an independent system operator when NG had long seen the advantages of maintaining integration. [S1].

The publication [R2] prompted a review of system operation by the regulator. In August 2015, Pollitt, was invited to meet with the then new Secretary of State, Amber Rudd, at Department of Energy and Climate Change (DECC) (now Department for Business, Energy and Industrial Strategy (BEIS)), the department responsible for energy. As noted by her then special advisor, at this meeting, Pollitt's articulation of the ISO proved convincing to the department prompting NG to announce the creation of a legally unbundled electricity system operator, wholly separate from their transmission asset business: '*Michael pitched his number one recommendation: the establishment of an independent system operator. After the meeting, the Secretary of State said "yes, we should do this".*' [S2]. The announcement was made in a joint statement from UK BEIS and Ofgem in 2018 [S3].

On 1 April 2019 NG created a legally separate system operation business [S4]. The benefits of creating a more flexible electricity system have been estimated at up to GBP8,000,000,000 per year (this analysis is based on the scenarios done for the Committee on Climate Change) [S5]. They include greater accountability through a more decentralised system focused on customers [S4]. It is anticipated that from this process the ISO could separate ownership from NG in the future [S6].

##### Impact on Procurement Rationalisation by National Grid

Pollitt's continued collaboration with National Grid has supported their efforts to rationalise procurement of electricity security of supply products. Pollitt highlighted some of the trade-offs

inherent to the procurement of such services (confirmed by [S1]). At a meeting in April 2016 he first presented his work on the re-design of frequency response markets [R3], whereby ancillary services markets (worth around GBP1,000,000,000 p.a. as estimated in the Monthly Balancing Services Summary 2019-20 March 2020, published by National Grid ESO) could be simplified into a smaller number of auctions (for example, 1 instead of 3 for frequency response). These results and recommendations were taken up and in June 2017 NG published their 'System Needs and Product Strategy' document [S7] which explicitly acknowledged the need to simplify the number of ancillary services products and set a timetable for trialling new auction designs. More competitive auctions have a track record of substantial cost reduction, relative to business as usual, and could reduce ancillary service costs by the order of 50%. Pollitt and colleagues at the EPRG have been working with NG since then to better facilitate the rapid increase in renewable electricity generation [S1].

#### Impact on the Chinese Power Sector: wholesale power markets and support for renewables

Since 2015, the EPRG has been working with the British Embassy in Beijing to support their efforts to assist the Chinese government in reforming the Chinese power sector. As the largest power sector in the world it produces around 8% of global greenhouse gases. It is now trying to introduce competitive wholesale power markets and efficient renewable support mechanisms, drawing on UK and other international experience. A common issue for both systems is how to reduce emissions at least cost. In a quote collated by the British Embassy in Beijing, the Director of the Strategy Department, Guangdong Power Exchange remarked: *"The reports done by Prof. Pollitt after his visit...provided to us valuable information and guidance to the design of Guangdong's power market model."* [S8]

As part of this collaboration, the EPRG approached NG to become involved. Over a sustained period, members of EPRG and NG have visited China in order to advise: the NEA (Chinese regulator), State Grid Company of China, China Southern Grid, leading generators and new retail companies. To facilitate the exchange, EPRG subsequently published [R4] and [R5] in Chinese, with the support of the British Embassy in Beijing.

China's National Reform and Development Commission (NDRC) cited Cambridge University support for power market reform specifically around transmission and distribution system regulation in a press release in 2017 [S9], published during the 19<sup>th</sup> Communist Party Congress. The NDRC is responsible for setting prices in energy, transport, medicine and a range of other sectors across China. The report acknowledges engagement with UK authorities at several points and outlines the adoption of specific UK regulatory practices for transmission and distribution pricing. Cambridge University experts are acknowledged alongside energy regulator Ofgem, National Grid and the UK BEIS. It is significant that the acknowledgement is made in a report during a period of heightened political sensitivity as part of the party congress.

Pollitt has been on eight Foreign and Commonwealth Office (FCO) supported trips to China since 2016 and met a large number of policy makers and stakeholders in six provinces. The EPRG has supported several FCO visits to the UK by Chinese delegations on power market reform. This has been appreciated by many key stakeholders. As evidenced earlier, by those heading up market design (see earlier remarks from the Director of the Strategy Department, Guangdong Power Exchange) [S8]. But also by influential media, as evidenced by the three times Pollitt was interviewed by Energy Observer (in 2017, 2018 and 2019) [S10], an influential energy media and think tank associated with China Southern Grid which has a wide readership across government, industry and academics.

**5. Sources to corroborate the impact** (indicative maximum of 10 references)

**S1.** Interview with Regulation and Strategy Manager, National Grid. Interview conducted 26 Jan 2020. Source contains full interview transcript.

**S2.** Interview with Special Adviser to Secretary of State, Department of Energy and Climate Change (formerly; later Business, Energy and Industrial Strategy). Interview conducted 14 Feb 2020.

**S3.** Statement on the future of Electricity System Operation, Department for Business, Energy and Industrial Strategy (BEIS), and the Office of the Gas and Electricity Markets (Ofgem) (2018) ([https://www.ofgem.gov.uk/system/files/docs/2018/01/joint\\_statement\\_on\\_the\\_future\\_of\\_electricity\\_system\\_operation.pdf](https://www.ofgem.gov.uk/system/files/docs/2018/01/joint_statement_on_the_future_of_electricity_system_operation.pdf)).

**S4.** The Legal Separation of National Grid ETO and ESO; Opportunity for the Transmission Customers. Published piece by industry consultants Gap Gemini May 28 2019.

**S5.** Strbac, Konstanelos et al (2016) Delivering Future-proof Energy Infrastructure. Report for National Infrastructure Commission (p. 6). Available at: <https://www.nic.org.uk/wp-content/uploads/Delivering-future-proof-energy-infrastructure-Goran-Strbac-et-al.pdf>.

**S6.** National Grid Open to Giving up Managing UK's Electricity, Financial Times, 6 Oct 2019.

**S7.** National Grid (2017), *System Needs and Product Strategy*, June 2017, (pp. 28-37) <https://www.nationalgrideso.com/document/84261/download>

**S8.** Quote from Guangdong Power Exchange. Quote in email listing collated testimony by British Embassy of Chinese energy stakeholders. Email from Foreign and Commonwealth Office dated 7 April 2020.

**S9.** Statement from China's National Reform and Development Commission (NDRC), press release from 19<sup>th</sup> National Congress of Communist Party of China, 18-24<sup>th</sup> October 2017. Source contains original press release as well as translated version (p. 9).

**S10.** Quote from Energy Observer. Quote in email of collated quotes and sources from FCO dated 7 April 2020. Also includes links to and articles from Energy Observer.