



Electricity and Telecom Regulations: China in Context¹

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Introduction

Electricity and communications services are both highly regulated infrastructure industries in most countries. While usually there is a historically state-owned monopoly, many countries have started to promote competition where possible. Around the world, however, telecom reforms are largely successful, while results of electricity reforms are mixed. China has implemented reforms in both sectors with significant success in terms of massive investment and increased subscribership. However, in both sectors there are longstanding problems that if unresolved will have significant opportunity costs in terms of growth and innovation.

In general, electricity and telecommunications markets differ in two respects. First, in telecom, wireline phone service now competes directly with mobile phone service. For electricity there is no direct competitors to the monopolist's transmission and distribution system.³ Furthermore, the intermittent nature of electricity from sources like wind and solar generate further costs to the transmission grid, which is optimally designed for a steady generation electricity, not ebbs and flows according to daylight or wind conditions. Second, communications can easily be stored and conveyed later, electricity cannot. The Internet can store and convey messages, which uses the network more efficiently service than traditional telecom.

This study analyzes both the telecommunications and electricity sector from three perspectives – market reforms, regulatory reforms, and their intersection with major challenges. Market reforms discusses the changes in market structure, both globally and in China. Regulatory reforms discusses changes in governance structure, both globally and in China, along with price reform. For telecom, the intersection is with Internet and media; for electricity, with the environment. In all cases, China's challenges are compared with other countries.

Telecom – market reforms

In telecom, the two big market reforms are de-monopolization and privatization. A related issue is the sequence of reforms, whether privatization or de-monopolization should take place first. Wallsten's World Bank study of 200 countries from 1987-1999 shows that establishing a regulatory authority before privatization increased telecom investment, fixed phone development and mobile phone development. Further, he found investors were willing to pay more to invest in telecom firms in markets with a regulatory authority; they required a risk premium to invest in countries without one.⁴

In many developing countries, opening the mobile market led quickly to mobile networks larger than the wireline. Beginning in 2002, there were more mobile phones in the world than fixed phones.⁵ In a study of over 100 countries from 2008-2014, the ITU reports that

competition is the most important factor that drives down price for mobile phone service. Regulatory environments have a significant, but less important effect.⁶

Telecom – market reform in China

No privatization. In China, all facilities based telecom operators are state-owned enterprises.

New entry and separate regulator. The separation of the Ministry from China Telecom occurred in 1997, partly to solve interconnection problems between China Telecom and the second operator China Unicom.

Vertical and horizontal separation. China Telecom's mobile operations were spun off to become China Mobile in 1999 to even the playing field for competition by Unicom. China Telecom remained the incumbent de facto monopoly in wireline telecom service. In 2002 the government split China Telecom north; the northern company became China Netcom, later merged with Unicom.⁷ Now, each of the two regions has one wireline company – Unicom in the north and Telecom in the south.

Leveling the playing field - 4G. 4G mobile service's major distinction from 3G services is that it allows faster Internet service. In December 2013, MIIT issued 4G licenses for TD-SCMA, one each to China Mobile, China Telecom, and Unicom; although only China Mobile was expected to deploy. China Mobile, which had received the least commercially viable 3G license, was the first to build out its 4G service, using the TD-LTE platform.⁸ The 4G TD-LTE has already had successful commercial deployment in several markets around the world.⁹ By the end of 2014, China Mobile's already had 90 million 4G subscribers. Unicom and Telecom's 3G FD-TDMA licenses were issued in March 2015.¹⁰

New entry- Mobile Virtual Network Operators. In 2014, the government allowed private companies to provide mobile service to customers by becoming a MobileVirtual Network Operators (MVNO). These companies may lease services from the big three network operators, but are not allowed to own their own facilities. The challenge is for MVNO's to attract customers away from their current provider with some value-added service. The first MVNO's went live in May 2014.¹¹ Reports in 2015 suggest that MVNO's are having difficulty getting good interconnection terms with from the large operators and, therefore, are finding it hard to offer a competitive retail prices.

Broadband Internet over telecom infrastructure. There are three large commercial Internet backbones in China, each of the three telecom operators – China Mobile, China Telecom, and China Unicom. At the retail level, there are numerous Internet service providers, mostly private, not state-owned. The retail Internet service providers must rely on the backbone providers for connectivity to the Internet.¹²

Internet applications. In the Internet market, applications and services are dominated by private, commercial companies, not state-owned enterprises. One example is WeChat, mobile app that allows subscribers to leave audio voicechat messages. WeChat's success shrank the telecom companies' texting revenue. Initially, the telecom companies demanded payment, but the government refused to take what would have been an unpopular action. Similar scenarios have occurred with Voice-Over-Internet Protocol in the past⁶ and are likely to continue in the future.

Telecom – regulatory reform

Separating regulation from operations. For governments that ran the telecom network, the first step was to separate the organization that operated the network from the organization that regulated the network. The regulator worked in the public interest; the operator in the interest of shareholders. In the telecom sector, the number of independent regulatory agencies skyrocketed from 14 to 148 from 1990 to 2007.^{13,14}

Bolstering the regulator's independence. Many countries implemented reforms that to increase the regulator's independence from industry and from political interference. Many countries have some combination of safeguards to preserve the regulator's freedom to act judiciously.¹⁵ A World Bank study of 200 countries from 1985-1999 shows that two functions were important to increasing telecom investment and boosting fixed and mobile subscriptions; a separate regulatory authority and privatization. Of the two, establishing a separate regulatory was more significant than privatization, especially if the regulator was created first.³ Edwards and Waverman's study of 15 European regulators from 1997-2003 showed that markets with an independent regulator and a privatized telecom operator had the lowest interconnection rates – the price that telecom networks pay each other to complete their calls. Next best interconnection rates were those markets with independent regulators with state-owned incumbents.¹⁶

Telecom- regulatory reform in China

Separating regulator from operator. The Ministry of Post and Telecommunications was separated from China Telecom in 1997. In 2008, MII was combined and reorganized to become part of the Ministry of Industry and Information Technology (MIIT). In addition to the scope of MII, industry management formerly under the NDRC, the Commission for Science, Technology, the Industry for National Defense, and the State Council Informatization Office.

Media regulator - SARFT. SARFT (State Administration for Radio, Film, and Television) is responsible for radio and television programming, particularly foreign content, and controls access to satellite and cable channels. Now that it is possible to watch television over the

Internet, SARFT and MIIT can be at odds. SARFT has succeeded in requiring telephone companies to work with commercial broadcasters if they want to offer IPTV services, but gray areas still exist.^{17,18}

State Council. State Council Leading Groups are one instrument for the State Council to exercise leadership. In early 2014, the government announced President Xi Jinping would lead a new State Council central Internet Security and Informatization Leading Group. The group's goal is to lead and coordinate Internet security and informatization policy, especially to balance the priorities of expanding Internet use in China and "maintaining proper guidance of online opinions in terms of timing, intensity and impact."¹⁹

Interconnection. The state has not yet succeeded in establishing a regulatory framework for interconnection that operators are willing to use, which creates market uncertainty that favors the most powerful operators. MIIT lacks the cost data from the firms to make good interconnection pricing decisions.

In 2010, the Chinese Academy of Social Sciences released a report noting that while limiting international Internet connections to China Telecom and Unicom was necessary to maintain an effective Chinese firewall, it means these two companies were providing poor service at high prices.²⁰ In early 2011, CNNIC released its first study of broadband speed, conducted by testing 20 major websites in 31 provinces and municipalities, once an hour for 24 hours. Guangzhou, Shanghai and Beijing were congested, so the top provinces turned out to be Henan, Hunan, and Hebei.²¹ Amid a general sense that broadband development in China had stalled, the NDRC announced an anti-monopoly investigation against China Unicom and China Telecom for abusing market power in the Internet market.¹⁹ Not only were broadband speeds slow, but broadband prices in China were three times higher than in Vietnam, four times higher than the US, and 29 times higher than South Korea.²² In December 2011, China Telecom and China Unicom submitted new price schedules to NDRC that were to lower consumer Internet access prices by 35% within five years.²³

Telecom pricing

For years, prices were held high by government-set tariffs; period price wars would break out among operators in contravention of regulations.⁶ Tariff reform in China's telecom market illustrates the futility of the government's effort to contain the market under state control. In May 2014, China's Ministry of Industry and Information stopped regulating retail tariffs for telecom service.²⁴

Relationship between retail and wholesale prices. In a competitive telecom market, while free market pricing is expected in retail, regulated pricing is expected for interconnection rates. For example, on May 15, 2015, Premier Li Keqiang complained that broadband prices

in China were too high; this was followed by immediate announcements by carriers that prices would be reduced.

Selected Markets Ranked by the Affordability of Fixed and Mobile Phone and Fixed Broadband Services, 2013

Source: ITU

Country	Rank	USD (PPP)	Fixed broadband as % GNI per capita
Hong Kong	6	28/ 8 mbps	0.7
US	15	33/1 mbps	0.7
Japan	18	19/12 mbps	0.6
Korea	26	33/50 mbps	1.3
China	63	32/ 1 mbps	3.5

One reason retail rates for Internet remain high is that the interconnection rates faced by Internet Service providers are high due to lack of competition. Both for basic interconnection of networks and for access to international gateways, Internet traffic in China all must traverse a limited number of points controlled by the state-owned telecom operators. Traffic patterns are controlled in order to comply with policies for Internet content filtering. Because these points are bottlenecks, these facility owners can charge a monopoly rate for the service. As long as these conditions remain, the telecom companies profit more by charging a monopoly price. They will not generate more profit by lowering their prices and increasing volume.

Telecom: Intersection with Media

While the focus of this study is telecom, the distinction between telecom and media is rapidly disappearing. In China, in 2014, 76% of all Internet traffic was video.²⁵ Internet video is driving growth in Internet traffic and investment. In response many countries have merged their telecom and media regulators.²⁶ However, in China this issue is unresolved.

IPTV. Currently, a company offering Internet Protocol television (IPTV) services in China requires four licenses. One license for IPTV from SARFT, one license for content from the Ministry of Culture; and two licenses from the Ministry of Information Industry and Technology (MIIT), one for Internet content provision and, for mobile providers, one license for mobile value added service. Most users were on the China Telecom trial network, for which China Telecom did not have license. Others were on the Unicom network, also without a license.¹⁶ While license are required, some seem to operate without them.

Three network convergence. For many years, the central government has sought to unify the telecom, broadcast, and Internet networks. The most recent effort began in 2010.¹⁶ However, by 2011, news reports suggested the three network convergence strategy was dead, as broadcast and telecom regulators fell out over the broadcast rights over programming.

Internet content filtering regime. Internet filtering takes place at two levels – nationwide backbone Internet service providers and local Internet service providers that interact directly with Internet users. Backbone providers filter content at the international gateways in Beijing, Guangzhou, and Shanghai; this prevents foreigners from seeing domestic sites and people in China from seeing foreign sites. Local Internet service providers censor content under the supervision of the local telecom authorities. They regularly carry out “strikes” against specific content.¹¹ Local authorities can also escape the firewall. A recent study of Chongqing documents the local government’s frustration with MIIT’s restrictions on Internet content. The Chongqing government wants to build a data center in its free trade zone that is outside the firewall in order to attract international customers. The work is still ongoing.²⁷

Electricity – market reform

For electricity reform in general, results are mixed and, unlike in telecom reform, there is less consensus internationally on the appropriate recipe of successful electricity reform. In a study of 36 developing and transition countries (1985-2003) Zhang³ found that competition was essential to better performance.

Competition in generation. For competition in generation to succeed, the government must separate generation and transmission. While this is true in all network industries, particular to electricity is that a vertically integrated operator profits from charging more during congestion.

Transmission and distribution. There are a range of approaches from vertically integrated systems to systems with completely independently owned and operated transmission systems. Most countries have something in between, such as legal unbundling or forcing the incumbent to separate transmission work into a different organization, while retaining ownership.²⁸ Leautier and Thelen’s work suggests that in systems with congestion, vertical

separation of generation and transmission combined with regulatory incentives are necessary to improve performance. Vertical separation alone is insufficient.²⁹

Retail competition. In general, competition in retail is less common than in generation.

Privatization. Privatization may improve performance in electricity reform, but competition policy and independent regulation are a higher priority. The World Bank identifies power utilities in South Korea, Taiwan and Singapore as good examples of state-owned utilities operating on commercial principles.³⁰ Zhang's survey shows, however, that privatization does aid in promoting competition.³¹

Electricity – market reform in China

History of state mandated market structure reform. In the 1980's, growing electricity demand pushed the government to allow private investment in electricity generation. After the Asian financial crisis in 1997, undercapacity became overcapacity due to declining demand. In response State Power Corporation was created in 1997 to consolidate the market. In 2003, the State Power Corporation was split into five generating companies, two grid companies, and several service companies. Dispatch remains with the grid companies.

Competition in generation. There is competition in generation. In 2003 reforms refocused on central government owned power plants. The five generators owned by the central government include about 40% of capacity in China; the rest are owned by primarily by consortia at the local government level.³² In recent years, the percentage of total power output of the five big power generators is increasing.

Modest competition in retail. For residential users, there is no significant competition in the retail market. However, since 2002, as a pilot project, large users of electricity have been able to buy directly from generators.³³

Transmission and distribution. The two state-owned grid companies each have a monopoly in their respective regions. In the 2003 market reform, while State Power Corporation was split up, distribution, transmission, and dispatch remain under the ownership of the grid operators.³² There are seven regional networks. State Grid is responsible for interregional dispatch, while each regional grid subsidiary has its own dispatch center.³² The electricity grid in China is not yet integrated, which makes challenging the development of regional wholesale markets and the transmission of electricity from the resource rich West to the power hungry East.³⁴

Distributed generation-microgrids. Distributed generation offers a modest opportunity to introduce some competition in China's transmission and distributed market. Policy measures in China to support distributed generation were accelerated in 2013 when the US raised taxes

on importing solar panels from China.³⁵ While large scale solar projects tend to be in western China, with more land and space but less demand, distributed generation solar projects tend to be in the east. Distributed generation projects are on or close to the user site, the electricity is directly consumed by the user, and requires no additional transmission lines.³¹

Electricity – regulatory reform

Independent regulator. As governments recognized the advantages of private investment in electricity, separating the regulatory authority from state-owned operators was one way to help assure private investors they would be on an even footing when it came to regulatory decisions.³⁶ In a survey of developing and transition countries, privatization or regulation on their own did little to improve performance of the electricity sector. Competition, especially in generation, improved performance most. When competition was weak, good regulation helped achieve gains in generation.³ In a contrasting approach, Haney and Politt concluded that regulators of competitive markets were more likely to use methods considered “best practice.” They found that countries with a large numbers of firms were more likely to use benchmarking, made it easier for regulators to apply this practice. Second, they found that regulators with more years of experiences and less subject to political intervention were more likely to use this best practice. Third, they found regional trends; regulators look to their neighbors as examples of good practice.³⁷

Relationship of national and local authorities. In electricity it is common for local authorities to have a prominent role in forecasting and planning. Whatever tensions there may be between national, regional, and municipal authorities in general are then replicated in electricity regulation. Local officials are especially keen to make sure electricity generated locally meets local needs first.

Relationships among power generators - Balancing load and managing dispatch. Electricity is expensive to store, therefore, delivering power from where it is generated to where it is needed in the proper time is a key function of the system. This is a characteristic unique to electricity, different from other utilities like telecom or water, for example.

Electricity – regulatory reform in China

Separate regulator from industry. Few observers would describe the regulator as independent. In China, both the corporate and government sectors are organized in a single administrative hierarchy. In many instances, corporate executives outrank regulatory officials in the administration hierarchy.³⁵ For more effective regulation of the sector, the government has concluded that it needs a more comprehensive, rather than independent regulator.

Disconnect between needs and project approvals. There is little focus on forecasting demand and assessing resources, and even less attention given to demand side management or grid resources. Instead, local authorities pour their attention into getting central level approval, a process that incentives rent-seeking behavior and corruption.³⁵ In the end, there is little connection between the approval of individual projects and the larger energy picture. So, in 2015, while there is an overcapacity of electricity generation, coal power generation projects continue to get approval.³⁵ New policies announced in 2015 that shift project approval decision making to the local level may alleviate this.³⁵

New goals. In early 2015, the government announced the focus of energy reform would be to improve air quality; this was the most significant reform program announced since 2002. Unusually, it was a joint announcement by the State Council and the Communist Party Central Committee, sending a powerful political signal.³³ Such strong political signals are necessary for state-owned enterprises to deliver.³⁸

Relationship of local and national authorities. Local authorities want to be able to offer and ideally, guarantee, reliable electricity service to investors and to the population in general. Mah and Hills' series of studies on Guangdong, Beijing, and Xinjiang wind energy policy demonstrate the significant influence of provincial authorities. In terms of pricing policy, Guangdong was able to countermand a central government policy of competitive bidding, with a fixed price approach that gave investors a better incentive to install wind projects. A few years later, the central government abandoned competitive bidding for a fixed price approach.^{39,40}

Balancing load and managing dispatch. The dispatch system is organized to support a mainly coal-powered generation. From the 1980's, China allocated operating hours equally among generators, an approach known as "equal shares dispatch," or average dispatch. The wholesale prices faced by generators was based on the financial lifetime of the unit, each generator needed to produce enough to cover a regulated rate of return.⁴¹ The consequences of such a system were, for example, in the 1980's even though there were power shortages, generators were guaranteed a number of hours to run. More efficient plants were not favored over others. In 2007, pilot programs began to increase power generation efficiency and reduce environmental impact. Instead of every generator receiving equal hours, as long as safety and reliability were not compromised, dispatch priority would go renewables and hydropower first, followed by nuclear, and then followed by coal, natural gas and oil. In December 2010, China Southern began applying the pilot to all of its five provinces.⁴¹

Electricity Pricing

Retail pricing. Industrial consumers comprise about 80% demand for electricity in China; residential consumers make up the remaining 20%.³³ On the whole, industrial consumers face relatively high prices for electricity compared to other countries, while residential users

face lower prices compared to other countries. The reasons for keeping residential tariffs low are to keep electricity access affordable for as many people as possible and to protect users from inflation.³²

Network pricing. In 2004, the government began setting tariffs based on coal prices. Coal-fired generators face two prices for coal. Generators can purchase coal at below-market rates up to a limited quantity. Beyond that, generators buy coal at a rate determined by the international market.⁴¹ Maintaining a below market rate for a limited amount of coal reflects the government's concern with minimizing upward price fluctuations. Allowing market-rate coal purchases reflects the government's concern with shortages.

In 2007, the government lowered on-grid tariffs for small, inefficient coal-powered generators. Most of these units have now been taken out of service.⁴² As China's government makes environmental goals a higher priority, on regulatory reform to watch are moves to increase on-grid tariffs that favor renewables relative coal.

Relationship between network and retail prices. Coal-fired generators face market prices for coal, on the one hand, and government-set tariffs to sell their electricity to the grid, on the other. From 2002-2008, for example, coal prices rose while the government held down retail tariffs. In 2008, power shortages occurred due to a combination of a cold winter and curtailed supply because of low retail tariffs.³² Grid companies keep the difference between the cost of on-grid tariffs and revenue from retail tariffs. The grid companies' own costs are not transparent. However, revenues from electricity sales likely outpace rise in costs in recent years, making the grid companies very powerful and a target of reform.³⁵

Electricity: Intersection with Environment

Changing gears. The State Council released in March 2015 a new framework that prioritized environmental goals in power sector reform.⁴³ However, currently, investment in and operation of power generators is decentralized, while planning and price-setting are centralized. The current regulatory system lacks the usual tools necessary to make adjustments in policies that would improve the environment.⁴⁴

Subsidies. Currently, there are massive fossil fuel subsidies, primarily through prices set below costs. In 1999, the IEA estimated the average rate of energy subsidies was 10.9%.⁴⁵ These subsidies lead to overconsumption of power and shift industry to move toward more energy-intensive production methods.⁴⁶

Transmission. A further challenge to lessening the impact of the electricity sector on the environment is the underinvestment in the electrical grid. Flow among the regional grids is very limited. Energy resources and centers of demand are in different regions. Renewable

resources like wind and hydro cannot be effectively transmitted outside their region, severely curtailing the usefulness of any investment in their development.⁴⁴

Price regulation - grid business model. Shenzhen has begun a pilot to change the business model of Southern Grid. Every three years, the provincial authority will review the assets of Southern Grid; the grid company will receive a percentage of its expenses as revenue, a rate of return model. This approach protects Southern Grid revenue if it becomes more efficient. In early 2015, the national government announced this approach would be adopted in several other provinces.^{33,47,48}

Price regulation – coal. In the early 2000's, a shortage of coal, exacerbated by bottle necks in coal rail transport, caused wholesale rates to rise. In 2008, they rose twice, while retail rates remain unchanged. The loss was born by the generators and the grid operators.⁴²

Price regulation – dispatch. Changing the dispatch system to incorporate renewables will create winners and losers and shift investment decisions.^{33,35} One common approach is to create a tariff that compensates the generator separately for both fixed and variable costs. A feed-in tariff that based on variable costs is favorable for renewables will not enough revenue for coal-fired generation to maintain investment. Creating a capacity fee based on fixed costs would address this issue.

Demand side management. On the demand side, reducing electricity use by consumers can also have a positive effect on the environment. In Zheng, et al⁴⁹ household survey, 61% had refrigerators and 44% had clothes washers that had grade 1-3 efficiency labels, suggesting this policy is effective but could be promoted more. Second, in those cities surveyed with time-of-use pricing policy, only 38% of surveyed were aware of it and only 14% had applied for it. Tellingly, only 13% of the surveyed had heard about it from the grid company. In the longer run, smart grids and electric cars can become elements of demand side management.

Conclusion: China's regulation in context

In both telecom and electricity, the large state-owned players are not so much subject to regulation as they are tools of regulation. In general, they execute the goals and reflect the priorities of the state. Seen from this perspective, when state-owned operators do not conform to announced public policies, they are reflecting conflicts embedded in the government itself.

Even so, any major change in regulatory direction substantially shifts the distribution of resources, profits, and influence among the players. One thing missing in China's efforts at consensus building is a broadly based consultative process. Consultation is kept within the confines of a select community. Innovation from outside has little opportunity for expression.

Success of the SOE-oriented approach. The great success of telecom and electricity industries in the last two decades is universal service. Everywhere in China there are phones and electricity. Compared to other countries of comparable level of development, this is a remarkable achievement and a great boon to the quality of life for ordinary Chinese.

Challenge to innovation. A thorough examination of electricity and telecom regulation uncovers many problems with noncompliance. The rules are written one way, and the reality in the market is another. This is a kind of innovation, albeit an illegal one. One approach would be to increase enforcement. Another would be to relax the rules make these kinds of innovation legal. A third approach would be more extensive consultation prior to implementing rules; first, to improve them through feedback, and second, to inform the market of their importance. Ultimately, business and technological innovation are easier when the regulatory environment is rational and predictable.

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² Irene S. Wu, Georgetown University and U.S. Federal Communications Commission (FCC). Contact: ireneswu@yahoo.com. This work represents the view of the author only, not of the FCC or its Commissioners.³ Zhang, Yin-Fang; David Parker; Colin Kirkpatrick. 2008. "Electricity Reform in Developing Countries: an Econometric Assessment of the Effects of Privatization, Competition, and Regulation." *Journal of Regulatory Economics*. 33. pp. 159-178.

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