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Institutional Innovation for Sustainability in Transitional China: The Green Electricity Market in Shanghai

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Abstract

This paper examines the evolution of the Shanghai Green Electricity Scheme - the first green electricity market in China - since it was introduced in 2005. This Scheme represents an institutional innovation to pursue sustainability objectives through the restructuring of energy markets. We also argue that the use of this market-based instrument (MBI) is linked with wider issues associated with policy and governance. The critical factors that appear to determine Shanghai's capacity for institutional innovation include local contextual conditions and the central-local dynamics while a major barrier is institutional inertia. As the green electricity market in Shanghai primarily involves wind energy, the analysis gives special attention to this particular form of renewable energy.

Key words: green electricity market, Shanghai, wind energy

Introduction

There is a growing recognition of the need to restructure energy markets in response to issues of energy security and climate change (Brennan *et al.*, 2001; Eikeland, 1998). In recent decades, institutional changes have been introduced to energy markets in both developed and developing economies to facilitate the transition towards more sustainable energy systems. Such institutional changes have been deployed in various ways and through different mechanisms. Some key institutional changes include tariff reforms, demand-side management and energy market reforms (Dubash, 2003; Prindle, 1991). The concept of the green electricity market is also a form of institutional changes.

Green electricity markets are an example of the application of market-based instruments (MBIs). Green electricity markets represent a new wave of MBIs that emerged in the 1980s (Berrah *et al.*, 2006) in several western countries including the Netherlands, Germany, the US, the UK and Sweden (Bird, L. *et al.*, 2002, 2008; MacGill *et al.*, 2006; Wüstenhagen and Bilharz, 2006; Söderholm, 2008; van Rooijen and van Wees, 2006).

Green electricity markets are based on the willingness of electricity consumers' willingness to pay a premium price on a voluntary basis to buy electricity generated from renewable energy or environmentally less harmful sources (Shanghai EC and Shanghai DRC, 2005; Salmelaa and Varho, 2006; Wiser *et al.*, 2000). The underlying rationale of green electricity markets is that they create a sizable market demand to create incentives for renewable energy investments, which then drives down costs through achieving economies of scale, and subsequently promotes the competitiveness of renewable energy (Morthorst, 2000; Wüstenhagen and Bilharz, 2006).

Globally, green electricity markets have yet to achieve mainstream status. Currently, their market share accounts for less than 5 percent of the global total (REN 21, 2010). However, some positive signs are emerging. First, the market demand for green electricity is growing. Between 2004 and 2010, the number of green power consumers in Europe, the United States, Australia, Japan, and Canada recorded substantial growth from 4.5 million to more than 6 million (REN 21, 2005, 2010).

Although green electricity has a small market share globally, some countries have achieved remarkable progress in the development of these markets. The Netherlands was the leader in green electricity markets between 2005 and 2008, with more than

three million green electricity consumers at the peak (REN 21, 2010). In Germany, where the green electricity market has experienced rapid growth in recent years, the number of consumers grew from 750,000 in 2006 to 2.2 million in 2008 with a total subscription volume of 6.2 TWh (REN 21, 2010). In the United States, there were more than 1 million green electricity consumers accounting for 24 TWh in 2008, double the 12 TWh purchased in 2006 (REN 21, 2010).

International experience has also shown that green electricity markets have helped to promote the development of renewable energy. In the United States, for example, at least 2 GW of additional renewable energy capacity had been built by 2004 to accommodate this market (REN 21, 2005).

The emergence of green electricity markets raises a number of important questions: What are the potential and the limits of this form of MBI to advance sustainability objectives? What are the prerequisites to support an effective green electricity market? What are the barriers that need to be overcome?

This paper focuses on these questions by studying institutional changes for sustainability with particular reference to the introduction of a green electricity market to promote wind energy in Shanghai.

Green electricity markets in transitional China

The Shanghai green electricity market was the first of its kind in China and in Asia when it was implemented in 2005 (SH ECSC, 2009). However, the use of MBIs for environmental protection is not new in China. China has introduced and completed two phases of pilot emission trading schemes for sulphur dioxide from the early 1990s onwards (Tao and Mah, 2009). More recently, a number of Chinese provinces including Jiangsu and Guangdong, have introduced their own local initiatives for emission trading (Chang and Wang, 2010). Although China has not participated in the trans-national emission trading scheme set up under the Kyoto Protocol, it has actively participated in the Clean Development Mechanism (Qi *et al.*, 2008).

The introduction of the Shanghai Green Electricity Scheme is an example of China's following the global trend of using MBIs. However, in contrast to those employed in the liberalised electricity markets in the West (Bird *et al.*, 2002), the Shanghai Green Electricity Scheme is distinguished by contextual features that have been shaped by China's on-going economic and power market reforms. It is therefore important to understand the contextual characteristics of transitional China within which the Scheme has evolved.

China started to launch its economic reforms in 1978 (Saich, 2003). Since then, marketisation and decentralisation have been the two major forces of change reshaping governance and political systems in China. One of the major changes in China's environmental governance system is the growing recognition of the importance of markets and society in supplementing traditional command-and-control mechanisms (Aizawa and Yang, 2010; Tao and Mah, 2009).

An important series of power market reforms have been introduced since 1985 (Williams and Kahrl, 2008). These have gradually introduced market competition into the formally centrally planned, vertically integrated, and state-owned power industry (Xu and Chen, 2006; Williams and Kahrl, 2008) and transformed the stakeholder landscape of this strategic sector. The most recent reforms, launched in 2002, have focused on the separation of generation and grids and the establishment of a new market regulator, the State Electricity Regulatory Commission (Mah and Hills, 2008; REEEP, 2010).

Thus far, China's power sector has only been partially liberalised. The power transmission and distribution sectors remained monopolies and operated by two state-owned grid companies, the State Grid and the China Southern Power Grid, which are fully state-owned (Mah and Hills, 2008). Market competition has been largely confined to power generation where five major state-owned power generation companies compete among themselves as well as with local electricity companies (REEEP, 2010).

It is in this dynamic, transitional context that Shanghai introduced the green electricity scheme. Most of the literature on green electricity markets is set in the western context. This paper is one of those few studies in the Chinese context. China has also become a central player in the global development of renewable energy. In the wind energy sector for example, China is a world leader in terms of new installed capacity in 2009, and has the world's second highest total of installed capacity (Li *et al.*, 2010). It is therefore of scholarly interest to examine the experience of Shanghai as an example of a pivotal city in China in introducing a major institutional change for promoting the development of wind energy.

In this paper, we will discuss the theoretical perspectives adopted to examine the case study of Shanghai Green Electricity Scheme. We then present the principal findings relating to the successes and limitations of the Scheme, with an emphasis on examining the key issues and factors that were critical in influencing the effectiveness of the Scheme.

Green electricity markets in theoretical perspective

This paper frames green electricity markets as an institutional change to restructure energy markets to achieve sustainability objectives. Institution is a “a relatively stable collection of practices and rules defining appropriate behaviour for specific groups of actors in specific situation” (Jordan *et al.*, 2003: 19). What, then, would an effective institution look like? According to Young (1992), “an institution is effective to the extent that its operation impels actors to behave differently than they would if the institution did not exist or if some other institutional arrangement were put in place” (p. 161). In assessing the Shanghai Green Electricity Scheme, our analytical focus therefore is on the behaviour of actors in responding to this new institution, and the way changes in behaviour promoted the development of renewable energy.

A scanning of the literature suggests that two substantive bodies of literature are instructive in illuminating these issues: these are the perspectives of policy and governance.

Policy perspectives

The policy perspective links with the concept of market-based instruments and the role that market signals play in the nature and workings of a green electricity market. This perspective has led to a rethink of the limits of traditional command-and-control policies, and the importance of broadening policy choices to include economic instruments such as subsidies (Wallace, 1995), market-based instruments such as green electricity markets (Huber *et al.*, 1998; Hull and St-Pierre, 1990; Stavins and Grumbly, 1993) and voluntary approaches such as information disclosure (Connelly and Smith, 2003).

The literature on policy is particularly instructive in highlighting the role of market signals in altering actors’ behaviour. MBIs are those policy instruments that use market signals rather than explicit directive for environmental protection (Stavins, 1998). Compared with other instruments, the advantages of MBIs are that they can mobilise consumers’ interest, generate additional funds from consumers, and therefore reduce reliance on government resources (Gan *et al.*, 2007). They are also a flexible tool for promoting participation from the private and societal sectors (Gan *et al.*, 2007).

There are however several major challenges in the use of MBIs that must be overcome. These include political, institutional and legal barriers (Huber *et al.*, 1998). Another key challenge is policy coherence. Policy coherence requires mutually reinforcing policy actions across government departments and agencies to create

synergies towards achieving defined policy objectives (Jones, 2002: 391-392). The work by Dinica and Arentsan (2003) for example draws attention to the way the Dutch voluntary green electricity system depends on the eco-tax exemption for green electricity and the continuation of price support.

Governance perspectives

The literature on governance complements the policy perspective by shedding light on the changing relations between government, market and society in the context of green electricity markets. Governance is the structure and processes by which societies share power and shape individual and collective actions (Young, 1992). A core concept is the shift from government to governance, emphasising the need for the state to reach out to the wider society including the markets to compensate for ineffective government (Stoker, 1998; Satterthwaite, 1999).

The perspective of governance suggests that in an era of shrinking public budgets and decentralisation, there must be a rethink of the limits on the ability of government to govern (Cope *et al.*, 1997; Kettl, 2000; Satterthwaite, 1999). This perspective assumes that the capacity of governments to govern needs to be enhanced by enabling the market actors (such as consumers and enterprises) and societal actors (such as NGOs, universities) to play a much more important role in achieving sustainability goals (Satterthwaite, 1999).

Although the market is accorded a prominent role in the governance perspective, the literature also highlights several major challenges for market approaches such as green electricity markets. Markets tend to bring in a large number of market and non-market actors into governance systems which have traditionally been dominated by state actors (Miranda *et al.*, 2002; Wüstenhagen and Bilharz, 2006). Market-building therefore is perceived as a complex process involving moral values (Zelizer, 2001) and shifts in power (Beeson and Robison, 2000) in a dynamic stakeholder landscape where inertia exists and there is resistance to change (Hekkert *et al.*, 2007).

The literature on governance suggests that a key factor to make markets operate effectively is institutional capacity. The literature suggests that collective sets of rules governing interactions between stakeholders are required (Fligstein, 1996). Processes such as gaining legitimacy (Cashore, 2002), learning and feedback have been identified as key facilitators for institutional innovation (Argyris, 1994; Hall, 1993; Lafferty and Knudsen, 2007; Mann, 1991; Rudalevige, 2009).

While the literature on policy and governance is instructive in explaining the nature and workings of MBIs, there is little literature dealing specifically with green electricity markets. Work by Gan and others (2007) notes that electricity prices and consumer awareness are two critical factors determining the effectiveness of green electricity markets in the diffusion of technological innovations such as renewable energy. However, the major forces of change and mechanisms of a governance system that are needed to support green electricity markets are important areas that have remained largely explored. As the concept of green electricity markets originated in the West, these gaps are particularly significant in the context of developing economies such as China, and at the sub-national level such as cities. This paper uses the case of Shanghai Green Electricity Scheme to partially fill these gaps. This paper addresses the following questions:

- (1) How did the introduction of this Scheme change the stakeholder landscape, power relations, and incentive structures in Shanghai's electricity sector?
- (2) How did interactions between stakeholders influence the effectiveness of the Scheme?
- (3) How can such interactions be conceptualised?

This paper adopts a single case-study methodology to examine the development of the Shanghai Green Electricity Scheme. A case-study approach is well suited to provide answers to “how” and “why” questions (Yin, 2003), and is therefore a useful research methodology to understand the workings of the green electricity market.

This paper uses data and information derived from desktop studies and interviews. The desktop studies were based on a careful examination of China's law and government documents, and a desktop review of published works from academic sources and other non-government sources such as reports and newspapers.

Eight semi-structured face-to-face and two telephone interviews were conducted in Beijing, Shanghai and Guangdong between 2005 and 2010. The interviewees were key informants in this field who were either directly involved in the Shanghai Green Electricity Scheme or were knowledgeable about it. The interviewees include government officials from relevant bureaus/ departments, representatives from a wind farm developer, a grid company, a think-tank and an NGO. As some interviewees agreed to be interviewed only anonymously, this study indicates interviews by number. The first two letters indicate the location (BJ for Beijing, SH for Shanghai;

GD for Guangdong), the two digits indicate the interview numbers, and that followed by the year of interviews. The list of interviews is provided in Appendix 1.

Shanghai Green Electricity Scheme

(1) Contextual background and overview

Located at the estuary of the Yangtze River on the east coast of China, Shanghai is a pivotal city in China's economy and political scene (Wei, 1987). Developing as a commercial and industrial center in the second half of the 19th century (Wei, 1987), Shanghai's GDP reached 1,370 billion yuan in 2008 (HKTDC, 2010). Shanghai is the largest city in China with a population of 18.9 million (HKTDC, 2010).

One of the major economic developments in Shanghai has been the development of the Pudong New Area in 1990 for foreign investment (Zhang, 2003). Shanghai's goal is to develop into "four centers (四个中心 *Sige Zhongxin*)", i.e. to become an international centre of economics, trade, finance and shipping. The Expo 2010 hosted by Shanghai was intended to strengthen Shanghai's status as a global city (Bureau of the Shanghai World Expo Coordination, 2008).

Politically, Shanghai has close links with Beijing. Shanghai is one of the four municipalities centrally directed by the central government (Tang *et al.*, 1997). Its irreplaceable role in national public finances and the appointment of Jiang Zemin and then of Zhu Rongji in 1985 and 1987 respectively as mayors of Shanghai before they became the country's leaders have created strong ties between Shanghai and Beijing (Yusuf and Wu, 2002).

Being a pivotal city which has already been successful both economically and politically, Shanghai has aspired to turn green in recent years. Such commitments are reflected, for example, in its plan to develop Dongtan in Chongming Island from a rural area to a world-class eco-city (Interview SH/06/2006; Shanghai Government, 2006; Shanghai Almanac Editorial Board, 2007).

Like many other Chinese cities, Shanghai's reliance on coal for energy consumption has led to many energy and environmental problems as well as issues of energy security. In 2005, energy consumption in Shanghai reached 80.69 million tons of standard coal equivalent, of which coal itself accounts for 53 percent (Shanghai Government, 2006). Shanghai has virtually no indigenous fossil fuels. In 2006, up to one-third of Shanghai's peak electricity demand had to be met by imports from power plants in other provinces (Shanghai Almanac Editorial Board, 2007; Shanghai Government, 2006). Shanghai has long given energy a high priority in its policy

agenda, and has shown a growing interest in developing renewable energy (Shanghai Government, 2002).

Of potential renewable energy sources, wind energy is a prioritised option in Shanghai's energy plan (Shanghai Government, 2006). It is in part because wind resources, particularly near-shore and offshore, is abundant while other sources such as solar and biomass are much less substantial (Shanghai Government, 2006).

Shanghai is a late-comer in the development of wind energy. While some provinces such as Xinjiang and Guangdong started to develop wind energy in the 1980s, the first wind farm in Shanghai was built only in 2003 (Mah, 2010). Since then, wind farms in Shanghai had been few in number and small in scale. Three wind farms built in Nanhui, Chongming and Fengxian between 2003 and 2005 have a total installed capacity of 24.4 MW, contributing to only 0.16% of Shanghai's total installed power generation capacity that reached 14.8 GW in 2006 (Shanghai Almanac Editorial Board, 2007; Shanghai Government, 2006).

Since 2008 however, Shanghai has embarked upon more ambitious plans to build China's first offshore wind farm – the 102-MW Donghai Bridge Offshore Wind Farm (Wang *et al.*, 2009). The recent completion of the offshore wind farm in early June 2010 to coincide with the 2010 World Expo in Shanghai has led to a five-fold increase of the total installed capacity of wind energy in the city (*Table 1*).

Table 1: Project Profiles –Wind Farms in Shanghai

	Year of Project Completion	Scale	Developers
(1) Fengxian Wind Farm ¹	2003	4 turbines; Total installed capacity: 3.4 MW	Shanghai New Energy Environmental Engineering Co. Ltd
(2) Chongming Wind Farm	2005	3 turbines; Total installed capacity: 4.5 MW	Shanghai Power Industrial and Commercial Company
(3) Nanhui Wind Farm	2005	11 turbines; Total installed capacity: 16.5 MW	Shanghai Power Industrial and Commercial Company
(4) Shanghai Dong Hai Bridge Offshore Wind Farm	2010	34 turbines; Total installed capacity: 102 MW	Shanghai Dong Hai Wind Power Co. Ltd (A consortium)

(Sources: SIDRI, 2009; Xu, 2005)

While the recent completion of China’s first offshore wind farm is a milestone in Shanghai’s wind energy development, the city’s pioneering use of the green electricity market is another distinctive feature of Shanghai’ wind development. Modeled on green electricity markets in the West, the Shanghai Green Electricity Scheme was first implemented in June 2005 (SH ECSC, 2009).

Under the scheme, participating customers, which can be organisations, enterprises or individual households, voluntarily pay a higher tariff of 1.147 yuan/ kWh (which is approximately double that of the normal tariff) to cover the extra costs of electricity generated from the three local wind farms at Fengxian, Chongming and Nanhui.

The green power is supplied by the Shanghai Municipal Electric Power Company (上海市电力公司 Shanghai Dianli Gongsi, SMEPC) and its subsidiary the Chongming Electric Power Company (崇明电力公司 Chongming Dianli Gongsi) (SH ECSC, 2009). The SMEPC is also the designated marketing agent for the green electricity.

¹ The Fengxian Wind Farm also has a 10 kW grid-connected PV system.

(2) An evaluation of the Scheme: achievements and limitations

As this paper frames the Scheme as an institutional innovation for promoting renewable energy, we assess the effectiveness of the Shanghai Green Electricity Scheme from three key dimensions: changes in stakeholder landscape, changes in the consumption side; and changes in the supply side.

Changes in stakeholder landscape

Before the Scheme was introduced in 2005, Shanghai's electricity sector reflected a centralised, top-down system that followed the national model. Grid companies, power generation companies and electricity consumers were linked in a uni-directional relationship.

The Shanghai Green Electricity Scheme is a market-based policy that was introduced to mobilise resources from the market to facilitate the development of renewable energy (Interviews BJ/01/2005, SH/01/2008). The MBI has resulted in some limited changes in the stakeholder landscape in Shanghai's power sector. These include:

Electricity consumers are given the right to choose: Electricity consumers have a more important role to play because through product differentiation (Fuchs and Arentsen, 2002; Salmelaa and Varho, 2006), the Scheme offers opportunities for consumers to exercise their rights to choose and pay a higher tariff to purchase green electricity. In the Scheme, green electricity is labelled as "Jade Electricity" (WWF, 2009).

New role of the Shanghai Government as a market-builder: The Shanghai Government has taken up a new role as a market-builder for the new green electricity market. A major responsibility of the government is to establish a regulatory framework and set the market rules for the Scheme. A key initiative was the introduction of a local administrative rule, the "Trial Measures of Purchase and Selling of Green Electricity in Shanghai (上海市绿色电力认购营销试行办法 Shanghai Luse Dianli Rengou Yingxiao Shixing Banfa)" in 2005 (Shanghai ETC and Shanghai DRC, 2005).

New actors have entered the electricity market: A new type of market actor, the intermediary firm, was able to enter Shanghai's electricity market because of the Scheme. An independent auditing firm, PricewaterhouseCoopers (PwC), has been commissioned to verify market transactions and enhance the integrity of the Scheme (SH ECSC, 2009). This indicates a higher level of specialisation has taken place in the Scheme (SH ECSC, 2009).

Inclusion of civil society in energy decision-making: The Scheme initiated a more inclusive form of environmental governance involving stakeholders outside the government. The World Bank (a multilateral financial institution) and a number of international NGOs such as the Worldwide Fund for Nature and the Energy Foundation played important roles as policy initiators in the Scheme (SH ECSC, 2009).

The Shanghai Green Electricity Scheme, however, has not been a great success. The scheme was ineffective in leading to desired changes in both the consumption and supply of electricity.

Changes in the consumption side

The Scheme has not resulted in major behavioral changes among electricity consumers. According to official data, by the end of 2006, there were about 7,000 household subscribers and 22 corporate subscribers. The total subscription volume was approximately 1.6 million kWh, representing only 30 percent of the green electricity that can be supplied to the market. This subscription volume represented only a minute proportion of approximately 0.002 percent of the total electricity generated in Shanghai in 2006 (Table 2) (Interview SH/03/2010). Although there was a slight increase in subscriptions between 2006 and 2007, no new subscriptions were made in 2008. Subscription plummeted to zero in 2009. Most of the subscriptions were on contracts that covered a period from one to three years, and all contracts had expired by 2009 (Berrah *et al.*, 2006; Interview SH/03/2010). At present, although the Shanghai Government has not officially terminated the Scheme, it is inactive with no subscribers (Interview SH/03/2010).

Table 2: Subscription Statistics of Shanghai Green Electricity Scheme

Subscribers/ Year (by year end)	2005	2006	2007	2008	2009
(1) Household Subscribers					
Number of Subscribers	N.A.	6,842	7,258	7,258	None
Subscription Volume (million kWh)	N.A.	1.06	1.14	1.14	None
(2) Corporate Subscribers					
Number of Subscribers	N.A.	22	24	24	None
Subscription Volume (million kWh)	N.A.	14.76	17.4 2	17.4 2	None
Total Subscription Volume: (1)+(2) (million kWh)	N.A.	15.82	18.56	18.56	None

(Sources: SH/ 03/2010)

Household electricity consumers played a very minor role in the Scheme. Most of the subscribers were corporate entities. In 2007, there were only 24 corporate subscribers and 7,258 individual subscribers in Shanghai. However, the corporates were responsible for about 95 percent of the total subscription volume (Interview SH/03/2010).

The supply side

In the liberalised electricity markets of the West, demand created by green electricity markets are expected to promote new investment in renewable energy, which will in turn drive down costs of renewable energy through market competition and economies of scale. Those markets generally are characterised by the presence of a number of suppliers and marketers whose prime objectives are product differentiation, the pursuit of higher profit margins, growth in customer numbers, and increased

revenue and market share (Wüstenhagen and Bilharz, 2006). In the UK, for example, green electricity is available from a number of suppliers (Bird *et al.*, 2002).

However, the Shanghai Electricity Scheme did not introduce major changes in the supply side of the electricity market in terms of new investment, cost reductions, or market competition.

The Scheme has not created profit incentives for new investment in renewable energy. Although Shanghai built the Donghai Offshore Wind Farm in 2008, the project was driven by many factors but not the market demand for green electricity. Building China's first offshore wind farm along the Donghai Bridge is of political significance to Shanghai because this state-of-the-art wind farm is expected to become an iconic structure for the 2010 Expo to strengthen Shanghai's green image (Interview SH/09/2008). This project was also driven by the strength in R&D capacity in heavy industry, and aspirations for high-tech products (Interview SH/04/ 2010; Zhang, 2003).

The Scheme did not induce cost reductions. The tariff for green electricity remained at around 1.147 yuan/ kWh throughout the five years between 2005 and 2009 (SH/03/2010).

Although green electricity markets in the West tend to encourage new entrants who specialise in green electricity, the Scheme in Shanghai was not able to induce such new market competition. No new market competitor entered the power generation market in Shanghai. The SMEPC and its subsidiary remained as the sole suppliers of electricity.

Critical issues and factors affecting the capacity for institutional innovation for sustainability

While the concept of green electricity markets may offer Shanghai a market-based institutional option to promote the development of wind energy, our study found that there are several critical factors that appeared to determine Shanghai's capacity for using this MBI. These include local contextual factors, institutional inertia and the central-local dynamics.

Contextual factors as drivers and pre-requisites for policy innovation

Shanghai was the first, and, so far, only city in China to implement a green electricity market. This case study has highlighted the importance of local contextual factors in enabling Shanghai to take this lead. These factors included its economic, environmental and cultural characteristics, its policy style and its openness to international influence.

The findings of the case study suggest that economic and environmental pressure in combination with political incentives were critical local drivers for Shanghai to deploy this type of MBI. As noted above, Shanghai's reliance on coal for energy consumption has resulted in many energy and environmental problems as well as issues of energy security. Environmental awareness among the general public in Shanghai is one of the highest in Chinese cities (CECPA, 2008). The Shanghai Government therefore was active in exploring more innovative ways to support renewable energy.

As a former 'semi-colonial' city in the early 1900s, Shanghai possesses a cosmopolitan culture that tends to make it more receptive to the concept of the western type of green electricity market (Wu, 2004; Yusuf and Wu, 2002; Interview SH/05/2006). In addition, Shanghai is the favorite location for headquarters or representative offices of international corporations (Wu, 2000, 2004). A large number of international corporations and an emerging middle-class in Shanghai appeared to be conducive to a sizable market demand for green electricity (Interviews SH/05/2006; SH/06/2006).

Another key factor is the policy style in Shanghai. It has been a tradition among Shanghai's political leaders to give priority to the vision of a market economy, institutional innovation and the promotion of science and technology (Yusuf and Wu, 2002). An example of Shanghai's aspiration for institutional innovation is its

establishment of an “Investigation and Enforcement Team for Energy Efficiency” as early as 1998. This investigation team, commonly known as the “Energy Efficiency Police”, was the first of its kind in China (Shanghai Government, 2001; Interview SH/04/2006).

As well as these local contextual factors, international influence on the forms of policy transfer and financial support was another key factor that enabled Shanghai to pioneer this type of MBI. Support from international institutions and NGOs including the World Bank, Energy Foundation and World Wide Fund For Nature (SH ECSC, 2009) was crucial. The role of the World Bank was particularly important. After introducing the concept of green electricity markets to Shanghai in 2003 (Berrah *et al.*, 2006), the World Bank arranged a number of study tours and training workshops for the Shanghai Government. The Bank also offered policy advice when Shanghai formulated the detailed design of the Scheme (SH-GreenPower, 2003). However, it is interesting to note that the World Bank was virtually absent during the policy implementation and evaluation phases.

International institutions also played an important role in financing renewable energy projects. Two of the three wind farms in this Scheme, the Nanhui and Chongming wind farms, benefited from the financial support from a World Bank/ Global Environment Facility project (Lewis, 2004).

Tensions between a changing state and institutional inertia

An interesting feature of the Scheme is that it encouraged some significant changes in the role of the Shanghai Government. The Government has made the transition from an administrative regulator to one that also assumed the responsibility of market-builder.

In its role as a market-builder, it established a regulatory role for itself through the formulation of a local rule for the Scheme (Shanghai ETC and Shanghai DRC, 2005). It also delegated some of the market tasks to parties outside the Shanghai Government. The marketing task of green electricity was designated to the Shanghai Municipal Electric Power Company (SMEPC) and its subsidiary Chongming Electric Company. An independent auditor was commissioned to verify market transactions (SECSC, 2009). The delegation of tasks from the government indicated a growing emphasis towards specialisation in tasks during the market building process.

However, the case study suggests that institutional inertia appeared to limit the capacity of the Shanghai Government to perform these new roles effectively. It did not take long for the Shanghai Government to realise that the Scheme was ineffective. However, it appeared to be slow in responding to the poor performance of the Scheme (Interviews SH/01/2008; SH/07/2008; Shanghai ETC and Shanghai DRC, 2005).

The Shanghai Government did contemplate several options to create new incentives to attract subscribers to the Scheme. Those included waiving the VAT for the additional costs of green electricity, and guaranteeing the corporate subscribers electricity supply even during periods of electricity shortage (SH-GreenPower, 2003). However, those proposed options were not realised largely because the Shanghai Government had difficulties in reaching a consensus across stakeholders, predominantly the government agencies, the grid companies and corporations (Interview SH/ 05/ 2006).

Why then was the Shanghai Government ineffective in realigning those interests among various stakeholders? It is evident that the government's reliance on the "lines-and-blocks (tiao-tiao-kuai-kuai)" administrative organisation (Lieberthal and Oksenberg, 1988) and institutional inertia were the key factors.

The problem of fragmented management system resulted from China's lines-and-blocks administrative structure – the coexistence of the vertical lines (from the ministries of the central government down to local government agencies) and horizontal lines of authority (across the local governments) - has been extensively documented (see for example Lieberthal and Oksenberg, 1988). The Shanghai Green Electricity Scheme is another good example illustrating those problems. Even though the Shanghai Government designated the Shanghai Economic and Trade Commission as the agency responsible for the overall management of the Green Electricity Scheme, the management structure of the scheme is still highly fragmented. The market building tasks of the Scheme rested with three government agencies (Shanghai Economic and Trade Commission, Shanghai Energy Conservation Supervision Center and Shanghai Development and Reform Commission), and a state-owned grid company, i.e. the SMEPC. This fragmented structure resulted in a diffusion of responsibilities that made it difficult for the Shanghai Government to formulate integrated policies for the Scheme (Interviews SH/01/2008; SH/02/2008) (Table 3).

Table 3: The diffusion of responsibilities for the Shanghai Green Electricity Scheme

Who	Responsibilities
Shanghai Economic and Trade Commission	<ul style="list-style-type: none"> ▪ the main supervisor of the scheme; to be responsible for the overall management of the scheme
Shanghai Energy Conservation Supervision Center, under Shanghai Economic and Trade Commission	<ul style="list-style-type: none"> ▪ with the technical and financial support from the Shanghai Economic and Trade Commission and a number of international NGOs (including the World Bank, Energy Foundation, and Worldwide Fund for Nature), it jointly conducted a study on green electricity market with the SMEPC ▪ to supervise and monitor the daily operation of the green electricity market ▪ to present award certificates to subscribers ▪ to evaluate effectiveness of the scheme; to collect information, and to make policy recommendation to improve the scheme; to assist the Green Electricity suppliers to formulate and revise marketing plans ▪ it itself was also a subscriber of green electricity
Shanghai Development and Reform Commission	<ul style="list-style-type: none"> ▪ macro-planning of the energy sector ▪ to formulate the local rules for the scheme jointly with Shanghai Economic and Trade Commission ▪ to enforce the scheme; to regularly check the implementation of the pricing rules and the annual plan of the scheme; to appoint an independent auditor for the scheme
Shanghai Municipal Electric Power Company (<i>SMEPC</i>)	<ul style="list-style-type: none"> ▪ to implement and market the scheme; to be responsible for the daily operation of buying and selling of green electricity.

(Source: author; Shanghai ETC and Shanghai DRC, 2005)

The “lines-and-blocks” organisational hierarchy of the Chinese state has furthered diffused the responsibility even within each concerned government agency. The Shanghai Development and Reform Commission and the Shanghai Economic and Trade Commission are held accountable along two coexisting management lines: the *horizontal* and *vertical* lines of authority. Horizontally they are accountable to the Shanghai Municipal Government; vertically they are accountable to their corresponding ministries within the central government. The Shanghai Municipal Electric Power Company also has two “bosses” – horizontally it is accountable to Shanghai Economic and Trade Commission while vertically it is accountable to the State Grid Company (Figure 1).

This fragmented organisation and a complex accountability system have encouraged institutional inertia in the Scheme. The government agencies were indecisive and slow in respond to the problems that emerged as the Scheme was implemented.

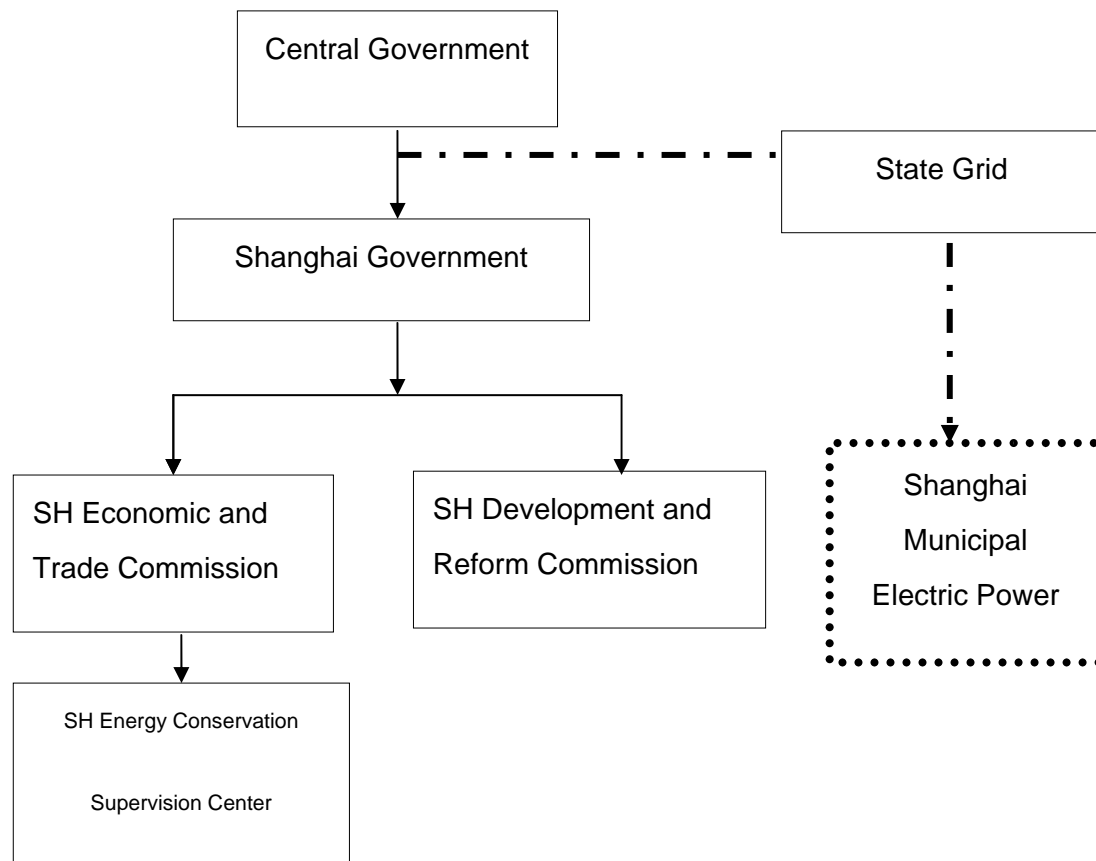


Figure 1: The fragmented management structure of the Shanghai Green Electricity Scheme

(Source: author; Shanghai ETC and Shanghai DRC, 2005)

It is interesting to note that institutional inertia was found not only among the relevant government agencies, but also within the SMEPC – the designated supplier and marketer of the green electricity. As electricity has long been a monopolised good and the SMEPC is a state-owned enterprise (SOE) wholly owned by the state as a subsidiary of the State Grid Company, the SMEPC had never needed to pay attention to consumers’ preferences before (Interview SH/07/2008). The SMEPC also had no marketing experience because it had never needed to increase sales (Interview SH/07/2008). Marketing the green electricity for this scheme was a new skill set that the SMEPC did not acquire, and for which it had no strong economic incentives to develop (Interview SH/07/2008).

Although the SMEPC did make some efforts to market the green electricity through, for example, TV commercials and distribution of leaflets (SH-GreenPower, 2003), these were far from effective in mobilising the wider general public. The SMEPC also did not introduce any organisational changes to take up the new marketing functions. To the SMEPC, the main driver for it to participate in the Scheme was its political obligation as a SOE to support the national policy for renewable energy development (Interview SH/08/2006).

The central-local dynamics

Another major finding of this case study is that the central government can both facilitate or constrain local institutional innovation. The enactment of China's first renewable energy law in 2005, and the growing political commitment to supporting renewable energy at the national level since then created a potentially favourable environment for Shanghai to pilot this Scheme.

However, it is also evident that the central-local dynamics can be counter-productive. Shanghai's attempt to enact a local regulation on renewable energy can be used as an example to illustrate this. As a reaction to the lukewarm response to the Scheme, in 2006 - about one year after it was launched - the Shanghai Government did attempt to create new incentives for subscribers to join. It drafted a provincial-level renewable energy regulation entitled the "Regulation of Shanghai Municipality on Renewable Energy 《上海市可再生能源条例》 *Shanghaishi Kezaisheng Nengyuan Tiaoli*" (hereafter referred to as the renewable energy regulation). The drafting of this local regulation itself is another example of Shanghai's aspirations for policy innovation. It was the first to formalise China's renewable energy law at the provincial level. With regard to the Scheme, the draft regulation was expected to serve as an effective tool to create market demand by proposing a mandatory purchase of green electricity among local enterprises (Interview SH/06/2006).

However, the legislative progress of this regulation has been slow. As of November 2008, almost two years after drafting started, the regulation had still not been submitted to the Shanghai People's Congress for approval (Interview SH/01/2008). One of the reasons for this delay is that the Shanghai Government has not been able to resolve conflicting interests between the local stakeholders including government agencies, the grid company, and enterprises relating to the mandatory purchase of green electricity (Interview SH/01/2008).

The difficulties in reaching consensus which was essential for the passage of this regulation reflect another deeper issue of governance in China: there has been a lack of reinforcing regulations between national laws and local regulations. When China's national renewable energy law was being drafted in 2004, a similar mandatory requirement was put in the draft for public consultation. However, the requirement was removed from the final version of the law when it was endorsed in 2005 (Interviews BJ/02/2006; GD/01/2006). In the absence of a corresponding mandatory requirement set out in the national Renewable Energy Law, the Shanghai Government was unable to build up policy legitimacy that could counteract opposition from the major enterprises in Shanghai (Interviews SH/01/2008, SH/05/2006). The experience of the Scheme suggests that the capacity for institutional innovation at the sub-national level can be seriously constrained if there is no corresponding support from the national policy framework.

Conclusions

This case study of Shanghai Green Electricity Scheme is consistent with the findings of earlier studies that costs and consumer awareness are major constraints on the development of green electricity markets (Dinica and Arentsen, 2003). The major contribution of this case study is its findings relating to the complexity of using this institutional innovation in the context of transitional China. The creation of a green electricity market can be perceived as an institutional innovation to restructure energy markets that is also associated with broader issues of policy and governance.

Our findings suggest that local contextual conditions played an important role as local drivers and pre-requisites for Shanghai to pioneer a green electricity market. Its cosmopolitan culture, its location as headquarters of international corporations, and its distinctive policy style are key prerequisites that allow Shanghai to take the lead ahead of other provinces.

There are various policy implications of these findings. Cities may possess a broad variety of contextual factors. Some of the local contextual factors found in Shanghai appear to be highly endemic – they are specific to the city and have particular historical, political and socio-economic roots. These contextual conditions may not be found in other Chinese cities, and may not be easily imitated by others, and are unlikely to be created and imposed by the central government in a top-down manner. A policy implication for the central government is that national policies for supporting cities in their pursuit of sustainability may need to pay attention to the local diversity of contextual conditions that may facilitate or constrain the efforts of cities to move towards greater sustainability.

Our analysis also reveals that local institutional capacity is associated with broader issues of governance. Shanghai's attempt to use this form of MBI revealed deeper tensions between the changing role of the Shanghai Government and institutional inertia. Moreover, the positive and negative dynamics between the central and local governments that influenced the effectiveness of the Scheme illustrate another aspect of governance that needs to be addressed.

The use of this form of MBI, although presenting new opportunities to facilitate the technological diffusion of renewable energy more effectively, requires more substantial changes in the role of government in market-building. The capacity of a local government to introduce organisational and institutional changes and the capacity to integrate policy appear to be priority areas that need attention. The central government should also strengthen the regulatory and policy frameworks at the

national level to support city initiatives in mobilising local resources and capturing local opportunities to advance towards sustainability goals.

Our analysis also suggests that there is also a need to overcome institutional inertia among existing players, particularly grid companies, in China's electricity sector. The SMEPC, the grid company in Shanghai, has no incentive to develop new functions or to acquire new skills even though it was the designated body to supply and market green electricity. To overcome the institutional inertia however is a challenging task in the context of transitional China because many key issues relating to power market liberalisation have yet to be resolved by the on-going power market reforms.

Although our findings are specific to a particular city (Shanghai) and are issue-specific (renewable energy) in the context of sustainable development, they are consistent with the Chinese literature on other MBIs in that the changing role of state and capacity building are key factors influencing the effectiveness of such innovative policies (see for example Tao and Mah, 2009). We therefore expect that our findings can be generalised in the Chinese context in relation to a wider range of MBIs particularly emission trading and the Clean Development Mechanism.

This paper has implications for future research on the cities and governance for sustainable development in China context. Future research could examine how to improve local governance systems so that they can respond more effectively in the sustainability transition. Future research could also examine and contrast the application of different MBIs in the context of sustainable energy in China. A comparative study of green electricity markets, emission trading and CDM in China would be likely to generate instructive knowledge because these MBIs have a shared need for local capacity building, institutional change, central-local policy coordination, and collaboration between state and non-state actors.

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Appendix 1: List of Interviews

Code	Interviewees Background	Types of interview	Date of interview
BJ/01/2005	A former senior researcher of the Energy Research Institute of NDRC	FI	Mar 22, 2005
BJ/02/2006	Wang Wanxing, Program Officer for Electric Utilities & Renewable Energy, The Energy Foundation	FI	Oct 26, 2006
SH/01/2008	A senior officer from Energy Conservation and Environmental Protection Department, Economic Commission, Shanghai Municipal People's Government	FI	Jun 4, 2008
SH/02/2008	A mid-ranking manager in the Shanghai Municipal Electric Power Company	EC	Nov 26, 2008
SH/03/2010	A mid-ranking manager in the electricity sector in Shanghai	EC	July 1, 2010
SH/04/2010	A representation of an energy think-tank in Shanghai	TI	June 23, 2010
SH/05/2006	Same interviewee as in SH/01/2008	FI	Sep 25, 2006
SH/06/2006	Zhou, Guoping, Director, General Research Division, The Development Research Centre of Shanghai Municipal Government	FI	Sep 28, 2006
SH/07/2008	Same interviewee as in SH/03/2008	TI	Jun 24, 2008
SH/08/2006	A senior executive of the Shanghai Municipal Electric Power Company	FI	Sep 6, 2006
SH/09/2008	A Senior Engineer of Shanghai Wind Power Co. Ltd.	FI	Jun 2, 2008
GD/01/2006	Yang Ailun, Campaigner, Greenpeace China	FI	Jan 7, 2006

FI: Face-to-face interview

TI: Telephone interview

EC: Email correspondence