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Energy conservation through energy service companies: Empirical analysis from China

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ABSTRACT. – *China's energy-service companies (ESCOs) have developed only modestly despite favorable political and market conditions. We argue that with sophisticated market institutions still evolving in China, trust-based relations between ESCOs and energy customers are essential for successful implementation of energy efficiency projects. Chinese ESCOs, who are predominantly small and private enterprises, perform poorly in terms of trust-building because they are disembedded from local business, social, and political networks. We conclude that in the current institutional setting, the ESCO model based on market relations has serious limitations and is unlikely to lead to large-scale implementation of energy efficiency projects in China.*

Keywords – energy policy, energy service companies (ESCOs),China

1. Introduction

Experts, academics, and industry leaders generally agree that the market for energy-service companies (ESCOs)[1] has a huge potential in China (Gan, 2009; Li and Colombier, 2009). China's ratio of energy use to GDP (i.e., energy intensity) is one of the highest in the world, 1.5 times the world average (IEA, 2010), pointing to untapped potential for ESCOs to improve the country's energy efficiency. The Chinese government has also been stressing and actively supporting energy efficiency measures in the last decade. In 2006, the National People's Congress approved the incorporation of a self-imposed national energy intensity reduction target in the 11th Five-Year Plan, and the central government signed contracts with 1000 of China's highest energy-consuming enterprises to increase energy efficiency (Price et al., 2010; Zhou et al. 2010). In April 2010, the State Council issued Document No. 25 calling for an accelerated development of China's energy saving service industry (State Council Document No. 25, 2010).[2] In addition to these formally promulgated targets

and national commitments, provincial governments and cities such as Beijing and Shanghai have formulated additional local policies to support the ESCO industry. For instance, in 2008, Shanghai set up a special fund to promote ESCO projects (Chen and Xu, 2010: 2).

Under such favorable market and political conditions, one would expect ESCOs to thrive. Yet, the development of the ESCO industry in China is far from reaching its significant potential (Gan, 2009; Li and Colombier, 2009; Limaye and Limaye, 2011) and even lags behind that of other developing countries. For instance, even though Brazil's primary energy demand is roughly 11% of China's and its energy intensity about half of China's (IEA, 2010), Brazil's ESCO industry dwarfs China's by a factor of over two (Delio et al., 2009: 12). Despite all of the potential, ESCOs have remained largely a marginal player in delivering energy efficiency goals in China. Some even claim Chinese ESCOs are a case of market failure with a limited ability to implement energy efficiency at a large scale (Hasnie, 2009 quoted in USAID, 2010: 11; World Bank, 2010). This begs the questions: why has the ESCO industry been a disappointment in China? How well are China's ESCOs placed to implement energy efficiency measures? What are the main challenges that hinder the success of the ESCO model in China? How might ESCOs structure their business plans to mitigate these challenges?

Based on on-site fieldwork, this article develops an analytical framework to explain why most ESCOs in China do not operate efficiently or effectively in the market. Using the theories of asymmetric information (Akerlof, 1970; Rothschild and Stiglitz, 1976), transaction cost (Coase, 1937; Williamson 1975, 1985) and network embeddedness (Granovetter, 1985), we hypothesize that trust generated through social networks and relations enables firms to overcome a general market failure in the

Chinese ESCO industry. Not all ESCOs are failing to grow. For many private ESCO firms, it is precisely their inability to place themselves in trust-generating networks with clients that undermines their growth potential. Public ESCOs or those spun off of state-owned enterprises (SOEs) are in a better position to serve clients, the majority of whom are government agencies, public institutions, and heavy industries (which are usually SOEs), and scale up rapidly because they are embedded in networks that foster trust. Our findings demonstrate that, among other factors, the success of the ESCO model in China depends critically on the formation of trustworthy relationships between ESCOs and potential customers. In short, the ESCO industry in China is characterized by a system of relational governance based on trust. Yet, most participants have been operating their business as if they are in a system of market governance or have been busy trying to recreate such a system, essentially copying the one they were accustomed to in Western countries where the ESCO sector first originated. This institutional mismatch is the most critical challenge for the industry's growth.

The analysis draws from over 30 semi-structured interviews in 2011 with Chinese and international ESCOs located in Beijing, Baoding (Hebei), and Dalian (Liaoning), members of the Chinese Energy Management Company Association (EMCA), and energy experts. Four cases, each representing a distinct mode of ESCO operation, are presented to illustrate in-depth the role of trust and networks in China's ESCO industry. The company cases are "most different" in their ownership form, size, and regional location and demonstrate how different characteristics affect ESCOs' ability to get access to and develop business opportunities.

2. Development of China's ESCO Market

Table 1: ESCO Activity in China

Year	ESCOs *(in Numbers)*	Total Value of ESCO Projects *(in million US$)*	Annual Investments in Energy Performance Contracting *(in millions US$)*	Tons of standard coal reduced *(Mtce)*
1998	3	0	4	0
2001	3	50	4	N/A
2003	3	270	22	N/A
2004	60	514	94	6
2005	106	723	242	14
2006	134	1,263	277	15
2007	185	3,314	1,033	53
2008	N/A	6,386	1,786	N/A
2009	502	8,994	2,989	N/A
2010	N/A	12,798	4,400	N/A
2011	523	N/A	N/A	N/A

Source: World Bank (2008), Delio et al. (2009), Chen and Xu (2010), Financial Times (2010), EMCA (2011)

Although it is indisputable that the overall number of ESCOs and their investments have been growing in China, obtaining reliable figures is challenging and many of the officially reported numbers are misleading. For instance, a reputable expert in the field claimed that "there might be 10 ESCOs in China" (Interview 051811), while another concurred that most Chinese ESCOs are not "real ESCOs because ESCOs are supposed to create a unique solution for the client, but Chinese ESCOs just sell the product that they make" (Interview 051211). On the other extreme, in March 2011, the central government's list of officially approved ESCOs totaled 984 (NDRC and Ministry of Finance, 2010 and 2011).[3] Most observers believe the majority of these are "phantom" companies merely taking advantage of the ESCO status to receive financial and tax benefits that were introduced in 2010 to promote the ESCO industry (Interview 051211). According to experts, "these ESCOs know almost nothing about

energy performance contracting (EPC)" (Interview 051211), and "70-80% have never done ESCO-related work" (Interview 050811). A long-time industry insider put it rather succinctly: "Everyone is called an ESCO" (Interview 051211).

The consensus among industry experts is that China's ESCO industry is rather underdeveloped. On average, ESCOs in China remain small,[4] are concentrated in a few big cities,[5] and "instead of offering entire energy solutions by combining different systems together, current investments are made only in standardized energy-saving projects such as changing light bulbs, motors, or broilers" (Interview 051211). Many ESCOs "do not dare to change entire production processes, as in the beginning it is much easier for clients to accept smaller changes" (Interview 051011). Different studies thus describe China's ESCO industry as "immature and short-sighted" (Li and Colombier, 2009: 2), lacking technical skills and capacity (Wang et al., 2008: 1881), predominantly selling energy efficiency products instead of services (Li and Colombier, 2009), and "lack[ing] the capability to contribute large-scale energy efficiency on the demand side" (USAID, 2007: 21).

3. Barriers to the Development of an ESCO Industry in China

ESCOs are expected to play an important role in promoting energy efficiency around the world, but numerous barriers often prevent the full growth of the ESCO industry in both developed and developing countries (Vine, 2005). Although the context in each country differs, the most important challenges facing ESCOs can be classified as market barriers (e.g., unfamiliarity with EPC, poor energy pricing policies, lack of government support), institutional barriers (e.g., weak legal and contract enforcements, high administrative hurdles, unfavourable tax regimes), financial barriers (e.g., high

credit risk of energy efficiency projects, inexperienced banking industry), technological barriers (e.g., absence of advanced energy measurement and verification technologies), and educational barriers (e.g., lack of qualified professionals) (Vince, 2005).

3.1. Barriers to the ESCO Industry in China

Existing research on China has also attributed the stunted ESCO market development to a variety of market, institutional, financial, technological, and educational barriers (Wang et al., 2008; Gan, 2009, Singh et al., 2009; Limaye and Limaye, 2011). The overriding assumption in the literature is that once these barriers are lifted, ESCOs will be well equipped to help China improve its energy efficiency. The underlying argument is that what the Chinese ESCOs need are simply the "right" market conditions: a highly marketized system of governance supported by well-functioning financial intermediaries and legal institutions to enforce contracts. While these barriers may be important for the growth of the ESCO industry in China in the long-run, in the following we argue that, in the context of contemporary China, in addition to these factors, trust and networks are critical features shaping current market outcomes.

3.2. China's ESCO Industry: Asymmetric Information and High Transaction Costs

Most ESCOs in China operate in an environment where transaction costs are extremely high. There are several sources of high transaction costs, but three are most fundamental: i) a new product or service whose quality is hard to discern; ii) the eclectic nature of the product itself; and iii) the long-term and recurrent nature of

transactions when outcomes are perceived to be uncertain because of the above two reasons.

First, the ESCO industry is relatively new in China and "no one understands the name ESCO" (Interview 051211). The majority of ESCOs are less than two years old (AFD, 2008a). From product and service to technology to financing mechanism, an ESCO "product" is a novel concept to most Chinese clients. Nonetheless, novelty in and of itself does not create high transaction costs. In the case of an ESCO, it is novelty combined with the sophisticated and non-commodified nature of its product that creates high transaction costs. ESCOs usually thrive on unique technologies, products, and financing methods. In highly marketized Western economies, ESCOs realize their growth potentials essentially by carving out a niche in the market through provision of customized solutions to clients. In China, however, such an approach may not be an advantage. From a consumer's perspective, the quality of an ESCO product is very difficult to discern – a classic case of asymmetric information (Akerlof, 1970; Rothschild and Stiglitz, 1976). In fact, many market observers and experts complain that Chinese customers (and financial institutions) distrust ESCO activities (Gan, 2009; Limaye and Limaye, 2011). But, their criticism is misplaced; customers simply do not understand what an "ESCO product" is or how to evaluate it (Interview 051811). A general manager of a small Chinese ESCO in Beijing notes that "unlike usual projects, where it is easy to estimate the value of the projects, it is really hard to count the amount of energy saved, so the banks find it hard to assess the project value.[6] As a result, the banks are careful to provide loans to ESCOs" (Interview 052011). Hence, customers and banks shy away from entering a contract with an ESCO, resulting in market failure. Even if transactions do occur, the market would be in a suboptimal equilibrium. ESCOs that offer high quality products and

services would particularly suffer, because customers would likely lump them together with incompetent ESCOs. If the problem persists, the former might even drop out of the market altogether, furthering the downward cycle towards market failure.

Furthermore, ESCOs work under the banner of "energy service" or "energy management," but in reality, they do not offer a single product. Over the years, the ESCO sector has evolved to include many different types of organizations that allegedly use the same "ESCO" concept or model, including energy suppliers, engineering firms, equipment manufacturers, building management companies, construction management companies, and electric contractors. Under the ESCO banner, hundreds of dissimilar services and technologies are offered to customers. From the consumer's perspective, it is again very difficult to evaluate an ESCO product because it is not a *single* commodity. Even if customers have a way to evaluate different products, the search cost to find the most suitable product is extremely high. All of these result in high transaction costs, rendering customers vulnerable.

Vulnerability cuts both ways, however. It is well documented in transaction cost economics that transactions characterized by complex, recurrent, and long-term relations are frequently jeopardized by "opportunism,"[7] especially when the items being exchanged possess qualities that are not easily measured (Williamson, 1975, 1985). In other words, there is always a risk that a party may default on a contract, and the resulting loss is proportionally greater if investment is specific to the transaction. Indeed, one of the most common issues for Chinese ESCOs is that Chinese customers do not abide by the original contract (Interview 041811, Interview 051211). According to the founder of a medium-sized private ESCO, "it is very hard

to find good energy projects in China as there is little or no payment guarantee. We are very strict in picking clients, as our customers have refused agreed payments in the past, and it took a lot of time and convincing to eventually get the money back, if at all" (Interview 052511). Chinese customers are also known to perceive and fear opportunistic behavior on the part of ESCOs as well, stemming primarily from the uncertain outcome of the transaction (AFD, 2008c; Gan, 2009). In either case, fearing and expecting that opportunism exists in their transaction, the parties refrain from doing business in the first place, which again results in market failure.

In short, an ESCO product or service is far from being adequately defined, let alone standardized, from the consumer's perspective. Under the context of imperfect information, long-term transactions characterized by ESCOs are further plagued by the specter of opportunism. The consumers' inability to evaluate the quality of the good, the lack of credible information, the hodgepodge nature of variegated products, the high search cost, and the risk of opportunism naturally create high transaction costs. In these circumstances, one should expect a general market disequilibrium, if not market failure. We contend that this is precisely the current state of the Chinese ESCO sector.

3.3. Low Sophistication of Intermediaries

Theoretically, the problems of transaction cost and market failure should be applicable to most developing countries where the ESCO sector is relatively new. In other words, there is no reason why ESCOs in China should under-perform compared to their counterparts in other developing countries. We argue that compared to their counterparts in other developing countries, under the current economic context, most

Chinese ESCOs do not have the means to reduce transaction costs effectively and have done a poor job of doing so, precisely because they are private ESCOs. Our research findings show that compared to their private counterparts, public ESCOs are in a better position to serve clients in large part because they can more effectively mitigate transaction costs.

There are two main channels through which transaction costs are reduced in a market. The first is through establishment of intermediaries. In highly developed market economies, these are usually legal institutions, financial intermediaries, certification systems, and regulatory institutions. This is precisely the reason why so many ESCO experts and industry leaders are exhorting the Chinese government and banks to establish a quality certification system and revise the "outdated" loan rules (Ürge-Vorsatz et al., 2007:13; Gan, 2009:699).

However, in China today, this route does not seem to be a viable option for ESCOs. First, if the history of advanced industrialized countries is any indication, these "hard" institutions take decades to develop. Second, the development of intermediaries also requires a high level of sophistication and technological knowledge on the part of intermediaries themselves. For instance, when banks consider giving loans to ESCOs, they have to evaluate the financial viability of the product in question, which in turn requires probing into the technical aspects of the product. ESCOs themselves bring new, innovative financial instruments to the market, which adds more burden on the financial and legal systems to upgrade their ability to handle complex financial transactions. In China, such sophistication on the part of intermediaries has been almost non-existent. In fact, in the history of market economies, sophistication of institutions has usually been a product of market development and maturation, not the cause (Demsetz, 1967; Finley, 1973; North, 1990).

3.4. Networks and Trust

What most observers of Chinese ESCOs fail to consider is what customers and buyers rely on to carry out their transactions in the absence of hard institutions. It is a "soft" institution – namely, trust – between the parties that enables market transactions to materialize. Two parties with mutual trust are "willing to be vulnerable" (Mayer et al., 1995), because what they trust is not the product in question *per se*, but the person or organization behind the product. From the consumer's perspective, even if she does not have all of the necessary information about product quality, confidence in the seller can impel her to enter a transaction that otherwise would not have occurred. The seller, expecting that the buyer is not going to renege only two years into a ten-year contract, for example, would also be more willing to enter a transaction. In other words, trust – a form[8] of social capital[9] (Loury, 1977; Bourdieu, 1985; Coleman, 1990) – greatly reduces transaction costs by mitigating the problem of lack of credible information, by rendering complex details of a contract less imperative, and by reducing or eliminating both *ex ante* and *ex post* opportunism. In the extreme case, hard institutions become unnecessary, because "[n]o lawyer need apply for business transactions underwritten by this source of social capital" (Portes, 1998: 9). For instance, ESCO contracts in the US are hundreds of pages while in China they are typically two pages. Chinese ESCOs and customers tend to fill in the details informally as the project moves forward (Interview 042211). Empirical studies show that even in economies where well-developed formal institutions exist, trust complements them, further improving inter-organizational exchanges (Zaheer and Venkatraman, 1995; Poppo and Zenger, 2002).

Trust in turn is primarily engendered in social relations and networks (Granovetter, 1985; Coleman, 1990; Powell, 1990; Burt, 1992). This happens in a number of ways. First, social ties embedded in networks facilitate two types of information. Reliable information about the quality of the product in question can be obtained through other actors in the network. The best such information is that which comes from someone with whom you have had repeated interactions and found to be reliable (Axelrod, 1984). The other type of information may be more important: information about the quality of the seller (or buyer) is also transmitted through networks. A buyer tends to trust someone whom she either knows personally from a previous positive experience or who came recommended from someone else in the network. In this case, what the buyer trusts is not the quality of the product *per se*, but the person who embodies the product. It is known that Chinese consumers evaluate the trustworthiness of an ESCO company rather than the product being offered, prompting some to suggest that they are "irrational" (Gan, 2009).[10]

Second, networks can produce a sort of certification of the actor's social credentials (Rousseau et al., 1998; Lin, 1999), especially if it comes from an authority figure within the network. When an authority figure "puts in a good word" on behalf of someone, it not only signals information about the latter's reliability, but it also reflects the latter's ability to navigate the network and "get things done." Perceiving this, other actors would be more inclined to conduct business transactions with such a person. Third, social relations constrain members to be beholden to reputation, which manifest itself as a mechanism of social control against malfeasance (Coleman, 1988; Powell, 1990; Portes, 1998). In a market overlaid with social relations and networks, an act of malfeasance can damage one's reputation not only in the business realm but also in the social realm. Moreover, it can also damage the reputation of others who

stood behind you. Thus, the collectivity of the network itself acts as a moderator and guarantor that transactions will be honored.

Recent empirical studies have shown that such a system of *relational governance* (Dwyer et al., 1987; Macneil, 1980) mediated through networks and trust is an efficient form of organizational structure (Palay, 1984; Saxton, 1997; Zaheer et al., 1998). That relational governance is relevant in the Chinese economy has also been empirically identified (Wank, 2001; Zhou et al., 2008). Our empirical research suggests that, especially in the absence of advanced formal institutions, the Chinese ESCO market is also characterized by relational governance (Interview 052011). However, to date, most ESCOs in China have been conducting business as if they were in a system of market governance. In fact, the involved actors have been trying to recreate the market governance model in the West because ESCOs there have developed quite successfully (Interview 042511; Interview 051211). This is reflected in two facts: i) almost all ESCOs are private enterprises; ii) their propensity to enter the market and deal with customers predominantly through market governance supported by written contracts and other legal institutions.

In the following section, we use four specific cases to illustrate that China's ESCO market is marked by a relational governance structure under the current imperfect market situation fraught with asymmetric information and high transaction costs. The case studies illustrate why public ESCOs or ESCOs that are subsidiaries of SOEs are better able to reduce transaction costs in the Chinese market context and thus might be particularly suited to grow and contribute to energy efficiency goals.

4. Case studies

The case studies differ in their founding organization. Case study 1 is a private company in Beijing and is most representative of the sector. Cases 2 and 3 are founded by a Chinese non-governmental organization (NGO) and a provincial government, respectively. The two companies in Case 4 are also private companies. However, they have access to wider business, social, and political networks and thus contrast mostly sharply with Case 1, in spite of the same legal status.

Table 2: Case Study Summary

	Case 1 Disembedded Private ESCO	**Case 2 NGO-affiliated ESCO**	**Case 3 Public ESCO**	**Case 4 Embedded Private ESCO**
Company	ClearWorld	Dalian East Energy Development	Fakai Company (Super ESCO)	Suzhen; Runli
Founding organization	Private	NGO: Global Environmental Institute	Provincial government: Hebei DRC (with USAID support)	Private
Location	Beijing	Dalian (Liaoning)	Hebei	Suzhen; Baoding (Hebei)
Investment capacity*	Low	Medium	High	Medium
Number of clients	NA	3	NA	11
Level of trust between the ESCO and clients	Non-existent or limited	Limited	High	High
Network scope	Limited	Binodal	Multi-nodal	Multi-nodal
Main challenges	Opportunism; locating new clients	Expanding client base	Technical expertise	Expansion to other regions

Source: Authors

4.1. Case 1: Disembedded Private ESCO

The majority of ESCOs in China are small and privately-owned (World Bank, 2008; AFD, 2008b: 10). Most of these companies "jumped" into the Chinese ESCO market because of China's rising demand for energy efficiency and hence perceived

business opportunities (Interview 051211). However, even from the beginning, private ESCOs face difficulties in penetrating the market and building a clientele base, largely because they lack relational resources (Interview 042211). While they consistently stress the importance of "networks," "connections," "*guanxi*," and trust-building, most private ESCOs simply do not know how to form such ties (Interview 041811; Interview 042211; Interview 042511). Interviewees emphasized the difficulties in linking with key customers and accessing financial credits, symptoms of their exclusion from systematic networks and relations. Hence, it is difficult for private ESCOs to create institutionalized trust between themselves and customers and financial institutions.

Lacking strong networks themselves, private ESCOs then turn to other ways to expand their business. A common strategy in many countries is to approach an ESCO association (Vine, 2005; Ürge-Vorsatz et al., 2007). China also has an ESCO association of its own: EMCA.[11] However, while EMCA might be functioning as a loose network among many Chinese ESCOs, the association itself is disembedded from a broader network that encompasses customers, financial institutions, and public institutions. An EMCA official described the association as an "information platform" that mainly disseminates policies and regulation regarding energy conservation (Interview 051811; for additional information on the EMCA, see also Gan, 2009). Therefore, EMCA does not function as an institution through which credible information about *both* ESCOs and customers can be facilitated and shared by both parties. In addition, EMCA also lacks the ability to certify members' business or social credentials and does not have the ability to sanction malfeasance. In addition to EMCA membership, some private ESCOs try to market themselves but they usually end up engaging in activities with low profit margins, such as a mere consultancy role

(Interview 042211). Many private ESCOs are forced to exit the market within a couple of years (Interview 051211) or "stop working as an ESCO and just lease equipment" (Interview 051911), while still insisting that enormous opportunities exist in the market. Most private ESCOs do not know why they failed; yet, placing the blame on lack of "connections" is nearly unanimous (Interview 041811; Interview 042511; Interview 051211). It is safe to deduce that even if a typical private ESCO is embedded in some kind of network (e.g., EMCA), it possesses neither "dense" ties (Coleman, 1990) nor "weak ties" (Granovetter ,1973; Burt, 1992) through which they can advance their interests.

For example, ClearWorld Energy is a private Beijing-based venture capital fund founded in 2003. It was incorporated as a subsidiary under the global clean energy provider Camco in 2006, and subsequently set up an ESCO to enter the waste recovery business. As with most small private ESCOs, ClearWorld had difficulty finding clients and establishing its credibility and reputation in the sector. Nonetheless, technologically, the company offered a sound solution to clients, as indicated by customer satisfaction and the fact that projects were profitable (Interview 041811). The real problem surfaced when the company's customer relations turned sour. After a relatively stable customer relationship that benefited ClearWorld with consistent cash flows in the beginning, its customers – satisfied with the energy savings already achieved thus far – suddenly refused to pay anymore. The problem was compounded by the fact that a standardized EPC or a sophisticated method to monitor energy savings do not exist in China. According to a Camco employee, the company began to distrust customers because "when the client's factory is 200 miles from the office, we have no way to ensure how much energy was saved and thus our payments are not

secure" (Interview 051011). Without customers' cooperation, ClearWorld was unable to verify any information; hence, their return on investment quickly turned negative.

This problem of *ex post* opportunism is faced by many small private ESCOs in China (Vine, 2005; Gan, 2009) and stems from the nature of both the product and the transaction. What is more revealing is that ClearWorld lacked effective means to mitigate this transaction cost. First, institutionalized trust was lacking from the beginning. Second, operating from Beijing, ClearWorld never had ties with the regional business and government networks within which the customers are embedded. As such, the company lacked the ability – indeed, legitimacy – to make moral claims on the latter's local networks to sanction the act of malfeasance. On the contrary, moral sanctioning actually went the other way around. As the problem escalated, ClearWorld's customers persuaded local government authorities to step in on their behalf, publicly harass and embarrass ClearWorld, and block the company's access to materials. Being disconnected from the local networks, the company was never able to build shared norms with the very actors who would have served the role of social police. The incident left one of the observers convinced that a "Chinese ESCO model" should be localized and include local officials or politicians (Interview 041811).

Over time, ClearWorld became conservative and now predominantly works with private companies who are willing to undergo time-consuming due diligence. But by doing so, the company is restricting the scope of its business opportunities and thus ultimately its growth. In fact, a company consultant confided that Camco now has a strong preference for foreign customers "because of similar culture that makes it easier to trust each other" (Interview 051011). Many private ESCOs share a similar experience. For instance, Ecosystem, Canada's largest ESCO, initially identified more

than 100 clients in China, but eventually decided to drop all but ten of them. Even after careful background checks on the ten clients, the company constantly felt "scared" (Interview 051211). While in North America Ecosystem usually signs 8-10 year-long contracts, in China they sign 2-3 year-long contracts because "even five years in China is too risky as we do not trust the clients" (Interview 051211). Building trust, according to Ecosystems' Regional Manager in China, "requires face to face interactions for a long time. We start by making simple changes, and after a year we focus on bigger projects" (Interview 051211). That the market failure in the case of Camco can be explained as a byproduct of lack of social relations and networks that offer collective assets like trust, credentials, reputations, and sanctioning is further substantiated by cases of more successful private ESCOs that we discuss in Case 4.

4.2. Case 2: NGO-affiliated ESCO

NGO-affiliated ESCOs, already in possession of an institutional affiliation, are often better at overcoming market failures than most private ESCOs. Initial market entry, for instance, is easier for the former, as the sponsoring NGO often facilitates seed money usually in the form of a grant from an international agency. This way, the need for capital from Chinese banks – and hence the need to build networks and trust with them – is obviated (at least initially). However, NGO-affiliated ESCOs' overall growth is also constrained by many of the same factors.

For example, Dalian East Energy Development, Ltd. (DEED) is an ESCO based in the northern city of Dalian and specializes in waste heat recovery technology. The ESCO was set up in 2006 as a joint venture between Dalian East, Ltd., Dalian East

Energy Development Holding Company, Ltd., and the Global Environmental Institute (GEI), an NGO based in Beijing. In the case of DEED, GEI and the firm's manager and CEO served as the main network nodes. GEI initially helped establish the business, particularly in acquiring seed capital, which was obtained through a grant from a US foundation (Interview 041511). On the other hand, DEED's clients – all of whom are private cement factories in Zhejiang, Fujian, and Liaoning – were found through the social networks of the company's manager and CEO. Both were previously involved in the cement industry; one used to be in a government department regulating the industry and the other used to work in cement factories. Their personal government network and industry network proved valuable in completing initial transactions (Interview 042111). The manager and CEO introduced to DEED clients whom they knew to be trustworthy from their previous work relationships. Clients, on the other hand, made a "leap of faith" in DEED because they had dealt with the company's important personnel in the past and found them to be credible.

Firmly rooted in such relations, DEED was able to rely on trust to maintain business relationships and did not have to face the most egregious type of problem that many private ESCOs like ClearWorld have to deal with: opportunism. The general manager of DEED emphasized that since it takes more than three years to see any return on initial investments, it is critical for the ESCO to establish and maintain an amicable long-term relationship with the clients. DEED was able to achieve this mainly by building upon common past experiences between the clients and its executives. Disputes and arguments arose between DEED and the clients frequently, but the manager and CEO managed to resolve them through direct communication

and through recalling positive past experiences (Interview 042111). As a result, DEED's customers in all three projects have been paying on time (Interview 042111).

Nevertheless, DEED's growth and expansion to other sectors is seriously hampered. This is primarily because its two main network resource providers – the manager and CEO of DEED and GEI – are limited in their network scope and do not occupy strategic network locations. For instance, DEED's manager and CEO might have dense or strong networks within the cement industry, but do not possess cross-sectoral networks needed for continued expansion and growth. In other words, the nature of their networks is bi-nodal, stretching only between themselves and a number of clients within one industry. In fact, even within the cement industry, it is doubtful that DEED has dense networks. China accounts for 47% of the world's cement production, including more than 5,000 plants operating in 2005, and it is known that an enormous demand for energy efficiency projects exists in the industry (IEA/ OCED, 2010; Andrews-Speed, 2009:1336). That DEED was able to enlist only three projects in six years is telling, especially when compared to more successful private ESCOs that we illustrate in Case 4 below.

Second, both DEED and GEI are essentially removed from the actual project sites in Zhejiang, Fujian, and Liaoning. The company was not keen on embedding itself in local relations that encompass other important actors such as local governments and financial institutions,[12] further limiting its ability to expand to other sectors even within the three localities. Lastly, unlike some Chinese NGOs that have an institutional "sponsor" – usually an organization in the government – who can act as an authority figure or a guarantor, GEI is an independent NGO that does not have such ties. Hence, opportunities to enlist the help of a higher level institutional player

to mitigate information problems and to "put in a word" for the firm, especially when seeking new customers in the public sector and SOE sector, are scant.

In short, lacking "network bridges" (Granovetter, 1973; Burt, 1992) and disembedded from local networks, DEED was unable to build trust with potential customers in other sectors and in other regions. Hence, the company (as well as customers and financial institutions) began to perceive and fear some of the same problems that many private ESCOs face. As a result, even though its technology is portable to other industrial processes, once the opportunities were maximized in these three isolated cement projects, there was no more clientele base for DEED. Once the foreign capital dried up, the firm was unable to convince Chinese banks to offer loans; nor could it guarantee to the banks that its new customers are going to make payments on time. As of late 2010, DEED's shareholders decided to halt embarking on any new ESCO projects. At the same time, however, DEED's general manager still insists that "this is a good business" and that he sees huge opportunities in the market (Interview 042111).

4.3. Case 3: Public ESCO

The newly emerging "public" ESCOs have drastically different experiences in the market, as epitomized by Hebei Fakai Scientific Electricity Services Limited Liability Company in Hebei Province. Fakai was established by Hebei Province Demand-Side Management and Instruction Center (DMS Center). The DMS Center in turn is fully invested by state-owned capital and directly established by the provincial Development and Reform Commission (DRC) to promote energy efficiency and demand-side management (DSM) in the province (Interview 052011). Hebei DRC

strongly support the DMS Center as the province now faces lots of pressures to meet provincial energy saving goals since the inclusion of binding provincial energy efficiency targets in China's 11th and 12th Five-Year Plans (Interview 051911; Kostka and Hobbs, 2012). Also referred to as a "super ESCO" by Limaye and Limaye (2011), Fakai is legally a separate, independent entity, but its provincial government provenance and DRC's support are widely known (USAID, 2009; Limaye and Limaye, 2011).

While Fakai's establishment met with much fanfare, its ultimate success is by no means guaranteed. In fact, most of its projects are in the initial stages, and hence it is premature to evaluate the firm's overall performance. Furthermore, some observers note that Fakai is still largely a government entity whose core personnel is made of "a group of young, passionate professionals with master degrees but not much experience in the industry" (Interview 051911). They lack the necessary technical expertise to evaluate and monitor ESCO projects, to create investment portfolios, or to design sophisticated contracts. An investor of Fakai said: "Fakai still has a long ways to go. Its future success will depend on whether it can build up real ESCO capacity" (Interview 051811).

Nevertheless, Fakai's experiences operating in the market have already been very distinct from those ESCOs in Case 1 and Case 2. For instance, whereas approximately 97% of ESCOs face financial barriers (EMCA, 1997 cited AFD, 2008c: 8), procuring capital has not been a key issue for Fakai as "loans are easy to get from domestic banks if Fakai can pass banks' standard approval procedures" (Interview 052011). By 2010, the total investment was 100 million RMB (equals to approximately 16 million US$), and it is expected that between 2011 and 2013, investments will increase to 1.6 billion RMB. The required investment of equity by 2010 was 90 million RMB

(Climate Technology Initiative, 2009). In July 2010, Fakai successfully acquired US$8.5 million from private financial institutions, with which it signed a contract with the Longhai Steel and Iron Company in Hebei to install a heat recovery system and steam-powered turbines that will use the facility's own waste heat to generate electricity (Interview 050811; Interview 052011).

The provincial DRC's impact on Fakai's rapid development is undeniable. One view is to stress the size, capacity, and financial resources that come along with a government affiliation as the main driver behind Fakai's development (USAID, 2010; Limaye and Limaye, 2011). While we do not discount the importance of such firm-level attributes, from the perspective of asymmetric information and transaction costs, the affiliation with DRC also provides network-level resources. DRC acts both as a conduit for credible information for both parties to a transaction, an authority figure to guarantee Fakai's credentials, and a social police against malfeasance.[13] This is especially important in China because ESCO customers are typically public entities such as audit department, and projects that have the most potential for energy savings are public projects such as LED street lights (Interview 052011). Public agencies find it more comfortable to work with Fakai, especially compared to working with private ESCOs (AFD, 2008c: 9). Among other reasons, it is because public agencies know who they are dealing with, namely DRC. In their view, it is almost impossible for DRC to walk out on them.

Similarly, with respect to potential clients, Fakai has "access to a pipeline and projects information through DMS and DRC" (Interview 051811) with which it has created a "strong supply and demand network with vendors, customers, and clients in SOEs and heavy industries" (Interview 051911). DRC knows and has repeatedly dealt with "the key decision-makers in the target enterprises" (USAID, 2010: 19),

especially those in the state sector, and thus facilitates a credible "dialog between the financial institutions, [the ESCO], and energy users" (USAID, 2010: 18). Whether valid or not, the client enterprises *perceive* a minimum level of quality guarantee. Fakai, on the other hand, even though it never had a working relationship with a particular enterprise, is led to believe that there is a reduced risk of *ex post* opportunism. As a manager of Fakai noted, "Fakai gains a lot of client information through the DMS Center, as it will request information reports from companies in the name of government. Thus, it has a pool of rather comprehensive internal information about potential clients and projects" (Interview 052011). As a consequence of reduced uncertainty, banks are more willing to provide loans.[14] Consequently, Fakai was able to quickly build strategic "alliances and partnerships with existing enterprises" across multiple sectors in Hebei (USAID, 2010: 17).

Fakai's dense and cross-industry, multi-nodal networks in turn worked to further signal its social credentials, as new customers began to perceive it to possess rich network resources. For instance, ECO-Asia Clean Development and Climate Program – a program under the auspices of US Agency for International Development (USAID) – chose to work with Fakai in 2009. Fakai's strategic alliances and partnerships were cited as one of the main reasons why ECO-Asia decided to work with the ESCO; the probability of success seemed higher (USAID, 2010; Interview 050811). In other words, potential customers are led to trust that its abundant network resources will enable it to "get things done" in the murky, uncertain, and complex Chinese ESCO market. Public agencies also have a similar perception. When asked about Fakai's ultimate decision maker, an employee responded that "the head of the DMS center makes all of final decisions. He is a government official and the top leaders in other government agencies care a lot about the fact that a government official is behind

Fakai" (Interview 052011). As customers flocked in and Fakai was able to successfully sign a contract with Xingtai Longhai Steel and Iron Company, a leading SOE in Hebei, Fakai quickly built reputation within the network, and a sort of self-fulfilling prophecy was the result (Interview 050811).

In recent years, the newest phenomenon in the Chinese ESCO industry is the ascent of SOE-affiliated or –owned ESCOs. According to EMCA (Interview 051811), China's largest energy-consuming SOEs such as State Grid, Baosteel, and Guangdong Nuclear Power Group have established their own dedicated ESCOs. Industry experts emphasize that SOE-based ESCOs have "more relationships, more clients, and more funds behind them" through networks of their parent SOEs (Interview 052011), and that China's state-owned banks are more likely to trust state-owned ESCOs (Interview 051011). Many of our interviewees stressed that large clients in particular, the majority of whom are also SOEs themselves, sense "*chengxin* (诚信) on the part of state-owned ESCOs" (Interview 052011), loosely translated as sincerity and honesty, or keeping one's word. The main reason is the repeated interactions that the customers have had with the parent SOEs. Undergirded by such a sentiment, SOEs "do not need 50-page contracts" because they can work with each other just by signing a memorandum of understanding (Interview 050811).

4.4. Case 4: Embedded Private ESCOs

We explained above that most private ESCOs in China have difficulties building trust with the customer base because they are disembedded from the existing networks that are usually regional. That is to say, the main determinant of an ESCO's success is not its legal status – private or public, for example – *per se*, but rather its

social relations and networks. The following two private firms do successfully form and maintain networks and relationships required in the Chinese ESCO market. However, our research finds them to be an exception to the rule, particularly given that most private ESCOs do not have a history of relationships with the majority of potential clients who are in the public sector and the SOE sector.[15]

Consider a relatively new private ESCO company, Suzhen,[16]in the city of Suzhen, whose main service is to improve energy efficiency in commercial malls and hotels. The firm's stellar growth is a stark contrast with Case 1 and even Case 2. Shortly after successfully completing its first project with the local government, the firm received a contract to provide energy efficiency services to all of the companies in an industrial park in another nearby major city. A representative claimed that "because of the track record, clients are coming to them directly now" (Interview 042111). Financially, the company is now receiving venture capital funds and has recently signed a contract with a major domestic bank which has guaranteed bank loans. Suzhen is currently preparing for an IPO with which it can further expand its financial streams. Moreover, its customer relations have been extremely stable. In contrast to the industry average of five to eight years in contract length, the firm usually signs contracts that are 20 to 25 years long with its customers. When asked if the company ever fears that customers will refuse to pay in the future, the company representatives simply responded, "people always pay" (Interview 040411).

Likewise, while the CEO of Baoding Runli Energy-Saving and Environmental Protection Limited Company in the city of Baoding (Hebei Province) is also concerned about many of the issues that are plaguing the majority of private ESCOs, the company's ESCO business has grown rapidly since it entered the market in 2010. In just one year, Runli signed EPCs with 11 different local companies to implement

technologies that recover and recycle residual heat from waste gas in industrial boilers. In contrast, as shown in Case 2, DEED signed a total of three projects in the span of six years. It is estimated that in 2010, each of the 11 projects saved about one million RMB worth of energy, with Runli taking about 30% of the savings. The local media as well as the government has been touting the company's success as well as the merits of the ESCO concept, and all signs indicate that the customers have been satisfied (Baoding Daily, 2011). The company to date has not faced the kind of *ex post* opportunism harrowing many fellow private ESCOs in China, nor is it overly concerned with cash flows, especially from local financial institutions (Interview 042611).

What sets Suzhen and Runli apart from many other private ESCOs is not only their success, but also their deep-rooted relations and networks. The local networks brought a certain amount of credibility and certainty to the outcome of transactions. For Suzhen, its network resources come primarily from its founder and CEO, who is a bureaucrat-turned-entrepreneur with an extensive background in the local government. It is known that he has a network of "friends" who occupy strategic positions in the government, including the mayor (Interview 042111). On the other hand, Runli's network in Baoding is both at the personal and firm level and is cultivated through repeated interactions with the local business and political community over the years. Established in 1985 as an equipment manufacturer, Runli has slowly built expansive working relationships with local enterprises – both private and public – over the last three decades. In addition, Runli is the first and the only ESCO in Baoding "officially" recognized by the city DRC.

The benefits of such embeddedness for firms' ability to enter the market and to consummate and maintain transactions with customers are manifested in several ways.

First, local networks improve access to capital, especially from traditional financial institutions. In the case of Suzhen, the initial capital for the first project was procured with the local government's help. A casual observer may look at this and claim that this is nothing more than pure political favoritism – if not corruption – at work. Indeed, we have no way to prove otherwise. However, such a view leaves no room for understanding the role of such connection. We argue that a more important theoretical and empirical issue is what that political connection does – i.e., its function – in the face of imperfect information and uncertainty.[17]

Instead, the real significance of the city government standing behind Suzhen is analogous to Fakai's having affiliation with the provincial DRC: transmission of some information about Suzhen's credibility. Local banks were led to trust Suzhen because the local government officials – with whom the banks have had a long history of relationship – gave a vote of confidence. The government officials in turn knew their ex-colleague's track record, at the minimum in his past government capacity. In other words, the founder's network within the government proved to be a sort of an unwritten certification of quality or reputation—valuable information in the context of no certification system. That the local financial institutions were ultimately moved more by assessment of trustworthiness and credibility rather than by administrative fiat or political favoritism is reflected by their reluctance to take too much risk. In the first project, the local banks made it clear to Suzhen that the loan is performance-based, and that it must successfully complete the first project and deliver the promised energy savings in order to have any chance at procuring future loans (Interview 042111). In the case of Runli, the tight local business community channeled enough information about the actors involved. The local banks had repeated interactions not only with Runli, but also with most of its customers who have also been firmly rooted

in the region for a long time. Expectation of positive outcomes based on the knowledge of their track records meant the banks were less concerned about risk than they otherwise might have been.

Willingness on the part of customers (as well as the companies themselves) to enter a contract is enhanced by a similar process. Again, for Suzhen, the network effect is similar to that of Fakai in Case 3 above, as most of its customers are public institutions. As for Runli, it is clear that its customers took a "leap of faith" in signing contracts with the ESCO. In Baoding, most businesses are unaware of EPC and do not understand ESCO services or products (Interview 042811). Without understanding the implications of the contracts, Runli's customers decided to work with Runli simply because they had worked with the company before and found it to be trustworthy (Interview 042611).

Lastly, malfeasance is mitigated through a social sanctioning feature of these interlocking networks. In the case of Runli and its customers, reputation not only in the business sphere but also in the social sphere seems to put a considerable constraint on their behavior. For one, rooted in the local economy, future business opportunities are dependent on whether or not one can maintain one's reputation. Thus, when transacting, actors tend to deliver and refrain from flouting their contract. Second, enterprise leaders and representatives frequently socialize and dine with each other, almost always at one or two upscale venues in the city. Thus, if a client reneges on a contract, the news spreads rapidly to other business partners by word of mouth. Sometimes, certain consequences such as ostracism and humiliation are irreversible. It is telling that even though he is acutely aware of and feels vulnerable because of the lack of contract enforcement by court (Interview 042611), the CEO of Runli is still willing to make transactions with customers.

For Suzhen, compared to its own reputation, the more important was the reputation of its supporter, i.e., the local government (or in particular, the mayor), especially in the beginning when Suzhen had yet to build its own network in the region. If the founder had hopes of maintaining his social relations with his colleagues in the local government, he had to make sure that the government does not "lose face" in the public because of the company's performance. That is to say, even if corruption exists and even if the company ultimately charges exorbitantly high prices for its products and services, it nonetheless faces enormous pressure to deliver on its promises. Thus, there is a minimum level of quality guaranteed. As for the customers, their relationship with the city government itself deters them from taking advantage of the company before the terms of the contract expire. The head of the transportation bureau, for example, does not want to get reprimanded by the mayor in a government meeting. A lower level of (perceived) malfeasance in turn makes the parties more willing to trust each other and conduct business transactions. Without such a level of guarantee against malfeasance, it is almost impossible to enter 25 year-long contracts (Interview 042111). Anticipating less malfeasance, financial institutions are also more inclined to invest in projects.

5. Discussion

The above examples illustrate that Chinese ESCOs, the majority of whom are private, struggle to create trust between themselves and potential customers. We find that most private ESCOs are unable to create networks with the potential customer base through which trust can naturally build up. Sometimes, they are not even interested in embedding themselves in local networks (Interview 042511). We believe

this is a problem – or "barrier" – much more serious and fundamental than the multitude of barriers frequently cited by other analysts and authors.

First, for maximum energy efficiency gains and thus for realizing maximum growth potential, major clients of ESCOs are government agencies, public institutions, and heavy industries (which are usually SOEs). Making these state actors trust in the quality of their product and service is a major challenge for private ESCOs. Chinese companies generally do not trust outside companies like ESCOs. This is particularly the case if energy-saving projects require modifying a company's process line, which imposes high market and technical risks and can be highly disruptive to business operations. As a consequence, only large ESCOs that have gained a strong reputation in the field and gained a customer's "trust" can provide for this kind of contract. Otherwise, companies prefer to take care of retrofits themselves and outsource only those projects that do not modify fundamental production processes, such as lighting and electric load management (AFD, 2008a: 9; Interview 0510 11).

Even without considering other political and institutional factors – such as well-documented discrimination against the private sector in the banking sector (Tsai, 2002; Huang, 2003) or government preference for creating "national champions" out of big SOEs (Nolan, 2001) – these private ESCOs simply do not have a history of working relationships with their potential customers. Second, many of the potential projects and transactions are localized. Trust becomes more important, when the main potential customers are local government institutions and local SOEs. Nonetheless, a bulk of ESCOs are conglomerated in major metropolitan areas like Beijing and Shanghai. Away from the actual work site, most of these ESCOs are disembedded from the local networks, i.e., the main source of trust building. The local customers

feel that it is difficult to build a long-term working relationship with a consultant a thousand miles away.

Public ESCOs like Fakai and SOE-affiliated ESCOs operate quite differently. Again, collusion and even crony capitalism may exist, but they fail to account for the whole story. With a long established working relationship, when an SOE or government entity establishes a new subsidiary company as an ESCO, the latter's potential customers and financiers have easier time trusting the quality of work it is going to deliver, because what they are trusting is not necessary the ESCO, but the institution standing behind it. It is well-known – and, in fact, widely complained by private ESCOs – that when a Chinese bank evaluates a loan request, what it judges is not necessarily feasibility of the project itself, but rather the client's trustworthiness (Gan, 2009). In addition, most of the more successful public ESCOs are deeply rooted in their respective localities. In other words, they have been embedded in local commercial, social, and political networks for a long time.

It is important to note that we are not claiming that only public ESCOs or SOE-affiliated ESCOs have a room to grow in China. Rather, this paper stresses the importance of socially embedded networks through which trust between transacting parties is created and maintained, which in turn helps the parties to overcome the inherent transaction cost problem and market failure in the Chinese ESCO industry. Nothing in this analysis or theoretical framework precludes private firm's ability to do so. Our empirical work in Case 4 clearly illustrates this. In our research, however, we have not encountered many private companies like Runli and Suzhen.

Even from a purely economic perspective, a system of relational governance provides impetus for ESCOs' growth in several ways. First, even if customers and financial actors do not completely understand the long-term consequences or viability

of an ESCO project, they are less reluctant to enter a long-term contract. Second, being embedded in local networks, both the customer and seller are perceived as less likely to renege on contract. Lastly, even if the specific details of the contract do not materialize exactly as planned, the engaged parties know – indeed trust – that they will be able to rework the details later on. Such flexibility takes on an added importance when contracts signed between the parties are usually only two pages long. Therefore, *ex ante*, they are more likely to enter transaction.

6. Conclusion and Policy Recommendation

This study analyzed how the ESCO market in China operates and what factors facilitate or hinder market development. Low awareness of energy efficiency saving potential, lack of access to capital because banks lack confidence in measurement and verification of project performance, and limited technical knowledge among professionals working in ESCOs, among other factors, all help to explain why China's ESCO industry has not yet fully developed its potential. In addition to these obstacles, this paper argues that with sophisticated market institutions still evolving in China, the formation of trustworthy relationships between ESCOs and potential customers is particularly critical.

We presented four representative cases to illustrate that local business, social, and political networks are key factors determining the success or failure of an ESCO in the Chinese market because trust is often institutionalized within those networks. The case studies of ClearWorld and DEED show that it remains challenging for the majority of ESCOs – which typically are small and privately owned – to form and maintain lasting business relationships with their potential customer base, which

predominantly consists of local public institutions and SOEs. Furthermore, a typical ESCO is based in large cities, far away from the actual project site, which further limits its ability to embed itself in local networks, the main source of trust building. In rare instances, when private ESCOs build sufficient network resources, they can also grow substantially. Suzhen and Runli illustrate some of the possible network creation strategies for private companies. Public ESCOs on the other hand operate quite differently, as epitomized by the Fakai case study. The company's dense and multi-nodal networks, created mainly through its ties with the Hebei provincial government, made it easier for potential customers and financial institutions to trust the company. Although Fakai as a governmental entity has access to a large client base, it currently lacks the technical competence to create energy efficiency investment portfolios, design sophisticated contracts, and evaluate and monitor ESCO projects. This suggests that human capital – including expert qualifications and technical expertise – are equally important for the development of China's ESCO industry.

The empirical findings of this paper suggest that, in the absence of advanced market institutions, the Chinese ESCO market is necessarily regulated by a system of relational governance. Recognizing this reality and refraining from imposing the market governance model practiced in the US or European ESCO markets may be the biggest obstacle for the industry's growth in China.

A number of policy implications emerge from these key findings. China needs to search for an ESCO model that is compatible with a diverse range of existing domestic institutional arrangements. Policy-makers and donor-agencies working on energy efficiency should not approach the development of an ESCO market just as a financial or technical issue, but need to also take into account the importance of facilitating networks and relationships between ESCOs and potential clients to help

the formation of trust between the players. This could, for instance, include sponsoring networking events where private ESCOs meet with potential clients and financial organizations. In addition, the geographic distance between smaller, private ESCOs and many of their clients calls into question how well placed private ESCOs are to implement energy saving projects requiring high levels of trust among players. Public and state-owned ESCOs are more embedded in existing government and business networks and, therefore, might be better positioned to attract and work with potential clients and financiers, many of which are government or state agencies.

In addition, with advanced formal and legal institutions lacking, favourable government policies can play a key role in nurturing trust in the ESCO market. Currently, NDRC's 2011 list of 984 approved ESCOs lacks transparent and stringent selection criteria and provides no information about an ESCO's technical and financial capabilities or its previous success in implementing energy efficiency projects. In an effort to increase the "trustworthiness" of ESCOs, the NDRC or other government agencies such as the National Energy Commission could introduce a ratings system to accredit ESCOs, with accredited ESCOs listed on government's website. Such an accreditation system, however, would require the relevant rating agency to have a sophisticated understanding of energy issues and to develop and apply transparent criteria for rating ESCOs to ensure there is confidence in the rating system. In order to increase the business opportunities for ESCOs, the Chinese government could also require mandatory energy audits for specified government bodies and companies, thereby substantially expanding the client base for ESCOs. Both tactics have been successfully used in India, where the Bureau of Energy Efficiency established both a rating system and commissioned energy audits in order to build trust and confidence in the ESCO sector (Harrison and Kostka, 2012).

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[1] An energy service company (ESCO) is generally defined as a company which invests in, or facilitates investments in, energy efficiency projects in other host enterprises, using energy performance contracting (World Bank, 2008: 1). ESCOs in China are also referred to as energy management companies (EMCs).

[2] The policies outlined in Document No. 25 were followed by numerous guidelines and rules promoting China's energy-saving service industry. In June 2010, the National Development and Reform Commission (NDRC) and the Ministry of Finance (MoF) jointly issued the 'Interim Measures

concerning the Administration of Financial Incentives to Fund the Energy Performance Contracting'. In August 2010, the General Administration of Quality Supervision, Inspection and Quarantine issued 'General Technical Rules for Energy Performance Contracting'. These different interim measures and technical rules indicate the central government's political will to promote China's ESCO industry. In the interim measures by the NDRC and MoF, the stated development goal is to develop a few large scale ESCOs by 2012. Specific financial and tax incentives outlined include offering RMB 240 for 1 ton of standard coal equivalent as an financial incentive for ESCOs from the central finance budget and exempting ESCOs from business tax for revenue generated from Energy Performance Contracting (EPC) projects. For a detailed summary, see Chen and Xu (2010).

[3] It is difficult to lump Chinese ESCOs into one category. First, one needs to distinguish between technology-oriented and market-oriented ESCOs (or vendor vs. service ESCOs), with the former selling specialized technologies and equipment and the latter working together with energy consumer companies to solve particular energy efficiency problems. Second, ESCOs are owned by private companies, state-owned enterprises, non-profit organizations, or local governments, with many different shades of ownership in between. A third distinction is between domestic and foreign companies, as larger international energy companies such as Honeywell, Siemens, and Schneider Electronics have also entered the Chinese ESCO market. Fourth, the size and investment capacity of ESCOs differ substantially. Moreover, the contractual model adopted by ESCOs can range from shared savings (mainly in the building sector), to outsourcing energy management (commercial buildings such as hospitals), to guaranteed savings (other industries).

[4] According to EMCA, the financial capacity of Chinese ESCOs is limited: 60% of the ESCOs have less than 10 million RMB registration capital; 20% has more than 50 million RMB registration capital. About 50% of ESCOs have less than 100 employees (Interview 051811).

[5] Of the 984 approved ESCOs in 2011, 461 (47%) were located in Northern and Eastern China with 153 in Beijing and 63 in Shanghai alone, 132 (13%) located in Southern China, 228 (23%) in Central China, and 163 (17%) in Western China. The majority of ESCOs are located away from energy intensive provinces. For instance, the high energy intensive provinces Inner Mongolia, Henan, and Shanxi have four, 34, and 30 ESCOs respectively.

[6] A number of commercial banks such as the Bank of Taizhou, Huishang Bank in Anhui, and Bank of Chongqing have started training bank loan officers using internal energy efficiency saving measures and standards, but there are currently no standardized measurements and verification protocols to verify energy savings at the national level.

[7] In this paper we do not discuss the other problem of "bounded rationality" (Williamson, 1985, 1975) because the under-development of legal institutions in China is a well-known fact already.

[8] There is some controversy and confusion in the literature as to whether trust is a form of social capital (Coleman, 1990), a source of social capital (e.g., Portes, 1998), or a structural feature of network and thus not a form of social capital (Lin, 1999). Teasing out these differences is an important task, and we do not intend to overlook these issues. However, we do not engage with this debate in this paper for two reasons. One, it is not immediately relevant to the central thesis of this paper. More importantly for this paper's central thesis, there is no controversy that network ties are an important determinant of relational assets like trust (Granovetter, 1985; Powell, 1990). Most authors do agree that trust – as mediated through networks and relations – is a means through which actors can better access and contribute to embedded resources.

[9] In this paper, without evaluating the merits of either schools of thoughts, by social capital, we are strictly following the original concept as developed in sociology that emphasizes social relations and networks as the basic nexus through which social capital is captured, rather than the later variant developed in political science that tends to emphasize organizations and communities (or even nations) (Putnam, 1993).

[10] Many ESCO firms that we have interviewed revealed to us their frustration over their clients' apparent "irrationality" or strangeness when discussing deals—namely, their habit of considering or evaluating the ESCO company and not necessary the product that the company brings to the table. While Western companies' usual business practice and habit may be to use the quality of the product to evaluate the company or its performance—that is, product comes before company and the two often go together—the Chinese clients often do not operate from such a frame of thought. They place an overwhelming emphasis on the company itself over its product. As a consequence, just because a firm has technically superior products or service does not mean that it will be able to strike a deal with clients. This is the reason why when a Chinese firm makes a presentation or sales pitch to its potential client, the majority of the presentation is about the company—its reputation, its history, its track record,

its awards, its collaboration with other high-profile institutions, and so on—rather than the specifics of the product or service being talked about.

[11] To become a member of EMCA, an ESCO must meet the following qualifications: (i) independent legal body implementing energy conservation projects, (ii) continuously operated for more than 12 months; (iii) registered capital of not less than one million RMB; (iv) has implemented at least one EPC project with an accumulated investment of not less than one million RMB (World Bank, 2008: 2).

[12] This is because GEI receives funding from international donors who are more cautious about interventions or partnerships that can potentially be political (Interview 042111).

[13] Theoretically, collusion between public institutions and public or state-owned ESCOs may exist, especially given the context of political economy in China. In this case, the former may create the latter or have tendency to work with the latter merely to pay a "lip service" to administrative fiat. This problem would be more accentuated at the local level, where actors are forced to respond to the central government's order. While we do not discount this possibility, we do not believe it can explain the whole picture for two reasons. First, public and state-owned ESCOs are a new phenomenon in the last two or three years, whereas administrative fiat with respect to energy efficiency gains has been going on for a number of years. ESCOs have also been around for a number of years in China. SOEs and public institutions should have used such a tactic much earlier, if the primary motive is to create a false accounting system. Second, if collusion is indeed the primary incentive, the quality of public ESCOs should remain very low. There is little reason to provide a high quality service when the primary objective is to create false numbers. Doing so would be redundancy. However, all signs indicate that public ESCOs are rapidly improving their capacities and aggressively expanding their market presence (Interview 051811).

[14] One may be tempted to argue that political favoritism is at work in such a case. While we have no way to disapprove such a claim, we contend that this cannot paint the whole picture, as we illustrate in case 4 below. In addition, even when banks are still reluctant, Fakai's clients are usually those with substantial budgeting and procurement autonomy, such as water/heating/power utilities, hospitals, and schools and universities (Singh et al., 2010: 69), and thus Fakai can bypass the need to go to banks.

[15] Many private enterprises attempt to partner with established institutions. For instance, ESCOs operating in China's construction market are reported to form strategic alliances with producers of technologies (mostly for lighting and air conditioners) that adhere to the energy efficiency label awarded by the China Standard Certification Center (CSC) (AFD, 2008a: 8). This strategy to partner with firms that are awarded the energy efficiency label adds credentials to the ESCO.

[16] To protect the human subjects involved in this case, we are using pseudonyms for the individuals, firm, and place related to this case.

[17] Simply assuming or judging that there is some kind of crony capitalism going on may be premature. Chinese banks have become largely profit-oriented market institutions over the last decade, and they are increasingly reluctant to provide loans simply because they are "ordered" by some influential government officials without knowing the prospects of business ventures. A former director of a national-level high-tech industrial development zone confided to us, "You would be foolish to think that banks will hand out loans to a company – or to us – just because we [the government] ask them to. That was possible twenty years ago, but not anymore. The company's project has to be feasible and profitability expectable in order to incentivize banks. If you think we [the government] can control them, you are too outdated" (Interview 040111).