Policy Brief

China

ESCOs as a Delivery Mechanism for Grid Company DSM in China

Lessons from International Experience

RAP

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This policy paper was written by RAP Senior Advisor David Crossley, who has 38 years experience in the energy sector, providing advice on sustainable energy policy and programs to governments, regulators, energy companies, industry associations, and NGOs. In China, David manages the provision of technical assistance on demand-side management and energy efficiency to governments, regulators, and the electricity industry. The review team for the paper included Max Dupuy, David Moskovitz, Bob Taylor, Rick Weston, and Mona Yew. Wang Xuan carried out research and sourced invaluable information from Chinese language documents and websites.

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Executive Summary

In November 2010, China's National Development and Reform Commission issued a guidance document that requires grid companies in China to carry out demand-side management (DSM) activities to achieve specified targets for reductions in electricity sales (GWh) and peak demand (MW). Chinese government support for energy service companies (ESCOs) and financial incentives for energy performance contracting have encouraged the grid companies to establish ESCOs as their main mechanism for acquiring energy and demand savings.

This use of ESCOs as the main delivery mechanism for grid company DSM locates the acquisition of energy efficiency resources in a separate, subsidiary business unit outside the grid company core business. In the United States, acquiring energy efficiency resources is often found to be cheaper, and more economically efficient than generating or purchasing electricity. In China, the grid companies currently do not assess the cost-effectiveness of acquiring energy efficiency resources as compared with purchasing bulk electricity from generators. Locating the acquisition of energy efficiency resources in ESCO subsidiaries outside their core business makes it more difficult for the grid companies to carry out this cost-effectiveness assessment. China could significantly reduce costs and increase economic efficiency by requiring the grid companies to acquire all cost-effective energy efficiency before purchasing electricity from generators.

International experience shows that the ESCO business model does not necessarily work well in all situations. Operating an ESCO is not simple. To become a successful and profitable business, an ESCO requires staff with a complex mix of skills plus a substantial level of equity capital. Consequently, ESCOs often manage the considerable risks inherent in the ESCO business model by limiting the scope of their operations. ESCOs usually undertake only relatively small projects and operate only in some parts of the market. Also, ESCOs often implement only simple and low-cost energy efficiency measures and ignore more complex yet still cost-effective measures at the same site that may yield larger energy savings over time (sometimes referred to as "cream skimming").

Given the limitations of the ESCO business model, it would be unwise for the government to allow grid companies to rely on wholly-owned ESCO subsidiaries as their only mechanism for acquiring energy and demand savings. To overcome these limitations, it would be better for the grid companies to:

- directly fund the costs of carrying out more complex and comprehensive energy efficiency projects, in addition to using grid company ESCOs to undertake simpler projects; and
- engage third-party ESCOs as contractors to collaborate with grid company ESCOs in carrying out energy efficiency projects in the particular market segments that the third-party ESCOs specialise in, rather than requiring grid company ESCOs to compete with third-party ESCOs across all market segments.

Even though energy efficiency is usually cost-effective as compared with purchasing bulk electricity from generators, grid companies face significant costs in acquiring energy and demand savings, plus their revenues are reduced because they sell less electricity. At present, the regulatory regime in China does not allow the grid companies to recover these costs nor compensate them for the reduction in revenue. In the United States and some other countries, regulatory regimes have been established that reduce the financial penalties experienced by utilities in acquiring energy efficiency, including allowing utilities to collect funds from customers to cover the costs of energy efficiency programs and, in some cases, even providing financial incentives for utilities that achieve target levels of energy and demand savings. Chinese regulators should investigate adapting some of these regulatory mechanisms for use in China.

In the meantime, Chinese grid companies could recover the costs of directly funding energy efficiency projects and of engaging third-party ESCOs:

- from the financial incentives provided by the central and provincial governments for projects that deliver verified energy savings;
- from the cost savings that the grid companies would make from reducing energy consumption and energy demand; such cost savings can result from, for example, a reduced need for grid augmentation and grid expansion; and
- from the additional funding sources identified in the *DSM Implementation Measures* guidance document.

Directly funding end-use energy efficiency projects and engaging third-party ESCOs would assist the grid companies to change their business models from supplying electricity to providing comprehensive energy services to their customers, thereby reducing costs and increasing economic efficiency.

Abbreviations and Acronyms

CNY	Chinese Yuan or Renminbi (currency unit)
DSM	Demand-Side Management
EMC	Energy Management Company (the Chinese term for energy service company or ESCO)
EMCA	Energy Management Company Association
EPC	Energy Performance Contract
ESCO	Energy Service Company
GEF	Global Environment Facility
GWh	Gigawatt-Hour
HVAC	Heating, Ventilation, and Air Conditioning
MoF	Ministry of Finance
Mt	Million Tons
MW	Megawatt
NDRC	National Development and Reform Commission
tce	ton of standard coal equivalent; by convention one tce equals 29.3076 gigajoules. China typically converts all its energy statistics into tce.
USD	United States Dollar (currency unit)

1. Introduction

In November 2010, China's National Development and Reform Commission (NDRC) issued the document *Demand Side Management Implementation Measures* (发改运行 [2010] 2643号).[1] This guidance document requires grid companies in China to carry out demand-side management (DSM) activities, including both energy efficiency and load management, to achieve specified targets for reductions in electricity sales (GWh) and peak demand (MW).

The grid companies have responded to this requirement by establishing energy service companies (ESCOs) to carry out energy efficiency projects. This paper examines both Chinese and international experience in using ESCOs as a delivery mechanism for end-use energy efficiency and identifies lessons from international experience that may be applicable in China.

1.1 What is an ESCO?

An ESCO is a business that develops, installs, and arranges financing for projects designed to improve the energy efficiency of facilities, and accepts some degree of technical and financial risk in doing so.

ESCOs generally act as project developers and undertake a wide range of tasks. Typically, they offer the following services:[2]

- develop, design, and arrange financing for energy efficiency projects;
- install and maintain the energy-efficient equipment involved;
- measure, monitor, and verify the energy savings achieved through projects; and
- take on all or part of the risk that each project will achieve a specified level of energy savings.

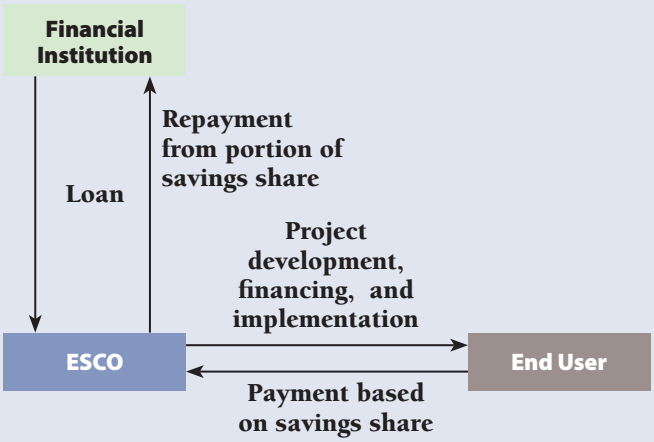
1.2 How Do ESCOs Operate?

Performance-based contracting is the factor that sets ESCOs apart from other businesses that offer energy efficiency, such as consulting firms and equipment contractors.[3] When an ESCO undertakes a project, the ESCO's compensation, and often the project's financing, are usually directly linked, under an Energy Performance Contract (EPC), to the amount of energy that is actually saved. In energy performance contracting, energy efficiency projects are implemented by one company (the ESCO) that provides a package of services to a second company (a facility owner) and guarantees the energy savings result. Typically the ESCO provides, or helps arrange, most of the financing of the project, and is compensated from the cost savings achieved through the project.[4]

In international markets, ESCOs typically carry out projects under one or more of three types of contracts.

Figure 1

Shared Savings Energy Performance Contract Model [5]



1 National Development and Reform Commission, 2010a.

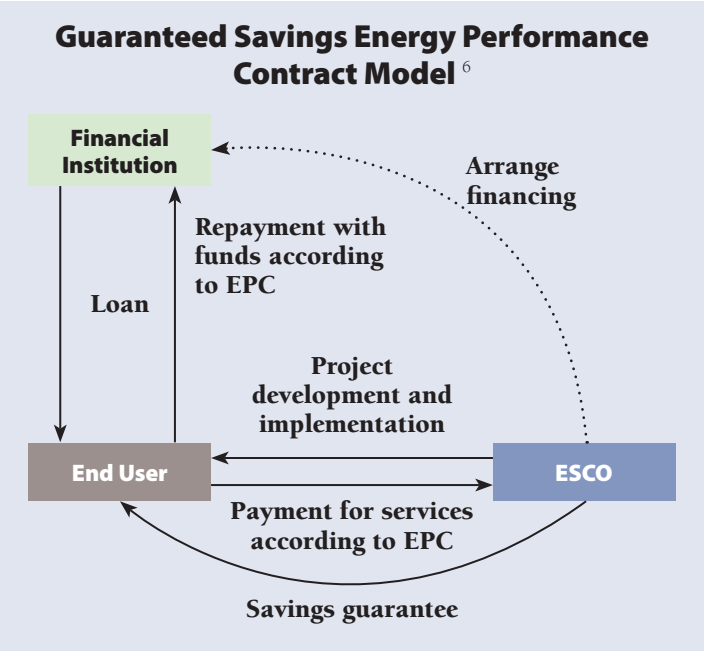
2 National Association of Energy Service Companies, 2012.

3 National Association of Energy Service Companies, 2012.

4 Sun, Zhu, & Taylor, 2011.

5 Taylor, et al., 2008.

Figure 2



In **shared savings contracts** (see Figure 1, page 5), the **cost savings** from implementing energy efficiency measures are shared between the ESCO and the facility owner at agreed percentages for a fixed number of years.

In **guaranteed savings contracts** (see Figure 2), the ESCO guarantees to the facility owner a specified level of **energy savings**; some or all of any cost savings resulting from energy savings in excess of the specified level are taken by the ESCO.

In **fee for service contracts**, the ESCO provides specified **energy efficiency services** for an agreed fee; the facility owner takes all the cost savings and there is no sharing of savings between the ESCO and the facility owner. This type of contract is not performance-based.

6 Taylor, et al., 2008.

2. ESCOs In China

2.1 Brief History of the ESCO Industry in China[7]

The ESCO[8] industry in China was launched as part of a deliberate plan by the Chinese central government, with support from the World Bank, Global Environment Facility (GEF), and several other international donors. In 1995-1996 the World Bank and the Chinese government agreed to mobilise technical and financial assistance to introduce and develop energy performance contracting in China. Funding was provided to three new pilot Chinese ESCOs that were started with assistance from the Liaoning and Shandong provincial governments and the Beijing municipal government. This funding provided the three ESCOs with a dedicated large line of credit from the start, enabling them to focus on making the new energy performance contracting business model actually work.

The three pilot ESCOs were successful in establishing viable businesses. During 2002 to 2004, total investments by the ESCOs in energy performance contracting rose to over USD 20 million per year, and then to over USD 30 million per year during 2005 and 2006, reaching a total investment of USD 181 million by June 2006.

The success of the three pilot ESCOs attracted interest from other groups. By November 2001, about six small new ESCOs had been formed by interested independent groups and some 15 to 20 other companies were beginning to test the energy performance contracting concept. Many more were expressing interest. The two biggest constraints faced were lack of practical knowledge and understanding among both ESCOs and facility owners about how to operate the business model, and lack of access to capital to finance projects.

The Chinese Government and the World Bank arranged additional funding to help meet these needs, and over the period since 2004 the ESCO industry in China has grown strongly, the number of ESCOs increasing from only about 90 in 2005, to 800 in 2010, and sharply to 3,900 in 2011.[9]

7 This section is based on Sun, Zhu, & Taylor, 2011.

8 In China, ESCOs are called "energy management companies" (EMCs). However, in this paper the international terminology "energy service company" and "ESCO" will be used.

9 Energy Management Company Association, 2012a.

10 Chandler, Chen, & Gwin, 2012. Based on data from Energy Management Company Association, 2012a, 2012b.

11 EMCA members include not only ESCOs, but also include financing organisations, law firms, and other organisations. Many ESCOs in China are not members of EMCA.

Table 1

Growth of the ESCO Industry in China[10]

	2005	2006	2007	2008	2009	2010	2011
Employees (thousand)	16	21	35	65	113	175	378
Total production value (CNY billion)	4.7	8.3	21.7	41.7	58.8	83.6	125.0
EPC investment (CNY billion)	1.3	1.9	6.6	11.7	19.5	28.8	41.2
Energy saving (million tce per annum)	0.9			12.4	17.6	10.7	16.5
CO_2 reduction (Mt per annum)	2.2			29.2	41.6	26.6	
EMCA members[11]	89	212	308	385	450	560	

Many of these are small companies with registered capital of less than CNY 5 million (USD 0.8 million), and many have tried only one or two EPC projects. However, there are also about 20 very large ESCO companies with registered capital of more than CNY 100 million (USD 16 million). Table 1 (page 8) shows the growth of the ESCO industry in China between 2005 and 2011.

2.2 Types of Energy Performance Contracting in China[12]

In China, EPCs are classified into three types. Although this classification is similar to those used in international markets, there are differences in how the contracts operate, and therefore the Chinese classification cannot be used interchangeably with classifications in other countries. In all cases, ESCOs in China undertake detailed project design, manage most project implementation aspects, and guarantee energy savings performance. However, financing, contractual, and asset ownership arrangements vary.

2.2.1 Shared Savings Contracts

In the full-service type of shared savings contract used in China (see Figure 3), ESCOs provide the bulk of project financing. This financing may be supported by a loan to the ESCO from a financial institution, a repayment guarantee from a guarantee company, or funding from the ESCO's own corporate shareholders. ESCOs are compensated for their investment and services by the facility owner from a portion of the cost savings resulting from the project. The assets created by the project are owned by the ESCO until contract completion, when they are transferred to the facility owner, usually for no charge.

The minimum cost savings stream from the project is estimated by the ESCO, usually conservatively, agreed by the facility owner, and included in the contract. In most cases, the contract provides for payment streams to the ESCO based on an agreed percentage share of the estimated cost savings stream, as long as monitoring of energy savings verify that at least the agreed level of energy savings has been achieved with normal asset operation. Any additional savings are usually taken by the facility owner.

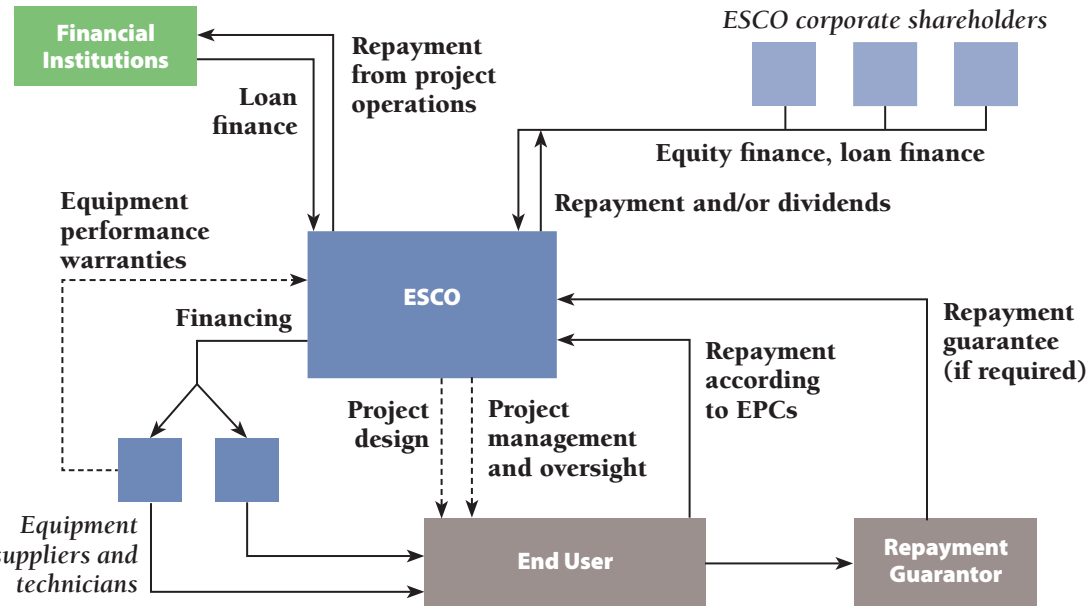
As long as the project is implemented as originally designed, and the estimated energy savings are achieved, these contracts typically result in a predictable payment

12 This section is based on Sun, Zhu, & Taylor, 2011.

13 Taylor, et al., 2008.

Figure 3

Full-Service Shared Savings Contract Model Used in China[13]



stream to the ESCO. Hence, most Chinese shared savings contracts are actually not the same as the traditional "shared savings" contracts used in international markets. The Chinese contracts are probably closer in principle to the "ESCO-financed guaranteed energy savings contracts" typically used for federal government energy performance contracting in the United States.[14]

As described later, shared savings contracts currently are the only energy performance contracting mode recognised for the Chinese government's financial incentives for energy performance contracting. Hence, the use of Chinese-style shared savings contracts is likely to further increase, and the contracts themselves will probably become more standardised.

2.2.2 Guaranteed Energy Savings Contracts

In these contracts, facility owners in China provide the bulk of project financing themselves. Assets created by the project belong to the facility owner. In addition to providing design and implementation services, ESCOs guarantee the energy savings levels from the project, and may receive an agreed share of the resulting cost savings. To be considered as true energy performance contracting, failure to achieve the guaranteed level of energy savings must have direct consequences for the ESCO's revenue stream.

2.2.3 Outsourcing Contracts

In this type of contract, ESCOs in China finance and install energy savings assets within the owner's facility, and operate these assets over an extended period for agreed compensation, which is linked in one way or another to the energy savings achieved. The ESCO owns the assets, and transfers them to the client at the end of the life of the contract, which may be eight to ten years.

One common example is the installation of on-site "build-own-transfer" power generating equipment using waste heat or byproduct gas from the manufacturing process located at the site. An ESCO constructs and operates the generating equipment, purchases the process energy resource for a small fee or no charge, and sells the electricity to the facility owner at a rate below the cost of purchasing electricity from the grid.

In another case, an ESCO develops or purchases local district heating assets, undertakes energy efficiency renovations, operates the system, and receives remuneration from the larger difference between heat sales revenue and fuel costs.

In a final example, an ESCO installs, purchases, or leases the lighting and/or space conditioning assets of a building, undertakes energy efficiency renovations, operates the systems, pays the building's electricity bills, and charges the building owner or occupant fees for predefined lighting and/or space conditioning services, at costs lower than before the ESCO's involvement. In international markets, this type of service is known as "chauffage."[15]

2.3 ESCO Markets in China[16]

The two main markets where ESCO businesses are currently active in China are industry and commercial buildings. Industrial renovation projects are generally equipment-focused, including, in particular, boiler renovations, technology upgrading in combustion systems, renovation of kilns and furnaces, waste heat or gas recovery and use, motor drive system renovations, cooling system replacements, internal power supply renovation, and introduction of automatic controls. Commercial building projects focus primarily on heating, ventilation, and air conditioning (HVAC) system renovations and innovations, although lighting system renovation projects also exist. Projects focus on fuel savings, especially direct savings in coal use, as well as electricity savings.[17]

Market surveys were carried out over the period 2007 to 2009 by the Energy Management Company Association (EMCA), the ESCO industry association in China. These surveys provide a snapshot of the ESCO market in China over this period.

Figure 4 (page 10) shows that, while the industrial and building sectors each accounted for about one half of the number of EPC projects undertaken, industrial sector projects accounted for about three quarters of total EPC investment.

Among the total number of EPC projects reported in EMCA member surveys between 2007 and 2009,

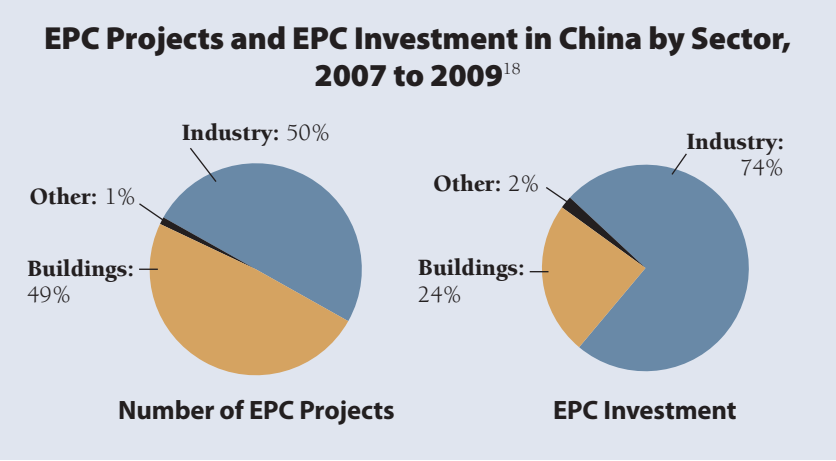
14 US Department of Energy, 2012.

15 Bertoldi & Rezessy, 2005.

16 This section is based on Sun, Zhu, & Taylor, 2011.

17 Taylor, et al., 2008.

Figure 4

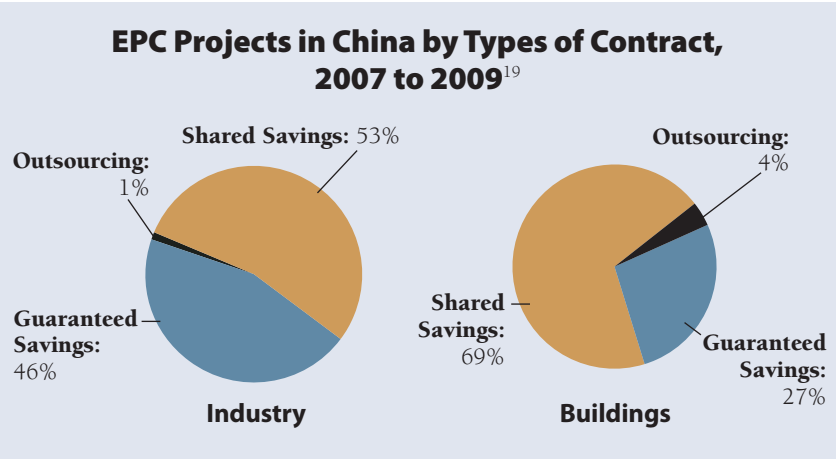


61 percent were carried out under shared savings contracts, while about 36 percent were undertaken with guaranteed savings contracts. Figure 5 shows that, in industry, shared savings contracts accounted for only 53 percent of total projects, while guaranteed savings accounted for 46 percent. Buildings projects provided a contrast, with shared savings projects accounting for 69 percent of the total.

Most facility owners in China prefer shared savings contracts, if they can be provided at reasonable cost, because the ESCO provides the financing off the facility owner's balance sheet. Shared savings projects can be a very attractive business proposition for facility owners, who need not provide most of the upfront funds nor pay the ESCO if the energy savings guaranteed for the project are not achieved. At the end of the contract period (usually three years or less), the facility owner will receive the assets and future continuing energy savings at no charge, and the asset will have been paid for entirely from the cost savings generated during the contract period.

However, guaranteed savings contracts have also played an important role in China. In some cases, a guaranteed savings contract business may evolve as an extension of a regular equipment sales business. In addition to providing standard warranties, vendors may offer energy savings performance guarantees as a means to help expand equipment sales. Over the period 2007 to 2009, the share of total EPC investment allocated to guaranteed savings contracts progressively decreased in favor of investment in shared savings and outsourcing contracts.

Figure 5



2.4 Government Support for ESCOs in China[20]

Energy performance contracting, among other market mechanisms, is now a key focus for the Chinese central government in the 12th Five Year Plan. Prior to the implementation of the Plan, the government ramped up its support for ESCOs with several fiscal and tax incentive policies plus some standardisation requirements.

In April 2010, China's State Council endorsed and issued a key policy document supporting further development of ESCOs in China. The document *Notice on Accelerating Energy Performance Contracting to Promote the Development of Energy Service Industry in China*[21] was prepared by the National Development and Reform Commission (NDRC), Ministry of Finance (MoF), People's Bank of China, and General Tax Bureau.

The document describes energy performance contracting as a market-based mechanism in which an ESCO signs an energy performance contract with an energy user, provides the client with energy efficiency diagnostics (ie, energy auditing), financing, renovation and other

18 Sun, Zhu, & Taylor, 2011.

19 Sun, Zhu, & Taylor, 2011.

20 This section is based on Institute for Industrial Productivity, 2012, and Sun, Zhu, & Taylor, 2011.

21 State Council, 2010.

services, and earns back its investment and a reasonable profit from a share of the energy savings results. The new policy instructs local governments and ministries to "fully recognize the importance of promoting energy performance contracting and developing ESCOs, take effective measures, and actively create a favorable policy environment for accelerating the development of the ESCO industry."

The policy sets a development objective for 2012 to "support the cultivation of a batch of specialized ESCOs, develop and strengthen a group of integrated large ESCOs, and establish a fully thriving, mature and orderly energy service market with fresh and distinctive characteristics." By 2015, the development objective is to "establish a relatively complete energy efficiency service system, achieve progress in the expansion of specialized ESCOs, achieve progress in enhancing service capacity, open up and broaden lines of service, and establish energy performance contracting as one of the main ways that energy using units implement energy efficiency renovations."

To help achieve these goals, specific supportive policy provisions include:

- government financial incentives for completion of qualified EPC projects;
- exemptions from turnover tax, value added tax, and part of corporate income tax for qualified EPC projects, and clarification of other aspects of the tax treatment of such projects;
- clarifications of accounting provisions for EPC projects, including provision for government entities to include EPC payments under their energy costs;
- directives to local governments to take measures to provide a favorable operating environment for ESCOs; and
- encouragement of banks and other financial institutions to create new credit products, open up and expand the scope of guarantee products, and simplify application and approval procedures to meet the special needs of ESCO financing.

In June 2010, MoF and NDRC released a new financial incentives policy[22] for ESCOs carrying out projects under shared savings contracts. To receive the incentives, ESCOs are required to first officially register with the NDRC and to have equipment and statistical systems in place to measure achieved energy savings. Under the policy, qualified EPC projects receive from the central government CNY 240 (USD 38) per ton of standard coal equivalent (tce) energy saved and at least CNY 60/tce (USD 9.60/tce) from provincial and municipal governments, with some of these governments opting to pledge more.

In October 2010, a further regulation[23] stipulated that incentives would be provided for projects involving boiler/furnace retrofitting, waste heat and waste pressure utilisation, motor system energy conservation, energy system optimisation, green lighting, and energy conservation in buildings. This regulation also listed categories of projects that are not eligible for rewards, such as projects with the purpose of increasing production capacity, and projects involving solar, wind, biomass, and combined heat and power. It was estimated that about CNY 2 billion had been awarded to EPC projects by the end of 2010.[24] In October 2010, the NDRC and MoF released a "first batch" list of 462 ESCOs that had qualified to apply for the incentives. By mid-2012, some 2,354 companies had been registered as qualified ESCOs by NDRC.[25]

In August 2010, China's National Standardization Management Committee released a national standard on energy performance contracting[26] that became effective on 1 January 2011, setting the technical requirements for EPC projects and including a template for energy performance contracts.

Finally, on 31 December 2010, the MoF and General Tax Bureau released a set of new tax policies for ESCOs.[27] The policies, effective from 1 January 2011, include exemption from turnover and value-added taxes for ESCO contracts meeting specified criteria. In addition, qualified ESCOs are exempt from income tax for the first three years of an EPC project and subject to only 50 percent of the applicable income tax rate for the second three years of that project. Among other criteria, projects must be carried out under shared savings contracts, with ESCOs providing at least 70 percent of the project finance to be eligible for the favorable tax treatment.

22 Ministry of Finance, National Development and Reform Commission, 2010.

23 National Development and Reform Commission, 2010b.

24 Xinhua News, 2010.

25 Chandler, Chen, & Gwin, 2012.

26 National Standardization Management Committee, 2010.

27 Ministry of Finance, General Tax Bureau, 2010.

3. Lessons From International Experience

3.1 International Experience with the ESCO Business Model

3.1.1 Advantages of the ESCO Business Model

The ESCO business model offers an appealing, market-based approach to energy efficiency project development for the following reasons:[28]

- ESCOs offer an attractive proposition to facility owners, carrying out the project design and management, taking on some or all of the project technical risks, providing off-balance-sheet financing, and seeking payment only from the cash flow generated by energy savings;
- even if financing is not included, ESCOs can play a key role by assuring both the facility owner and the financier that the cash flow from the project will materialise;
- ESCOs can serve as aggregators of energy efficiency projects, enabling financial institutions to provide financing for a package of projects, thereby reducing their direct involvement with facility owners; and
- project aggregation can also achieve economies of scale, especially where projects use similar energy efficiency measures, as in retrofitting of commercial buildings.

3.1.2 Problems with the ESCO Business Model

While the ESCO business model may be appealing, it does not necessarily work well in all situations. In particular:

- establishing and operating energy performance contracts requires understanding and acceptance of the concept by the parties to the contracts, plus the existence of a relatively sophisticated legal system through which the contracts can be enforced;
- financial institutions are often unwilling to provide funds for energy efficiency projects because they usually do not have a good understanding of such projects, the projects are often too small to meet their lending criteria, and future cash flows from energy savings are seen as too intangible and uncertain to be accepted as collateral for a loan;[29]
- in some countries, large companies that would be the most profitable clients for ESCOs engage ESCOs only to identify energy efficiency opportunities and then proceed to finance and implement energy efficiency projects themselves, using in-house technical expertise, thereby avoiding sharing cost savings with the ESCO;[30] and
- some large companies in the industrial sector are reluctant to allow ESCOs to audit core industrial processes because of fears about revealing trade secrets and because specialised knowledge and interruptions of production processes would be necessary to implement changes.[31]

3.1.3 Limited Scope of ESCO Operations

Operating an ESCO is not simple. To become a successful and profitable business, an ESCO requires:[32]

- staff with a complex mix of skills, including both broad and specific technical skills, business skills such as how to market the business, sell its product, and close transactions, and financial skills, particularly skills in assessing and mitigating repayment risk; and
- a substantial level of equity capital, both to support any borrowing requirements and to back up performance guarantees to make them credible to the market.

28 Taylor, et al., 2008.

29 Crossley, et al., 2005.

30 Ürge-Vorsatz, et al., 2007.

31 Ürge-Vorsatz, et al., 2007.

32 Taylor, et al., 2008.

Consequently, ESCOs often manage the considerable risks inherent in the ESCO business model by limiting the scope of their operations. In particular:

- ESCOs usually undertake only relatively small projects and operate only in some parts of the market, such as certain building market segments, particular types of relatively simple industrial projects, and projects with technical assessment requirements that match the ESCO's technical capability and capacity; and
- ESCOs often implement only simple and low-cost energy efficiency measures (so-called "low hanging fruit") and ignore more complex yet still cost-effective measures at the same site that may yield larger energy savings over time. Prioritising low-cost measures in this way (sometimes referred to as "cream skimming") may make returning to the site at a later date to carry out more complex measures not cost-effective.

3.2 US Experience with Utility-Affiliated ESCOs

The United States has the most extensive experience with ESCOs established by, or closely affiliated with, electricity utilities. With the deregulation of the US electricity industry in the 1990s, most large electricity utilities attempted to gain a competitive edge and make money in the unregulated energy services market by either creating their own ESCOs or, more commonly, by purchasing commercial ones. In just a few years, the number of utility-affiliated ESCOs increased from less than 30 to more than 300.[33]

In the early years of utility involvement in ESCO businesses, there was some conflict between what was seen as the utilities' traditional business of selling energy and the reductions in energy sales resulting from ESCO activities. In addition, utilities found that the limited operational scope of ESCOs made ESCO businesses by themselves unable to meet the obligations to acquire all available cost-effective energy efficiency[34] placed on utilities by regulators and governments in some US states.

During the early 2000s, utility involvement in ESCOs in the United States dropped sharply and many utilities closed or sold their ESCO businesses. Reasons for this reduced involvement included:[35]

- utilities paying too much to purchase existing ESCO businesses;
- unrealistic expectations on the part of utilities about the cost structure and growth potential of ESCO businesses;
- utilities' lack of experience in running an energy services business rather than supplying energy; and
- utilities' lack of infrastructure to deliver energy services directly to customers.

3.3 US Experience with Utility Acquisition of Energy Efficiency

In the United States, utility programs to reduce demand for electricity commenced in the late 1970s, following the two energy crises of that decade. Several pieces of federal legislation passed in the late 1970s encouraged utilities to develop programs to promote energy efficiency and reduce demand in peak periods. The *Public Utilities Regulatory Policies Act* of 1978 required state regulators to take account of these programs in setting the prices paid for electricity by retail customers. Utility energy efficiency programs took off in the early 1990s, with utilities spending a total of nearly USD 2 billion (2007 values) on energy efficiency programs in 1993. After 1993, electric utility spending on energy efficiency started to decline as electricity markets were being restructured to introduce more competition, and utilities reduced expenditures on energy efficiency programs as part of lowering costs to increase their competitiveness in retail markets. Utility expenditure on energy efficiency programs started to increase again from the mid-2000s.

The rationale for these utility energy efficiency programs was that acquiring energy efficiency resources was often found to be cheaper and more economically efficient than generating electricity or purchasing bulk electricity for resale to retail customers.[36] A recent study examined over 15 years of data from customer-funded energy efficiency programs implemented by utilities and third parties in

33 Musser, 2003.

34 "All available cost-effective energy efficiency" is defined as all reductions in energy consumption that are cheaper to acquire than supplying energy.

35 Musser, 2003.

36 Eckman, 2011.

the United States.[37] The study found that these programs produced an estimated one-percent savings in electricity consumption over the period 1992 to 2006 and almost two-percent cumulative electricity savings when savings in future years were taken into account. The electricity savings came at an expected average cost to utilities of roughly five cents per kWh saved when future savings were discounted at a standard discount rate of five percent. This is substantially cheaper than the average national retail electricity price in 2006 of 9.1 cents per KWh across all sectors. Energy savings were also more cost-effective than the levelised costs of investment in new generation capacity in 2006 that ranged from 8 to 9 cents per kWh for new baseload fossil fuel-fired capacity to about 13 cents per kWh for new gas turbine peaking plant.

Given the cost-effectiveness of energy efficiency, regulators in some US states require utilities to acquire all cost-effective energy efficiency before building additional generation capacity or purchasing bulk electricity from independent generators.

Since divesting themselves of largely loss-making ESCO businesses, many utilities in the United States have focussed on implementing energy efficiency programs mandated by regulators. Because regulators have established mechanisms that allow utilities to make money from energy efficiency programs, such programs provide a more predictable financial return to utilities than ESCO businesses. Many US states have cost recovery mechanisms whereby utilities are allowed to raise prices or add a surcharge in order to cover the costs of their energy efficiency programs, effectively making such programs customer-funded. Some regulators tie increases in retail electricity prices directly to energy efficiency spending or provide other financial incentives to utilities that achieve specified levels of energy efficiency performance.[38] Because the revenues of utilities that implement energy efficiency programs are reduced as a result of selling less electricity, some regulators have also implemented regulatory mechanisms that "decouple" or separate utility revenues from the amount of electricity that the utility sells.[39]

37 Arimura, et al., 2011.

38 Frank, 2008.

39 Lazar, et al., 2011.

4. Role of Grid Company ESCOs in China

In China, government support for ESCOs and financial incentives for energy performance contracting have encouraged grid companies to establish ESCOs as their main mechanism for acquiring energy and demand savings to meet their energy and demand reduction targets under the *DSM Implementation Measures* guidance document.

Commencing in 2011, State Grid Corporation of China has created ESCOs in all 26 provinces within its service territory as subsidiaries of State Grid-owned provincial grid companies. Ten of these are registered as qualified ESCOs by the NDRC and the MOF. The main roles of the State Grid ESCOs are implementing energy efficiency projects, delivering specialised energy and consultancy services, and helping to organise workshops and seminars to better engage end-users in energy efficiency programs. Between late 2010 and early 2012, State Grid ESCOs signed 116 energy management contracts, which are estimated to deliver 667 GWh of electricity savings. State Grid ESCOs have also constructed an energy efficiency service platform where experts and energy users can get together to study energy efficiency policies and technologies and conduct energy audits.[40]

In contrast, China Southern Grid Company has established one fully owned ESCO that it plans to use to implement energy efficiency projects. Southern Grid is planning to save 27.2 TWh of electricity from 2010 to 2015 by building efficiency power plants fully exploiting energy efficiency potential in green lighting, high-efficient electrical devices, and residential appliances. Southern Grid also plans to emphasise energy services by changing from pure peak load management to end-use energy efficiency, and from concentrating on electricity consumption management to providing comprehensive energy services.[41]

However, experience during 2011 and 2012 has shown that the grid company ESCOs are not competitive and progress is slow for the following reasons:

- insufficient capital – the registered capital for each grid company ESCO is about CNY 30 to 40 million (USD 4.8 to 6.4 million), which is quite low compared with the scale of the energy and demand savings that are required to be achieved;
- lack of projects – the grid company ESCOs lack marketing know-how;
- internal processes – State Grid requires headquarters' approval for projects above CNY 10 million (USD 1.6 million) and the time taken for approval is lengthy; and
- staffing – the process to hire ESCO staff is complicated.

Despite the limitations of the ESCO business model outlined in Section 3 of this report, ESCOs are a useful mechanism for grid companies to acquire energy efficiency resources in specific situations. ESCOs can offer an attractive proposition to facility owners, particularly when they arrange off-balance-sheet financing for energy efficiency projects. Grid companies can improve their implementation of the ESCO business model by:

- providing education and training to facility owners on the concept and operation of energy performance contracting;
- making sufficient funds available to grid company ESCOs to enable the ESCOs to provide off-balance-sheet funding for energy efficiency projects at facility owners' sites;
- providing detailed training for grid company ESCO staff in the full range of skills required, including technical, business, and financial skills;
- establishing partnering arrangements with technical experts who have specialised technical skills and expertise that existing grid company ESCO staff do not have; and
- marketing grid company ESCO services to owners of facilities in areas of the market that match the technical capability and capacity of the ESCO and its partners.

40 Crossley, et al., 2012.

41 Crossley, et al., 2012.

5. Conclusion

The major issue with the Chinese grid companies' current use of ESCOs as the main delivery mechanism for DSM is that it locates the acquisition of energy efficiency resources in a separate, subsidiary business unit outside the grid company core business. In the United States, acquiring energy efficiency resources is often found to be cheaper, and more economically efficient than generating or purchasing electricity. In China, the grid companies currently do not assess the cost-effectiveness of acquiring energy efficiency resources as compared with purchasing bulk electricity from generators. Locating the acquisition of energy efficiency resources in ESCO subsidiaries outside their core business makes it more difficult for the grid companies to carry out this cost-effectiveness assessment. China could significantly reduce costs and increase economic efficiency by requiring the grid companies to acquire all cost-effective energy efficiency before purchasing electricity from generators.

Given the limitations of the ESCO business model, it would be unwise for the government to allow grid companies to rely on wholly owned ESCO subsidiaries as their only mechanism for acquiring energy and demand savings. To overcome these limitations, it would be better for the grid companies to:

- directly fund the costs of carrying out more complex and comprehensive energy efficiency projects, in addition to using grid company ESCOs to undertake simpler projects; and
- engage third-party ESCOs as contractors to collaborate with grid company ESCOs in carrying out energy efficiency projects in the particular market segments that the third-party ESCOs specialise in, rather than requiring grid company ESCOs to compete with third-party ESCOs across all market segments.

Even though energy efficiency is usually cost-effective as compared with purchasing bulk electricity from generators, grid companies face significant costs in acquiring energy and demand savings, plus their revenues are reduced because they sell less electricity. At present, the regulatory regime in China does not allow the grid companies to recover these costs nor compensate them for the reduction in revenue. In the United States and some other countries, regulatory regimes have been established that reduce the financial penalties experienced by utilities in acquiring energy efficiency, including allowing utilities to collect funds from customers to cover the costs of energy efficiency programs and, in some cases, even providing financial incentives for utilities that achieve target levels of energy and demand savings. Chinese regulators should investigate adapting some of these regulatory mechanisms for use in China.

In the meantime, Chinese grid companies could recover the costs of directly funding energy efficiency projects and of engaging third-party ESCOs:

- from the financial incentives provided by the central and provincial governments for projects that deliver verified energy savings;
- from the cost savings that the grid companies would make from reducing energy consumption and energy demand; such cost savings can result from, for example, a reduced need for grid augmentation and grid expansion; and
- from the additional funding sources identified in the *DSM Implementation Measures* guidance document.

Directly funding end-use energy efficiency projects and engaging third-party ESCOs would assist the grid companies to change their business models from supplying electricity to providing comprehensive energy services to their customers, thereby reducing costs and increasing economic efficiency.

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http://www.raponline.org/document/download/id/4414

Government Oversight of Grid Company Demand-Side Management Activities in China

In January 2011, China established a new delivery mechanism for energy efficiency when it placed energy efficiency obligations on the two large grid companies that supply electricity to end-use customers. This mechanism joins the already successful system of establishing energy efficiency targets to be met by all levels of government and by selected individual enterprises. This paper provides our ideas for government oversight of grid company demand-side management (DSM) activities in China, based on international experience. Government oversight is important because, while the grid companies have the capability to be highly-effective deliverers of energy efficiency, they have no track record and their energy efficiency obligations are not inherently consistent with grid company internal incentives. Grid company delivery of energy efficiency has the potential to be as successful as the existing system. However, for this potential to be realized, it is important for China to establish robust procedures for government oversight of grid company DSM activities. The recommendations in this paper are intended to assist in establishing such procedures.

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http://www.raponline.org/document/download/id/6097

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An energy efficiency obligation (EEO) is a regulatory mechanism that requires obligated parties to meet quantitative energy saving targets by delivering or procuring eligible energy savings produced by implementing approved end-use energy efficiency measures. Governments in various jurisdictions around the world have endeavored to improve end-use energy efficiency, and in some cases also achieve other objectives, by designing and implementing EEO schemes. These schemes require energy providers, such as electricity and gas companies, to meet quantitative energy saving targets through assisting their customers to implement energy efficiency measures. This report includes detailed case studies of 19 EEO schemes implemented in a range of jurisdictions around the world. A table in the Appendix summarises and compares key design parameters among the schemes. The table and the case studies themselves demonstrate that there are many different ways to design and implement EEO schemes. Through a comparative analysis of the information in the case studies, the report identifies best practices in designing and implementing an EEO scheme. Adopting these best practices in designing and implementing new schemes, and updating existing ones, should improve the effectiveness of EEO schemes in delivering cost-effective energy efficiency.

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