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Expanding Energy Performance Contracting in China: Policy Solutions and Market Mechanisms

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In collaboration with

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CHINA: POLICY SOLUTIONS AND MARKET MECHANISMS**

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Executive Summary

Energy performance contracting is an important market mechanism that uses energy savings to pay over time for the upfront costs of energy efficiency retrofits in buildings, industries, and other types of facilities. Through energy performance contracts (EPCs), Energy Service Companies (ESCOs) play an important role in implementing energy efficiency retrofits. Both China and the United States have large markets for EPCs and significant opportunities for growth.

The Chinese government has made great efforts in promoting the country's ESCO business and expanding its EPC markets. This paper makes a series of recommendations for China to adopt more ambitious policy measures to encourage deep energy savings projects via EPCs. These recommendations are built on initial insights from a white paper developed by researchers at the Pacific Northwest National Laboratory and the Lawrence Berkeley National Laboratory with the assistance from the ESCO Committee of China's Energy Conservation Association (EMCA). Key recommendations are listed below.

Stimulating energy savings through incentives for EPCs

- Allow for more diverse contracting and financing models to benefit from government incentives
- Encourage deeper energy savings projects through energy performance-based incentives and establishing national accreditation and credit rating systems

Effective leveraging of government funding key recommendations

- Leverage government resources to address key barriers to market adoption in underserved sectors, including public and commercial buildings, the residential sector, and small-to-medium enterprises (SMEs)

Scaling up energy performance contracting in China's public sector

- Develop training programs that raise awareness and build capacity of major stakeholders to implement EPCs in the public sector. Major stakeholders include government officials, financial institutions and ESCOs.
- Modify government budgeting rules to allow public institutions to keep their energy budgets for the duration of the EPC contract.
- Amend procurement rules to authorize EPCs and introduce facilitating mechanisms, such as long-term contracting and two-stage tendering in the public sector.

执行摘要

合同能源管理（EPC）是一种利用节能收益支付建筑、工业和其他行业节能改造初始成本的重要市场机制。合同能源管理中，能源服务公司（ESCOs）是实施节能改造的重要力量。中国和美国都有巨大且增长的市场。

中国政府已在推进中国的能源服务和扩大合同能源管理市场方面做出了巨大努力。本政策建议报告提出了一系列建议，以利中国采取更积极的政策措施，通过合同能源管理挖掘更广阔的节能机会。这些建议是基于美国西北太平洋国家实验室、美国劳伦斯伯克利国家实验室、中国节能协会节能服务产业委员会（EMCA）合作撰写的美中合同能源管理白皮书对中美合同能源管理发展总结的基础上提出的。主要建议如下。

通过激励政策刺激合同能源管理市场

- 政府激励政策应鼓励所有适合市场条件的合同能源管理的合同模式、以利扩大使用合同能源管理机会。
- 政府激励从对节能改造项目直接补贴转向支持消除节能技术市场化及实施合同能源管理的障碍，从而节能量不再是公共财政驱动而是来自于市场需求。

有效利用政府融资

- 利用政府资源来解决关键市场壁垒，包括公共和商业建筑、住宅建筑、和中小型企业建筑。

推动公共部门扩大合同能源管理

- 制定培训项目，提高公共部门合同能源管理主要利益相关者的认识，对其进行能力建设。主要的利益相关者包括政府官员，金融机构和能源服务公司。
- 改进公共部门预算规则，使公共机构可以在合同期限内保持其能源预算。
- 修订公共部门采购规则（如允许两段招标），使公共部门使用合同能源管理更便捷，程序更一致。
- 鼓励创新的融资激励措施，实施多种最佳实践，鼓励更深层次的节能改造。

Table of Contents

Executive Summary	i
执行摘要.....	ii
Acronyms and Abbreviations	iv
Introduction.....	1
Stimulating Energy Savings through Incentives for EPCs Key Recommendations.....	1
Allowing for More Diverse Contracting and Financing Models to Benefit from Government Incentives	2
Encouraging Deeper Energy Savings Projects through Performance-Based Incentives and Establishing Accreditation and Credit Rating Systems	3
Effective Leveraging of Government Funding Key Recommendations.....	3
Leveraging Government Resources to Address Key Barriers	3
Scaling up Energy Performance Contracting in China’s Public Sector.....	10
The Public Sector in China	10
Current Policies on Energy Efficiency in the Public Sector	11
Institutional Arrangements	12
Capacity Building Is Vital to Scaling up EPCs in the Public sector	12
Relevant Issues: Budget Rules and Procurement Policies	14
Conclusions.....	16
Acknowledgements.....	17
References.....	18
Appendix A. Examples of EPC Incentives at National and City Levels.....	22
Appendix B. Existing Tax and Fiscal Incentives in China	23
Appendix C. Green Bonds As Financing.....	24
Appendix D. Types of Public Facilities in China	25
Appendix E. Current Institutional Arrangement of the Chinese Public Sector	27
Appendix F. Additional Options to Promote Deep Energy Savings in the Public Sector	29

List of Figures and Tables

Figure 1 Structure of the Greening the Supply Chain financing scheme	9
Figure 2. Number of Public Facilities in China by Type, 2010 (in Thousands)	25
Figure 3. Public Sector EPC Projects in China by Province	26
Figure 4. EPCs Projects in China by Public Institutions Type	26
Figure 5. Institutional Framework for EPCs in Government Buildings	27
Table 1. Examples of EPC Incentives in China at National and City Levels	2
Table 2. Examples of EPC Models by Target Sector, Primary Barriers Overcome and Challenges with Implementation	5
Table 3. Local Fiscal Incentives in Selected Locations	23

Acronyms and Abbreviations

Btu	British thermal unit
CHUEE	China Utility-Based Energy Efficiency Finance Program
CNY	Currency of China Yuan
DOE	U.S. Department of Energy
EES	Energy Efficiency Star
EMC	Energy Management Company
EMCA	ESCO Committee of China Energy Conservation Association
ESCO	Energy Service Company
EPC	Energy Performance Contract
ESPC	Energy Savings Performance Contract
FEDS	Facility Energy Decision System
FEMP	Federal Energy Management Program
FYP	Five-Year Plan (China)
GDP	Gross Domestic Product
GEF	Global Environmental Facility
GOA	Government Offices Administration of the State Council
HVAC	heating, ventilation and air conditioning
IDB	Inter-American Development Bank
IFC	International Finance Corporation
IPMVP	International Performance Measurement and Verification Protocol
LBNL	Lawrence Berkeley National Laboratory
MNC	multinational corporation
M&V	Measurement and Verification
MOF	Ministry of Finance (China)
MUSH	Municipal, University, School and Hospital
NAESCO	National Association of Energy Service Companies
NDRC	National Development & Reform Commission (China)
OBF	on-bill financing
PACE	Property Assessed Clean Energy
PNNL	Pacific Northwest National Laboratory
PPP	public-private partnership
SEF	sustainable energy financing
SME	small-and-medium sized enterprise
SPV	special purpose vehicle
tce	ton of coal equivalent
USD	U.S. dollar
WB	World Bank

Introduction

Energy performance contracts (EPCs) are transformative because they integrate project development, design, financing, construction, operation, and measurement and verification (M&V) in carrying out energy-savings measures. China and the United States have large markets for energy performance contracting (EPC), estimated at over \$6 billion in investments in each country in 2011 (Evans et al. 2014). The two countries are collaborating to capture deep energy savings opportunities through a joint EPC initiative launched in 2014 as part of the U.S.-China Climate Change Working Group under the U.S.-China Strategic and Economic Dialogue.

With the assistance from the ESCO Committee of China's Energy Conservation Association (EMCA), researchers at the U.S. Pacific Northwest National Laboratory (PNNL) and the Lawrence Berkeley National Laboratory (LBNL) developed a white paper entitled *Unleashing Energy Efficiency Retrofits through Energy Performance Contracts in China and the United States* as the first deliverable under this initiative. The white paper (Evans et al. 2014) examines differences in the EPC mechanisms and markets between China and the U.S. and identifies various policy, technical, financing, and market issues that confront the two countries. It points out general opportunities for expanding the EPC markets in each country.

This report builds on the initial insights from the white paper and provides policy recommendations to address specific barriers. The report offers detailed insights on creating feasible solutions and effective mechanisms to address challenges in the EPC market, especially underserved segments such as public institutions, small and medium enterprises, and the buildings sector. The discussion and recommendations of this paper focus heavily on the government's role because government policy can be essential in enabling healthy EPC market expansion. Both the central government and local governments have adopted policies to promote EPCs. Cities are already investing in incentives for EPCs, and they are seeking ways to make these investments as impactful and cost-effective as possible.

This report focuses on some important elements in unlocking financing and technical “know-how” for energy efficiency retrofits. It first describes the types of incentives that can be used to stimulate energy savings through EPCs and then discusses how government can leverage funds allocated to supporting EPCs more effectively. These recommendations are not mutually exclusive and governments can experiment with various combinations of these options. This paper also focuses in particular on the public sector and discusses ways to capture untapped EPC opportunities in this sector.

Stimulating Energy Savings through Incentives for EPCs Key Recommendations

Policymakers at the national, provincial and local levels in China have many options to stimulate EPCs as a way to facilitate deep energy savings projects. The most important strategies include:

- Allowing for more diverse contracting and financing models to benefit from government incentives
- Encouraging deeper energy savings projects through performance-based incentives and establishing national accreditation and credit rating systems

Allowing for More Diverse Contracting and Financing Models to Benefit from Government Incentives

The Chinese government at the national and subnational level has created ESCO reward programs targeting EPCs. The national government has offered favorable tax exemptions and reductions to support the country’s ESCO industry. These incentives have played a significant role in stimulating the early development of EPCs in China. However, further development of the Chinese EPC market would benefit from greater flexibility in incentives that allows for more diverse financing and contracting models. Innovations in financing and contracting can help expand the opportunities for projects in the EPC market, particularly for larger and more complex projects that require external financing. In this way, they can accelerate sector growth. Policymakers at the national, provincial and local levels in China can encourage development of such innovation by creating a level playing field for various financing and contracting models (i.e. providing similar incentives to all models). The Chinese government is currently providing incentives for the shared savings model in most cases, but it could encourage companies to experiment with other options, such as variations of the guaranteed savings model (Box 1) and other new approaches, like energy service agreements (ESA) (Box 2).

Several municipal and local governments have begun experimenting with flexible incentives that allow for different types of financing and contracting mechanisms. For example, the city of Shanghai offers incentives for projects that use either a shared savings model or a guaranteed savings model, and the city of Shenzhen also provides incentives for projects that use a range of models (see Table 1). These incentives went into effect in 2011. The Beijing Municipal Commission of Development and Reform is also considering expanding existing incentives to cover outsourcing of energy management. Appendix A provides more detailed information on China’s EPC incentives on both national and city levels.

Table 1. Examples of EPC Incentives in China at National and City Levels

	National	Beijing	Shanghai	Shenzhen
Contracting Model	Shared savings model	Shared savings model	Shared savings model and guaranteed savings model	Shared savings model and combined shared savings-guaranteed savings model
National Requirements	ESCOs cover at least 70% of the project cost; annual energy savings of 100 to 10,000 tonnes of coal equivalent (tce) for non-industrial projects; annual energy savings of 500 and 10,000 tce for industrial projects.			
Incentives	CNY 240/tce from Ministry of Finance (MOF)	CNY 240/tce from MOF, and CNY 260/tce from Beijing Finance Bureau	CNY 240/tce from MOF, and CNY 360/tce from Shanghai Finance Bureau	CNY 240/tce from MOF, and CNY 300/tce from Shenzhen Finance Bureau

* ESCOs registered at the national level can apply for national incentives, which are jointly funded by MOF and local MOF equivalents. National incentives are CNY 240/tce, and different cities have different levels of local incentives (no less than CNY 60/tce). Appendix A has more detail on incentives for ESCOs registered at local level.

Sources: Interim Management Regulations on Financial Rewards of Energy Performance Contracting Projects Beijing Energy Performance Contracting Financial Incentives Interim; Shanghai Energy Performance Contracting Financial Incentives; Shenzhen Energy Performance Contracting Financial Incentives Interim.

Encouraging Deeper Energy Savings Projects through Performance-Based Incentives and Establishing Accreditation and Credit Rating Systems

The Chinese EPC sector has opportunities to expand in terms of implementing deeper energy savings retrofits, i.e. with a greater percentage of saving per unit of energy consumed. Initially, it is common for ESCOs to test the market with small and technically “simple” projects. However, deeper retrofits can help access energy savings after EPC projects deploying short-term payback measures are exhausted in the market. Bundling short-term and longer-term energy saving measures make it easier to achieve deeper savings as this will build a project portfolio that has a good average rate of return, making the portfolio attractive for investment. Governments can stimulate deeper savings by providing energy performance-based incentives. For example, they can target incentives on contracting and financing models that encourage longer-term projects and/or providing progressive financial stimulus based on the energy-savings levels of varying measures rather than on a fixed incentive for per unit of energy-savings regardless of types of measures. For a program of energy performance-based incentives to succeed, it will require a more rigorous and detailed measurement and verification procedures. In particular, a more comprehensive M&V protocol could support projects with multiple energy savings measures; it could also help ESCOs and their customers accurately measure and verify the energy savings levels.

Energy efficiency financing can signal the value and security of the investment opportunity to financial stakeholders, since it enhances the confidence of savings from retrofits and customer repayment. China could increase the market confidence in EPC projects through forward-leaning measures. For example, while China has made efforts to rate ESCOs based on comprehensive technology capability, it still lacks an effective ESCO accreditation system for ESCOs to demonstrate rigorous standards of technical and managerial competence to design and implement EPC projects. An accreditation system would increase customer confidence in EPC projects performed by accredited companies meeting rigorous standards set by the government and industry. Moreover, governments can facilitate the development of a reliable nationwide credit rating system that not only tracks and documents the credit history of businesses but also issues credit rating to promptly evaluate a debtor’s creditworthiness, especially a business. Such a credit rating system could assist third-party financiers in effectively and objectively determining the debtor’s ability to repay the debt and the likelihood of default, easing the process of financing and reducing associated transaction costs.

Effective Leveraging of Government Funding Key Recommendations

- Leveraging government resources to address key barriers to market adoption in underserved sectors, including public and commercial buildings, the residential sector, and small-to-medium enterprises (SMEs)

Leveraging Government Resources to Address Key Barriers

China provides a number of fiscal incentives for EPC projects. (Appendix A provides more detailed information on the ESCO incentives and some issues that could constrain EPC market expansion in China). China’s fiscal rewards and tax incentives primarily benefit shared savings projects. This discourages ESCOs from pursuing contract options other than the shared savings model that could better suit the EPC project conditions. Moreover, according to case studies described in an LBNL paper (Romankiewicz et al., 2012), China’s

government financial rewards only marginally impacted payback periods of retrofit projects. This can influence whether deep energy savings measures are installed, suggesting a missed opportunity for public funding to be more impactful.

International experiences outside China have shown that government incentive programs have shifted from simply subsidizing retrofits to providing value-added support to significantly address the fundamental barriers to the market adoption of energy efficient technologies in industrial facilities and buildings so that energy savings will be achieved through increasing market demand rather than by government subsidies. In fact, government financial support in other countries has targeted activities such as moving energy innovation effectively and quickly to the market place, creating the next generation of energy professionals and clean energy entrepreneurs, addressing the “soft cost” associated with the deployment of efficient technology, raising public awareness and facilitating behavior changes regarding energy efficiency, enhancing the credit of market participants, promoting energy efficiency through significantly improving operation and management, and supporting innovation in SMEs who play a critical role in economic growth and job creation.

Direct public incentive for EPC projects may be necessary in the beginning of EPC industry development. However, to grow and optimize ESCO development and create great leverage for public funds, public funding should promote all suitable EPC models in order to maximize and diversify EPC opportunities. China could benefit from focusing its incentive policy on long-term solutions and addressing the fundamental barriers to market adoption of energy efficient measures, better attracting private capital to deep-savings projects and mitigating risks to EPC market participants.

The vast majority of EPC projects in China are self-financed by ESCOs. This prevents ESCOs from maximizing their expertise and taking on more and deeper energy savings EPC projects, because their assets are tied up in their current projects. At the same time, financing by a third party incurs transaction costs. China’s policymakers can use government resources to facilitate third-party financing. National, provincial and local governments can develop and implement dedicated financing programs¹ in special units or functional areas of existing Chinese financial institutions, such as China Development Bank, and other mechanisms that promote longer-term contracts, offer credit enhancement or bring down interest rates.

Such leverage-focused government programs need not to be a burden to governments, and they could harness the creativity of the private sector by gathering ideas and feedback on program design that goes beyond the shared-savings model. See examples set forth below in Boxes 1 to 4 below which attempt to overcome barriers for possible adaptation in different target sectors in China, as summarized in Table 2 below.

¹ In the United States, subnational entities, like the New York Green Bank, have implemented investment schemes encouraging the private sector to co-invest with the state government, while the government uses private sector fund management skills to execute deals that the private sector may be reluctant to finance alone. Private sector financing in clean energy markets is crowded in through various financing approaches, such as credit enhancements, project aggregation, asset-backed securitization and deploying long-term (“patient”) capital by extending project terms beyond what’s offered by private funding (NY Green Bank, 2014).

Table 2. Examples of EPC Models by Target Sector, Primary Barriers Overcome and Challenges with Implementation

Model	Target Sector	Primary Barriers Overcome	Select Challenges with Implementation
Traditional Guaranteed Savings	Public buildings	Financing by third party that allows ESCOs to grow; Clear payment schedule, making budgeting and financing easier; Clear M&V protocols attractive to customers	Host may not want financing on its balance sheet; government budget rules must be amended to allow institutions to repay retrofits (e.g., out of retained budget due to savings)
Short-Termed Guaranteed Savings	Commercial and public buildings	Self-financed by host or by third party financing. Project host withholds portion of ESCO's fee (e.g., 20% of project costs) for an agreed term until after M&V, limited to first year of ESCO's savings guarantee in effect, is complete and savings are verified	Because guarantee is shorter-term, measures with longer paybacks will not be adopted.
Energy Service Agreement	Public buildings, commercial buildings	Government-owned or authorized special purpose vehicle (SPV) bears loan on its balance sheet – no upfront finance by ESCO or host client, relieving ESCO from financing and host credit risk and relieving host from upfront capital cost which may limit host's ability to obtain future financing for core business needs	Government-owned SPV could increase government debt; amend government budget rules to let public institutions keep savings to repay retrofits; enforcement of complex agreements and M&V; government must develop in-house or outsource capacity to assess host credit risk and technical risk of efficiency measures
On-Bill Financing	Residential, commercial buildings	No upfront financing by customer or ESCO; Diversified types of financing as long as payment made via utility billing; Bill payment history help assess and enhance customers' creditworthiness	Requires regulatory changes; requires utilities to modify billing system. For heating services, on-bill financing may be more feasible for buildings in Southern China where district heating is not provided, as compared with difficult application in Northern China where heating services are not metered
Supply Chain-Driven Finance	SME manufacturers	SME access to third-party financing guaranteed by multinational corporation (MNC) so no (or limited) upfront equity by SME host or ESCO; product cost-savings shared between SMEs and upstream buyer MNC	Resistance from SMEs in sharing cost data; SMEs hosts may not want financing on balance sheet

Box 1. Short-Term Guaranteed Savings Contractual Arrangements

A short-term performance guaranteed savings model used by Johnson Controls, Inc., is a modification of the traditional guaranteed savings agreement that covers a longer period of performance. It involves a contract in which the host facility client agrees to pay the ESCO for approximately 80% of total project costs upfront and to pay the remaining contract value after M&V which verifies project performance in the first 1-2 years of operation. The ESCO provides a short-term savings performance guarantee (e.g., up to 2 years). An independent, government-certified third-party conducts the M&V to assure savings performance before final payment is made to the ESCO. To mitigate the non-payment of host client, an escrow account is established. The financing may be from a third-party or the host facility client, and projects usually have payback periods of approximately 5 years. This model may be suitable for China's public sector where the host facility is unlikely to change ownership, and if used in other sectors, such as the commercial sector, a central government credit enhancement (e.g., first loss reserve to support borrower credit risk) could assist with accelerating deployment.

Box 2. Energy Service Agreements

Internationally, the energy or efficiency service agreement model (ESA) is receiving increasing attention. An ESA is a pay-for-service financing solution that allows host customers to benefit from comprehensive efficiency upgrades without upfront capital expenditure (DOE 2014; ACUPCC 2014). Evans et al. (2014) provides additional details on ESA.

Governments can be instrumental in creating ESA type contracts, for example, by establishing a government-owned or -authorized special purpose vehicle (SPV). The government-supported SPV serves as the obligor of a third-party loan, as supported by both an agreement from the host facility to pay the government-owned or authorized SPV for the energy services and an energy savings performance guarantee from the ESCO backstopping any savings shortfall. In the United States, the ESA has been used as an off-credit model (i.e., Chicago Infrastructure Trust) that does not impact the credit rating of the city or central government and its ability to raise debt financing in the future because the payments based on the client's energy savings is variable and therefore contingent. The variability of the stream of payment from the host client based on energy savings is smoothed out by the payments made by the ESCO for any savings shortfalls so the government-owned or -authorized SPV can pay the lender according to a fixed amortization schedule.

China could consider promoting ESA type financing, especially with an entity at the city level serving as the government-supported SPV, perhaps backed up by a central government credit guarantee to induce third-party lending, that contracts with third-party M&V auditors. China's state-owned utility companies, such as the State Grid and China Southern Grid, have created their own ESCOs to conduct energy retrofits for meeting their mandatory energy reduction target. In view of grid company requirements to meet annual targets for investing in energy efficiency, these utility-owned ESCOs or a China policy bank could form the SPV or serve as a prime contractor working with city or industrial park governments throughout China to develop large-scale energy efficiency programs using ESA and ESCOs for the installation work.

Box 3. Diversifying Financing Options via On-Bill Financing

On-bill financing (OBF) is a new tool for energy-related financing that leverages a utility's unique relationship with its customers to provide access to funding for energy efficiency retrofits and allows customer repayment through their utility billings. In the United States, where OBF has been popular in the buildings sector, at least 23 states have implemented or are ready to implement OBF (ACEEE, 2012). Depending on the retrofit type, OBF can be "bill-neutral," with energy savings sufficient to cover the scheduled payments for the financing so that the total energy charge on the utility bill is less than or equal to the pre-retrofit bill. A utility can be an active player in pursuing OBF, by directly using its own ratepayer funds collected by a state regulator through an approved tariff, by a utility public benefit charge or by arranging the third-party financing to support customers' energy retrofits. Utilities may also play a less active role serving only as a payment collector, allowing a third-party to directly offer financing to the utility customers and collect payment via the utility billing system. In return, the utility generates revenue for its payment collection service.

Benefits of OBF include no upfront cost for customers' retrofits, bill payment history for assessing customers' creditworthiness, and flexible and diverse financing options that enable the utility to convert financing it provides to off-balance-sheet operating expenses through utility bill payment. The current utility advance payment practices in parts of China may facilitate use of OBF financing for the untapped residential sector.

Under this advance payment scheme, repayment by customers of the retrofit financing may be facilitated by reprogramming the calculation of customer's account balance. In cases where OBF is "bill-neutral" before and after the retrofit, customers will have the same or more amount left on their prepaid account over a defined time period depending on the financing repayment schedules. For OBF to be a successful financing tool, issues like split incentive and complex property ownership still need to be addressed. For heating services, OBF may be more feasible for buildings in southern China where district heating is not utilized and may be difficult to apply in Northern China where heating services are not metered.

Box 4. Innovative Financing Driven by the Supply Chain

Small-and-medium sized enterprises (SMEs) represent a large untapped energy saving and pollution reduction potential in China. Unlike for large, state-owned enterprises, financing is more difficult and more costly for SMEs to access, and the EPC market for SMEs has historically faced many barriers due to small project size and the unavailability or fragmented nature of data on SMEs' credit histories. Removing barriers to financing energy efficiency in SMEs requires innovative mechanisms.

An MNCs-facilitated financing scheme initially proposed by LBNL and supported by companies like Ernst Young is a model that leverages Greening the Supply Chain programs of MNCs and global buyers/brands to overcome the efficiency financing barriers for SMEs. This scheme uses financing arrangements that leverage established business relations between MNCs and their long-standing SME suppliers with strong credit ratings of MNCs as risk mitigation strategies.

Under this model, the MNC serves as a guarantor of the SME host supplier's loan from a third-party financier, which proceeds pay for the upfront costs of a portfolio of efficiency measures including retrofits installing the MNC's products or solutions. The MNC's loan guarantee induces the third-party financier to extend credit to the SME host supplier. The SME supplier repays the third-party financier and shares with the MNC cost savings generated from the efficiency measures through a price discount in the SME host supplier's products procured by the MNC. In entering supply agreements with SMEs, MNCs typically conduct financial due diligence on SME counterparts to assure stable supply at contracted prices. The MNC's level of transparency into the SME's financial condition from this process and investment-grade energy audit as a prerequisite for the MNC to provide a loan guarantee can form a baseline for establishing a negotiated sharing of cost savings. ESCOs design and install the efficiency measures, collect fixed fees for the services, and assume only the technical risk of a project through an energy savings performance guarantee without providing the financing for upfront costs. The MNC's credit enhancement and ESCOs' performance guarantee could work together to mitigate both credit and technical risks of financing efficiency retrofits of SME suppliers, significantly lowering the transaction costs, while also relieving ESCOs from financing the upfront costs of their installations thereby enabling their continued growth. The MNC's risk of providing a guarantee under this scheme could be mitigated if the International Finance Corporation (IFC) were amenable to sharing or assuming first loss on the SME's risk under the IFC's CHUEE program.

The supply chain-driven financing scheme can effectively leverage provincial government programs, such as the Energy Efficiency Star program, to create both policy push and market pull for promoting and financing energy retrofits in China's SMEs. The Energy Efficiency Star (EES) program is a one-to-five-star comprehensive labeling scheme initiated by the Suzhou city government to evaluate and rate local manufacturing enterprises based on their comprehensive performance in multiple areas, including energy management practices, savings from energy retrofits and improvements in energy efficiency or environmental quality. Programs like EES can drive SME participation by helping MNCs identify the SME suppliers to target and assist MNCs with measurement of savings improvement targets set by MNCs.

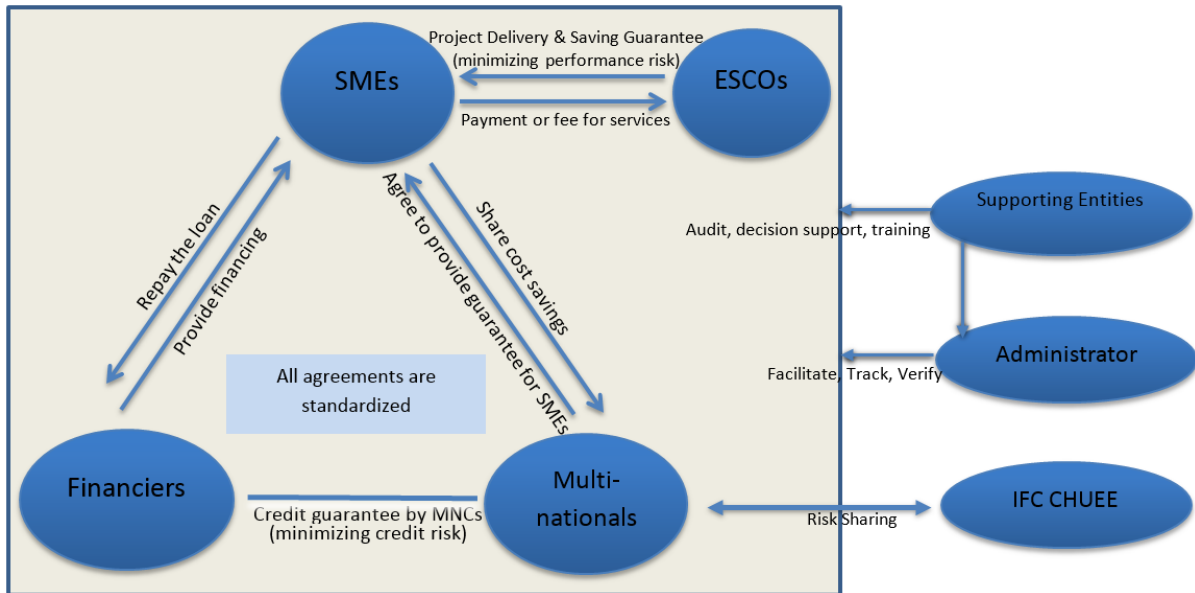


Figure 1 Structure of the Greening the Supply Chain financing scheme

The above examples in Boxes 1 to 4 demonstrate that governments can play important and effective roles in working directly with the private sector to address market adoption and financing barriers to comprehensive and deeper energy savings retrofits. Now is the right time for China to explore ideas on creating an innovative and strong partnership using a panoply of business models, financing tools and approaches whereby governments can significantly leverage private resources to enable energy efficiency financing and EPC market development.

Finally, tapping China’s corporate or asset-backed bond markets may unleash in the long-term larger pools of capital to finance energy efficiency retrofits, as has been done through investment funds sponsored in the United States and Europe by private and public entities. China is developing its asset-backed securitization (ABS) market, with the release in November 2014 by the China Securities and Banking Regulatory Commissions (CSRC, CBRC) of new provisions relaxing approvals required to facilitate this market development. Even with these changes, the China bond market remains fragmented and illiquid, with short maturities (i.e., 3-5 years) and untested laws on special purpose vehicle trusts for ABS. Nevertheless, China may consider piloting in a select municipality an ABS model that uses monetized savings from standardized operational efficiency retrofits to repay bondholders. Box 5 below and Box 6 in Appendix C offer examples of ABS bond offerings that could be piloted by central or provincial governments.

Box 5. Sustainable Energy Financing.

The Sustainability Energy Financing (SEF) is designed by the Foundation for Renewable Energy and Environment and implemented in several U.S. jurisdictions (e.g., Delaware, California, Pennsylvania, and Washington D.C.). The SEF is organized and administered by an implementing entity that is affiliated with a local authority or an independent third-party contracted by the local authority and responsible for leading state or local level implementation of energy efficiency and onsite renewable energy generation programs. Under the SEF, the implementing entity leverages private capital through issuing tax-exempt, low-interest sustainable energy bonds or tax-exempt leases using bank loans. The low-cost financing results from the higher credit rating of the implementing entity and is achieved by pooling common credits, streamlining repayment management, and using an objective, measurement-based contractual guarantee of monetized energy savings which must always be greater than the debt service payment. The financing is issued in series to meet the specific funding requirements of projects with different terms and different technologies (FREE, 2013). China's onshore bond market offers state-owned and private, well-capitalized entities lower interest rates than bank loans with the same term. The SEF concept could be piloted in select municipalities authorized to issue onshore bonds if the underlying project assets and documents can be standardized.

Scaling up Energy Performance Contracting in China's Public Sector

- Develop training programs that raise awareness and build capacity of major stakeholders to implement EPCs in the public sector. Major stakeholders include government officials, financial institutions and ESCOs.
- Modify government budgeting rules to allow public institutions to keep their energy budgets for the duration of the contract.
- Amend procurement rules to authorize EPCs and introduce facilitating mechanisms, such as long-term contracting and two-stage tendering in the public sector.

The Public Sector in China

The public sector² in China offers many opportunities for energy efficiency improvements and for ESCO market expansion.³ The sector consumed 6.2% of the country's total energy use in 2010 (World Bank 2012)⁴ and consisted of 1.9 million public facilities that occupied about 6 billion m² of floor space (Yu et al. 2014). (See Appendix D for more information on public facilities in China).

EPCs can help tap the large energy efficiency potential of the Chinese public sector, but it may require building capacity of major stakeholders as well as re-examining China's related institutional framework and public procurement process (Evans et al. 2014).

² Public buildings in this report refer to buildings owned or occupied by government or government-sponsored entities.

³ In China, most ESCOs are called energy management companies. "Energy management companies" is a slightly broader category as some of these companies provide energy and energy efficiency services without getting paid based on the performance of their projects.

⁴ This number also includes the transportation fleet.

Current Policies on Energy Efficiency in the Public Sector

Recognizing the significance of the public sector, the Chinese government has adopted a series of policies and measures to improve energy efficiency, including collecting better data on energy consumption, setting energy saving targets and expanding government financing and incentives (GOA 2008; NDRC and MOHURD 2013). The government has encouraged the use of EPCs in energy efficiency retrofits in the public sector, but to date, there have been relatively few EPC projects in the public sector. By comparison, the U.S. public sector commonly relies on EPCs for energy efficiency retrofits, and the mechanism helped improve energy intensity (energy consumption per m²) in existing federal facilities by more than 30%, compared to when EPCs were first introduced in 1985. In fact, government and institutional⁵ facilities currently account for up to 84% of U.S. ESCOs' total revenue (Larsen et al. 2012). In China, the public sector could also offer a stream of projects for ESCOs.

The EPC mechanism is already established in other sectors in China. Currently, 72% of the contracts are in the industrial sector (Evans et al. 2014). In the public sector, ESCOs have completed just 470 EPC projects to date, which cover less than 0.1% of existing public facilities (GOA 2014).

As noted previously, the Chinese central government has introduced policies to encourage energy efficiency in the public sector. In 2008, GOA of China's State Council issued the *Public Sector Energy Conservation Rule*, which encouraged public facilities to work with ESCOs and use EPC for energy efficiency financing, retrofits and management, and also laid out a system for developing detailed goals for improving energy efficiency. Specifically, it required NDRC, GOA and MOF to develop targets for energy use per m² for different regions and building types. The State Council also mandated that government agencies determine allowable budgets for energy costs at public institutions (GOA 2008). Further, the directive required that public institutions procure energy efficient products in accordance with national mandatory procurement rules or from product reference lists.

In 2013, the NDRC and Ministry of Housing and Urban-Rural Development (MOHURD) of China's State Council issued the *Green Building Action Plan*, which encouraged public buildings to use EPCs to finance retrofits. This action plan called for 60 million m² of retrofits in government office buildings and another 60 million m² of retrofits in other types of public facilities (NDRC and MOHURD 2013).

Incentivizing energy efficiency improvements is an important factor in developing an EPC market in the public sector. However, experiences in the United States and other countries show that public sector EPCs require additional support, in particular through capacity building of various stakeholders, developing budgeting and financing mechanisms, and creating supportive procurement rules.

At the local level, several provinces and cities have experimented with policies to encourage EPCs in the public sector. For example, Beijing introduced *Interim Measures on Supporting EPC Projects in Public Institutions* in 2009 and *Beijing Energy Performance Contracting Financial Incentives Interim* in 2010 (BMCDR and BFB 2010). Through these policies the Beijing government rewards EPC projects initiated by public institutions and large-scale public buildings and allows public facilities to retain a portion of savings as internal funds for the first three years after the end of the contract period. Scaling up such policies and implementing other best practices outlined here can help harness the energy efficiency potential of the public sector in China.

⁵ Institutional refers to municipal facilities, universities, schools and hospitals.

Institutional Arrangements

EPCs can vary in their complexity but typically involve ESCOs, facility managers, building occupants, building owners and financial institutions. In the public sector, stakeholders can also include various government agencies, legislative authorities and taxpayers. Owners and managers of public buildings can also be local, provincial or central government institutions, and solutions to scaling up EPCs need to consider this context.

In China, the GOA of the State Council guides, manages and monitors energy efficiency in central government buildings and facilities. Meanwhile, provincial GOAs or their local-level equivalents manage and monitor government facilities at their respective levels. The MOF as well as provincial and local finance departments manage energy budgets for public buildings at their respective levels. NDRC, MOHURD and MOF provide policy and financial support and guidance on energy efficiency in public institutions. The local equivalents of these national agencies manage provincial and local-level energy efficiency of public institutions, and they set local targets and policies (see Appendix E for a more detailed description).

It is important to consider these various stakeholders to obtain the necessary buy-ins and approvals and secure cash flows in EPC projects. For example, if local finance bureaus sign off on a facility budget or an EPC payment, they need to understand how EPCs generate savings.

Capacity Building Is Vital to Scaling up EPCs in the Public sector

Capacity building is a critical first step in gaining buy-in from stakeholders on the need for new budget and procurement rules that are essential for EPCs. These rules would represent a departure from some existing budgeting practices. At the same time, strengthening capacity can help stakeholders view EPCs as more feasible. Below, we describe options for building capacity and awareness among government and public sector stakeholders, at financial institutions and in ESCOs.

Raising awareness and building capacity of government officials and other stakeholders

Government officials, facility managers, building occupants and other stakeholders lack awareness of EPCs and capacity to initiate projects. This section covers two distinct types of activities: (1) activities to raise the awareness of key stakeholders and create an increased understanding of the value of energy efficiency retrofits, and (2) training specifically to build capacity among government managers to initiate, design and manage EPCs.

Many stakeholders have a limited understanding of the specific benefits of improving energy efficiency in buildings. Raising awareness among government officials will help ensure that public sector decision-makers have sufficient awareness and motivation to undertake EPCs. Universities, research institutes or the EMCA could raise awareness about energy efficiency and EPCs among Chinese government agency officials and other stakeholders through educational campaigns and targeted media outreach. Educational campaigns could target stakeholders related to government office buildings, hospitals, universities and schools, with a particular emphasis on key energy decision-makers in the facilities.

Trained facility managers can reduce EPC negotiation time, save costs and increase the likelihood of project success. Meanwhile, it is rare for public facilities in China to have professional facility managers, with the exception of large buildings. Much of the

responsibility for implementing EPCs typically lies with staff at public facilities who have other full-time responsibilities. Thus, it is important to identify the right staff at facilities, who would benefit from training in energy and building management and the use of EPCs in retrofits.

EMCA already offers fee-based, in-person EPC training, however, this training is mainly for ESCOs. Chinese universities, research institutes or EMCA could provide more training courses specifically targeting government officials and public facility managers. Examples of additional training areas that could help build the capacity of government managers include scoping EPC projects, contracting issues, financing from the perspective of a facilities manager, project implementation, and M&V.

An example of such a program in the United States is the Federal Energy Management Program (FEMP). FEMP builds capacity by offering more than 600 free on-demand video courses and presentations designed for various government and institutional stakeholders. Videos cover such topics as audits, building management systems, contracting and finance, energy efficient technologies, energy management, labs and data centers, legislation, operations and maintenance, renewable energy, sustainability and institutional change, and water use reduction.

China already has experience in building capacity for retrofits in other sectors by increasing the capacity of stakeholders. One example is China's large-scale efforts to retrofit multifamily housing in cold climates. The China Academy of Building Research (CABR) has provided training on energy efficient technologies, energy efficiency evaluation and labeling in both residential and public sectors. The training targeted management teams from construction departments and quality supervision stations (CABR 2014).

Capacity building in the financing sector

The public sector offers many opportunities for energy efficiency improvements, and third-party financing will make it easier to achieve these savings.

Education and capacity building need to focus on assisting banks and insurance companies in developing and promoting financial products that are specifically tailored to energy efficiency and EPCs. Further, education and capacity building should focus on creating diversified and innovative financing mechanisms. Thus, financial institutions could benefit from several types of targeted training and capacity building. Such training could cover EPCs and evaluation of cash flow, profits and risks. It could also include sharing information on business models that might work in the public sector, such as what types of guarantees might be available, and how government funds might co-sponsor certain projects. There are several existing business models for the public sector. Examples are models where financial institutions agree to purchase future receivables from the project, =finance bond issues for projects, or provide financing to ESCOs to implement projects (Evans et al. 2014). The risks and benefits of each vary and exposure of financial institutions to these models could help stimulate the market.

Some commercial banks in China, such as Bank of Beijing, Industrial Bank, Hua Xia Bank, China Merchants Bank and SPD Bank, have provided loans to ESCOs (ISC 2013). It is difficult for small-sized ESCOs with limited credit histories to obtain bank loans from large state-owned banks. However, state-owned banks could lend to public institutions to implement EPCs, which will reduce ESCOs' financial pressure. More training on these alternative financing channels would be beneficial to financial institutions as well.

Building capacity of ESCOs for public sector EPCs

To work efficiently with the public sector, ESCOs and service providers have much to learn, as public facilities operate within certain constraints and must follow specific rules. Training, specifically developed for ESCOs, can help further reduce the learning cost. Currently, EMCA hosts a training center for ESCOs in China, which provides courses covering a wide range of topics, such as policy, financing, technologies, EPC taxation and financial management, energy auditing, project management, and measurement and verification (EMCA 2014). The training fees range from RMB 1,000 to 10,000 per person depending on the course level. EMCA also provides free in-person training to its members and shares free training resources online. The EMCA or other training providers could include more training resources that are free and available online, such as pre-recorded webinars and training materials.

In addition to EMCA's current general courses, more specific training could be beneficial. Special courses might include public sector procurement rules for ESCOs, financing public sector retrofit projects, technology choices for public sector projects and integrated, comprehensive approaches to retrofits in public buildings. For comparison, in the United States, the National Association Energy Service Companies (NAESCO) hosts an annual Federal Market Workshop, which provides ESCOs with updates, changes and processes in the vast federal energy efficiency market (NAESCO 2014). Also, the FEMP has specific training on energy efficient technologies, energy management, contracting and finance. Other examples of specific courses are case studies that offer ESCOs information on successful peer experiences.

Relevant Issues: Budget Rules and Procurement Policies

In China, a public institution's energy budget depends on its set energy use targets (expressed as energy use per m²), in accordance with the State Council's 2008 *Public Sector Energy Conservation Rules* (GOA 2008). This approach encourages efficiency in theory, but in practice, after the target is set any savings result in budget cuts. This approach makes it very difficult for public institutions to pursue EPCs because they will not have the budget savings in hand to repay the ESCOs. On the other hand, allowing public facilities to retain their original energy budgets for the entire contract period would help motivate public institutions to implement EPCs; it would also ensure that public facilities could repay the ESCOs under the EPC. The United States and several other countries have re-written government budgeting rules to allow public institutions to keep their energy budgets uncut during the period of the contract to allow for repayment.

Examples of such policies already exist in China at the local level. The Beijing Municipal Development and Reform Commission and Beijing Finance Bureau issued the *Beijing Energy Performance Contracting Financial Incentives Interim* in November 2010, which requires that budgets for energy use are allocated according to a decreased energy use within the period of EPC projects. Meanwhile, payments to ESCOs will be categorized as part of the EPC project expenditure budget, and the portion of savings retained by public institutions can be used as internal funds within the first three years after the end of the contract period. However, this provisional legislation only applies to the shared savings contracts, which limits the flexibility to innovate in financing and contracting based on project needs.

Shenzhen serves as an exemplary practitioner at the local level. The Shenzhen Government Offices Administration, Shenzhen Municipal Development and Reform Commission and Finance Commission of Shenzhen Municipality issued *Shenzhen Energy Performance Contracting in Public Sector Implementation Plan* in 2012, which requires that

energy performance contracting is the main approach to energy efficiency in the public sector. By June 2014, Shenzhen implemented 7 million m² and completed 4.2 million m² of EPCs projects in the public sector (Shenzhen News 2014). It is also worth noting that Shenzhen has utilized an innovative mechanism for budgeting rules. The Finance Commission of Shenzhen Municipality requires that budgets for energy use are allocated based on original budgets standards or energy intensity. At the same time, facilities are required to report energy savings to the Finance Commission of Shenzhen Municipality and make payments to ESCOs, which has resolved the contradiction between allocation of energy savings and budget rules. GOA has pointed out that EPCs in public sector should learn from Shenzhen's experience in EPCs in Public Sector Symposium in July 2014 (ECPI 2014).

Public sector entities must follow public procurement rules, so the existence of supporting legislation is critical, based on experience around the world. Thus, existing public procurement rules need to be adapted to allow EPCs to flourish in the public sector. There are three main reasons for rule adaptation. First, public procurement rules are typically designed for simple purchases of goods or services; they may not have any provisions for procurements that involve performance requirements. Without such provisions, there may not be legal authority for undertaking EPCs, making it harder to obtain approval for EPCs. At the national level, the State Council's 2008 *Public Sector Energy Conservation Rules* indicated public institutions can use EPCs for energy efficiency retrofits and financing. At provincial and local levels, policies and guidelines support EPCs in the public sector to varying degrees. Stronger legislative and policy support of EPCs at the national level, such as amendment of government procurement rules, and required harmonization of provincial and local rules with national legislation and policies would help scale up EPCs in the public sector (GOA 2008).

Second, public procurement rules may need to be adjusted to allow for selection of awards based not just on the lowest cost but on the lowest life-cycle cost. In other words, an EPC proposal with the lowest first costs may not provide the best financial value to the public institutions; procurement rules should reward lower life-cycle costs, particularly for effective EPCs.

Third, EPCs are relatively complex contracts; streamlining the procurement policy will facilitate EPCs in the public sector. Streamlining can also help in meeting the specific requirements of EPCs (particularly regarding the need for high-quality investment grade audits (IGAs)). In the United States, the FEMP designed a procurement process, called a Super Energy Service Performance Contract (Super ESPC), that streamlines contracting for facilities in the public sector. Under this program, the FEMP requires ESCOs to compete for large "umbrella" contracts every 5 years; any federal agency can access these umbrella contracts for specific projects by issuing a task order. About 15 ESCOs receive awards, and the FEMP then rotates assignments for developing projects with federal agencies among the ESCOs (agencies may also choose to hold a limited competition among several ESCOs). This approach significantly reduces the procurement expenses, negotiation time, and risks for ESCOs and public facilities. Another flexibility built into this contract process is that ESCOs are allowed to modify initially proposed energy conservation measures post-award, based on a more in-depth audit or IGA, before guaranteeing savings. This modification process allows for a higher quality audit, which reduces risks for all involved and allows the ESCO to guarantee larger savings.

The Chinese government could also experiment with a two-stage procurement process, which can be an alternative way of allowing the ESCOs to conduct IGAs. In such a procurement model, public facilities first select one or a few ESCOs based on their qualifications and (sometimes) a simple proposal. In the second stage, the winning ESCOs submit a proposal in which energy conservation measures have been examined more

thoroughly. Typically, ESCOs are unwilling to invest in an IGA unless they have a very strong chance of winning a project, but skipping the IGA typically leads to smaller, riskier projects. A two-stage procurement process allows ESCOs and facilities to take on less risk and lowers ESCOs procurement costs, as the selection at the first stage limits competition. If the results of an IGA deviate significantly from the client's expectation, the client has the right to cancel the EPC project without paying the ESCO for the prior analysis. Appendix F describes additional options to promote deep energy savings in the public sector.

Conclusions

EPCs are an important market mechanism in unlocking financing and technical know-how for energy efficiency. By pursuing EPCs, ESCOs play an important role in achieving energy efficiency retrofits in buildings, industry, and other types of facilities. The Chinese government has made a great effort in promoting the country's ESCO business and expanding the EPC market. This paper makes a series of recommendations for China to adopt more ambitious policy measures in encouraging deep energy savings via EPCs.

To bring optimal results, it will be valuable for China to use its public funding to support all suitable EPC models to maximize and diversify EPC opportunities. It will also be beneficial for China to start focusing its incentive policy on long-term and more cost-effective solutions, making a transition from directly subsidizing EPC projects to creating market conditions necessary for deploying deep-saving solutions and financing frameworks that support demand. While policy changes at the national level are complex and time-consuming, Chinese cities and provinces often serve as early adopters in much the same way as localities in the United States and elsewhere and experiment with innovative incentive policies, financing models, and public procurement rules, as is done in the United States and other countries. Innovation in financing could help China extend EPCs to underserved market segments such as commercial buildings, SMEs and the residential sector. At the same time, pursuing long-term and comprehensive energy efficiency solutions require more effective contracting options beyond the shared savings model. Regardless of what options are adopted, however, standardizing contractual procedures with common terms and conditions will help China smooth the contracting process and minimize transaction costs associated with financing. Such contract standardization will also better position China in the long-term to tap its capital markets and private resources for innovative financing for energy efficiency. It is equally important for China to promote EPCs in the public sector as it can unleash great energy efficiency retrofits in a sector that leads by example to demonstrate the public sector's commitment to environmental and energy sustainability while reducing operation costs.

It is important for both China and the United States to seek continuing policy support and greater market flexibility in developing innovative mechanisms to attract investment at lower costs and to trigger technology integration focused on deep energy savings. It is also important for both countries to strengthen their collaboration in EPCs to share valuable insights and lessons learned in incentives, financing, contracting, technologies, project development, risk management, and M&V. Such innovation and collaboration will allow both countries to create tremendous opportunities to expand EPCs and unleash deep-savings retrofits.

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References

- ASE (Alliance to Save Energy). 2008. Brief #1: Funding Mechanisms for Energy Efficiency. <http://www.ase.org/resources/brief-1-funding-mechanisms-energy-efficiency>
- ACUPCC (American College & University Presidents' Climate Commitment). 2014. Financing Sustainability Projects on Campus: Efficiency Services Agreements. <http://www.presidentsclimatecommitment.org/resources/financing/efficiency-services-agreements>
- ACEEE (American Council for Energy-Efficient Economy). 2012. On-Bill Financing for Energy Efficiency Improvements. http://www.aceee.org/files/pdf/toolkit/OBF_toolkit.pdf
- Beijing Evening News. 2010. Establishment of Special Funds for Energy Management Contracting. December 5, 2010. <http://www.elechina.com.cn/index.php?c=form&a=show&id=1629&modelid=7&cid=932&page=2>
- Beijing Municipal Commission of Development and Reform, Beijing Finance Bureau. 2010. *Beijing Energy Performance Contracting Financial Incentives Interim*. <http://policy.emca.cn/n/20110712115110.html>
- Beijing Municipal Commission of Development and Reform, Beijing Finance Bureau. 2013. *Suggestion on Beijing further promoting Energy Performance Contracting in developing energy efficiency service industry*. <http://www.bjpc.gov.cn/tztg/201306/t6304521.htm>
- BMCDD and BFB (Beijing Municipal Commission of Development and Reform and Beijing Finance Bureau). 2010. Beijing Energy Performance Contracting Financial Incentives Interim. <http://policy.emca.cn/n/20110712115110.html>
- CABR (China Academy of Building Research). 2014. Training Information. <http://www.cabr-betc.com/list.aspx?id=250846114252>
- DOE (Department of Energy). 2009. Revolving Loan Funds and the State Energy Program. https://www1.eere.energy.gov/wip/pdfs/sep_rlf.pdf
- DOE (Department of Energy). 2014. Energy Department's Loan Portfolio Continues Strong Performance While Deploying Innovation. <http://energy.gov/articles/energy-department-s-loan-portfolio-continues-strong-performance-while-deploying-innovation>
- DOE (Department of Energy). 2014. Energy Service Agreement. <http://www4.eere.energy.gov/alliance/sites/default/files/uploaded-files/Service%20Agreement%20Financing%20Summary.pdf>
- ECPI (Energy Conservation for Public Institutions). 2014. Public Institutions Demonstration Projects and Energy Performance Contracting Promotion Symposium, Government Offices Administration. http://ecpi.ggj.gov.cn/tpxw/201407/t20140728_286124.htm
- EMCA and IFC (Energy Management Company Association and International Finance Corporation). 2012. China Energy Service Company (ESCO) Market Study. EMCA. 2014. China Energy Services Training Center. <http://www.emca.cn/bg/pxzx/index.html>
- Evans, M., Yu, S., Roshchanka, V., Halverson, M., Shen, B., Price, L., Liu, M., Miao, P., Dai, F., and L. Meng. 2014 (in print). Unleashing Energy Efficiency Retrofits through Energy Performance Contracts in China and the United States

- Finance Commission of Shenzhen Municipality. 2011. *Shenzhen Energy Performance Contracting Financial Incentives*.
http://www.szfb.gov.cn/ywpd/jnjp/201409/t20140920_2578171.htm
- FREE (Foundation for Renewable Energy & Environment). 2013. Sustainability Energy Utility (SEU): Understanding the Basics. http://freefutures.org/wp-content/uploads/2013/05/2013_FREE_Policy_Brief_January.pdf
- Frusha, M., and J. Karger. 2011. “Leveraging Federal Funds: Department of Energy PACE Webinar.” January 15, 2011, U.S. Department of Energy
- Goldman C.A., Peters, J.S., Albers, N., Stuart, E., and M.C. Fuller. 2010. Energy Efficiency Services Sector: Workforce Education and Training Needs. Lawrence Berkeley National Laboratory and Research Into Action, Inc.
<http://emp.lbl.gov/sites/all/files/REPORT%20lbl-3163e.pdf>
- GOA (Government Offices Administration of the State Council). 2008. Public Sector Energy Conservation Rule. <http://www.ggj.gov.cn/zxft/ls/>
- GOA (Government Offices Administration of the State Council). 2011. Public Institutions Energy Conservation Plan in the 12th FYP.
http://www.ggj.gov.cn/gwfb/201110/t20111010_275650.htm
- GOA (Government Offices Administration of the State Council). 2014. Strengthen Public Sector Energy Conservation and Promote Ecological Civilization.
http://www.ggj.gov.cn/gzdt/201405/t20140505_285133.htm
- ISC (Institute for Sustainable Communities). 2013. Guangdong Public Building Energy Efficiency Guideline. <http://www.iscvt.org/wp-content/uploads/2014/06/Public-Building-Energy-Efficiency-Guidebook.pdf>
- IFC (International Finance Corporation). 2012. Study on the Potential of Sustainable Energy Financing for Small and Medium Enterprises in China. October 2012.
<http://www.ifc.org/wps/wcm/connect/39ecf5004ff94de2acc8ff23ff966f85/China+SME+Report+for+web.pdf?MOD=AJPERES>
- Kostka, G., Moslener, U., and Andreas, J. 2013. Barriers to Increasing Energy Efficiency: Evidence from Small- and Medium-Sized Enterprises in China. *Journal of Cleaner Production*. 57 (2013): 59-68.
- Larsen, P., C. A. Goldman and A. Satchwell. 2012. *Evolution of the U.S. Energy Service Company Industry: Market Size and Project Performance from 1990-2008*. Lawrence Berkeley National Laboratory, 5447-E. Berkeley, CA
- MOF (Ministry of Finance). 2010. Notice on Interim Management Regulations on Financial Rewards of Energy Performance Contracting Projects, June 3, 2010.
http://jjs.mof.gov.cn/zhengwuxinxi/zhengcefagui/201006/t20100609_321884.html
- NAESCO (National Association of Energy Service Companies). 2014. Federal Market Workshop. <http://www.naesco.org/federal-workshop-2015>
- NDRC (National Development and Reform Commission). 2010. Directive of Administrative Measures in DSM Implementation.
- NDRC and MOHURD (National Development and Reform Commission and Ministry of Housing and Urban-Rural Development). 2013. *Green Building Action Plan*.
http://www.mohurd.gov.cn/zcfg/gwywj/201302/t20130204_212772.html

- NY Green Bank. 2014. Investment Strategy. <http://greenbank.ny.gov/Approach/Investment-Strategy>
- PNNL (Pacific Northwest National Laboratory). 2014. The Facility Energy Decision System (FEDS). <http://www.pnl.gov/feds/>
- Romankiewicz, J., Shen, B., Price, L., and Lu, H.Y. 2012. “Addressing the Effectiveness of Industrial Energy Efficiency Incentives in Overcoming Investment Barriers in China.” Proceedings of the European Council for an Energy-Efficient Economy’s 2012 Summer Study in Industry, pp. 875-885. Stockholm: ECEEE.
- SEIA (Solar Energy Industries Association). 2014. Loan Guarantee Program. <http://www.seia.org/policy/finance-tax/loan-guarantee-program>
- Shanghai Municipal Commission of Economy and Informatization. 2010. *Shanghai Energy Performance Contracting Financial Incentives*. <http://www.sheitc.gov.cn/0105021603/656959.htm>
- Shenzhen GOA, Shenzhen MDRC and FC of Shenzhen (Shenzhen Government Offices Administration, Shenzhen Municipal Development and Reform Commission and Finance Commission of Shenzhen Municipality). 2012. *Shenzhen Energy Performance Contracting in Public Sector Implementation Plan*. <http://www.gdstc.gov.cn/msg/image/LED/jyjl/2013/20130327jyjl01.pdf>
- Shenzhen News. 2014. Innovative Shenzhen Model on Energy Performance Contracting in Public Sector. http://sztqb.sznews.com/html/2014-07/23/content_2948954.htm
- Wei, Y.J. 2010. Introduction of Work Done by Shanghai Energy Conservation Supervision Center, 2010. *Proceedings of 2010 China Industrial Energy Efficiency Workshop*, August 19-20, 2010 Xi’an, China
- World Bank. 2012. China - Improving Energy Efficiency in Public Institutions. ESMAP (Energy Sector Management Assistance Program) [https://www.esmap.org/sites/esmap.org/files/ESMAP_China_EnergyEfficiency_in Public Institutions.pdf](https://www.esmap.org/sites/esmap.org/files/ESMAP_China_EnergyEfficiency_in_Public_Institutions.pdf)
- World Bank. 2014. Scaling Up Energy Efficiency in Buildings in the Western Balkans Energy Services Market Development. Guidance Note. May 2014. Washington, DC
- Yu, S., M. Evans, and Q. Shi. 2014. *Analysis of the Chinese Market for Building Energy Efficiency*. Pacific Northwest National Laboratory, PNNL-22761. College Park, MD

APPENDICES

Appendix A. Examples of EPC Incentives at National and City Levels

	National	Beijing	Shanghai	Shenzhen
Contracting Model	Shared savings model	Shared savings model	Shared savings model and guaranteed savings model	Shared savings model and shared-guaranteed savings hybrid model
Scoping	Register at the national level	Register in Beijing	Register and implement EPCs in Shanghai	Register and implement EPCs in Shenzhen
National Requirements	ESCOs cover at least 70% of the project cost; annual energy savings of 100 and 10,000 tonnes of coal equivalent (tce); industrial project's annual energy savings of 500 and 10,000 tce.			
Incentives for ESCOs registered at national level	CNY 240/tce from Ministry of Finance (MOF)	CNY 240/tce from MOF, and CNY 260/tce from Beijing Finance Bureau	CNY 240/tce from MOF, and CNY 360/tce from Shanghai Finance Bureau	CNY 240/tce from MOF, and CNY 300/tce from Shenzhen Finance Bureau
Local Requirements	N/A	ESCOs cover at least 70% of the project cost; annual energy savings of at least 100 tce; industrial project's energy savings of at least 300 tce.	ESCOs cover at least 50% of the project cost; annual energy savings of at least 50 tce.	Annual energy savings of at least 50 tce; industrial project's energy savings of at least 200 tce.
Incentives for ESCOs registered at local levels		Two types of incentives: 1. Annual energy savings: CNY450/tce; 2. Energy savings rate: 15% of investment amount (rate between 15% and 25%); or 20% of investment amount (rate at least 25%) (annual energy savings of at least 500 tce.)	Three types of incentives: Shared savings: 1. Annual energy savings: CNY500/tce; 2. Energy savings rate: at least 20% of investment amount (rate between 15% and 25%); or at least 30% of investment amount (rate at least 25%). Guaranteed savings: 3. 60% of shared savings' incentives standards.	One type of incentive: 1. Annual energy savings: CNY 500/tce.

* There are incentives at both national and local levels. National incentives are available for ESCOs registered at the national level, and are jointly funded by MOF and local MOF equivalents. Local incentives are available for ESCOs registered at the local level, and are funded by local MOF equivalents.

Sources: Interim Management Regulations on Financial Rewards of Energy Performance Contracting Projects
Beijing Energy Performance Contracting Financial Incentives Interim;
Shanghai Energy Performance Contracting Financial Incentives;
Shenzhen Energy Performance Contracting Financial Incentives Interim.

Appendix B. Existing Tax and Fiscal Incentives in China

The Chinese government has created ESCO reward programs targeting industrial projects with energy savings achieved between 500 and 10,000 tons of coal equivalent (tce) (18-360 million Btu) and projects in other sectors with energy savings between 100 and 10,000 tce (3.6-360 million Btu). For every tce of verified energy savings, provincial/local governments offer a minimum of CNY 60 (\$0.28/thousand Btu) to match the national incentive of CNY 240 (\$1.11/thousand Btu) (MOF 2010). Local governments have also provided rewards to support EPC projects. Table 1 lists fiscal rewards offered by local governments in China.

Table 3. Local Fiscal Incentives in Selected Locations

Location	Amount of Incentives (CNY/tce Saved)
Beijing	Industry: 600, Non-industry: 800; chauffage option: 360
Shanghai	600
Shenzhen	540
Guangdong	500
Fujian	Industry: 500, Building & Transportation: 800
Shanxi	400
Tianjin, Hainan, Chongqing	360
Xiamen	340
Xinjiang	240

Source: Evans et al. 2014

China's government has also provided favorable tax exemptions and reductions to support the ESCO industry. ESCOs in China are normally subject to three types of tax: value-added tax, business tax, and corporate income tax. The new tax policy allows qualified ESCOs to get an exemption from business and value-added taxes. In addition, ESCOs will not pay any income tax for the first three years of the associated qualifying project, and only 50% of the income tax rate for the next consecutive three years during the project. Any fixed or intangible assets are allowed to be depreciated or amortized over the shared savings contracting period.

These incentives have played a significant role in stimulating the early development of EPCs in China. However, the effectiveness of this incentive policy, especially for projects targeting deep-energy savings, has not been clear. First, both existing fiscal rewards and tax incentives favor shared savings contracts which discourage ESCOs from pursuing other contract options that may better suit the EPC project conditions. Second, the prerequisite for ESCOs to cover at least 70% of the upfront costs of efficiency improvements remains a formidable obstacle for most SME ESCOs to finance EPC projects. The large amount of required self-funding discourages ESCOs from pursuing, and is a barrier to participation by SME ESCOs in, deep energy savings projects that typically require a large, upfront injection of capital. Third, despite the tax benefits, government tax policy allowing EPC project assets to be depreciated or amortized over the contracting period creates an actual effect that encourages ESCOs to enter into short-term projects as a shorter period creates higher depreciation or amortization, resulting in less tax payment. Fourth, local incentives have been linked to the registration of ESCOs with local jurisdictions. This may to a certain extent confine ESCO business within geographic boundaries, fragmenting the EPC market. Finally, case studies described in an LBNL paper (Romankiewicz et al., 2012) reveal that government financial rewards only marginally impacted payback periods of efficiency retrofit projects, indicating a missed opportunity for public funding to be more impactful.

Appendix C. Green Bonds As Financing

Box 6. Green Bonds as Financing

The Inter-American Development Bank (IDB) has structured a capital markets solution for energy efficiency financing in Mexico that may have applications for deploying energy efficiency retrofits in China at scale, even as China seeks to develop its bond market. The project seeks to securitize a pool of energy efficiency projects originated by ESCOs competitively selected to participate in this facility in order to obtain debt financing that offers better financial conditions and terms appropriate to the projects' needs. The facility's main objective is to issue the first green bonds backed by clean energy projects in Mexico's capital market, in order to help mitigate greenhouse gas (GHG) emissions and open a new long-term financing channel to promote this type of investment among institutional and impact investors. The first stage of the proposed project consists of a senior revolving line of credit (warehouse line) for up to US\$50 million for the construction of the efficiency projects. Once these projects become operational, the second stage consists of periodic green bond offerings backed by energy efficiency projects for up to Mex\$2 billion (US\$149 million), as supported by an IDB partial credit guarantee program for up to a total amount of Mex\$750 million (US\$56 million) and a second loss guarantee from the Clean Technology Fund (a funding window of the Climate Investment Funds which provides concessional financing through five partner multilateral development banks for large-scale, country-led projects in renewable energy, energy efficiency and transport) for up to a total amount of \$19 million, that will refinance the construction loans and provide the long-term financing. This project also involves a competitive fund manager selection process, standardization of legal contracts, establishment of project eligibility criteria, project selection methodology, a GHG emission calculation methodology, and energy efficiency calculation methodology in order to create a homogenous class of assets that could be securitized and given a credit rating that will attract institutional investors, like pension funds and insurance companies.

While still in the early warehousing phase of developing projects, this facility has not yet issued any green bonds supported by the energy savings of underlying operational projects. Nonetheless, this presents a capital markets alternative in which the central and provincial governments could play a role like IDB's in facilitating the development of such a standardized facility, and China's financing institutions, like the China Development Bank, could provide a second loss guarantee and/or partial credit guarantee for the asset-backed green bonds.

Appendix D. Types of Public Facilities in China

Public facilities in China include central, provincial and local government-owned facilities with a range of functions, such as educational institutions; government offices; healthcare institutions; social, cultural and sports facilities; and science and technology centers (see Figure 2).

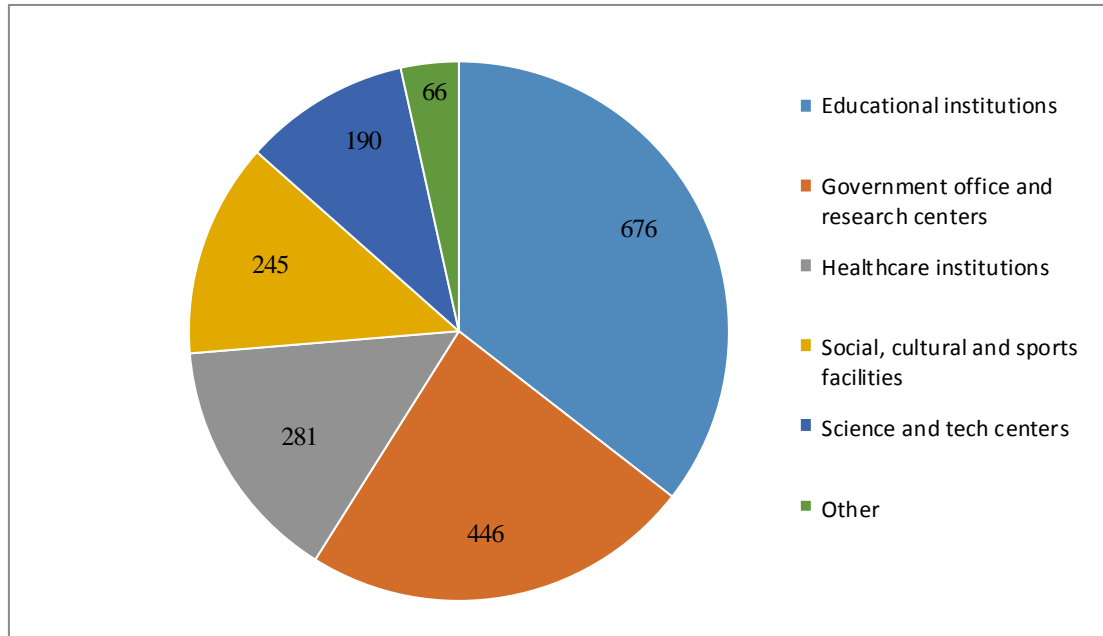


Figure 2. Number of Public Facilities in China by Type, 2010 (in Thousands)

Source: Adapted from World Bank 2012.

The Government Offices Administration (GOA), the National Development and Reform Commission (NDRC) and the Ministry of Finance (MOF) have started the Conservation-Oriented Public Sector Demonstration since 2012, and EPCs have been widely used in this demonstration program. For example, 18 EPCs are completed in the central government and 292 EPCs are completed in local governments (CABR 2015). Jiangsu and Zhejiang are top two provinces that have completed more than 20 EPCs in public institutions (see Figure 3). Among the total 310 EPCs projects, 48% are implemented in government buildings, and 31% and 16% of EPCs projects are carried out in universities and hospitals respectively (see Figure 3).

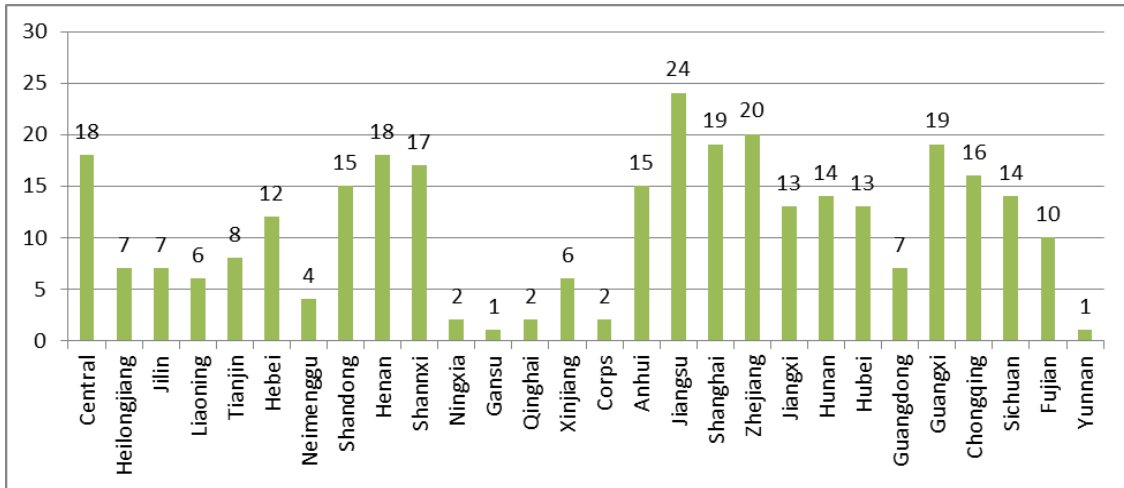


Figure 3. Public Sector EPC Projects in China by Province

Source: Adapted from China Academy of Building Research 2015.

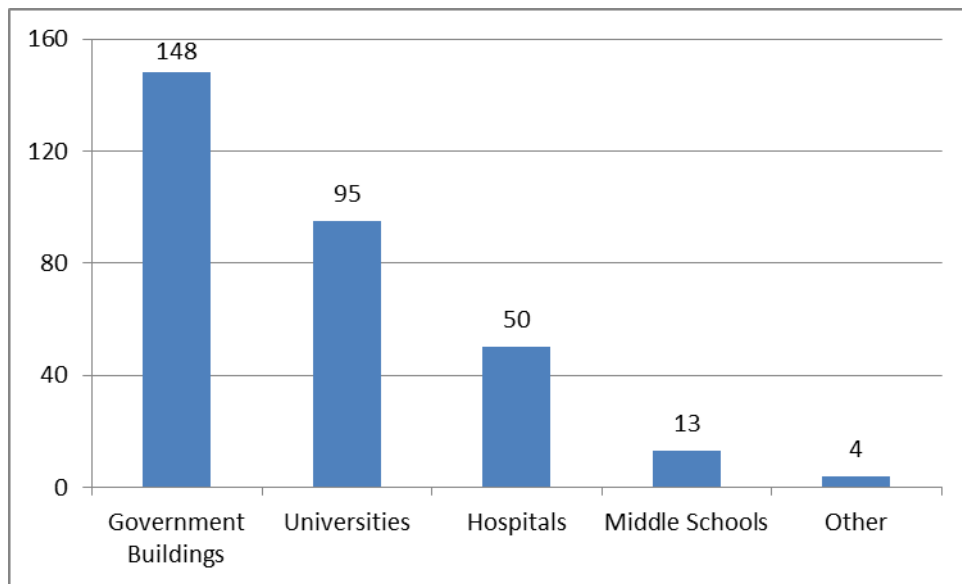


Figure 4. EPCs Projects in China by Public Institutions Type

Source: Adapted from China Academy of Building Research 2015.

Appendix E. Current Institutional Arrangement of the Chinese Public Sector

World Bank describes and existing framework for ownership and responsibilities for buildings in the public sector in China (World Bank 2012). As shown in Figure 2, the GOA of the State Council guides, manages and monitors energy efficiency in central government buildings and facilities. Meanwhile, provincial GOAs or their local equivalents manage and monitor government facilities at their respective levels. The MOF as well as provincial and local finance departments manage energy budgets for public buildings at their respective levels. According to known case studies, ESCOs have received payments directly from public facilities (see red arrows in Figure 2) when implementing EPCs (ISC 2013). Thus, Figure 2 illustrates an integrated potential institutional framework, with the public buildings management structure and the project payment stream from facilities to ESCOs.

Also, GOA coordinates with many central government agencies at the same level regarding energy efficiency. For example, GOA coordinates with NDRC, MOHURD and MOF in setting targets, standards and financing instruments. Specifically,

- NDRC oversees national energy efficiency policies
- MOHURD manages national building energy efficiency programs
- MOF provides special energy conservation funds.

Moreover, GOA coordinates with other central ministries, such as the Ministry of Education (MOE) and the Ministry of Health (MOH). At MOE, officials oversee universities reporting to the central government, and MOE local government affiliates oversee primary and secondary schools and some universities reporting to local governments. On the other hand, MOH and its local government affiliates own hospital buildings, but the hospital managers are in charge of facility operation and maintenance. There are also health service centers and village health stations, which report to provincial or local government health departments (World Bank 2012).

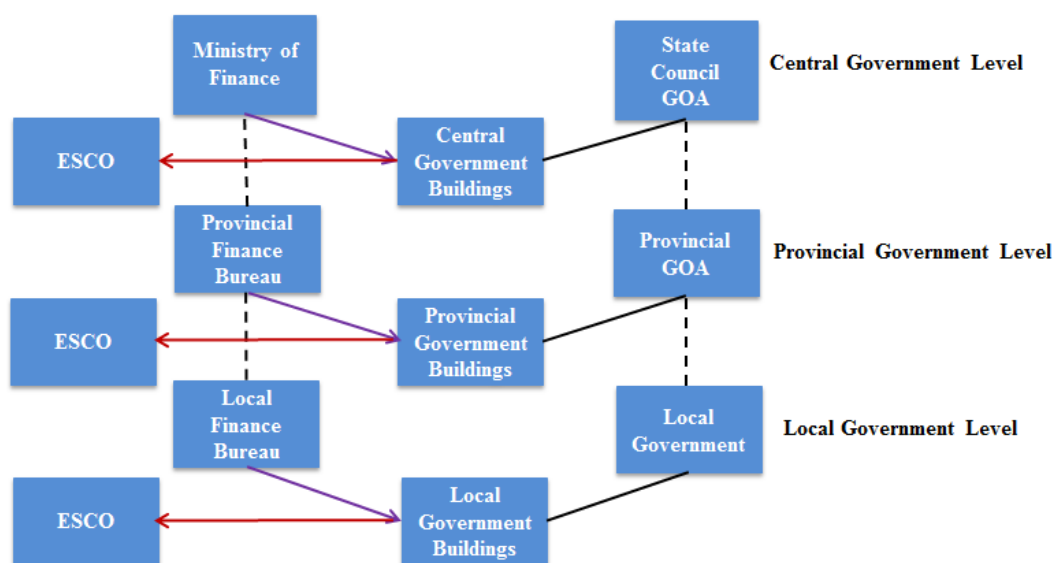


Figure 5. Institutional Framework for EPCs in Government Buildings

Source: World Bank 2012 and ISC 2013.

Provincial and local governments would report to the leadership at their own levels and also collaborate with upper or lower governments, as shown by the dotted lines in Figure 2. The purple arrows reflect the energy budget streams from finance departments to government buildings at different levels. The red arrows indicate that ESCOs get paid from the energy savings of public facilities. This institutional set up is important to understand when considering the necessary buy-ins, approvals and cash flows in an EPC project. All relevant stakeholders must be able to understand and review EPC projects and generated energy savings.

Appendix F. Additional Options to Promote Deep Energy Savings in the Public Sector

Public facilities can typically implement small, simple projects (such as replacing lighting) using their own resources, when they are motivated and have the necessary technical skills. Hiring a competent ESCO brings in the expertise for more complex projects that can generate deep savings. Bringing in ESCOs allows for the packaging of solutions for energy improvements in a building in a way that balances short and longer payback measures. If the facility commits to a project with only short payback measures, undertaking the remaining capital-intensive, long payback retrofits later is economically difficult. For this reason, government agencies should encourage deep (comprehensive) retrofits.

Pursuing large retrofits with deep energy savings requires an innovative financing model. The energy service agreements (ESAs) discussed previously are one example. Sometimes, ESAs can include a bundle of projects. For the ESCO, the advantage of the ESA model is that transactions can be off the balance sheet. For public facilities, the advantage is that projects can be initiated with no up-front cost and the risks are allocated to parties best positioned to bear them – technical risk to ESCOs and credit risk of project hosts to third-party lenders.

Some other options that could help maximize savings retrofit in the public sector include the following:

- Assign energy management to public institutions facility managers' existing duties and require public institutions to have qualified professional energy management staff
- Consider developing software that allows facility managers to easily assess options for retrofits to initiate projects (an example of such software is the [FEDS](#) tool)
- Share information on deep retrofits and innovative technology case studies
- Develop a mechanism to allow public institutions to hire qualified, cross-cutting technology experts to assist in evaluating retrofit options and ESCO proposals. An example of such a mechanism is technical assistance from U.S. DOE's national laboratories, which typically involves a qualified person detailed to a federal facility to assist with procurement process and/or implementation
- Set up reputation-based incentives through assessing and scoring energy savings performance, publicize the results and give recognition to public institutions' energy efficiency work, and share the best practices across the country
- Monitor energy use in public facilities, and conduct energy audits and energy use monitoring to evaluate the implementation of energy efficiency
- Develop a network of universities interested in energy efficiency and incorporate building energy efficiency related activities into educational curricula. An example of such a network is the American College & University Presidents' Climate Commitment⁶ in the United States
- Exchange information and share EPC best practices across the provinces in China.

⁶ More details could be found at <http://presidentsclimatecommitment.org/resources/climate-action-planning>