Energy Performance Contracting Recommendations for China’s Public Sector

February 2018

Yuanrong Zhou, Artur Denysenko, Meredydd Evans, Sha Yu
(Pacific Northwest National Laboratory)

Mei Lu, Shaoshan Xu, Nan Hu, Yingjin Jiang
(China Quality Certification Centre)
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Pacific Northwest National Laboratory
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# Acronyms and Abbreviations

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
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<tbody>
<tr>
<td>DOD</td>
<td>Department of Defense</td>
</tr>
<tr>
<td>DOE</td>
<td>U.S. Department of Energy</td>
</tr>
<tr>
<td>DOS</td>
<td>U.S. Department of State</td>
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<tr>
<td>ECMs</td>
<td>energy conservation measures</td>
</tr>
<tr>
<td>EISAct</td>
<td>Energy Independence and Security Act</td>
</tr>
<tr>
<td>EPAct</td>
<td>Energy Policy Act</td>
</tr>
<tr>
<td>EPC(s)</td>
<td>energy performance contracting; energy performance contract(s)</td>
</tr>
<tr>
<td>ESCO(s)</td>
<td>energy service company(ies)</td>
</tr>
<tr>
<td>EUI</td>
<td>Energy use intensity</td>
</tr>
<tr>
<td>FEDS</td>
<td>Facility Energy Decision System</td>
</tr>
<tr>
<td>FEMIAct</td>
<td>Federal Energy Management Improvement Act</td>
</tr>
<tr>
<td>FEMP</td>
<td>Federal Energy Management Program</td>
</tr>
<tr>
<td>FYP(s)</td>
<td>Five-Year Plan(s)</td>
</tr>
<tr>
<td>GOA</td>
<td>National Government Offices Administration of China</td>
</tr>
<tr>
<td>M&amp;V</td>
<td>measurement and verification</td>
</tr>
<tr>
<td>MOF</td>
<td>Ministry of Finance</td>
</tr>
<tr>
<td>NDRC</td>
<td>National Development and Reform Commission of China</td>
</tr>
<tr>
<td>NECPAct</td>
<td>National Energy Conservation Policy Act</td>
</tr>
<tr>
<td>O&amp;M</td>
<td>operations and maintenance</td>
</tr>
<tr>
<td>OMB</td>
<td>White House Office of Management and Budget</td>
</tr>
<tr>
<td>PNNL</td>
<td>Pacific Northwest National Laboratory</td>
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<tr>
<td>RECs</td>
<td>renewable energy certificates</td>
</tr>
<tr>
<td>tce</td>
<td>tonne of coal equivalent</td>
</tr>
</tbody>
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Executive Summary

Energy Performance Contracting (EPC) allows energy users to improve their energy efficiency, conserve water, install renewable energy generation, and improve facilities without up-front capital costs. Since the introduction of EPC in China in 1998, the Chinese EPC market has grown rapidly, but mainly in the industrial sector. The Chinese government recognizes the great savings potential in the public sector, and to tap this market more deeply, the Chinese government is exploring several policy revisions to encourage retrofits and energy performance contracts (EPCs). Finding more meaningful ways of motivating public institutions through rigorous, yet achievable goals is very important. Budgeting rules are also crucial in the public sector as they determine whether and how public institutions could repay an EPC. Training and support services can also help facilities navigate retrofits and performance contracting. Based on feedback from the Chinese government, these barriers are among the most important to address in scaling up EPCs in the public sector; they are also the focus of active discussion within the government. This report draws on examples from the U.S. federal and state governments and an analysis of the situation in China to provide recommendations and options on implementing current Chinese goals and plans.

This report discusses three key policies: (1) energy reduction goal setting; (2) budgeting rules; and (3) program resource center and project facilitation. The report reviews examples from both the U.S. and China; and drawing on this analysis, provides recommendations to the Chinese government to scale up EPCs in the Chinese public sector. The research team’s key recommendations include:

Policy 1. Energy Reduction Goal Setting and Enforcement

- Provide flexibility to public institutions by (1) setting goals at the institutional level instead of at the facility level; and (2) defining targets based on energy intensity rather than total energy use.
- Ensure high-level accountability for the goals. For example, have the head of the agency or institution report on the goal to senior policymaking bodies and to the public, particularly at the provincial level.
- Streamline the actual reporting process with clear reporting rules, supportive guidance, and easy-to-use reporting tools that cover all reporting needs.

Policy 2. Budgeting Rules

- Allow public institutions to retain savings from EPCs for payments to ESCOs and investments in energy-efficient activities.

Policy 3. Resource Center and Facilitation Program

- Establish a government-wide program website providing necessary and relevant public sector EPC information and resources.
- Provide facilitation services to public institutions to help them at different phases of EPC projects.
The Chinese government understands the barriers to EPCs in the public sector and has made significant efforts to promote EPCs. Adjusting policies in targeted areas can help address these barriers and increase the scale of EPCs in China, based on the experience in the U.S. federal and state governments.
执行摘要

合同能源管理（EPC）允许用能单位在无需投入前期资本的情况下进行节能改造，以提升能效、节约用水、安装可再生能源和改善设施。自合同能源管理在1998年被引入中国，中国市场发展迅速，但主要集中在工业领域。然而中国政府已意识到公共机构的巨大节能潜力。因此，为了更深入地挖掘合同能源管理在公共机构的市场，中国政府正在探讨一系列可行的政策修订，以鼓励节能改造与合同能源管理。其中非常重要的一点是通过设定严格而可实现的节能目标，以激励公共机构节能。预算规则在公共部门也是至关重要的，因其决定了公共机构能否以及如何支付合同能源管理项目。培训和项目辅助服务也可以帮助公共机构找寻适合的节能改造措施。在和中国相关政府部门的探讨中，如何克服以上这些障碍是在推广公共机构合同能源管理方面最重要的问题之一；它们也是政府内部积极讨论的焦点。这份政策建议报告借鉴了美国联邦和州政府的例子，结合中国的情况，为中国实施当前的节能目标和规划提供建议和选择。

本报告讨论了三项关键政策：（1）节能目标的设定；（2）预算规则；（3）资源中心和项目辅助。报告回顾了美国和中国的例子，并通过分析，为中国政府在中国公共机构推广合同能源管理提供了建议。主要建议包括：

政策 1、节能目标的制定和实施

- 为公共机构提供一定的灵活性：（1）在机构层面而不是在单体建筑层面制定目标；（2）设定基于用能强度而不是总能耗的节能目标。
- 采用针对节能目标实施的高级别问责制。例如，让机构或机构的负责人向高级政府部门和公众（尤其省级层面公开）报告目标实施进展。
- 通过明确的节能进展报告规则、报告指南准则和易于使用且满足所有报告需要的报告工具，来简化实际的报告过程。

政策 2、预算规则

- 允许公共机构保留节能收益，以支付节能服务公司和其它节能项目投资。

政策 3、资源中心和项目辅助

- 建立一个政府范围的网站，对公共机构提供必要和相关的合同能源管理信息和资源。
- 向公共机构提供项目辅助服务，协助它们在合同能源管理项目的不同阶段开展工作。

中国政府了解存在的障碍，并且已在推广合同能源管理方面作出了重大努力。根据美国联邦和州政府的经验来调整相关政策可以帮助克服这些障碍，扩大中国合同能源管理的市场。通过这些政策方面的努力，中国将见证更大规模的节能改造。
Background

Introduction to the U.S.-China EPC Initiative

Energy Performance Contracting (EPC)\(^1\) is a market mechanism where private sector Energy Service Companies (ESCOs) provide services for energy users (hosts) to achieve energy efficiency retrofits through contracting. It allows the hosts to use future energy savings to pay for the upfront costs in implementing energy conservation measures (ECMs).

Both the United States and China have great potential to grow their EPC markets. In 2014, the U.S. and China launched a joint EPC initiative to accelerate development of the EPC markets in both countries, with support and leadership from the U.S. Department of Energy (DOE), U.S. Department of State (DOS), and National Development and Reform Commission of China (NDRC). One of the main activities under this initiative is to scale up energy performance contracts (EPCs)\(^2\) in the Chinese public sector\(^3\).

EPC History and Current Status in China

The concept of EPC was first introduced in China in 1998 and since then, this market has grown rapidly and steadily. The number of registered ESCOs has increased from 787 in 2010 (IEA, 2016) to 5,816 in 2016 (EMCA, 2017a). ESCOs invested approximately $16 billion (¥107.4 billion) in EPCs in China in 2016; according to the IEA, the Chinese market made up 55\% of global ESCO revenue in 2015 (IEA, 2016; EMCA, 2017a).

The majority of EPCs in China lies in the industrial sector, followed by the building and transportation sectors, accounting for 55\%, 28\%, and 17\% respectively in 2016 (EMCA, 2017b). Unlike in the United States, where the government and institutional sector\(^4\) takes up 84\% of ESCO industry revenue (Stuart, *et al.*, 2013), the Chinese public sector has a limited scale of EPCs. Nonetheless, the public sector in China presents significant opportunities to save energy. The sector consumed 180 million tonne of coal equivalent (tce) and accounted for 4.26\% of total energy consumption in China in the year of 2015 (GOA, 2016).

Existing Efforts in China’s Public Sector and Potential Future Progress

China has already made some progress in promoting EPCs in the public sector. Some of the efforts include setting energy efficiency goals, encouraging public institutions to use EPCs in the

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\(^1\) While the United States regulation and federal government use the term “Energy Savings Performance Contracting”, this report uses the term “Energy Performance Contracting”, which is common outside of the U.S.

\(^2\) In this report, we use EPC to stand for energy performance contracting or energy performance contract depending on the context.

\(^3\) In this report, public buildings refer to buildings owned or occupied by government or government-sponsored entities.

\(^4\) The U.S. government and institutional sector covers federal, state, and local government facilities, hospitals, universities, and schools.
country’s Five-Year Plans (FYPs), and setting up reward programs to provide incentives to ESCOs at both national and subnational level.

Some additional efforts could help further expand the EPC market in the Chinese public sector. First of all, developing supportive policies would be a vital step in expanding public sector EPCs. Some of the relevant policies that the Chinese government could consider modifying include more effective energy reduction goal setting and enforcement; energy budgeting rules to allow the retention of energy savings by public institutions; and public procurement rules to support and facilitate EPC in public institutions. The Chinese government could also consider developing clear contracting standards and technical guidelines. In addition, a facilitating program with necessary resources and technical assistance could unlock know-how and thus effectively engage EPC stakeholders and scale up EPC in public sector.

Capacity building of various stakeholders is another important factor to unleash EPC in public sector. EPC trainings already exist in China; however, more systematic training programs targeting specific stakeholder groups could engage stakeholders more efficiently and meet their particular needs more effectively.

**Focus of this Policy Recommendation Report**

This report shares U.S. experience in EPC policies and provides recommendations for China focusing on three topics – energy reduction goal setting; budgeting rules; and the set up of an EPC-based public building retrofit facilitating program. Each policy section first provides an overview of U.S. and Chinese policy, followed by a detailed analysis of the differences between the two countries and last, recommendations. These topics were picked based on the interests of Chinese governmental officials through past conversations with NDRC and other agencies. Appendix A provides some additional recommendations based on an analysis of the Shenzhen experience.

Currently, the Chinese government is looking for more comprehensive methods to design the energy reduction goal setting and enforcement system to engage and motivate public institutions to implement energy retrofits. The Chinese government is also considering modifying the budgeting rules to unleash EPC in public sector. In addition, more robust resources and tools can help in scaling up the program and supporting institutions that want to undertake retrofits.

**Energy Reduction Goal Setting**

Setting challenging yet attainable energy reduction goals can be an effective way to motivate agencies to undertake retrofits to improve their operational efficiency. Federal agencies in the United States have been constantly striving to meet energy intensity reduction targets established by legislative mandates and Executive Orders for over three decades, resulting in a 49% reduction between 1975 and 2016 (Tremper, 2017). This section first reviews recent energy reduction goals and introduces how goals are set and enforced in the U.S., followed by a comparative analysis with China and recommendations to the Chinese government.
U.S. Energy Reduction Targets Overview

Federal Agencies
In the U.S., energy reduction goals for federal buildings were first introduced in the 1970s, and several pieces of legislation have set and strengthened targets over time. The National Energy Conservation Policy Act (NECPAct) in 1978 clearly required the establishment and publication of energy performance targets (Public Law 95-619, 1978). The Federal Energy Management Improvement Act (FEMIAct) of 1988 established several rules regarding energy reduction goals for federal agencies, which are still in place today (Public Law 100-615, 1988):

(1) Reduction targets are set at the agency level (i.e. not requiring targets for individual facilities);
(2) One single reduction target applies to all federal agencies (i.e. target is not differentiated by agency);
(3) Energy use intensity (EUI), which is energy consumption compared to total floorspace, is the target metric rather than total energy consumption;
(4) Each agency is allowed to exclude certain facilities; and
(5) Each agency must report annually to Secretary of Energy, who then reports to Congress.

Since then, several pieces of legislation and Executive Orders have updated and strengthened the percentage-based energy reduction goals (Appendix B).

For the recent goal reduction period covering fiscal year FY2006 – FY2015, two legislative mandates, the Energy Policy Act of 2005 (EPAct 2005) and the Energy Independence and Security Act of 2007 (EISAct 2007) updated and specified the annual percentage reduction in EUI for federal agencies. The reduction targets from these two mandates are listed in Table 1.

Table 1. Percentage energy intensity reduction targets compared to a FY2003 baseline from two legislative mandates EPAct 2005 and EISAct 2007.

<table>
<thead>
<tr>
<th>Fiscal Year</th>
<th>Percentage Reduction (EPAct 2005)</th>
<th>Percentage Reduction (EISAct 2007)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>2007</td>
<td>4</td>
<td>4</td>
</tr>
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<td>2008</td>
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<td>2013</td>
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<td>24</td>
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<td>2014</td>
<td>18</td>
<td>27</td>
</tr>
<tr>
<td>2015</td>
<td>20</td>
<td>30</td>
</tr>
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</table>


EISAct 2007 superseded EPAct 2005 and set more stringent targets.
Executive Order 13693, released in March 2015, required a 2.5% reduction in EUI annually for federal agencies from FY2016 to FY2025 relative to the baseline of FY2015. The 2.5% annual reduction target allows agencies to lower their energy intensity by 25% by 2025. This Executive Order not only specified energy reduction requirements, but also highlighted EPC as an effective tool to help federal agencies in meeting their energy efficiency goals. It laid out a goal of $4 billion in federal performance-based contracts from December 2011 to the end of calendar year 2016. This Executive Order also asked the head of each principal agency to provide annual agency targets for EPCs to be implemented in FY2017 and annually thereafter (Executive Order 13693, 2015). Moreover, Executive Order 13693 allowed on-site renewable power to contribute to meeting the energy intensity goals, as long as the relevant agencies own the on-site renewables\(^6\). It also set a minimum percentage of energy supply from renewable sources that federal agencies must demonstrate. Specifically, agencies should achieve at least 25% of electric and thermal energy consumption from renewable energy sources by 2025. In addition, Executive Order 13693 also asked federal agencies to improve data center energy efficiency by setting targets for power usage effectiveness and using advanced meters (Council on Environmental Quality, 2015).

State Examples
In addition to efforts at the federal level, some states also set targets for state and local buildings. California issued Executive Order B-18-12 in 2012 requiring all state agencies, departments, and other state entities to reduce their grid energy use by 20% by 2018, compared to a 2003 baseline (Executive Order B-18-12, 2012). The New York Executive Order 88 set the target of reducing the average EUI in state-owned and managed buildings by at least 20% by April 1, 2020 compared to a 2010/2011 baseline (Executive Order 88, 2012). The Massachusetts Executive Order 484 in 2007 asked its state owned and leased buildings to reduce EUI by 20% by 2012 and 35% by 2020 compared to a 2004 baseline (Executive Order 484, 2007).

U.S. Goal Setting Approach
Goal Setting Framework
The National Energy Conservation Policy Act (NECPAct) required the Secretary of Energy to submit to Congress recommendations for new federal energy reduction targets for FY2016 to FY2025 by December 31, 2014. For that purpose, the Federal Energy Management Program (FEMP) of Department of Energy (DOE) worked with the Pacific Northwest National Laboratory (PNNL) to model the future energy savings potential in federal buildings and provided recommendations on new energy reduction goals. The modeling results were released in a report in May 2014 (Judd, et al., 2014).

\(^6\) The ownership of on-site renewable includes the installation of renewable energy systems, the retention of renewable energy certificates (RECs), and purchase of replacement RECs.
Methodology for Setting the Reduction Percentage

In order to recommend future energy reduction goals, the PNNL modeling team considered energy savings potentials from both retrofits to existing buildings and the addition of new buildings that need to meet higher energy efficiency standards. For existing buildings, four modeling steps were taken: (1) Defining prototype federal buildings to represent civilian buildings (offices, warehouses, laboratories, and hospitals) and Department of Defense (DOD) buildings in five geographic locations to account for climate and utility price variations. (2) Modeling the impacts of energy efficiency retrofits on the prototype buildings. Researchers used the Facility Energy Decision System (FEDS) model for this analysis. The model simulates building systems as well as energy use and analyzes the cost and performance impacts of energy conservation measures (ECMs). The result from the second step was a life-cycle-cost-effective mix of ECMs and estimated EUIs for each of the prototype buildings and locations with the implementation of the ECMs. (3) Extrapolating EUI results to the federal sector as a whole by weighting and scaling each prototype and location. (4) Establishing a national reduction percentage estimates by comparing future EUI from ECMs and baseline EUI. Two steps were followed for the modeling of new constructions: (1) Estimating the amount of new building floorspace that would be added between 2016 and 2025; (2) Determining the average expected reduction in EUI based on the consideration of impacts of building efficiency standards (Judd, et al., 2014).

In modeling both existing and new buildings, the PNNL research team estimated the EUI reduction potential of civilian buildings at 15.6%, and DOD’s at 24%. For federal buildings as a whole, the estimated savings potential is 22.6% by the end of FY2025 compared to a 2015 baseline, with an
additional 4% and 9% reduction feasible in civilian and DOD buildings through on-site renewables\(^7\) (Judd, et al., 2014).

During the analysis and modeling phases, the research team had several back-and-forth conversations with other federal agencies for feedback to correct modeling assumptions (Judd, 2017). The modeling results were reviewed by the Secretary of Energy and presented to Congress and served as the basis for the FY2016 – FY2025 energy use intensity reduction targets. Ultimately, the EUI reduction target for all federal agencies was determined through internal negotiations among the federal agencies and set at a 2.5% annual reduction, i.e. 25% by FY2025 compared to the FY2015 level, specified in Executive Order 13693.

**U.S. Energy Goal Enforcement (Performance Reporting and Evaluation)**

Setting energy reduction goals alone is not enough; rather, it can be more impactful if combined with frequent measurement, reporting, analysis, and follow-ups to ensure consistent progress toward the targets.

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\(^7\) The reduction percentage represents an upper limit of government-wide potential by implementing technically feasible renewables.
To help federal agencies in reporting their energy management measures, FEMP has developed a spreadsheet workbook, in which federal agencies can record their performance results for energy and sustainability goals including information on energy use, costs, square footage, associated operational data, and calculated greenhouse gas emissions. Each year, federal agencies are required to submit this data report to FEMP. Moreover, FEMP provides a template for narrative information reporting, including building benchmark or making adjustments to previous years. In addition to the reporting templates, FEMP also provides detailed reporting guidelines.

**Government-wide Reporting**
Under the NECP Act, DOE is required to report annually to Congress with information on energy consumption in federal buildings, operations, and vehicles.

To meet that requirement, FEMP compiles all the annual reporting data submitted by federal agencies. The data indicate government-wide progress towards the required energy and sustainability goals. FEMP also publishes the data on its *Comprehensive Annual Energy Data and Sustainability Performance* website, making the energy efficiency progress transparent to the public.

**Performance Evaluation**
In addition to the reporting program, the White House Office of Management and Budget (OMB) issues an annual agency Energy/Sustainability Scorecard, indicating whether an agency is on track to achieve the required sustainability targets. Energy intensity reductions are among the seven categories scored. The Scorecard is available to Congress as well as the public.

**Overview of China’s Energy Reduction Policy**

China has also been working on energy reduction goals in recent years. China’s 12th FYP set the EUI goals for the public sector of reducing per capita energy consumption by 15% and reducing per unit area energy consumption by 12% by 2015 compared to the 2010 level (GOA, 2014). The 13th FYP, released in June 2016, set goals for the public sector of reducing per capita energy consumption by 11% and reducing energy consumption per square meter of floorspace by 10% by 2020 compared to the 2015 level (GOA, 2016). Both FYPs emphasized and promoted EPC as an effective means to help public sector to achieve the reduction goals.

Similar to the U.S., China also developed an energy reporting system to track energy performance from public institutions (GOA, 2017). For institutions at the central level, they are required to report institutional and data center energy consumption monthly, and energy consumption from heating annually to the National Government Offices Administration of China (GOA). Other public institutions are required to report the three, above-mentioned indicators annually to the local government offices administration office. This data is then compiled and reported to government offices administration at the provincial and national level.

The Chinese public sector has indeed seen progress in energy efficiency. The energy intensity in public buildings decreased by almost 15% from 2005 to 2010 (GOA, 2014) and a further 14% from 2010 to 2015 (GOA, 2016), surpassing the reduction requirement of 12%.
Table 2. Chinese public sector energy reduction goals and actual reduction realized from 2005 to 2020. Numbers are the percentage reduction of energy consumption per unit area.

<table>
<thead>
<tr>
<th>Energy Reduction Goal</th>
<th>Actual Energy Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005 – 2010</td>
<td>-</td>
</tr>
<tr>
<td>2010 – 2015</td>
<td>14.85</td>
</tr>
<tr>
<td>2015 – 2020</td>
<td>13.88</td>
</tr>
</tbody>
</table>


Lessons Learned and Recommendations

Goal-setting

*Providing Flexibility to Institutions*

Setting ambitious goals and enhancing goals over time are important to keep institutions pursuing energy efficiency. It is also important to provide flexibility to agencies to allow for deeper energy reductions. The U.S. legislation provides federal agencies with several levels of flexibility.

First, energy reductions are required at the institutional level rather than at the facility level. This ensures an institution the flexibility to identify and implement the most cost-effective and impactful retrofits among all the facilities it owns instead of investing in every single facility. In addition, it is more efficient to manage and keep track of energy performance across an institution’s property portfolio rather than at each individual facility.

Second, requiring reductions in EUI instead of total energy consumption allows agencies to pursue energy efficiency while expanding floorspace. This makes sure that meeting energy targets would not contradict other activities or priorities by the agencies.

Third, federal agencies are allowed to exclude some facilities from energy reduction goals where (1) all practical ECMs have already been implemented at the facility; (2) energy requirements are impractical due to energy intensity or national security; (3) energy management reports are already completed and submitted; or (4) agency has achieved compliance with energy efficiency requirements (FEMP, 2006) so that agencies’ overall performance will not be adversely affected by these facilities. 8

Moreover, Executive Order 13693 assigns an alternative target for the agencies that overachieved their target from the previous period but may not have an immediate opportunity to meet new targets. 9 This practice provides agencies the flexibility to allocate their internal resources while pursuing further energy efficiency.

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8 Each agency needs to list excluded buildings in the annual report and demonstrate the reasons for excluding. Although facilities could be excluded from the goal requirement, the energy performance of these facilities still needs to be reported annually, which encourages agencies to keep as many facilities as possible within the targets.

9 Overachieving agencies have the option of an overall energy reduction of 25% by 2025 compared to 2016 level instead of a 2.5% annual reduction.
In contrast, China sets goals that are differentiated by province and institution with the purpose of providing flexibility. The national GOA and NDRC first set energy reduction goals for the public sector as a whole based on the previous five-year’s energy consumption and the reduction goal in the public sector. These targets are then broken down to each province by the national GOA and to each institution by the provincial and local government offices administration based on regional and local climate characteristics and economic status (GOA, 2016). Chinese officials have concerns that it might be difficult to get all the public stakeholders to agree to a single target as public institutions have varying degrees of energy savings potential.

Table 3. Comparisons of existing goal setting procedures in the U.S. and China.

<table>
<thead>
<tr>
<th>Level</th>
<th>The United States</th>
<th>China</th>
</tr>
</thead>
<tbody>
<tr>
<td>Federal/National</td>
<td>The government sets national energy reduction goals for federal buildings across the U.S.</td>
<td>The national GOA and NDRC set energy reduction goals for the public sector as a whole</td>
</tr>
<tr>
<td>State/Provincial</td>
<td>State governments set energy reduction goals for state-owned and leased buildings</td>
<td>The national GOA breaks down energy reduction goals for each province</td>
</tr>
<tr>
<td>Agency</td>
<td>Each federal agency has uniform energy reduction goals set by the federal government. Each agency can then decide how it wants to achieve these goals across its building portfolio</td>
<td>Once the energy reduction goal is set at the provincial level, the provincial or local government offices administration further breaks down the energy reduction goal for each institution</td>
</tr>
</tbody>
</table>

While experience in the U.S. shows that a single target can work effectively, we also wanted to share insights from the U.S. experience on how modeling can be used in developing differentiated targets.

**Analysis to Set Targets**

Modeling for energy reduction potential can help in establishing energy savings goals. In the U.S., the Department of Energy asked a PNNL modeling team to model and assess the energy savings potential of federal buildings for the latest phase of the program, which began in 2016. The analysis began with an assessment of the status of building energy use in different federal agencies. It found that all but a few agencies were on target for meeting a goal of 20% energy intensity reduction over the previous 10 years (with a notable exception of DOD, the largest energy consumer). The PNNL team then assessed the technical potential of for future savings, differentiating between civilian buildings and DOD buildings since buildings in most agencies consist primarily commercial office space, but this is not true of DOD. PNNL adjusted the existing prototype buildings to reflect these differences. Prototype buildings are statistically designed to represent typical buildings, such as medium-sized office buildings or hospitals. The modeling team also used five geographical locations to better represent regional differences in energy prices and climate.
They ran the prototypes in the Federal Energy Decision System (FEDS), a tool designed to model energy use and potential energy conservation measures in government buildings. The potential savings between 2016 and 2025 averaged just above 20% for all federal buildings, though civilian agencies had a lower average. (Judd et al., 2014). This same approach in principal could be used to develop differentiated targets, though much more analysis of individual buildings would likely be necessary (Judd et al., 2014). In U.S. experience, having a single target for all facilities has led to significant energy savings over the past 40 years.

Goal Enforcement
Enforcing energy efficiency goals is another challenge. One option is to provide financial incentives and staff recognition or awards to motivate public institutions in reaching their goals. In the U.S., the NECPAct listed several incentive options:

1. A Federal Energy Efficiency Fund could provide grants to agencies to meet their energy reduction goals;
2. Agencies could accept financial incentive, goods, or services from utilities;
3. A financial incentive/bonus program rewards outstanding federal facility energy managers;
4. Agencies could retain the value of their saved energy to repay the ESCOs and invest in other energy-efficient activities.

The other option is to require institutions to report performance to senior leadership and the public. In the U.S., issuing a Scorecard motivates agencies to meet targets, as OMB shares the Scorecard results with Congress and the public.

Reporting and tracking performance against goals can also be an effective way to engage agencies and boost their participation. Although China has established a reporting system, only 0.75 million out of the 1.75 million public institutions participated in energy reporting in 2015 (GOA, 2016). Thus, a first step is increasing the importance and value of reporting to institutions so that they are willing to engage in reporting.

In the U.S., the energy reporting process is relatively straightforward as federal and state are separated and each is in charge of its own jurisdiction. The Chinese energy reporting system is different in that reports need to go through different jurisdictional levels. This raises the question of data quality and accuracy since reported data need to be compiled at each level, indicating that the more levels the data go through, the greater the possibility of adding human error to the data. In order to ensure data accuracy, the energy performance reporting guidance provided by FEMP instructs agencies to keep documentation on data collection procedures and provide a qualitative report on the verification and validation process, including the use of second-party or third-party verification (Council on Environmental Quality, 2016). In addition, according to the EISAct 2007 U.S. federal agencies need to install metering and assign facility energy managers to conduct thorough energy evaluations, which combined could provide agencies with accurate and relevant data to implement energy efficiency measures and meet agency’s energy reduction goals (Council on Environmental Quality, 2015). FEMP also reviews submitted data and would follow up with agencies for data clarification. Similarly, GOA in China has designed a spot check system to
sample the data for quality in at least 5% of the public institutions in each jurisdiction. Nonetheless, GOA could further improve the reporting system in China by developing more detailed instructions and requiring data verification and validation.

Reporting tools are also different in the U.S. and China in terms of format and content. In the U.S., FEMP develops and provides a spreadsheet-based workbook covering an agency’s general information, facility level electricity and fuel consumption\(^{10}\), renewable energy, greenhouse gas emissions and other planning reporting such as new building design\(^{11}\) (FEMP, 2017). The energy use data are acquired through metering. The EPAct 2005 required federal buildings to be metered for the purpose of energy efficiency and DOE provides detailed metering guidance. The monthly-metered energy data are entered into the Environmental Protection Agency ENERGY STAR Portfolio Manager for performance management and benchmarking (Council on Environmental Quality, 2015). The reporting workbook also provides a performance summary and comparison with the goals to help FEMP keep track of agencies’ performance and help agencies to plan for future ECMs. Such a standardized reporting spreadsheet helps with data analysis and presenting data results, which is crucial for performance tracking. In China, GOA has developed reporting templates for agencies to record and submit data on agency information and energy consumption. However, the format makes it hard to analyze and compare the data. GOA could also consider developing a spreadsheet tool instead of the table format that is currently used.

**Budgeting Rules**

**Importance of Appropriation and Budgeting Rule Issues to EPCs**

Budgeting rules are critical to public sector EPCs as they define whether public institutions could retain the savings generated from EPCs to repay the ESCOs and how. Multi-year projects, like EPC, depend on the details of budgeting and procurement rules to determine how they can sign contracts that go beyond the scope of annual budget appropriations. As such, budgeting rules play a critical role in promoting public sector EPCs.

**Overview of U.S. budgeting and EPCs**

**Federal Agencies**

*Introduction*

The federal government of the United States is the nation’s largest energy consumer. In 2015 alone, the federal government spent more than $21 billion on energy costs. Due to the energy savings policies and improvements implemented, the energy intensity of federal facilities has decreased significantly. Despite such progress, the federal government’s infrastructure still provides vast opportunities for further energy efficiency improvements. These improvements require significant

\(^{10}\) Facility level data are summed up for an agency’s portfolio.

\(^{11}\) Information of new constructions comparable with building design energy efficiency standards.
investments, but repaying these investments requires federal agencies to keep their savings at a minimum for enough years to pay back the initial costs.

**Evolution of Federal Legislation on EPCs**

The National Energy Conservation Policy Act (NECPAct) of 1978, as amended in 1985, not only established energy reduction goals, but also introduced the initial regulatory framework for EPCs. It encouraged federal agencies to implement energy conservation measures (ECMs) using private financing. To improve energy efficiency at facilities, NECPAct provided authority for federal agencies to enter into an EPC, called “shared energy savings contracts” in the Act. This gave agencies the authority they needed to retain their savings in order to repay an EPC.

The Energy Policy Act of 1992 (EPAct 1992) introduced the term “energy savings performance contracts”. Section 155 of EPAct 1992 allowed agencies to enter into contracts with an ESCO for a period of up to 25 years (Public Law 102-486, 1992). This gave agencies greater flexibility and more options in implementing ECMs, including those with long payback periods. This Act also required that the combined total payments to the ESCO and for utilities during the contract term should not exceed pre-retrofit utility payments. ESCOs were required to provide performance guarantees, which is how the government ensures that it does not pay more after an EPC than before the retrofit.

Typically, savings exceed EPC payment amounts by about 5% during the contract period. EPAct 1992 was amended in 1995 to further clarify that agencies could retain half of their savings beyond the ESCO payments. Federal agencies could use these savings for other energy efficiency measures, including staff incentives at the affected facilities. Agencies can also receive special incentive payments from local utilities that are promoting energy efficiency.

In 1998, the Office of Management and Budget (OMB) issued Memorandum M-98-13, which included clarifications about budget treatment and retention of savings generated through EPCs. Specifically, the Memorandum prescribed that federal agencies should have sufficient resources for the first year of the EPCs; agencies can also retain half of the savings left after the payment to the ESCO and utilities; agencies can spend these savings on additional energy efficiency measures and/or to provide incentives for facility managers. However, this memo also made it clear that savings after the first year are considered discretionary. Thus, while the agencies’ energy budgets are not automatically reduced, Congress can decide to change an agency’s appropriations (OMB, 2012). In practice, agencies have retained their savings to repay EPCs, but as their operations and maintenance budgets have been cut in recent years, they do not effectively have the money to do much more beyond EPC payments.

The Energy Independence and Security Act of 2007 (EISAct 2007), prescribed agencies’ energy managers to use a web-based compliance tracking system to report and publish data on energy efficiency evaluations and improvements as well as savings for implemented projects in federal facilities\(^\text{12}\) (Public Law 110-140, 2007). Such a tracking system enables the agencies and FEMP to keep track of measured cost savings from EPC projects and enables the agencies to identify

\(^{12}\) An agency may request to exempt specific data from disclosure for national security purposes.
potential energy efficiency activities. The EISAct 2007 also allowed agencies to use a combination of private financing and appropriations to plan and finance EPCs and provided permanent authorization for EPCs (U.S. DOE, 2017a).

The Energy Savings through Public-Private Partnerships Act of 2017 is currently being considered in Congress. This bill would amend NEPAAct by requiring federal agencies to implement energy efficiency measures if they were cost-effective. In addition, if enacted, this Act will allow federal agencies to trade or transfer energy savings and apply the proceeds to fund a performance contract (U.S. Congress, 2017).

Regulatory Rules and Budget Treatment of the EPC
To assist agencies in planning, developing, and implementing EPC projects, the U.S. DOE released comprehensive guidelines on how to interpret and apply statutes and rules on EPC in federal buildings (FEMP, 2009). This document provides clear guidance on how agencies can count eligible savings and how to make payments to ESCOs. In particular, the document outlines general rules and accounting principles in planning, budgeting, and making payments for EPCs.

When entering into an EPC, a federal agency should have sufficient funds for first year payments. The agency and ESCO agree on the contract terms including a fixed term and price and an annual payment to the ESCO, which might vary from year to year. The sum of the payments to the ESCO and for utilities during the term of the contract cannot exceed the payments for utilities and operations and maintenance (O&M) before the contract (U.S. DOE, 2016). Once the contract begins, the federal agency continues to budget and request appropriations for utility and related O&M expenses at the pre-retrofit baseline level. By law, payments to the ESCO must be paid from cost savings generated by an EPC and must come from funds for energy efficiency improvements or for payment of energy, water, wastewater treatment, and related O&M expenses. However, regulations do not impose requirements for agency’s internal accounting for EPCs. That means federal agencies have the flexibility to distribute the cost of the payment to the designated utility and related O&M, based on percentage shares or other appropriate method, for its annual financial commitment to the EPC payments. These accounts accrue savings achieved due to the implementation of ECMs. EPCs payments also lie in these accounts and show up annually as a clear line-item obligation during the contract period (FEMP, 2009).

State Examples
The ability of agencies to retain the energy budget is critical to EPC. Some states also allow the retention of energy savings from EPCs. For instance, state agencies in Hawaii that perform energy efficiency retrofits are allowed to receive energy budget appropriations no less than their pre-retrofit energy budget and they can even receive higher amount in proportion to any increase in the overall budget during the contract term (State of Hawaii, 2011). Similarly, in New Mexico, state agencies get utility budgets and appropriations based on the pre-retrofit energy consumption level during the contract term and they are allowed to carry over the remaining savings after

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13 Allowable cost savings include energy and water cost savings and related cost savings, both reoccurring and one-time savings.
payments to the ESCO and utilities as a reserved designated fund balance to the next year. Such fund can be used 100% for additional ECMs, or after encumbrances for ECMs, 50% of the excess savings can be used for responsibilities assigned to the agency while returning the rest to the appropriate fund. Once the contract term ends, new budgets will be approved based on actual consumptions (State of New Mexico, 2009). Colorado also put efforts into structuring a supportive budgeting mechanism that allows to use utility appropriations to pay for annual costs from EPCs (Executive Order D 014 03, 2003).

Overview of China’s Budgeting Rules

National Rules
In 2010, the General Office of China’s State Council issued a document called Notice on Accelerating Energy Performance Contracting to Promote the Development of Energy Service Industry in China. This document recognized the importance of EPC and provided some clarifications on accounting provisions on the use of EPC. Specifically, the document ruled that government agencies at all levels could make payments to ESCOs out of their energy budget (State Council, 2010), which is appropriated based on the institution’s actual energy expenses in the preceding year (IESM, 2012). Payments by public institutions other than government shall be under related expenses (State Council, 2010). In 2016, the Ministry of Finance (MOF) released a rule called Management of Carry-over and Balance in Central Institutions. This rule clarified that during a project term, an agency can carryover its annual, appropriated budget balance to the following year, indicating that an agency is able to retain savings during the project term of EPC (MOF, 2016). Retained savings cannot be used for other activities since public institutions have no authorization to change the use of budget expenditure, required by the China’s Budgeting Law (MOF, 2015). When the project term ends, an agency shall return all savings to MOF (MOF, 2016).

Provincial and City Examples
Some local governments in China, based on the national policies, further specified the expenses and savings accounting method for EPC to better support EPCs in the local public sector. For example, the government of Guangzhou allows the local public institutions to keep the energy budget at the level of pre-retrofit energy cost during the contract term and the budget cannot be cut while savings are realized from an EPC. When the contract term ends, the energy budget appropriated to the institution would be based on its actual post-retrofit energy costs. Moreover, the Guangzhou Development and Reform Commission has set up an energy conservation fund and provides one-time financial support to public institutions pursuing EPCs and meeting certain energy saving requirements. Such financial support can only be used for energy conservation practices (The People’s Government of Guangzhou Municipality, 2014). In Shenzhen, public institutions are authorized to keep part or all savings from an EPC even when contract term ends for the use of post-retrofit maintenance or additional energy conservation practices (Shenzhen Government Offices Administration, 2012). The financial support in Guangzhou as well as retention of post-retrofit savings in Shenzhen could motivate public institutions to pursue EPCs.
Table 4. Examples of public sector EPC budgeting rules in Chinese provinces and cities.

<table>
<thead>
<tr>
<th>Province/City</th>
<th>Policy</th>
<th>Year</th>
<th>Budgeting Rules</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jiangsu Province</td>
<td>Opinions on Promoting Energy Performance Contracting in the Public Sector 关于推进公共机构合同能源管理的意见</td>
<td>2017</td>
<td>For government agencies, payments to ESCOs should be from an agency’s energy budget. For other types of public institution, payments shall be under related expense. Energy and related budget cannot be cut and savings can be retained during the contract term.</td>
</tr>
<tr>
<td>Shenzhen City</td>
<td>Implementation of Energy Performance Contracting in the Shenzhen Public Sector (Trial) 深圳市公共机构合同能源管理实施方案（试行）</td>
<td>2012</td>
<td>During an EPC, a public institution’s energy budget is based on the pre-retrofit energy consumption level. Public institutions can keep all the post-retrofit annual savings as long as the savings are under ¥100,000. For amounts over ¥100,000, public institutions need to return half to the finance bureau, with a maximum retention of ¥500,000. The retained savings should be used for energy conservation related expenses, such as post-retrofit equipment maintenance.</td>
</tr>
<tr>
<td>Guangzhou City</td>
<td>Guangzhou Public Sector Energy Performance Contracting 广州市公共机构合同能源管理办法</td>
<td>2014</td>
<td>Energy budget during the contract term is based on the pre-retrofit energy consumption level. When the contract term ends, public institutions receive energy appropriations based on actual post-retrofit energy expenses. Public institutions can get one-time financial support for pursuing EPCs and achieving certain levels of energy savings. The financial support can only be used for energy conservation measures.</td>
</tr>
<tr>
<td>Shanghai City</td>
<td>Interim Measures for Energy Performance Contracting in the Shanghai Public Sector 上海市公共机构合同能源管理项目暂行管理办法</td>
<td>2015</td>
<td>The energy budget for public institutions is appropriated based on baselines in the EPC. Payments to the ESCO are treated as energy expenses. Energy expenses and EPC payments should not exceed the energy cost from the year preceding the contract. When the contract ends, the public institution would get energy appropriations based on post-retrofit conditions.</td>
</tr>
</tbody>
</table>

Lessons Learned and Recommendations

Allowing public institutions to retain their energy budget during EPC projects can make these projects more financially attractive and feasible, which in turn will encourage investment in energy efficiency measures. Currently, policy makers have made budgeting rules for public institutions at both national and local levels. However, central level rules are lacking details. For example, although payments to ESCOs are treated as energy budget, there is no clarification of whether the budget would be cut during the contract term as energy consumption goes down due to retrofit. In addition, the Management of Carry-over and Balance in Central Institutions rule allows carrying over balance or savings during the project term; however, whether the project term means the retrofit period only or the entire contract term for EPC is not clear. It would be helpful to provide detailed guideline for institutions at central level to support their interpretation and implementation of these rules.

Some provincial and local policy makers, on the other hand, have established budgeting rules for EPC payments and savings with clear instructions, listed in Table 4. However, it is still a small number of provinces and cities with supportive budgeting rules for public sector EPCs. It would be more impactful if other provinces and cities could learn from the successful experience of these examples.

Supportive budgeting rules can not only overcome the challenge of EPC payments, but also motivate public institutions in pursuing energy efficiency, such as allowing the retention of savings beyond EPC payments. Both the U.S. and the city of Shenzhen in China are taking this approach, which provides financial motivation to public institution. Moreover, as the rules specified that retained savings could be used only for additional energy conservation related activities, such as capacity building, it is likely that staff awareness of energy conservation could be raised as well. Based on the scale\textsuperscript{14} of public sector projects in Shenzhen, applying such rules on a larger scale to central government agencies and other provincial and local institutions would likely unleash broader investment in public sector EPCs.

EPC Program Set Up

In the U.S., DOE FEMP provides federal agencies with affordable solutions and supports in public-private partnerships, including EPC, to enable agencies to meet energy related goals. The Chinese government, particularly GOA and NDRC, could consider developing a FEMP-like program in China to help manifest the use of EPCs in the Chinese public sector. This section introduces how DOE organizes resources and support services for federal and state agencies in the U.S., which could potentially be useful in China as well.

\textsuperscript{14} As of the first half of 2014, the total retrofits in the Shenzhen public sector using EPC has reached 7 million square meters with an annual electricity saving of 7.6 million kWh, equivalent to savings of 9,340 tce and a reduction of 23,000 tons of carbon dioxide.
EPC Resource Center

Resource Center for Federal Agencies

FEMP organizes and provides federal agencies with all relevant information needed for implementing EPC projects, including legal and regulatory information on energy efficiency and EPCs, training materials and seminars, and case studies. In addition, several EPC project guidelines on FEMP’s website could assist agencies with EPC project implementation effectively. For example, to ensure that federal agencies and facility managers have complete and accurate data on buildings’ energy use, FEMP issued metering guidelines for federal facilities (U.S. DOE, 2014). In addition to the guidelines on planning, budgeting, and using EPC (FEMP, 2009), U.S. DOE also issued comprehensive measurement and verification (M&V) guidelines (U.S. DOE 2015), providing procedures for facility managers, procurement officers, and other personnel involved in the implementation of EPC projects to quantify resulting energy and cost savings. The resource center serves as the go-to place when federal agencies have any EPC related questions or need any assistance. Agencies can navigate the website to find answers or solutions in an efficient manner.

Another resource provided on FEMP’s website is a list of ESCOs that are pre-qualified by DOE. DOE issues indefinite quantity contracts for ESCOs who can work on federal EPCs. It selects the ESCOs based on detailed selection criteria; these criteria include issues such as ESCO experience, track record and proposed fees (U.S. DOE, 2017b). The advantage of having pre-qualified ESCOs and indefinite quantity contracts are twofold:

1. This makes it significantly easier for federal agencies to sign task orders for EPCs with individual ESCOs. DOE allocates the ESCOs to projects on a rotating basis, unless the agency wants to hold a competition among the approved ESCOs.
2. This allows for high-quality, investment grade audits. ESCOs guaranteeing deep retrofits will typically only agree to use their own audit, but the cost of the audit can be significant, and few ESCOs would agree to pay for it without certainty that they will implement the project. The audit costs are then bundled into the EPC. Higher quality audits also typically lead to higher performing projects.

Resource Center for State and Local Institutions

DOE also provides a separate EPC resource center for state and local institutions on its Better Buildings site. This site provides several useful resources and toolkits to streamline the EPC process and assist state and local agencies with decision-making at different stages of an EPC project. Examples include:

- Virtual Technical Assistant, which is an online interactive tool providing step-by-step instructions along an EPC life-cycle;
- EPC Financing Decision Tree, which is a flowchart that helps state and city government make decisions on financing options;
eProjectBuilder, a platform for EPC that creates financial schedules that become part of the contract. These schedules include annual payments and ESCO guaranteed savings. The platform also supports project data collection, tracking, and comparisons; and

- Facility Energy Decision System (FEDS), which can help facility managers assess retrofit options. It is available for free to federal, state and local agencies.

In addition to toolkits, other resources, such as model EPC contract documents, M&V guidelines, and project benchmark sheets are also available to the state and local agencies.

Lessons Learned and Recommendations

Currently, in China, the public sector EPC information and resources are scattered. Different sites host different pieces of information, making it hard for public institutions to understand EPC in a holistic way and thus discouraging institutions to implement EPCs. There is a risk that even though useful resources or toolkits exist, users may not be aware of them, limiting their value. GOA could consider setting up a resource and toolkit oriented center to provide public institutions with necessary information, guidelines, training, and supportive tools. In addition, energy performance data as well as achievements, such as cost savings, from EPC projects by institutions at the provincial level could be posted on the resource center and made available to the public. This could motivate and facilitate EPCs and energy efficiency projects in Chinese public institutions at various levels of government.

EPC Project Facilitator

FEMP also supports federal agencies with project facilitation. Specifically, agencies can hire a FEMP-approved project facilitator to obtain technical and financial advice through different stages of EPC projects. Some of the assistance provided by project facilitators include the review of proposals and reports, contract modifications, and finance review. Qualified project facilitator, who can be a private sector third party not representing the host, ESCO and financier, should have obtained EPC related trainings and follow FEMP standards and guidelines. Service provided by FEMP-designated project facilitator is on a reimbursable basis that agencies can bundle facilitation costs into their EPC contract terms to be paid from future savings or pay for them up front.

Some states in the U.S. also developed similar facilitation programs to support state institutions with their EPC projects. For example, the Colorado Energy Office provides free coaching and technical assistance to public institutions throughout the life cycle of an EPC project, including support on technical, legal, and financial aspects (State of Colorado, 2017).

Technical assistance provided by government-approved EPC experts can be a very effective way of supporting public institutions, especially those lacking EPC experience. With such assistance, the institutions are likely to be more comfortable with initiating EPC projects, and the whole EPC process could run smoother. China right now does not have such a facilitation program, but the government could consider setting up such a project facilitation program to help scale up EPCs in the Chinese public sector.
Conclusions

EPC is a proven market mechanism to help improve building energy efficiency. ESCOs have been operating in China for almost twenty years, particularly in the industrial sector, where many businesses have undertaken EPCs. EPC is relatively new in the Chinese public sector, but given experience in the U.S., the Chinese market potential is likely large. The expansion of EPC into the Chinese public sector, however, requires carefully thinking through government policies. This report provides an analysis of three relevant public sector EPC policies: goal setting, budgeting rules and EPC resources and support.

Setting energy reduction goals could be the first step to propel public institutions to pursue energy conservation measures through EPCs. The Chinese policy makers should consider the following points when designing their reduction goal system: (1) set ambitious but realistic goals that increase over time; (2) provide flexibility to institutions in meeting goals, such as portfolio-wide goals instead of goals at each facility; (3) ensure accountability for the goals at a high level and publicly to maximize motivation to achieve them.

Budgeting rules also play important roles in public sector EPCs as they determine whether and how institutions could repay the ESCOs. GOA, NDRC, and MOF should consider modifying the budgeting rules to allow public institutions to retain energy savings from EPC projects for both payments to ESCOs and further energy efficiency retrofits. It is also important to provide guidelines to instruct institutions on following these rules.

GOA could also consider developing a centralized EPC resource center and a project facilitation program given the fact that there have been relatively few EPCs in the Chinese public sector. The resource center could serve as a go-to place for EPC related resources and tools. Project facilitators could provide technical assistance to institutions throughout the EPC project life cycle. These two supports not only help build capacity in public institutions but also help build confidence among facility managers in implementing EPCs.

Developing supportive policies is vital to unleashing EPCs in public sector. The U.S. revised some of its policies and rules to overcome the barriers in public sector EPCs. This report shares insights and lessons learned from the U.S., which might be useful in China. China has a large opportunity to expand EPCs in the public sector, and the government is committed to overcoming existing barriers through policy adjustments and program support.
References


Judd, KS. 2017. Personal communication with Judd KS. PNNL, August 8, 2017.


https://www.govtrack.us/congress/bills/95/hr5037/text


https://www.afdc.energy.gov/pdfs/2527.pdf


Shanghai Government Offices Administration. 2015. Interim Measures for EPC in the Shanghai Public Sector. 
http://www.shjgj.gov.cn/InfoView.aspx?ColumnID=c043372f-3871-4b81-9eae-d9c5d0e945aa&InfoID=b61c7756-2572-4d25-a9d2-84a68bda525a

http://www.gdstc.gov.cn/HTML/led/jyjl/13648952253372000120939526821763.html

http://www.gov.cn/zwgk/2010-04/06/content_1573706.htm


http://zwgk.gd.gov.cn/007482532/201410/t20141027_552044.html


Appendix A. Shenzhen Public Sector EPC Experience and Recommendations

Shenzhen is one of the cities in China that has experimented with different practices to support the development of EPC in public sector. In 2012, the Shenzhen Government Offices Administration released the Implementation of Energy Performance Contracting in the Shenzhen Public Sector (Trial), which provided instructions regarding budgeting and procurement and asked for the development of a database of ESCO credit worthiness (Shenzhen Government Offices Administration, 2012). The Shenzhen Public Sector 12th FYP Energy Conservation Action Plan in 2013 made it a requirement for energy intensive public institutions to implement EPC projects and strengthened the accountability and monitoring system to track energy reduction goals (People’s Government of Shenzhen, 2013). The development of supportive policies in Shenzhen has led to several positive outcomes. As of the first half of 2014, the total retrofits in the Shenzhen public sector using EPC has reached 7 million square meters with an annual electricity saving of 7.6 million kWh, equivalent to savings of 9,340 tce and a reduction of 23,000 tons of carbon dioxide (NDRC, 2014).

Shenzhen’s success reflected the necessity and effectiveness of developing supportive policies. It is important that different policy makers, such as the city government offices administration, development and reform commission, finance bureau, and procurement department, could collaborate and design a system suitable for local EPC market. In addition to measures such as retaining post-retrofit savings, a streamlined procurement procedure has also proven helpful in Shenzhen. Shenzhen has developed a centralized procurement system and developed a procurement template for public sector EPC. Moreover, Shenzhen allows small-scale public institutions of the same type to bundle projects in order to reduce transaction costs for each component. These procurement rules largely improved the efficiency of procurement and motivated public sector entities to pursue EPCs. In the U.S., the Department of Energy has utilized two-stage tendering. DOE FEMP pre-qualifies ESCOs under the indefinite-delivery, indefinite-quantity (IDIQ) contracts, which functions like an umbrella contract. Under the IDIQ contract, a federal agency then negotiates a more detailed task order with the ESCO. Such a streamlined process could reduce the procurement expenses and risks for public institutions compared to organizing each contract individually. Other cities or provinces in China could also consider developing a streamlined tendering and procurement process for EPC based on local situations.

Another challenge that the public sector in China is facing is the lack of knowledge and experience. Capacity building could help to build know-how in public sector EPC. Shenzhen has conducted a series of training activities to help familiarize public institutions with relevant policies and EPC project implementation process. In the U.S., FEMP provides both in-person and online trainings to federal agencies on specific EPC topics. Once public institutions are more familiar with EPC process and the benefits they could gain from EPC, they would be more confident and motivated to apply EPC for energy retrofit.
Appendix B. List of U.S. Legislations for Energy Reduction Goals

- **Executive Order 12003** – Energy Policy and Conservation in 1977
  - Required for the total of all federally owned buildings
  - Reduction indicator: average annual energy use per gross square foot
  - Existing buildings: 20% reduction in 1985 compared to 1975; New buildings: 45%

- **National Energy Conservation Policy Act (NECPA) in 1978**
  - Required the establishment and publication of energy performance targets for federal agencies
  - Specified the use of life cycle cost method as the basis of energy-related procurement rules

- **Federal Energy Management Improvement Act (FEMIA) of 1988**
  - Required for federal agency (agency level reduction)
  - Reduction indicator: energy consumption per gross square foot (energy use intensity reduction)
  - 10% reduction by 1995 compared to 1985
  - Allowed exclusion of certain buildings
  - Required for an annual report of reduction progress from agency to the Secretary of Energy
  - Required for an annual report of government wide progress from the Secretary to Congress

- **Energy Policy Act (EPAA) of 1992**
  - Expanded FEMIA to a 20% reduction by 2000 compared to 1985

- **Executive Order 12902 of 1994**
  - Expanded EPAA to a 30% reduction by 2005 compared to 1985

- **Executive Order 13123 of 1999**
  - Required each agency to report reduction progress to the President annually

- **Energy Policy Act (EPAA) of 2005**
  - Required for a 20% reduction by 2015 compared to 2003 with interim annual targets between 2006 and 2015

- **Energy Independence and Security Act of 2007**
– Amended EPAct to a 30% reduction by 2015 with interim annual targets 将 2015 年目标修改成下降 30%

• Executive Order 13693 of 2015 总统行政令 13693
  – Required for a 2.5% annual reduction by 2025 compared to 2015 (i.e. 25% by 2025) 要求至 2025 年每年单位面积能耗下降 2.5%
  – Agencies overachieved the “30by15” goal may choose an alternative target of a combined total reduction of 47.5% from 2003 to 2025 instead of meeting annual target 超标完成的机构可以选择到 2025 年较 2003 年基准总体下降 47.5% 的目标，而非每年下降 2.5% 的目标