Part A Final Report

TA 4706-PRC: Energy Conservation and Resource Management Project

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Part A Chapter 1. Introduction and Summary

1.1. "Efficiency Power Plants" (EPPs) and China's Energy and Environmental Goals

An Efficiency Power Plant (EPP) is a virtual power plant consisting of a bundle of energy efficiency investments that provide predictable load carrying capacity in much the same way that a generating unit does. The EPP concept provides a powerful framework to overcome existing barriers to substantial increases in investment in energy efficiency in China. As described in more detail later in this paper, it is designed to enable the direct comparison of energy efficiency investments to conventional power plants on a scientific, economic, financial, and environmental basis. Under some approaches, the EPP is fully integrated into China's reformed power sector.

This project comes at an especially important time because of the priority China places on the goal of improving the efficiency of energy use by 20% by 2010. EPPs and the policy reforms associated with them can deliver much of the hoped-for energy efficiency improvement. During the past year while researchers and government officials have been hard at work discussing how to meet the goals, energy intensity and pollution increased. Failing to make progress in the first year makes it especially important to find new and more effective policies

China has three macro-level goals that relate directly to the EPP concept:

1. The 11th Five-Year Plan goal of improving energy efficiency by 20% by 2010;
2. The 11th FYP goal of reducing emissions by 10% by 2010; and
3. The goal of moving power sector reform forward.

The EPP concept serves all three of these high-priority goals.

1.1.1. The 11th FYP Goal: Improving Energy Efficiency by 20% by 2010

China is pursuing four main strategies to achieve its ambitious energy efficiency goals:

1. Promoting energy efficiency through structural adjustments by moving the economy away from heavy reliance on energy-intensive industries.
2. Promoting energy efficiency through technological advancement by increasing investment in R&D for advanced energy-efficient technologies and promoting the energy-service company (ESCO) industry.
3. Promoting energy efficiency through stronger regulation aimed at improving:
   - electricity demand-side management and the dispatch of resources (generation and demand response) in the wholesale markets;
   - energy efficiency-related legal systems;
   - planning and the approval of investment in fixed-assets projects;
   - energy efficiency improvements for the top 1000 enterprises; and
   - efficiency labeling and certification for consumer products.
4. Promoting energy efficiency through more extensive institutional reforms including:
   - energy pricing policies;
   - mechanisms to provide stable funding for energy efficiency;
   - taxation policies to promote energy efficiency; and

- utility and customer incentives to invest in energy-efficiency.

In general, the EPP concept is a perfect fit with these strategies, although some of the EPP options described in Chapter 3 do a better job than others. Achieving the 2010 energy saving target means energy savings of about 640-700mtce. Current estimates are that 10% of this target could come from EPPs and related DSM programs. More importantly, some of the EPP options provide concrete implementation approaches needed to turn strategies into results.

1.1.2. The 11th FYP Goal: Reducing Emissions by 10% by 2010

The State Environmental Protection Administration (SEPA) has identified multi-pronged strategies to meet the goal of reducing emissions by 10% by 2010. These strategies specifically include integrating SEPA's regulatory approach with power sector reform and increased emphasis on energy efficiency. The EPP concept can be used to support these strategies.

1.1.3. Moving Power Sector Reform Forward

Finally, power sector reform in China progressed quickly in its first few years, but the reform process has lately stalled. Experts have observed that the slowing of progress and the loss of some top-level support is due to the lack of appreciation for the strong connection between power sector reform and solutions to the major energy efficiency and environmental challenges China faces.

The EPP concept has a special, symbiotic relationship with power sector reform. The best EPP options need power sector reform (of a particular kind), and power sector reform needs EPPs to demonstrate to top leaders the great potential that the reform has to address the nation's energy efficiency and environmental challenges.

1.1.4. Developing Energy Strategy to 2030

Finally, China government is working on the development of long-term energy strategy. The establishment of an appropriate energy management system is a very important component of the strategy. The goal of setting up an energy management system is to introduce the sustainability into energy sector. The EPP concept fits this goal well.

1.2. Project Structure and Status

A team of international and domestic experts, coordinated by Optimal Energy, Inc., has been engaged by the Asian Development Bank (ADB) to provide technical assistance to the National Development and Reform Commission (NDRC) of the People's Republic of China (PRC).

The ADB's original Terms of Reference (TOR) set forth an integrated two-part process (Parts A and B) that would generate a comprehensive set of recommended policy reforms to support the most cost-effective pilot EPP in a province to be selected as part of the project. The original TOR stated in part:

> *"…it is crucial for successful initiation and implementation of an EPP project to overcome market barriers. ……Based on studies already done and detailed available information about the economic benefits and financial costs of implementing EPP projects in the PRC, an EPP demonstration project can be developed only if at the same time national policy and regulatory issues are*

addressed to ensure that appropriate incentives for all parties to undertake such an EPP project will be provided, including a fair distribution of its obvious economic benefits among the national and provincial governments, investors, suppliers of electricity, and beneficiaries…"

There were two events that caused the project to take a less radical, more incremental approach. First, Guangdong was selected as the location for the pilot before the project began. Second, the Guangdong Provincial Government (GGP), the NDRC, and the Ministry of Finance agreed at the outset that the EPP pilot would not recover the costs of servicing an ADB loan through electricity tariffs. Instead, the EPP would be based on an "on-lending" loan model, with funds to repay an ADB EPP loan recovered directly from end-users and/or middle-users.

As a result of these changes, the project is now taking a more staged approach. Part A, as originally planned, identifies and evaluates the full range of policy options for maximizing least-cost EPP investment. Part B focuses on one province and one EPP option, due to the constraints placed on near-term funding methods. Together, the Part A and B reports present a coordinated discussion of the EPP potential under different funding and policy options, with pre-feasibility economic and financial analysis focusing on initial sub-project on-lending prospects for the pilot EPP. The various Part A tasks and their location in this report are shown in Appendix A.

1.3. Energy Efficiency in China

Energy efficiency is now a very high priority in China. It is a key goal of China's 11th Five-Year Plan and has the focused attention of China's top leaders. The State Council recently issued its **Decision of the State Council on Enhancing Energy Conservation,** Guo Fa (2006) No.28. The State Council Decision leaves no doubt that every approach to increasing end-use energy efficiency is being pursued. These include:

- **Energy efficiency standards**. Energy efficiency standards for appliances, equipment, and buildings are being implemented extensively in China. These standards could be strengthened by broadening them to cover more electricity uses and by increased enforcement.

- **Tax and fiscal policies to encourage energy efficiency**. There are a variety of tax and fiscal policies that can be used to improve energy efficiency. Taxing inefficient users and products, providing tax incentives for clean and efficient users and products, imposing taxes on energy use or its consequent pollution, and imposing other kinds of energy taxes or pollution fees are some of the many ways to improve energy efficiency.

- **Loan programs**. There are many examples of loan programs where funds have been made available at commercial or subsidized interest rates to allow consumers to invest in capital-intensive energy-efficiency projects.

- **Creation and support for Energy Service Companies (ESCOs)**. China, like many other countries, has a relatively short history of developing an ESCO industry to capture energy efficiency. The first three demonstration ESCOs were established in China in 1998.

- **Energy efficiency education**. Increasing consumer awareness and education about energy efficiency is a common practice in most countries. Efforts range from mandatory labeling of the efficiency of major energy-using equipment to public education campaigns about the many benefits of energy efficiency.

- **Utility DSM programs**. Utility investment in energy efficiency options has been shown to be one of the most effective means of reducing energy costs and increasing energy efficiency. (See discussion of DSM and EPPs in Section 1.5 below.)

The **Efficiency Power Plant** (EPP) is a new approach to energy efficiency that combines many of the best features of international energy efficiency experience. The EPP concept is designed to meet many of the special conditions faced in China. It is a set of policies and practices that fit well with current national energy efficiency goals and priorities. Indeed, the State Council's Decision No. 28, Article XXVI, specifically states that China will:

> *Strengthen management of the power demand side and of power scheduling; give full play to the comprehensive advantages of power demand-side management; optimize the use of power schemes for cities and enterprises; promote the use of high-efficiency energy conservation technologies; push forward the construction of efficiency power plants (EPPs); and increase the efficiency of power use.*

1.4. What is an Efficiency Power Plant (EPP)?

An EPP can be partly explained by contrasting it to a conventional power plant (CPP). A typical CPP in China is a 300-MW coal-fired power plant that operates for approximately 6,000 hours per year. For each kilowatt-hour (kWh) generated (the amount of electricity needed to run one typical microwave oven for 1 hour), a CPP:

- burns 340 or more grams of coal;
- emits four or more grams of sulfur dioxide and similar amounts of nitrogen oxides; and
- costs between 35 and 40 fen.

EPPs, on the other hand, fill the same power need by saving kWhs instead of producing them. An EPP is a bundle of investments in energy-saving technologies, such that a 300 MW EPP substitutes directly for a 300 MW CPP. For each kWh that it saves, the EPP:

- burns no fuel,
- emits no pollution, and
- costs about 12 fen, or about 1/3 as much as a CPP.

As China's energy demands grow, each EPP can provide China with the equivalent of a new CPP in terms of capacity and energy– and do it faster, at lower cost, and with no pollution. Alternatively, the "output" of an EPP can allow an old dirty CPP to be retired. In a capacity shortage area, an EPP can substitute for missing CPPs and reduce blackouts. The EPP brings other tangible benefits to the system, compared to a CPP, such as avoiding line losses.

With the right policies and actions by the government, an EPP can be financed and paid for in the same way as a CPP. From a financial perspective, all of the EPP models are fundamentally long-term loans made to financially secure entities for economically and technically viable energy-efficiency projects that include identifiable revenue streams capable of repaying the loan.

1.5. Energy Efficiency, DSM and EPPs

We use the terms "energy efficiency," DSM, and EPP very often. In many respects the terms are the same, but in some cases they are different.

Demand-side management (DSM): DSM is a well established concept that is fundamental to EPPs. DSM refers to measures sponsored, funded, and/or implemented by electric utilities or other entities that modify end-use electrical energy consumption through "energy efficiency" or "load management." In China, until recently, most DSM was limited to load management, but the term "DSM" includes both load management and energy efficiency. Recently, several provinces have begun to focus on energy efficiency.

Load Management: Load management programs reduce electricity demand during periods of peak power consumption or high prices (often the two coincide). Load management programs rely on a variety of means to encourage customers to reduce their demand, for example, interruptible load tariffs, time-of-use rates, real-time pricing, direct load control, and voluntary demand-response programs. Load management efforts may save some energy and kilowatt-hours, but mostly they save capacity and kilowatts.

Energy Efficiency: Energy efficiency reduces electricity consumption during any and all hours when the cost of saving electricity is less than the cost of supply. Typical energy efficiency programs provide financial incentives to end users to modify their energy consumption by investing in higher efficiency end-use equipment; such incentives include, for example, low-cost loans for upgrading industrial motors or rebates for switching to more efficient light bulbs or air conditioners. The best energy efficiency programs are designed to save not only energy (kilowatt-hours), but also capacity (kilowatts).

Efficiency Power Plants (EPPs): An EPP is a collection of DSM programs designed to produce energy and capacity savings of a specified size and with specified characteristics. An EPP that emphasizes load management will resemble a conventional peaking power plant. An EPP that makes use of energy efficiency will resemble a base-load power plant.

The current EPP project resembles a base-load plant and focuses on energy efficiency, for three reasons:

- China's highest priority is to improve energy efficiency;
- China has substantial and successful experience with load management, and there are very few barriers to it; in contrast, China has relatively little experience with energy efficiency, which faces significant barriers; and
- There are few policy reforms needed to encourage load management, while many are needed to encourage energy efficiency.

When we use the term "DSM" we are generally referring to both energy efficiency and load management. "DSM" is also used in many Chinese studies, regulations, and decrees that are referenced or quoted in this report. When we use the term "EPP," we mean a bundle of energy efficiency programs or measures as described above.

Because the barriers to energy efficiency and EPPs are very similar and the policy options to address the barriers are also very similar, our discussion often uses the terms interchangeably.

Although EPPs and DSM have much in common, the EPP concept improves and expands China's usual approach to DSM in at least five additional important characteristics to:

1. The EPP concept allows policymakers to more clearly see the role and capability of energy efficiency.
2. The aggregation of efficiency programs into large EPPs allows for integration of energy efficiency into the new power markets. The new markets can be designed so that EPPs can compete against conventional power plants.
3. EPPs aggregate a large number of energy efficiency options, thereby making large-scale, low-cost external financing possible and reducing administration and transaction costs.
4. EPPs simplify comparisons of supply- and demand-side options and, in so doing, improve China's planning and investment processes.
5. The need for, and approach to, cost recovery, is simplified by amortizing the cost of the EPP's aggregation of energy efficiency activities in the same fashion as the cost of a conventional power plant.

EPPs can specifically address five goals identified by the government in recent DSM-related documents (The State Council Decision on Strengthening Energy Conservation Work [2006- No. 28], the May 2004 Joint SERC-NDRC DSM Guidance, and the NDRC Medium- and Long-Term DSM Plan):

- Promoting the construction of EPPs;
- Expanding DSM implementation;
- Increased and better use of DSM funding options;
- Integrating energy efficiency programs in resource planning;
- Encouraging grid company involvement in DSM planning and delivery, and encouraging the construction of EPPs

1.6. Barriers to Energy Efficiency and EPPs

There are two important categories of barriers to EPPs. First, there are the barriers to that prevent consumers or other entities from either investing in energy efficiency themselves or creating a business that seeks to profit from delivering energy efficiency to consumers. These barriers can be addressed by policies and practices that have been proven around the world. Second, are those conditions in China that create barriers to the policy reforms themselves. These are unique to China and must be understood and addressed in a manner that will work in China.

1.6.1. Barriers to EPPs

International experience has identified a very long list of barriers to energy efficiency and EPPs including electricity prices below full marginal cost, lack of information, and split incentives. All of these barriers exist in China. The most significant barriers affecting the EPP relate to energy efficiency funding issues, and several aspects of ongoing power sector reform.

- **Legal and Institutional Issues**: The laws and regulations relating to energy efficiency are outdated and inadequate. Energy efficiency policies are not integrated or coordinated. Institutional issues also extend to China's power sector planning and investment practices, which do not use modern, scientific, least-cost methods. China's investment approval practices are not transparent and seem disconnected from the energy and environmental planning processes.
- **DSM Funding**: Energy efficiency is low cost, but it is not free and must be paid for. Present funding levels, whether through loan programs or other sources, are too low to procure a significant portion of readily available cost-effective energy efficiency. The lack of an adequate and stable source of funding is the greatest overall barrier to energy efficiency and EPPs in China.
- **Power Sector Reform**: Not all kinds of power sector reform are good. Current and planned reform in China is actually increasing barriers to energy efficiency. For example, grid companies are generally allowed to include the full costs of power they purchase in the prices they charge consumers. But, there is no policy that allows grid companies to include the cost of EPPs in a similar fashion**.** EPPs can help integrate energy efficiency into sector reform. The separation of generation from the grid has created new challenges for DSM. At present, government departments are still responsible for DSM, while the grid companies are in charge of DSM implementation. Generation companies are not involved in DSM and view energy efficiency as a competitor.

1.6.2. Barriers to Policy Reform

There are two main barriers to needed policy reform. The first relates to how China views the roles of markets and government with regard to energy efficiency. The second relates to the role of the power sector versus the government.

- There is a widely held view that the government's role in energy efficiency should be limited to activities such as standards, labeling, education, improving energy prices and tax reform, and that markets will take care of the rest. All of these steps are important and contribute to increasing energy efficiency, but many years of international experience have proven that large low-cost energy efficiency potential will remain even if these steps are taken. The market barriers to energy efficiency are too significant and varied in nature to be solved by standards, education, and information alone.

  The experience of the US relating to the need for government policy intervention to support DSM and EPPs is very useful because the past 20 years have seen an evolution from a planning approach, to a market approach, to a balance of both. Today, there is widespread agreement that EPP-type energy efficiency programs are proven and that they should be significantly increased and supported with government regulation and policies.[1]

[1] See *National Action Plan for Energy Efficiency*, U.S. EPA, 2006. http://www.epa.gov/cleanenergy/pdf/napee/napee_report.pdf and *State And Regional Policies That Promote Energy Efficiency Programs Carried Out By Electric And Gas Utilities: A Report To The United States Congress Pursuant To Section 139 Of The Energy Policy Act Of 2007*, USDOE, March 2007. Available at http://www.oe.energy.gov/DocumentsandMedia/DOE_EPAct_Sec._139_Rpt_to_CongressFINAL_PUBLIC_RELEASE_VERSION.pdf

- Many policy makers are reluctant to integrate energy efficiency in power sector reform or pricing. The benefits of integrating energy efficiency with power sector reform are significant and this fact was recognized by the International Energy Agency in its recent review of China's power sector.[2]

- China has made very significant commitments to power sector reform. Unfortunately, the power sector reform plans were made before energy efficiency became such a high national priority. Officials involved in power sector reform are so busy trying to implement the planned reforms that there is little time to consider energy efficiency related reforms.

- EPP related pricing reforms are difficult because all extra electricity fees and surcharges were eliminated as part of the power sector reform efforts in the late 1990s. Abolishing the fees was a major reform made with strong approval at the highest level of government. Today, any new fee receives a very high level of scrutiny. Although small new fees could provide significant environmental, economic, and energy benefits to China, it will take strong political leadership to make the necessary policy course corrections.

  Many officials support the concept of raising prices to pay for energy efficiency but resist allowing the grid companies to keep the extra funds or to expand the grid companies' size and scope. They see the companies as being too large, powerful and well-compensated already.

1.7. Summary of EPP Options

Two EPP options were described in the original TOR:

> *The preferred option is for local power transmission and distribution companies to provide the energy-efficient equipment and appliances to the various consumers, with a subsidy as compensation for the higher cost of the more energy-efficient equipment and appliances and the surrender of the equipment and appliances in use, and subsequently recover this subsidy cost from an additional charge in the electricity tariff for energy conservation.*
>
> *Alternatively, energy services companies (ESCOs) could provide energy-efficient equipment for relatively large electricity consumers and recover their investment through a service charge levied on them.*

These two approaches do not, however, fully encompass the broader range of funding and administrative methods for EPPs. We have identified four general policy options for implementing EPPs: grid company funding, system benefit charge, government funding, and direct consumer funding.[3]

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[2] See *China's Power Sector Reforms: Where to next?* IEA, 2006 http://www.iea.org/w/bookshop/add.aspx?id=288

[3] As discussed in the Inception Report, a Memorandum of Understanding (MOU) signed by the GGP, NDRC, and MOF states that Guangdong will not recover the costs of servicing an ADB loan through electricity tariffs. This agreement recognizes that the needed policy reforms to support full EPP implementation will not be in place within the time frame for the loan relating to the first EPP. The MOU is not intended to limit the range of policy options for the future.

The first two (Options 1 and 2, described in greater detail below) are aimed specifically at integrating the EPP into power sector reform and addressing one of the major well-known barriers to energy efficiency, that is, the lack of an adequate stable funding source. Although energy efficiency typically costs one-third or less of the cost of conventional power, it is not free and must be paid for.

Under current policies, if a grid company buys power from a conventional power plant (CPP) for, say, 40 fen/kWh, it is allowed to include the cost of that power in prices it charges retail consumers for electricity. Indeed, recent reforms make the grid company's recovery of power supply cost easier and faster. But, if the same grid company buys efficiency from an EPP for 15 fen/kWh, there are no established policies allowing the it to recover those costs. This gives the grid company no reasonable financial choice except to meet demand with the more expensive, more polluting CPP option.

The lack of a stable, predictable, and adequate energy efficiency funding mechanism is the major impediment to large-scale energy efficiency implementation in China. International experience provides two basic approaches (Options 1 and 2 in this paper) for utility-based EPP funding:

- **Option 1. Grid company cost recovery**: Many utilities in the US and other countries treat energy efficiency costs as just another element of the cost of electricity service – like salaries, generation costs, and wires. A variation of this option could fit China especially well. In regions areas where China has implemented competitive generation markets, China could integrate EPPs at the power market level by having the market operator be the purchaser of EPPs. The cost of EPPs would then be included as part of the power market's costs and be passed on in the prices paid by purchasers in the market.
- **Option 2. Public Benefit Fund (PBF)**: A PBF is collected through a small surcharge on electricity sales, prices or electricity generators. The charge is often called a System Benefit Charge (SBC). Funds collected using an SBC are used to pay for EPPs and other energy efficiency efforts. In one variation of this option, the grid company has a central role in acquiring energy efficiency and, in a second variation, the grid company's role is very limited. Current conditions in China cause us to focus on the non-utility version.

A second set of EPP options (Options 3 and 4 in this paper) propose alternatives to utility-based funding of efficiency:

- **Option 3. Government funding**: Funding for efficiency investments can come from existing revenue sources or from new taxes such as energy or pollution levies. Such taxes have the added benefit of rewarding consumers for being efficient: the more efficient they are, the less tax they pay.
- **Option 4. Direct consumer funding**: This approach, which is China's preference for the first EPP, is based on a competitive market model in which consumers who choose to invest in energy efficiency pay for the investment over time, using traditional Energy Service Company (ESCO) arrangements or other loan mechanisms. Individual loans are made to participants but, for purposes of risk management and repayment, the participants are treated as a group. Loan repayment is structured as an "Energy Saving Fee" (ESF) equal to the average cost per kWh saved for the aggregated EPP. The ESF may be

set higher than the average lifetime EPP cost to shorten the loan repayment period. Each participant pays the same ESF based on the kWh savings estimated for its particular project. To account for differences in the cost-effectiveness and lifetimes of different projects, the duration of each participant's ESF will vary. For example, Participant A invests in motor efficiency improvements with a ten-year lifetime and annual savings of 100 MWhs and Participant B invests in efficient lights with a seven-year lifetime and savings of 50 MWhs per year. A and B both pay the same ESF per kWh saved, but A's payments will be for a longer term than B's. The ESF is included on participants' power bills. The fees are collected by the utility and are remitted to the EPP administrator for relending or loan repayment.

All the models have certain essential elements, or functions. In some models, a particular entity can fulfill more than one function. In other models, a particular function may need to be divided among several entities, either due to the limited capabilities of a single entity or for administrative or governmental requirements. For example, the role of the utility in EPP planning, implementation, and oversight can range from full involvement to very little. Different delivery mechanisms can be used, the role of ESCOs can be large or small, and different approaches to government oversight can be used. These variations are discussed later in this report.

As a general matter, the fewer entities involved, the more efficient and lower-cost the process will be.

1.8. EPP Study Tour Summary

In January 2007, a group of 12 Chinese national and provincial government and industry representatives undertook a study tour in the US.[4] Their goals were to learn about DSM and EPP policies and practices in the US, and consider their usefulness for improving the EPP concept in China and implementing the EPP pilot project in Guangdong.

The tour chose to focus on two states, California and Vermont. California has implemented DSM for 30 years and has kept electricity consumption per capita unchanged while GDP has quadrupled. Vermont established the first non-utility EPP in the US and has reduced its load growth about 50% through DSM. The study tour also focused on these two states because they have different implementation arrangements. In California the utilities design and administer the EPPs. In Vermont a government supervised, non-utility party designs and administers the EPPS. In both states costs are recovered through electricity bills and in different ways both integrate EPPs in power supply planning.

The tour participants desired a comprehensive understanding of DSM and EPP approaches, including the roles of government, regulators, utilities and the private

[4] Study tour participants represented the State Development and Reform Commission (NDRC), Ministry of Finance, State Electricity Regulatory Commission (SERC), Guangdong Provincial Development and Reform Commission, Guangdong Energy Conservation and Monitoring Center, Guangdong Provincial Department of Finance, State Grid Corporation of China, China Southern Power Grid Corporation, Guangdong Power Grid Corporation and Guangdong Haihong Transformer Corporation.

sector. They achieved this through extensive and in-depth exchanges with both high-level decision makers and lower-level operators at relevant organizations including the California Public Utilities Commission (CPUC), California Energy Commission (CEC), Pacific Gas and Electric Corporation (PG&E), Vermont Energy Efficiency Utility (VEEU), Lawrence Berkeley National Laboratory (LBNL), Nexant (an energy services company), and end-users. The group also went on three EPP project site visits.

Upon their return to China the participants considered their study tour observations, as well as China's unique conditions. They conducted a symposium, continued to research options and then formulated recommendations to promote DSM and EPPs in China.
The following insights and recommendations are taken from the study tour final report, which is published in its entirety in Appendix D.

Study Tour Insights

- Many countries have set energy conservation and emission reduction targets and made real gains.
- Good system design and policies are the necessary foundation for energy savings and emission reductions. These elements of good design and policy were noted:
    - All society benefits from these energy savings and emission reductions, so many EPPs are designed to share the costs of those benefits with all society. This also helps overcome market failures in the energy-saving sector.
    - Adequate funds are needed for EPP expenses such as publicity, training, rebates, loans, assessments
    - Implementation organizations and systems can involve the government, third party institutions or grid corporations.
    - Management needs to be accountable for implementation. Good evaluation and auditing procedures are necessary, often done by independent third parties.
- Grid corporation cooperation often depends on whether the EPP system is designed to benefit them.
- Government plays a decisive role in the improvement of energy efficiency.
- Demand side resources often have cost advantages over their life cycle and should be considered as the primary option to meet energy demand.
- Equipment and building standards and labeling programs like Energy Star have reduced electric load significantly in many countries.
- Improving EE needs long-term, painstaking work, tailored to local conditions. The best programs offer many different approaches and accumulate knowledge to improve results over the long-term.

Study Tour Team Policy Suggestions

- Government should confidently play a stronger role to improve energy efficiency. It can and should set binding targets and develop supportive policies such as incentive and punitive measures.
- Speed up the establishment of incentive mechanisms. First, establish the reliable funding that is needed for long-term effective DSM. It can come through a small charge on electric use or power supply costs or government revenues. It should be small in the beginning and scale up as capacity

increases. Tax policies should be aligned to support DSM and pricing policies can support the most efficient use of the power system.

- Construct a robust organization system for EPPs by transitioning existing government agencies, energy companies or third parties to take on this role.
- Strengthen targets and achievement. The government assigns energy saving targets to regions, industries and key enterprises, but this must be backed up by comprehensive data collection, and a strong evaluation system.
- Further promote application of energy efficiency labels and standards for buildings, appliances and equipment.
- Increase role of the grid corporations; leverage their many resources and management experience. They could be evaluated on energy efficiency and energy security accomplishments. The power system design and pricing policies could improve incentives for grid corporations to be involved.
- Strengthen DSM publicity, training of human resources and further develop international exchanges.

Study Tour Team Implementation Suggestions for Guangdong EPP

- Relevant parties need to invest more time and energy to speed up the deployment of TA projects and preparations for loans. The conditions in Guangdong province are ripe for the EPP pilot. Motivation is high for two reasons. First, there is urgency because the province has less time to meet the 11th Five year plan energy savings goals. Second, important ministries, the ADB and other parties are very concerned and well-informed and ready to provide support and cooperation.
- Government authorities should provide leadership by improving policies supportive of the EPP and providing technical assistance.
- Establish provincial re-lending mechanisms if needed due to the difference in loan cycles for EPP projects and the ADB's loan cycle.
- Gradually implement various projects according to the "easiest to hardest" principle. The Guangdong EPP can proceed quickly using existing policies and focusing on "low hanging fruit" or projects with known technology and significant savings. The pilot project can also be used to try out different approaches, and gradually take on projects that need new policy support or have higher risks or are more complicated.

1.9. General Findings

Our general findings and recommendations are based on our assessment of a number of experiences and factors, including:

- Prior work done on EPPs in China by the ADB and others;
- Prior EPP-related efforts in China conducted by many international and domestic entities;
- The history and status of government laws, regulations, policies, plans, and goals;
- The status and plans of China's power sector reform and power sector pricing;
- Our review of related international experience;
- The analyses conducted in Part B of this project;
- Input from EPP workshops in Beijing and Guangzhou; and
- The findings and recommendations of the 12 member EPP study trip to the US.

Our findings can be summarized as follows:

1. China has a great need for EPPs.
2. EPPs can contribute substantially to China's energy efficiency and environmental goals
3. China's electric sector has erected many barriers to energy efficiency and EPPs, and current plans for power sector reform plans will exacerbate these barriers.
4. All of the four EPP options identified are financially viable, although some are much more effective than others.

- Significant EPP development **requires** the adoption of new central policy support;
- Some variation of Option 2, or a mix of Option 2 and 3, best fits China's conditions but this requires action by the central government;
- Significant EPP development **would benefit** from better integration and coordination between energy efficiency efforts and power sector reform and power sector regulation;
- Option 4 is a significant improvement over existing energy efficiency loan approaches and can be implemented without central level policy reform;
- There are policies available to provincial governments to substantially improve the performance of EPPs;
- Provincial governments using Option 4 should adopt on-bill collection and should coordinate energy use quota systems with EPP design and operation; and,
- Option 4 is designed to allow easy transition to more powerful EPP options.

The following Table shows the main points and reference to relevant sections of this Report

Policy & Regulatory Concerns	Recommendations	Reference
The lack of an adequate and stable source of funding for DSM	All four proposed EPP options are designed to overcome the energy efficiency funding barrier. Each option requires different policy reforms summarized in Table 2. Strong government leadership will be needed for any Option. Some variation of Option 2, or a mix of Option 2 and 3, best fits China's conditions but this requires action by the central government Option 4 is a significant improvement over existing energy efficiency loan approaches and can be implemented without central level policy reform; There are policies available to provincial governments to substantially improve the performance of EPPs; Provincial governments using Option 4 should adopt on-bill collection and should coordinate energy use quota systems with EPP design and operation; and, Option 4 is designed to allow easy transition to more powerful EPP options	1.6.1, 2.2.4, Ch 3, 5.3
The lack of grid company incentives, and the presence of strong disincentives, to invest in DSM	Develop mechanisms for cost-recovery of efficiency investments and decouple profits from sales. Improve price-setting, accounting, and related regulatory methods to eliminate existing utility disincentives.	1.6.1, 2.2.5, 2.3, 2.3.2, 5.3.1.2.1, 5.3.1.2.2
Prices that fail to reflect the full cost of electricity, including the environmental damage costs, undervalue efficiency; and "split" incentives removes decision maker from energy impacts	Design or structure prices to overcome barriers to increased energy efficiency and efficient investment (e.g. inclining blocks, hook-up fees, efficiency linked prices)	2.2.6, 2.3 - 2.3.1.3, 5.3.1.2.1
Power sector reform does not yet fully integrate energy efficiency and other demand-side resources into it.	EPPs provide an excellent opportunity to move the best power sector reforms forward, because reforms that support EPPs will address environmental, energy and economic challenges.	1.6.1, 2.2.3, 2.2.7, 5.3.1.1, 5.3.1.3, 5.5.1
The presence of significant barriers to energy efficiency and EPPs	Design EPP Options to overcome barriers.	4.1

Part A Chapter 2. EPP Review

2.1. Review of Government Energy Efficiency Policies, Practices, and Targets

Demand Side Management (DSM) was introduced to China in the early 1990s when the concept was first included in government regulations in Shenzhen. These regulations were the first step in the development of today's EPP. Until recently, DSM efforts in China were limited to peak load management measures. Today, however, the government realizes that load management is only one element of DSM, that load management and electricity efficiency are different, and that they require different types of policy support.

2.1.1. China's Past Energy Efficiency Practices

China has a long history of load management activity, and these efforts have intensified recently because of power shortages. Load management efforts have included widespread implementation of time-of-use (TOU) pricing, with very large peak and off-peak price differentials; interruptible tariffs that compensate consumers for voluntary demand reductions during peak periods; and off-peak storage techniques such as ice-storage air conditioners and heat-storage electric boilers. In addition, many large customers have lowered their contribution to peaks by shifting production schedules, and are participating in other government-mandated load management efforts. In the context of EPPs, load management is like a peaking power plant; it provides low capital-cost capacity but it operates only a few hours per year.

Energy efficiency, by contrast, focuses on increased use of energy-efficient equipment such as energy-saving lamps, adjustable-speed motors and water pumps, and high-efficiency transformers. In the context of EPPs, energy efficiency is like a base-load power plant producing savings every day over a wide number of hours and years.

The current focus of EPPs is on energy efficiency rather than load management. There are three reasons for this: (1) the barriers to load management and energy efficiency are very different, as are the needed policy responses to overcome them; (2) China has less experience with energy efficiency, and the EPP is an excellent means of helping China build the institutional capability to deliver energy efficiency; and (3) China's priority is on energy efficiency and the goal of improving energy efficiency by 20% by 2010.[5]

Most of China's early energy efficiency experience involved government action; the utility sector was not directly involved. For example, from 1981 to 1990, China directed an average of 9% of its total energy investment on energy conservation measures each year.[6] Significant energy savings were achieved, mainly in industrial boilers and energy-intensive industries such as steel, cement, and chemicals.

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[5] Load management, especially if combined with improved power plant dispatch rules, can improve generation efficiency.

[6] Lin, Jiang. *Trends in Energy Efficiency Investments in China and the US,* Lawrence Berkeley National Laboratory, 2005. See: http://china.lbl.gov/china_pubs-policy.html.

Power shortages in the late 1980s caused the government to establish the Three-E offices to oversee electricity planning and electricity-saving efforts. They were usually set up in power grid enterprises because of their close relations with consumers. They provided useful bridges between the government, power grid enterprises, and consumers. The Three-E offices focused on load management and energy efficiency approaches to help consumers change their energy usage patterns and save energy. For example, the Beijing Three-E Office invested Y 20 million annually to shift peak loads in 1997–98, Y 60 million to improve power-saving efficiency, and Y 60 million in technical transformation. The office provided support for replacing motors, transformers, and other equipment with high-efficiency products.

In the early 1990s, China conducted a number of studies aimed at energy efficiency. A 1992 study, for example, found that DSM programs alone could reduce electricity use in Hainan by 21 percent in 2000, with savings of $200–$400 million. Despite the successes of the Three-E offices, the recommendations of these various studies were not widely implemented.

In 1993, a study in Shenzhen identified what essentially would have been the first EPP. The study found that implementing the recommended efficiency measures would eliminate the need for a planned 600 MW generating unit. The cost of the recommended efficiency measures was 330 million RMB, only half the cost of the planned power plant (the plant's unit construction cost was 5500 RMB/kW). The recommendations of this study were never implemented.

In 1997, the Three-E offices were closed as part of the reorganization that occurred when government functions were separated from those of enterprises. As a result, the government had no department with clear, ongoing DSM responsibility. With the lack of an institutional home, DSM planning and policy lost its champion and government support.

China's experience with energy efficiency funding has varied as well. Before 2000, funds for DSM mainly came from fees, or surcharges, added to electricity prices and fines for the excessive use of power. These sources of funds were eliminated partly as a result of government efforts to remove fees from electricity prices and partly due to the termination of excessive power use rules in the late 1990s, when power shortages turned to power surpluses.[7] There has been no stable source of funding for energy efficiency in China since this funding source was ended.

2.1.2. Current and Recent Experience

2.1.2.1. Energy Efficiency and EPP-related Experience in China

China is making impressive efforts to improve energy efficiency in every sector of its economy. For example, with the help of numerous international assistance

[7] Beginning in 2000, the Chinese government began to adjust power supply surcharges. In June 2000, the State Planning Commission and the State Economic and Trade Commission jointly issued a notice to reduce the power supply surcharges and the standard charge for power expansion capacity to reduce the burdens on power consumers. The collection of power supply surcharges would stop by the end of 2000, when the state-approved urban power grid construction and transformation projects were completed. The power supply surcharges were abolished in 2002.

organizations, China is developing a wide range of programs, regulations, and incentives designed to transform the market for efficient technologies. These activities include the creation of efficiency codes and standards, product certification and labeling programs, development of private energy service companies (ESCOs), demonstration projects, training courses, and public education programs.

In recent years, several energy efficiency programs have been implemented. China Green Lights was launched nationwide in1996. Pilot DSM programs aimed at energy efficiency were launched in Hebei and Jiangsu, and programs encouraging the use of variable-speed drives in industrial applications were launched in Jiangsu and Shanghai.

In 2003, Hebei, 300 km south of Beijing, became the first province to implement a surcharge on retail electricity sales specifically to fund investment in DSM. Hebei extracted 0.001 yuan/kWh from the urban surcharge to fund DSM projects (Ji Cai Jian [2003] No. 1). The charge yields about 10-12 million USD each year.

In January 2006, a comprehensive study of energy efficiency in Jiangsu was completed. This study provided the technical input to the initial analysis of an EPP project in Jiangsu. The study is important for several reasons:

- It introduced international best practices in electric utility energy efficiency programs to DSM experts in Jiangsu. It created a common economic, technical, and financial framework for analysis that has continuing value.
- The results were impressive and consistent with similar studies in other countries. The extensive studies in Jiangsu documented over 12,000 MW of EPP potential, at an average cost well below that of conventional power supply.
- As a result of the study, Jiangsu is moving forward with an energy efficiency pilot program. The province recently set up a 100 million RMB DSM fund and work is progressing to establish a more substantial, permanent and stable funding mechanism. In addition, officials are considering a grid company DSM cost-recovery and incentive mechanism.[8]
- Jiangsu is also developing the technical, administration, financial, monitoring, verification and oversight mechanisms and institutional arrangements that are required for a successful, comprehensive DSM program. These systems will be ready to be scaled up to a provincial or even national level as soon as a the sustainable funding mechanism is in place.
- As part of the DSM pilot, Jiangsu and international experts are developing a DSM implementation manual.

The Jiangsu DSM pilot program shows great promise. It is being designed on the basis of best international practices. The major deficiency thus far is that funding is from a relatively small, special allocation. Critical central-level pricing and funding

[8] Jiangsu created the energy efficiency fund from part of the government's proceeds from a joint venture power project. Some funds were left over when power prices were reduced after a joint venture power plant repaid capital with interest. The provincial power grid companies used the funds under the supervision of the provincial economic and trade committee.

reforms are still the main missing ingredients. There is even a funding mechanism, although it is small and not necessarily sustainable.

2.1.2.2. China's Recent Experience with the ESCO Model

Lack of capital is a barrier to energy efficiency that has received considerable attention. Many attempts have been, and continue to be, made to overcome it.[9] The most intensive and relevant effort in recent years is a multi-country project to develop energy efficiency financing methods, to increase the banking sector's confidence in energy service companies (ESCOs; also known as energy management companies, or EMCOs), thus freeing up loans and other forms of credit to finance their activities. This project, led by a collaboration of the World Bank, UNEP, and UNF, is called "Developing Financial Intermediation Mechanisms for Energy Efficiency Projects in Brazil, China, and India," or more familiarly as the "Three-Country EE Project."[10]

The Three-Country EE Project has made substantial progress and has given China some excellent experience with this particular approach to financing efficiency. The project has resulted in the creation of more than 100 ESCOs that in 2005 completed 327 energy efficiency projects with a total investment of about 2 billion RMB.[11] There are several large ESCOs, but most are very small. Great progress has been made with this approach, but the project revealed continuing difficulties. Some conclusions to be drawn from the Three-Country efforts are:

- Financing mechanisms and procedures need to be simplified in order to reduce costs.
- "In China, the two biggest challenges (to ESCO development) are to create a sustainable system for ESCO financing and ensuring stability as the industry grows."[12]
- The ESCO model "is not a magic bullet to solve problems in delivery of Energy Efficiency Investments."[13]
- Better bridges are needed between opportunities with energy efficiency potential and lenders/investors.
- There is a need to move away from project-by-project loan review.
- New energy efficiency concepts will not succeed in China without strong, affirmative government support.
- Lack of confidence in energy efficiency technologies in China's market must be addressed.

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[9] See, for example, *Developing an Energy Efficiency Service Industry in Shanghai.* Lawrence Berkeley National Laboratory, 2004. http://china.lbl.gov/china_pubs-policy.html

[10] For more information, see http://3countryee.org/

[11] *Advancing more banks entering into the field of energy conservation,* presentation by Shen Longhai, China Energy Conservation Association, 2006.
http://3countryee.org/Paris/ChinaResults_%20Longhai.pdf

[12] *Developing Financial Intermediation Mechanisms for Energy Efficiency,* presentation by Chandra Govindarajalu, World Bank, 2006.
http://3countryee.org/Paris/ProjectFindings_Govindarajalu.pdf

[13] Ibid.

2.1.2.3. Top 1000 Enterprises

One of the current priorities for energy efficiency is China's Top-1000 Enterprises Energy Efficiency Program (T-1000). This program is targeted toward China's 1000 most energy-intensive enterprises, drawn from nine major energy consuming industries: iron and steel, non-ferrous metals, coal, electric power generation, petroleum and petrochemical, chemicals, building materials, textiles, and paper. The energy consumption of the T-1000 enterprises accounts for 33 percent of the nation's total energy consumption.

Elements of the T-1000 program include the setting of energy saving targets, energy auditing, energy planning, and tracking and evaluation. The plan is designed to reduce unit energy consumption to domestic best-practice levels for all major products; drive some enterprises' energy use to either international best-practice levels or sector best-practice levels; improve the energy efficiency of each sector; and achieve energy savings of approximately 100 million tons of coal-equivalent during the 11th Five-Year Plan period.

The targets have been broken down to the factory level and all 1,008 enterprises have signed energy conservation agreements with local governments, promising to reach their energy savings targets in the next five years.

The relationship of the T-1000 effort to DSM and EPPs has been explored. For example, as part of the Jiangsu DSM Pilot described above, Jiangsu DSM experts visited the Sogo Petrochemical Facility to understand how the DSM fund would work to complement the Top 1000 program. This factory is required to cut its energy use by 53,000 tons of standard coal (tce) equivalent by 2010. The facility managers performed an energy audit and found that they could nearly double their energy savings--to 100,000 tce by 2010--using only existing technologies. The company is using its own money to achieve the required energy savings, but has applied to the Jiangsu DSM fund for financial incentives to achieve the additional 50,000 tons tce of savings.

2.1.3. EPP Related Policies: Laws, Decisions, Decrees, and Regulations

Over the years, EPP-related DSM policies have been incorporated into national plans, policies, regulations and standards, although they have not yet been widely implemented. These efforts have recently intensified as a key element of China's efforts to achieve its ambitious national energy efficiency target. The Energy Conservation Law has not changed since 1998, although significant efforts are now underway to update and strengthen it. In the meantime, State Council Decrees, government regulations, and China's five-year planning process have all been steadily increasing emphasis on energy efficiency. The following is a brief summary of recent events.

The Tenth Five-Year Plan, for the 2000-2005 period, called for the development of DSM provisions that could guide the rational planning and allocation of resources utilization, government procurement and voluntary agreements.

In 2000, the State Economic and Trade Commission (SETC) and the State Development Planning Commission (SDPC) jointly issued a guidance document that required provincial and municipal Economic and Trade Commissions to facilitate DSM efforts. Utilities were directed to make increased use of load management. Article 18 of the guidance document required power planning, in particular integrated

resource planning, to consider DSM as a resource. Article 21 encouraged utilities to promote DSM and permitted them to recover the costs of DSM education and information efforts (but not measure installation costs) in their management budgets.

In June 2003, SETC and SDPC issued a joint circular entitled "Announcement of Issuing Management Measures for Electricity Conservation." This circular recognized the importance of DSM as an electricity-saving strategy, and included suggestions for further advancing DSM work in the power sector. Shortly thereafter the SETC was abolished and the SDPC renamed and reorganized as the National Development Reform Commission (NDRC). Some SETC departments were moved to the new NDRC and DSM momentum slowed.

2.1.4. China's Energy Conservation Targets

The two most recent documents setting forth energy efficiency targets, policies, and plans are "The Medium- and Long-Term Special Program for China's Energy Efficiency and Conservation" issued by NDRC on November 25, 2004, and the "Decision of the State Council on Enhancing Energy Conservation," Guo Fa (August 2006) No.28.

Together, these documents set forth the priorities and policies that will be followed to achieve the goal of a 20% improvement in energy efficiency by 2010. Key program areas are identified, plans to allocate energy efficiency targets to provincial and local areas are described, and aggressive policies to hold officials accountable for implementation are set out.

The Medium and Long-Term Plan has several key provisions relating to EPPs. China's electric sector will:

> *…implement integrated resource plans and power demand side management; incorporate energy saved quantity as resources into overall plans; guide appropriate resource allocation; take effective measures to improve power end-use efficiency, optimize power consumption way and save electric power.*
>
> *..spread the energy performance contracting mechanism so as to remove market barriers in promoting new energy conservation technology; facilitate energy conservation industrialization, and provide a series of services including diagnosis, design, financing, renovation, operation, and management for enterprises conducting energy conservation renovation activities.*
>
> *..establish an energy conservation investment guarantee mechanism and promote development of the energy conservation technology service system.*

The provisions of the "Decision of the State Council on Enhancing Energy Conservation**"** are both more authoritative and more specific as they relate to the EPP concept. The Decision provides that the sector will:

> *(XXVI) Strengthen management of the power demand side and of power scheduling. Give full play to the comprehensive advantages of power demand side management; optimize the use of power schemes for cities and enterprises; promote the use of high-efficiency energy conservation technologies; push forward the construction of efficiency power plants*

(EPPs); and increase the efficiency of power use. Improve the dispatching rules for power generation; give priority to power generation that uses clean energy; optimize the scheduling of coal-fired thermal power generating units; constrain power generation by high energy-consuming, heavy-polluting and low-efficiency generating units; and achieve energy-saving, environmentally friendly and economic power scheduling.

At least six announced government measures will influence the design and role of EPPs:

1) the central and local government will periodically issue energy efficiency indicators;
2) a system defining energy efficiency target responsibility and requiring evaluation will provide incentives to leaders to promote energy efficiency, implement energy efficiency investment and develop fiscal incentives;
3) pricing reform will focus on more efficient prices, improving TOU tariffs, expanding the implementation of energy efficiency-targeted tariffs, and developing pricing policies aimed at excessive energy use;
4) an energy conservation fund will be added to local government fiscal budgets;
5) the government will provide assistance in arranging investment to support key energy efficiency projects, demonstration projects, and dissemination of efficiency products; and
6) financing agencies will increase loans for energy efficiency projects.

2.2. Barriers to EPPs

The barriers to EPPs are the barriers to energy efficiency. A group of respected international experts recently compiled a very comprehensive list of barriers to energy efficiency. [14] They are summarized in Table 1. The authors divided the barriers into three categories: general barriers, policy-related barriers, and program-related barriers. They found there is one overarching general barrier: the lack of government attention to energy efficiency and load management. In other words, where energy efficiency is not a top priority in power sector reform, little improvement in efficiency is achieved. While this may have been the case in other countries, or in China's initial efforts at power sector reform, we believe energy efficiency is now a high-priority in China.

[14] E. Vine, J. Hamrin, N. Eyre, D. Crossley, M. Maloney, and G. Watt, "Public Policy Analysis Of Energy Efficiency And Load Management In Changing Electricity Businesses," *Energy Policy*, Vol. 31 (2003), pp 405-430.

Table 1 Energy Efficiency Barriers in Power Sector Reform

Type	Barrier
General barrier	Lack of government attention to energy efficiency and load management
Policy barriers	1. Utility (Grid Company) price setting process (a) Cost recovery barriers (b) Net income coupled to sales 2. Pricing (a) Non-transparent pricing (b) Non-cost-reflective pricing 3. Split (misplaced) incentives to energy providers 4. Separation of energy policy process (from environment & social policy) 5. Imperfect information (restricted access to customer information) 6. Lack of awareness by policy makers (of EE opportunities) 7 Lack of available expertise 8. Inadequate competition (market power problems) 9. Customer instability (problem for energy providers) 10. Lack of adequate paradigm (for evaluating the value of EE) 11. Import tariffs and duties on EE technologies 12. Little market transformation experience (by end-users or others) 13. Excess capacity 14.Short-term perspective
Program barriers	1. Low cost of energy to end users 2. Lack of information to end users (a) Lack of energy consumption data (b) Lack of energy provider information 3. Information/search costs (to end users & other actors) 4. End-users do not invest in EE because of habits or custom 5. Lack of end-user and other market actors' experience: (a) Lack of experience with proven cost-effective measures (b) Performance uncertainties (may perceive EE to be unreliable) (c) Reluctance to adopt new technologies (d) Fear of disruption in routine (e) Lace of the trust between customers and ESCOs 6. Financial barriers (a) Limited investment capital available for EE (b) High initial cost 7. Product/service unavailability or poor quality 8. Inseparability of product features 9. Organizational (institutional) barriers (a) Low priority of energy efficiency (b) Views of upper management (c) Multiple decision makers 10. Split (misplaced) incentives when one entity is responsible for paying energy costs and another is responsible for making energy efficiency related investments.

All of the policy and program barriers exist in some measure in China and many are serious barriers that must be addressed if progress on the 20% goal is to be made. The greatest are those that relate to policy questions, the legal and institutional issues, funding issues, the lack of incentives for utility investment in energy efficiency, split incentives, and ongoing power sector reform.

2.2.1. Policy Issues

The greatest policy barrier is the widely held misconception by policy makers that energy efficiency goals can be met simply by moving to market-based prices for electricity and energy. Many years of international experience have proven that large, low-cost energy efficiency potential will remain even if prices reflect full marginal cost, including environmental costs.

Other barriers to policy reform relate to:

- The lack of recent concrete experience with energy efficiency and the knowledge of the established and verifiable means of demonstrating the effectiveness of energy efficiency;
- Reluctance to reverse recent decisions to eliminate fees from electricity prices;
- Reluctance to increase the revenues or responsibilities of grid companies; and
- Preoccupation with efforts to implement power sector reform plans made before energy efficiency was a high priority issue.

These issues are discussed in more detail in section 5.

2.2.2. Legal Issues

China's energy sector in general and the power sector in particular are in an awkward process of reform. Many laws covering energy efficiency and the power sector are now outdated and have been superseded by reforms started by the State Council. The pace of power sector reform has slowed due to many factors inside and outside China. Work on some laws, in particular the Energy Conservation Law, is moving forward but the lack of consensus and leadership on other laws that could accelerate investment in energy efficiency are stalled, making progress difficult.

2.2.3. Institutional Issues

Government reorganizations, power sector reform, and the separation of the utilities' historic governmental functions from their business functions have left energy efficiency and DSM responsibility dispersed and without effective coordination. At the present time, the Department of Resource Conservation and Environment Protection in NDRC is responsible for general energy efficiency affairs, while the Economy Operation Bureau is responsible for utility DSM, including EPPs. Other departments of NDRC, including the Energy Bureau and the Pricing Department, are responsible for policies that directly relate to EPP policy and implementation.

The most successful international DSM experiences have clear policy support and direction from government. Often, utility-sector regulators and other relevant government agencies work cooperatively toward common efficiency goals. In China, DSM policy support from the government is improving, but more support, coordination, and a clear articulation of responsibility is needed.

Institutional issues also extend to China's energy planning and investment practices. Around the world, the best DSM and EPP policies are part of an overall power sector planning and investment process. In it, the costs and benefits of all demand-side and

supply-side options are considered in a scientific and integrated fashion, and the least-cost, or optimal, mix of resources is identified and included in investment plans. The costs and benefits of each option include not only its direct financial costs and benefits, but also its social and environmental factors.

This is currently not the case in China. China's power sector planning process does not use modern scientific least-cost methods, or integrated resource planning (IRP). China's investment approval practices are not transparent and seem disconnected from the energy and environmental planning processes.

2.2.4. DSM Funding

Energy efficiency opportunities in China are plentiful and low-cost, but there is no significant, stable funding stream to enable them to be captured. The extensive studies in Jiangsu documented over 12,000 MW of EPP potential, at an average cost well below the cost of conventional power supply. As stated previously, energy efficiency is low cost, but it is not free and it must be paid for. Regardless of the source of funds, international experience clearly shows that DSM funding must be adequate and stable.

2.2.5. Lack of Incentives for Utility Investment

There are two powerful disincentives for utility investment in EPPs. First, and closely related to the problem of inadequate DSM funding, is the lack of an existing mechanism to pay for energy efficiency through electricity prices. Grid companies are generally allowed to include the costs of buying power in the prices they charge consumers. Currently, however, there is no policy that allows grid companies to include the costs of EPPs in a similar fashion, even though the cost of efficiency is much lower and efficiency produces no pollution. Secondly, EPPs will reduce the volume of electricity sales and, under the present system, this will reduce the profits of the grid enterprises. As a result, new regulatory methods for setting utility revenues may be needed to support energy efficiency.

2.2.6. Split Incentives

Split incentives are a substantial market barrier to energy efficiency in China. Split incentives occur when one person or entity makes the initial investment decisions relating to a building's design, construction, and electricity-consuming equipment and appliances, but another person pays the building's operating costs of which electricity is one. China is in the midst of an unprecedented period of massive new construction: split incentives present a major hurdle to the acquisition of all cost-effective energy efficiency.

2.2.7. Power Sector Reform

When it comes to energy efficiency, power sector reform presents both a large barrier and a great opportunity. Many experts have reviewed the effects of power sector reform on energy efficiency and have concluded that, without specific policy attention to energy efficiency, the ordinary effect of power sector reform is to increase the barriers to energy efficiency. Thus far, this has been the case in China, where the promise of end-use energy efficiency has played no significant role in shaping reform. Barriers to grid company investment in energy efficiency in China have been increasing. Separation of generation from the grid means that the benefits of energy efficiency are diluted, as they are now divided between two entities. At the same time, price reforms make it easier and less risky for the grid company to buy high-priced power from CPPs and there is no mechanism to buy lower-cost energy efficiency from EPPs.

Although power sector reform thus far has been a growing barrier to energy efficiency, EPPs may provide a way to gain high-level support to push power sector reform forward. A recent review of China's progress on power sector reform cited the "lack of consensus on electric power system reform." The lack of consensus is due, at least in part, to a lack of understanding among policymakers of the critical connection between power sector reform and solutions to pressing problems such as energy supply adequacy, the wasteful use of energy, and environmental protection. Any sectoral reform that inhibits investment in a resource that can address these several problems simultaneously will be inadequate at best. EPPs can help policymakers make that connection.

2.3. Review of Tariff Structures, Pricing Policies and Other Practices as They Relate to EPPs and Energy Efficiency

The electricity prices paid by consumers and the prices paid to grid companies and generators can, depending on how they are structured, either increase or reduce the barriers to EPPs in China. Our review of China's electricity tariffs, pricing policies, and power pricing practices focuses on two areas:

- The level and structure of retail electricity tariffs and how those prices may be a barrier to increased consumer investment in energy efficiency, and
- The pricing methods used to set retail prices and how those methods may present a barrier to grid company support for, and even investment in, end-use energy efficiency.

There are two guiding pricing principles that bear directly on energy efficiency. First, electricity prices should reflect the full marginal cost of service, including environmental costs. Second, pricing methods should provide the grid company with incentives to buy or invest in low-cost energy efficiency before higher cost power supply. These guiding pricing principles are not followed in China.

2.3.1. Retail Pricing

China has been improving and simplifying consumer prices by reducing the number of price categories and abolishing various surcharges, fees, and taxes.[15] Current prices consist mostly of per-kWh energy prices, differentiated mainly by customer groups, with demand charges for large industrial consumers. Also, the prices in each customer class are uniform throughout a province; there is no differentiation depending on location.

Generally, average retail electricity prices have increased gradually and they now compare reasonably well with the long-run marginal cost of supply, excluding environmental costs. But, prices for some customer classes are below marginal cost, for others they are more than marginal cost. For example, China's residential and agricultural prices are generally below estimated marginal cost. These non-cost-reflective price levels result in the undervaluation of energy efficiency.

Investment in energy efficiency is influenced by both price levels and price structure. With the exception of time-of-use (TOU) prices and the recent energy efficiency-related price differentials described below, China's electricity price levels and

[15] The number of customer classes is being reduced to five: households, agricultural production, industry, business, and other uses. Within each class, separate prices will be allowed for different voltage levels, with one exception (small- and medium-sized fertilizer manufacturing).

structures are not designed to encourage energy efficiency or address known market barriers to energy efficiency. And some present TOU pricing policies are flawed, providing incentives to suppliers to sell more peak power (see next section).

2.3.1.1. TOU Prices

In response to the current power shortage, China has widely implemented retail TOU prices. Over the years, the differential between peak and off-peak prices has increased. On-peak/off-peak price differentials now range from 3:1 to 6:1. The implementation of TOU prices has played a significant role in mitigating the acute power shortage over the past few years by encouraging the shifting of loads in peak periods to off-peak periods.[16] Although TOU prices for consumers may encourage them to shift load off-peak, TOU prices paid to generators and/or grid companies can be so high that they result in perverse incentives by making on-peak sales more profitable.

2.3.1.2. Prices Linked to Energy Efficiency Performance

A recent retail pricing reform announced in the NDRC March 2005 Pricing Circular links prices for some large customers to their efficiency performance. China has reviewed the efficiency of several energy-intensive industries, including electrolytic aluminum, ferroalloy, calcium carbide, alkali, cement, and steel. Energy-intensive consumers are divided into four categories based principally on their overall levels of energy efficiency: "encouraged," "permitted," "limited," and "eliminated." Electricity prices vary for the different categories and are designed to phase out the least efficient enterprises and encourage the most efficient. Currently, enterprises in the "encouraged" and "permitted" categories pay the normal prices for electricity in their areas. At first, consumers in the "limited" and "eliminated" categories paid surcharges of 2 fen and 5 fen per kWh, respectively. Recently the surcharges have been increased and a planned schedule to increase them further has been announced.

This pricing policy has been very effective. As of May 2006, 30 provinces (including autonomous regions, the municipalities, excluding Tibet) had implemented the efficiency related price differentials. In 2004, there were about 8,000 energy-intensive electrolytic aluminum, iron alloy, calcium carbide, sodium hydroxide, cement, and iron & steel facilities. About 2500 of these were under the new pricing policy. About 2,000 firms were in the "eliminated" category and 500 were in the "limited" category. By May 2006 there were only 1,100 firms in the "eliminated category and 120 were in "limited." About 1,200 high energy-consuming enterprises shut down, suspended operation, invested in energy efficiency, or changed production processes.

2.3.1.3. Planned Pricing Reforms

Other planned pricing reforms announced in the NDRC March 2005 Pricing Circular are:

- Below cost energy-only prices (price per kWh) will be continued for household and agricultural production and others connected below 100 kVa.

[16] Guangdong began to use TOU prices in all cities in 2003. Prices were divided into three-eight-hour time periods. The ratio of prices was widened to 1.5:1:0.5. This program reduced peak load by about 500 MW. By the end of 2003, 68,000 consumers with demands in excess of 315 kVa had installed multiple-function meters. This represented 95 TWh of energy use in 2003 and 58 percent of all sales. Guangdong province plans to build a load management center to monitor and control the loads of these customers.

- Prices for larger customers will have an energy charge and a capacity charge with a 12-month ratchet. The capacity charge will be based on the transformer size or a demand level selected by the consumer. If the demand level is selected by the consumer, the actual demand in excess of 105% of the requested demand is billed at two times the normal demand charge.
- TOU prices will be implemented more broadly.
- Provinces are encouraged to experiment with price structures and product offerings, including high-reliability electricity prices, interruptible prices, holiday electricity prices, and incremental or decremental electricity prices.

This latter provision, encouraging provinces to experiment with prices, could be used to adopt prices that would encourage greater consumer interest in energy efficiency. We note also that the continuation of below-cost prices for some customers may support social goals, but it will deter efficiency investments unless separate efficiency programs for these customers are implemented.

2.3.2. Price-Setting Methods

Retail prices and incentive/penalty schemes can induce consumers to invest in energy efficiency generally. The greater barriers to EPPs, however, are the pricing methods used to set electricity prices and enable utilities to recover their needed revenues. It is the pricing methods that give grid companies the incentive, or disincentive, to invest in, or encourage others to invest in, energy efficiency or EPPs.

In China, before generation was separated from the grid, the vertically integrated utility had some small incentive to invest in or encourage energy efficiency during times when its generation costs exceeded its retail revenues from additional sales (i.e., when marginal cost was greater than marginal revenue). With generation separated from the grid, the incentives for grid companies have changed. In China today:

- Generation companies have no interest in investing in or encouraging end-use energy efficiency. Where generation markets have been created, high demand leads to high generation prices and this is good for generators. The same is true even where sales are made bi-laterally – generators have a profit motive to lower their operating costs to improve supply-side margins, but have no interest in (and indeed can be hostile to) efforts to lower demand, lower peak prices, and improve energy efficiency among end-users.
- Current pricing methods discourage grid company investment in end-use energy efficiency. Revenue and profits are linked to electricity sales. Indeed the combination of recent and planned reforms is making grid companies even less interested in energy efficiency. Power supply cost recovery is being made easier, faster, and less risky.[17] Some retail pricing reforms, such as TOU prices, actually make on-peak sales much more profitable than off-peak sales.[18]

[17] A recent study by the IEA's Demand-Side Management Program examined how power sector reform affects DSM. The study found that typical power sector reforms do little if anything to reduce the barriers to DSM. Many reforms, such as China's separation of generation from the grid, actually increase the barriers to DSM, unless perverse incentives are addressed. The IEA study also found that the "…overarching policy barrier that affects all electricity industry structures …is the lack of regulatory or legislative attention and interest in energy-efficiency issues."

[18] This is because, under current wholesale market rules, generation dispatch is not based on marginal cost but rather on total average cost. This means that, at times of peak when retail customers are

- There is no provision in existing pricing methods for recovery of energy efficiency or EPP-related costs even though EPP costs are expected to be a small fraction of power supply costs for an equivalent amount of load carrying capability.

2.3.3. Pricing Reform Considerations

Inefficient pricing is not the only, or even the largest, barrier to end-use energy efficiency. The existence of other, well-documented market barriers (e.g., split incentives, high up-front capital costs of efficient equipment, lack of information about energy efficiency, etc.) means that, even with retail prices at full marginal costs, very substantial amounts of cost-effective energy efficiency will remain untapped.[19]

Thus, in addition to striving to set prices at full marginal costs (including environmental costs), encouraging energy efficiency in general, or EPPs in particular, will require:

- careful design or structure of prices to overcome barriers to increased energy efficiency and efficient investment (e.g. inclining blocks, hook-up fees);
- the adoption of international best practices in the use of utility or non-utility DSM programs together with improved planning methods; and
- the use of price-setting, accounting, and related regulatory methods to eliminate existing utility disincentives to investment in energy efficiency and EPPs.

paying high TOU prices, the profit margin (i.e., the difference between price and average cost) on energy sales is very high. At off-peak times, the margin is much smaller or even negative.

[19] For example, consider Pacific Gas and Electric Company in California, where average residential retail electricity prices are about US$0.15 per kWh and increase to more than US$0.21/kWh for usage in excess of a preset baseline and then to $.37/kWh for very high levels of usage. These prices are in excess of marginal costs and give consumers very strong incentives to invest in energy efficiency. Still, as a result of other barriers to consumer investment in energy, the utility's DSM programs continue to acquire electricity savings that cost about US$0.03 per kWh.

Part A Chapter 3. EPP Options

We have identified four main policy options for implementing EPPs. First we will describe the functional elements or "actors" involved in any EPP option. Then we will describe each option in some detail, including relevant international experience with that option and a summary of each option's pros and cons in China's context.

Figure 1, below, provides a visual summary of the elements and relationships basic to all the EPP options.

Figure 1 EPP Elements Basic to All Options

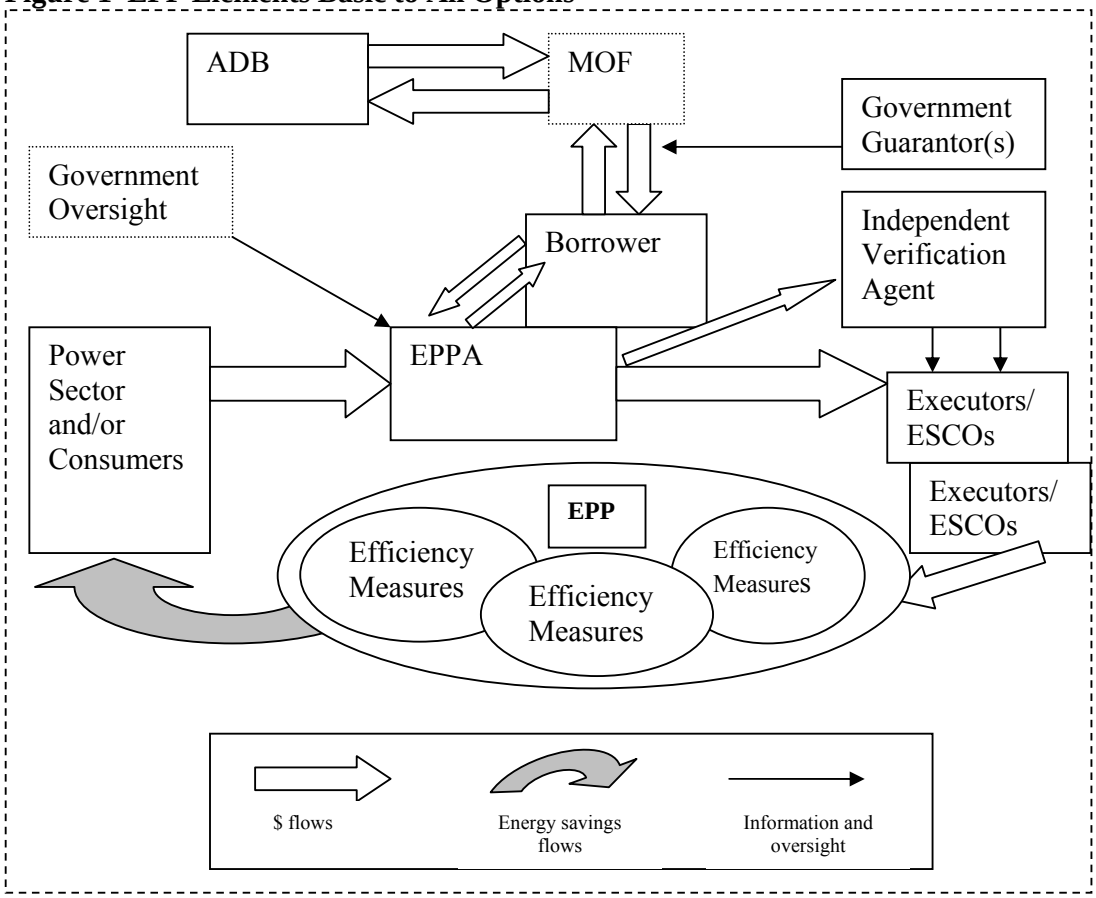


Table 2, below, describes the set of possible elements and their functions in EPP options, with those that are necessary shown in **bold**. Other elements could be added to enhance the financial attractiveness of the EPP option, but they are not essential.

Table 2 Functional Elements Used in EPP Options

Element	Description of function or role	Who	Comments
Borrower	Every EPP option must have a borrower that will receive funds from the ADB. The borrower must: →Be legally able to receive the loan; →Be financially sound or credit worthy; and →Have a sound plan to repay the loan.	In China, existing practices involving loans from ADB or other international banks require all loans to be approved by MOF.	In the case of Guangdong, the borrower is WBOFBGDC
Guarantor	If the borrower is not credit worthy, or in an effort to reduce the risk to the lender, a financially secure third entity may guarantee the loan's repayment.	In China, all ADB loans are guaranteed by the government.	The government will ask borrowers to provide an additional guarantee for an ADB loan.
Implementing Agent (IA) Or EPP Administrator (EPPA)	The EPPA is the manager of the overall process and is responsible for all technical, economic, and financial aspects of the EPP. At a minimum, the EPPA must be financially responsible for the overall EPP project. Technical, economic, and financial oversight of individual energy efficiency projects may be done by the EPPA or by others under the IA's management and coordination The EPPA and the Borrower can be the same entity.	The best candidates for the EPPA include the Grid Company, a municipal utility, commercial bank, or another existing, well-established government or non-government entity with the necessary management capability and experience.	
Executor	The Executor is the entity or entities that deliver the technical services, equipment, etc.	The Executor could be a mix of end users, ESCOs, or middle users.	
Verification	Verification is done by an entity that checks to see that goods and services were delivered and operating as promised.	Verification must be done by an entity that is both technically qualified and unaffiliated with any entity that is in a position to gain or lose based on the findings of the verifier.	
Government oversight	Oversight is done by a government entity that reviews and approves the EPP and oversees its implementation.	Likely to be the Provincial DRC. Could be NDRC or SERC if EPPs are regional instead of provincial.	

3.1. Option 1 - Comprehensive and Integrated

3.1.1. Description

Under this option, EPPs are fully integrated into China's power sector reform. EPP-related costs are included in electricity prices, ideally in concert with specific price reforms that are designed to encourage energy efficiency. For example, price reforms may include hook-up fees, inclining block rates for small and medium customers, industrial price differentials based on efficiency, and perhaps an incremental pollution fee. This option incorporates the best international practices into a single, comprehensive, and integrated set of policies. If adopted, these policies will assure the greatest and most economical development of EPPs and will make them a critical component of ongoing power sector reform and other national policy initiatives.

The basic features of this option are:

- *Planning and Investment.* Energy planning and investment policies in the electric utility sector are reformed and based on a least-cost scientific planning process where the costs (including environmental costs and other social costs) of all power supply options and energy efficiency options (EPPs) are considered on an equivalent basis. Investment and licensing approvals are made on a least-cost basis. As part of these reforms, energy efficiency potential is assessed and Least-cost investment plans are prepared optimizing investment in supply and demand side resources. Energy efficiency options are bundled into EPPs.
- *Grid Company Purchase of EPP Output*. Grid companies buy the output of the least-cost mix of conventional power plants and EPPs. Grid company involvement in EPP planning, administration, delivery, and evaluation can vary from full involvement to very little.
- *EPP Integration into Wholesale Markets*. It is also possible that, where there are competitive wholesale generation markets, EPPs can be an integrated part of the demand response programs built into the markets. In this case, the market operator is essentially the purchaser of the EPP output and the cost of the purchases is included in the generation prices buyers in the market pay.
- *Tariff-setting practices that reward grid companies for least-cost performance*. As described in Chapter 2.3 China's current electricity pricing methods discourage grid company investment or support of energy efficiency. Under Option 1 pricing methods are reformed so that grid companies are encouraged to support EPPs.
- *EPP Costs Recovered in Retail Prices*. EPP-related costs are included in electricity prices, ideally in concert with specific price reforms that are designed to encourage energy efficiency. For example, price reforms may include:
    - *Internalizing environmental costs in electricity prices*. Environmental problems in China are very serious and they are directly linked to high energy consumption. China's 11th Five-Year Plan includes both energy efficiency and environmental goals: a 20% improvement in energy efficiency and a 10% reduction in pollution. Increasing electricity prices to fully reflect environmental costs has been strongly recommended by many Chinese and international experts.[20]

[20] See *National Fiscal and Tax Policy Research for Clean Energy Development Executive Summaries,* Energy Foundation, 2005.

- *Inclining (or inverted) block prices*. Retail prices for most small users are below the marginal cost of production and well below full marginal cost (that is, marginal cost plus marginal environmental cost). Prices are closer to marginal costs for large users but still well below full marginal cost. With inclining block prices, the prices for incremental blocks of consumption increase as usage increases. Higher levels of consumption can be priced at marginal cost without increasing average power prices. For residential consumers, inclining block prices can also establish an initial low-priced block serving social development and universal service goals.
- *Hook-Up Fees*. Split incentives can be addressed with hook-up fees. New developments—houses, commercial buildings, industrial facilities—are charged a one-time fee to connect to the grid. A fee tied to the size of the load, with offsetting credits for investments in measures that meet stringent energy efficiency standards, would encourage developers to invest more in energy efficiency.
- *Energy Efficiency Related Prices*. China already sets prices for industrial consumers that use inefficient processes higher than prices for similar consumers using an efficient process. EPP costs can be collected by expanding this pricing option to other customers and by increasing the price differentials.

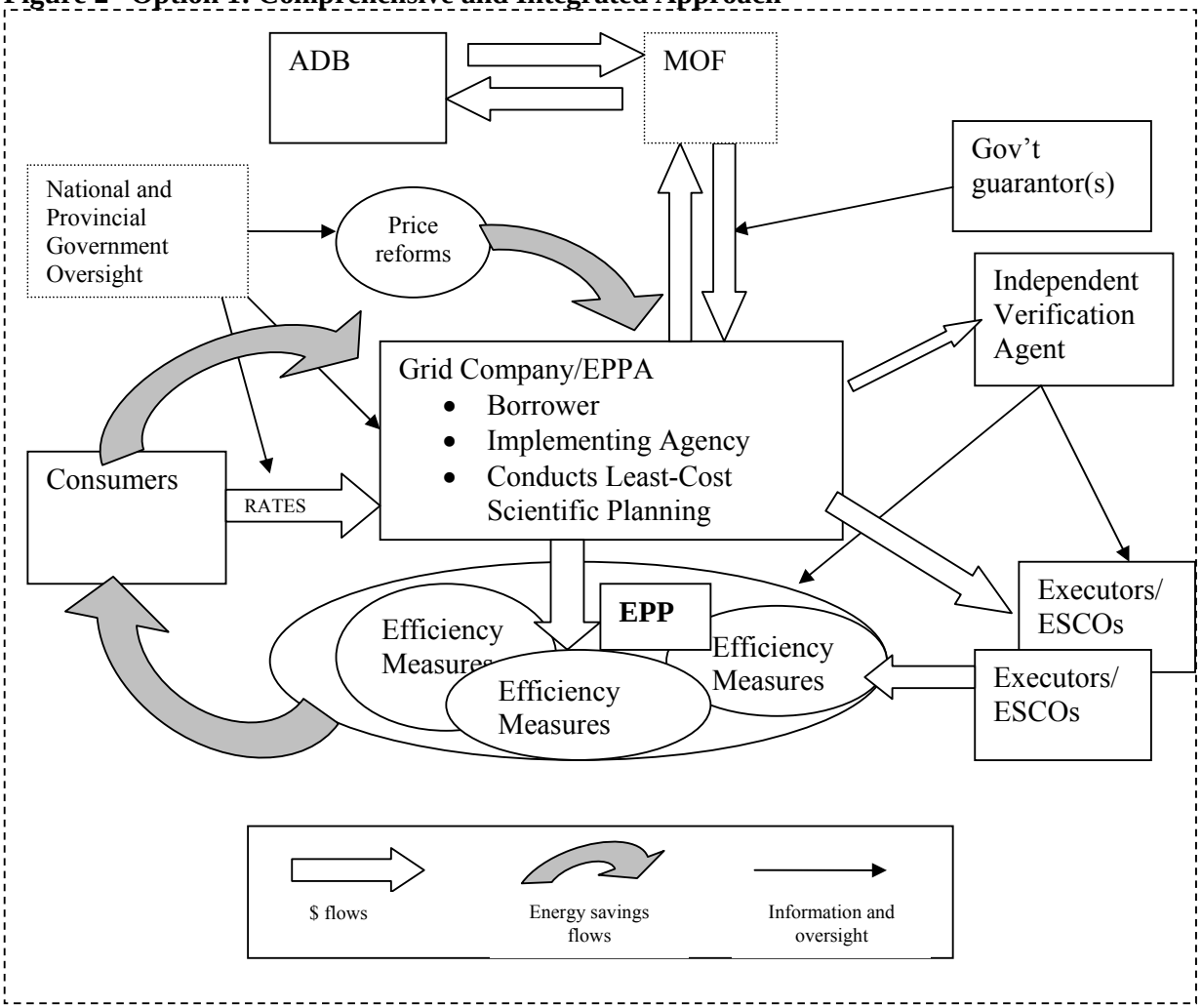
Option 1 is designed to maximize the development of EPPs. It is consistent with the findings and recommendations of recent domestic and international studies by the World Bank, IEA, and others. It is also based on the largest, the most successful, and best integrated approach to DSM anywhere--that of California. It is designed to yield:

- Better planning,
- Better pricing,
- A sustainable source of funds, and
- A stronger, more vibrant ESCO market.

Figure 2 graphically summarizes this option's financial structure and the structure for the design, delivery, verification, and oversight of the EPP. A narrative of these elements is given in the subsections that follow.

http://www.efchina.org/csepupfiles/report/2006102695218216.07221842673113.pdf/summary_report.pdf

Figure 2 Option 1: Comprehensive and Integrated Approach



3.1.1.1. Financial Structure

Under Option 1, the grid company has a central role. It is the borrower and the implementing agency and it is responsible for repaying the loan that finances the EPP. The decision to give the grid company this central role is based on five considerations:

1. International experience shows that the most successful energy efficiency programs result when financial responsibility is vested in the distribution utility.
2. The grid company's financial and technical strengths and its relationships with consumers allow it to overcome the major barriers to other energy efficiency financing schemes.
3. Integrating energy efficiency into the grid company's duties is a consistent recommendation of a wide range of international and domestic experts studying China's power sector.
4. Consideration of end-use energy efficiency is an integral part of the scientific planning and investment approval processes that many international and domestic experts have recommended that China adopt.
5. Implementation and enforcement are the weak elements in many of China's best energy and environmental policies. These weaknesses can be overcome improved pricing practices and market rules and also by making use of the

grid company's strong centralized administrative and information-management capabilities.

In China, generation has been separated from transmission and distribution. The grid company meets its obligation to serve customer demand by buying power from power suppliers. A key policy reform of this option is to define the grid company's obligation more broadly to meet consumer needs in the least costly fashion, that is, by putting together the optimal mix of both the supply-side (CPPs) and the demand-side (EPPs) resources. Under Option 1, the grid company has the opportunity to buy energy efficiency in the same way it buys power. It does not need to build or operate the EPP.

A variation on this option could fit China especially well. In regions areas where China has created wholesale generation markets, China could integrate EPPs at the power market level. Ever since the California power crisis in 2001, a fundamental feature of power markets has been their incorporation of demand-side resources. As a matter of principle, demand response is now an established best international practice in power market design.[21]

EPPs can be integrated into power markets by having the market operator be the purchaser of EPPs. The EPP costs would then be included in the market costs of power and be collected in the capacity and energy prices paid by purchasers in the market.

Currently, utility planning functions are weak and uncoordinated with power sector investment practices. International and domestic experts have recommended the adoption of IRP (scientific least-cost planning) practices and linking of the planning process to the investment and investment approval process. One feature of the EPP generally, and of Option 1 in particular, is that its design may help the grid company and power sector planners more easily and directly compare demand-side (EPP) opportunities with supply-side options.

In summary, the grid company's financial role is to:

- Receive funds from ADB or other lenders and make sure that they are available when needed for program delivery;
- Ensure that the funds are properly accounted for, are spent only on those programs approved by the government, and are not diverted for other purposes;
- Collect funds from consumers on a schedule as needed to make payments to the lender under the terms of the EPP loan; and
- Provide regular financial reports to the proper government agencies, Asian Development Bank, and other lenders on the financial status of the EPP program.

[21] Practices are still evolving and some markets have done a better job than others. At the forefront of these efforts in America is the New England market, where day-ahead and real-time bidding of demand response (load curtailment) has been conducted for several years and where currently a new market in which generation, load curtailment, and energy efficiency can compete to provide long-term capacity is being designed.

3.1.1.2. Government Oversight Structure

Government oversight of the EPP program in China takes place at different government levels and for different purposes.

The Ministry of Finance (MOF) must review and approve the financing involving ADB or other international lenders. This is common to all four options.

Under Option 1, the EPP is the equivalent of a power plant and so it makes sense that those government agencies with authority for the power sector and power sector investment will have the responsibility for approval of EPP projects and related loans or other financing, supervising the EPP and overseeing its delivery and performance.

The EPP is a new concept in China so the responsibility for its oversight is not clear. Currently, the authority over power sector regulation is divided between the National Development and Reform Commission (NDRC) and the State Energy Regulatory Commission (SERC). NDRC has primary authority over utility planning, investment, and pricing. SERC has authority over electricity markets, licensing, reliability and other matters. The exact division of responsibility may change over time. But, because the EPP involves planning, investment, pricing, and reliability, we assume that NDRC will have EPP approval responsibility, perhaps with a review-and-comment role by SERC:

This project and ADB's initial examination of the EPP concept in Jiangsu both focused on provincial level needs and responsibilities. Although central government approval and oversight is required, we also expect that the provincial DRC or ETC will be substantially involved. Their roles may include:

- Supervising the delivery of efficiency programs and measures by the selected efficiency providers, and taking corrective actions as needed to meet the program's savings targets and financial goals;
- Recommending approval of the tariff provisions needed to implement the program and repay the loan, and seeking approval from NDRC for resulting retail prices; and
- Reviewing regular financial reports from the utility or the financial agent and progress reports from the Efficiency Program Manager, and taking corrective actions as needed to ensure the EPP program meets its goals.

3.1.1.3. Delivery Structure

While the grid company will have overall responsibility to design and implement the EPP programs, it may not deliver all of the efficiency measures to customers directly. It would likely contract with ESCOs and others to deliver the efficiency programs that make up the EPP.

Under Option 1, the grid company will perform the following tasks:

- With other expert assistance, it will develop detailed program designs and action plans to "construct" the EPP, based on scientific and realistic information about efficiency technologies and opportunities.
- It will use a transparent selection process to identify one or more contractors to deliver programs and measures to customers. A broad range of potential efficiency contractors should be considered, including the Municipal Power

Corporation, ESCOs, general contractors, equipment vendors, and non-governmental organizations.

- It will enter into performance-based contracts with the selected efficiency contractors, to ensure high-quality and low-cost delivery of the EPP efficiency measures.
- It will prepare regular reports on the status of the EPP program, energy and capacity savings, and any recommended improvements for review by central and provincial and government officials, efficiency providers, and the lenders who are providing financing for the project.

3.1.1.4. Monitoring and Verification

A barrier to policy reforms that would support energy efficiency and EPPs is the lack of confidence that the energy savings are real. Energy efficiency cannot be measured with a device as tangible as an electricity meter but decades of international experience have resulted in reliable practical standard procedures to verify energy savings. The cost of measuring and verifying energy savings adds from 2% to 5% to the cost of EPPs. Reliably measuring a kWh saved costs more than measuring a kWh supplied, but it costs less than half the cost of kWh losses incurred to deliver electricity.

An essential element of all EPP options is a well-designed plan to measure program savings, verify that they are real and continuing, and use the data to improve the program and lower its cost over time. A sound monitoring and verification (M&V) procedure should be built into the EPP program from the beginning. A good M&V system will improve program selection, provide feedback to EPP implementers, produce reliable savings calculations, and inform the planning process for the next program cycle.

An independent M&V entity is essential for the success of the EPP. Because payments to efficiency contractors and others will depend in part on these performance data, it is important that the M&V be conducted by an entity that has no conflict of interest and will not receive rewards or pay penalties for energy efficiency performance. This is crucial because in order for EPPs to compete with CPPs, decision makers must know that EPP data is reliable and accurate.

An independent M&V entity is also the best means of ensuring that energy efficiency dollars are well-spent and achieving the expected benefits. When all participants know that M&V is done independently and transparently, the EPP will be designed to achieve the most efficient savings possible. In addition, good M&V allows the EPP to improve over time, as administrators select the most efficient portfolio of energy savings programs.

Worldwide, jurisdictions that are experienced with DSM rely on standardized M&V approaches that have proven reliable over time. Engineering and other energy professionals collaborate on regional, national and international levels to assure that M&V practices continue to evolve along with new technology and new efficiency approaches. One result is the International Performance Measurement and Verification Protocol (IPMVP), which provides updated technical protocols that can be used to guide M&V programs.[22] These protocols cover a range of approaches

[22] This document is available in Chinese from the Efficiency Valuation Organization at http://www.evo-world.org.

from deemed savings to comprehensive performance audits. The exact approach to use of these protocols varies from jurisdiction to jurisdiction, depending on local conditions.[23]

3.1.2. Needed Policy Reforms

Option 1 requires several major policy reforms having to do with cost-recovery, planning, and investment.

3.1.2.1. Grid Company EPP Cost Recovery

Cost recovery has been the single largest barrier to full, productive grid company support for energy efficiency in general and EPPs in particular. One of the key features of this option is that it aims to treat EPPs and CPPs equally. The manner in which grid companies have recovered CPP costs has been evolving since major power sector reforms began. The clear trend has been to allow easier, faster, more automatic recovery of CPP costs though price linkage mechanisms. However, there is still no mechanism to allow grid company recovery of EPP costs. Energy efficiency currently causes grid companies to lose money. This is the basic reason that the companies are uninterested in energy efficiency or EPPs.

3.1.2.2. Adoption of Improved Least-Cost Planning

China's current power sector planning and investment process should be improved to get the most from EPPs and to avoid China's boom/bust cycle. This means adopting Least-Cost or Scientific Energy Planning methods that rely on sound economic and analytical methods to identify how to meet power needs at the least total social cost. Achieving the least total social cost requires identifying and implementing a portfolio of supply-side and demand side resource options (e.g., EPPs) that meet China's power needs at the lowest total long-term capital, operating, environmental, and other social costs imposed by the power sector. China's current planning process is inconsistent with Scientific Energy Planning in many important respects. Ongoing and planned market reforms in the generation sector will not lead to efficient investment and cannot substitute for better planning. China needs both: more and better planning to identify the desired energy future, and better markets where competition is likely to achieve those objectives most efficiently.

3.1.2.3. Improved Linkage between Planning and Investment Processes

A sophisticated planning process that identifies the need to add many low-cost EPPs has little value unless it is connected to a rigorous and predictable investment approval process. China's power plant approval process is not described in any formal document. The process appears to be a fluid one that changes to meet current conditions. At the peak of the power shortage, most proposed projects were quickly approved. Many projects began construction before approval was received. The process is far from transparent and there is no current opportunity for EPPs to compete against CPPs for investment approval.

3.1.3. International Experience

There are many good international examples of Option 1. The best example is California. South Africa is also of interest, and is described in Appendix C.

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[23] California takes a very comprehensive approach to M&V. See http://www.cpuc.ca.gov/static/energy/electric/energy+efficiency/rulemaking/eeevaluation.htm for current information. M&V does not have to be as intensive as is done in California to provide satisfactory results.

3.1.3.1. California

California's comprehensive and successful integration of energy efficiency into power sector reform and power sector regulation is the best example of Option 1. It is described below. More detail on California's experience is in Appendix B.

Structure

California's privately-owned electric utilities must design and implement a portfolio of energy efficiency and demand response programs in order to meet MW and GWh savings goals. These goals are established through an integrated planning process (called Long-Term Procurement Planning or LTPP) aimed at meeting energy needs with a least-cost mix of demand and supply-side options.[24]

Utilities are required to prepare plans that compare supply and demand side resources on an equal basis. In addition, utility plans must show that they comply with California's Energy Action Plan, which requires that cost-effective demand-side solutions be procured before pursuing new supply-side options. Investments in new supply-side options that do not follow the Energy Action Plan and the LTPP rules may not be recovered by the utilities in rates.

The process also considers environmental costs. In addition to strict emissions standards for power plants, utilities employ a "greenhouse gas adder" when evaluating supply resources. This requires utilities to add $8 per ton of carbon dioxide emissions to the bid prices of all fossil–fuel generation. The $8 is never actually charged or paid, but is factored into the utility's resource decision-making process: it has the effect of increasing the relative cost of fossil fuel-fired power plants and thereby decreasing investment in, or purchases from, such plants. The adder is expected to increase over time, and is designed to reflect the cost of climate change to California. California regulators are currently conducting proceedings on a greenhouse gas emissions cap-and-trade system for the power sector. In addition, recent legislation establishes a greenhouse gas (GHG) performance standard for "baseload" generation resources that seek to sell into the state's electricity markets.

All energy efficiency programs are funded through electricity prices, but two separate mechanisms are used. A System Benefits Charge (SBC) of about $.0025/kWh provides a minimum amount of funding for energy efficiency, renewable energy, and Research and Development (R&D) programs. The SBC is charged on a per-kWh basis and is paid by all consumers. Additional funding needed to meet savings goals is included in electricity prices through the same methods used to include power supply costs in electricity prices ("procurement funding"). In 2004-2005, SBC funding for energy efficiency was approximately $275 million annually. During the same years, annual procurement funding for energy efficiency was about $125 million statewide. Total spending on energy efficiency in 2004-2005 was roughly $400 million each year.[25] Since 2004, SBC funding has remained fairly constant. However, procurement funding has increased in order to allow utilities to meet their efficiency savings goals, which will increase annually through at least 2013. For the 2006-2008

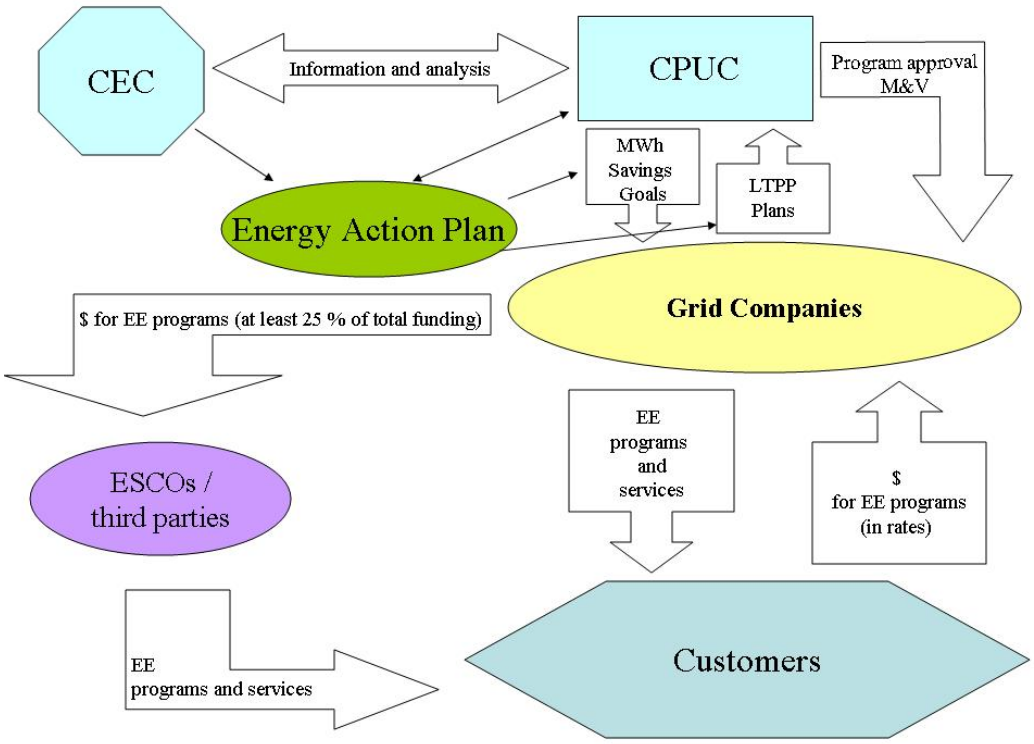
[24] More information on California's LTPP process can be found at http://www.raponline.org/Feature.asp?select=14#IRP%20Survey

[25] Efficiency programs and funding for 2004-2005 were combined into one program cycle. 2004-2005 funding information can be found in CPUC Decision 03-12-060. See http://www.cpuc.ca.gov/PUBLISHED/FINAL_DECISION/32828.htm.

program cycle, combined SBC funds for efficiency and efficiency procurement funds are equal to roughly $650 million statewide.

A schematic illustrating roles, responsibilities, and flow of funds in California's energy efficiency structure is seen below, in Figure 3.

Figure 3 California Energy Efficiency Structure



Programs

California utilities must meet stringent annual energy efficiency savings goals. For California's largest utility, Pacific Gas and Electric (PG&E), incremental annual savings goal, using both funding sources, was 744 GWh/yr in 2004 and it will increase to 1277 GWh/yr by 2013 (about 1% - 1.5% of annual sales). These savings are for energy efficiency programs alone and do not incorporate demand response measures to alleviate short-term peak demands; PG&E must meet separate demand response goals as well.[26]

Regulators have determined that, since every customer contributes to the SBC funds, every customer must have access to SBC-funded programs. As a result, SBC-funded efficiency programs are designed to target all customer classes equitably.

By contrast, procurement-funded programs are targeted toward areas with the greatest savings potential. PG&E's approach is to design programs that meet the needs of specific customer groups (i.e., schools, factories, farmers, hospitals, etc.). This allows the utility to approach customers with a comprehensive range of savings programs designed to meet industry-specific needs. Other utilities have programs oriented

[26] A wide range of demand response (load management) programs, also ratepayer-funded, are used to reduce peak load, increase reliability, and decrease system costs.

toward specific end-uses (e.g., lighting, heating, cooling) as well as toward specific end-users (e.g., schools, hospitals, agriculture). Statewide, new energy efficiency programs are expected to provide cumulative savings of over 23,000 GWh/year by 2013, avoiding the need to build twelve (12) 300 MW power plants.[27] The average cost of savings is projected to be $0.0302/kWh. For a complete list of 2006-2008 programs offered by two of California's major electric utilities and the cost-effectiveness calculations for all four major utilities' programs, see Appendix B.[28]

Key Policies

The approach taken in California has been very successful in delivering large amounts of cost-effective energy efficiency. The success has been due to the following:

- Clear government and regulatory policies that encourage energy efficiency and environmental protection.
- An integrated planning process (LTPP) that treats the demand and supply sides equally and calls for the direct consideration of externalized environmental costs.
- A planning process that is linked directly to the investment process.
- Full recovery by the utilities of the costs of energy efficiency.
- A revenue-setting process that eliminates the utilities' profit disincentive to reduce kilowatt-hour sales; it is called "decoupling" because it breaks the link between electric sales and net revenues.

The Role of ESCOs

ESCOs participate in the delivery of utility efficiency programs. ESCOs may administer particular programs or assist customers in implementing measures that receive utility rebates. Roughly half of California's ESCO customers are state, local, or federal government entities (including schools). ESCOs have been particularly active in implementing utility Standard Performance Contract programs, which offer customers incentives based on actual achieved savings. At least 25% of utilities' energy efficiency budgets must be spent on ESCOs or other third parties, in order to encourage ESCO development and allow third parties to develop innovative approaches to efficiency.

Results

In 2004 alone, California's private utility energy efficiency programs saved 1843 GWh of incremental electricity, about 1% of sales by these utilities.[29] Since then, energy efficiency programs have expanded considerably, and by July 2006 California utilities were on target to achieve close to 2,000 GWh in net annual energy savings by the end of the year. As of July 2006 demand response programs had achieved reductions of 84 peak summer MW. This represented 19% of 2006 goals, and was

[27] California Public Utilities Commission Decision D. 04-09-060. See http://www.cpuc.ca.gov/PUBLISHED/FINAL_DECISION/40212.htm, Table 1E.

[28] 2006-2008 energy efficiency programs, goals, and budgets can be found in CPUC Decision 05-09-043 and accompanying tables. See http://www.cpuc.ca.gov/PUBLISHED/FINAL_DECISION/49859.htm

[29] Rogers, Cynthia, Mike Messenger, and Sylvia Bender. 2004. *Funding and Energy Savings from Investor-Owned Utility Energy Efficiency Programs In California for Program Years 2000 through 2004*. California Energy Commission. See http://www.energy.ca.gov/2005publications/CEC-400-2005-042/CEC-400-2005-042-REV.PDF

much less than expected.[30] However, the CPUC continues to see demand response as a useful tool in reducing peak load, and utilities are proposing modifications to 2007 programs to realize greater savings.

3.1.4. The Pros and Cons of Option 1

There are at least twelve major benefits to this EPP Option:

1. It is likely to produce the maximum number of, and the lowest–cost, EPPs;
2. It supports the full range of energy efficiency options;
3. It fits well with China's energy efficiency and environmental protection goals;
4. It is based on substantial, successful international experience;
5. It fits well with China's desire to support the development of the ESCO industry;
6. It comes at the early stages of, and thus can become and integral component of, power sector reform;
7. It can be combined with more economically efficient pricing reforms to achieve greater effect;
8. It overcomes many of the difficulties caused by other financing options;
9. It makes energy efficiency easily financed and it minimizes the number of parties to the financial transaction;
10. It takes advantage of the grid company's relationships with retail electricity consumers, thereby avoiding the development of a parallel infrastructure;
11. It allows the grid company to target energy efficiency measures geographically within the grid to alleviate local transmission and distribution constraints; and
12. It takes advantage of an existing revenue collection mechanism to recover the costs of efficiency investments, and of an existing billing structure to collect any portions of the costs that are to be paid directly by participant customers.

There are two drawbacks to this option:

1. It requires several significant reforms to China's approach to power sector regulation. Reform has progressed much more slowly than first expected. Very powerful and important interests must reach agreement before the reforms needed to support Option 1 can be adopted.
2. Government responsibility for the various essential elements of this option is divided between several key agencies and offices. Reaching agreement on the reforms and the appropriate allocation of government oversight may be difficult.

3.2. Option 2 – Public Benefit Funds

3.2.1. Description

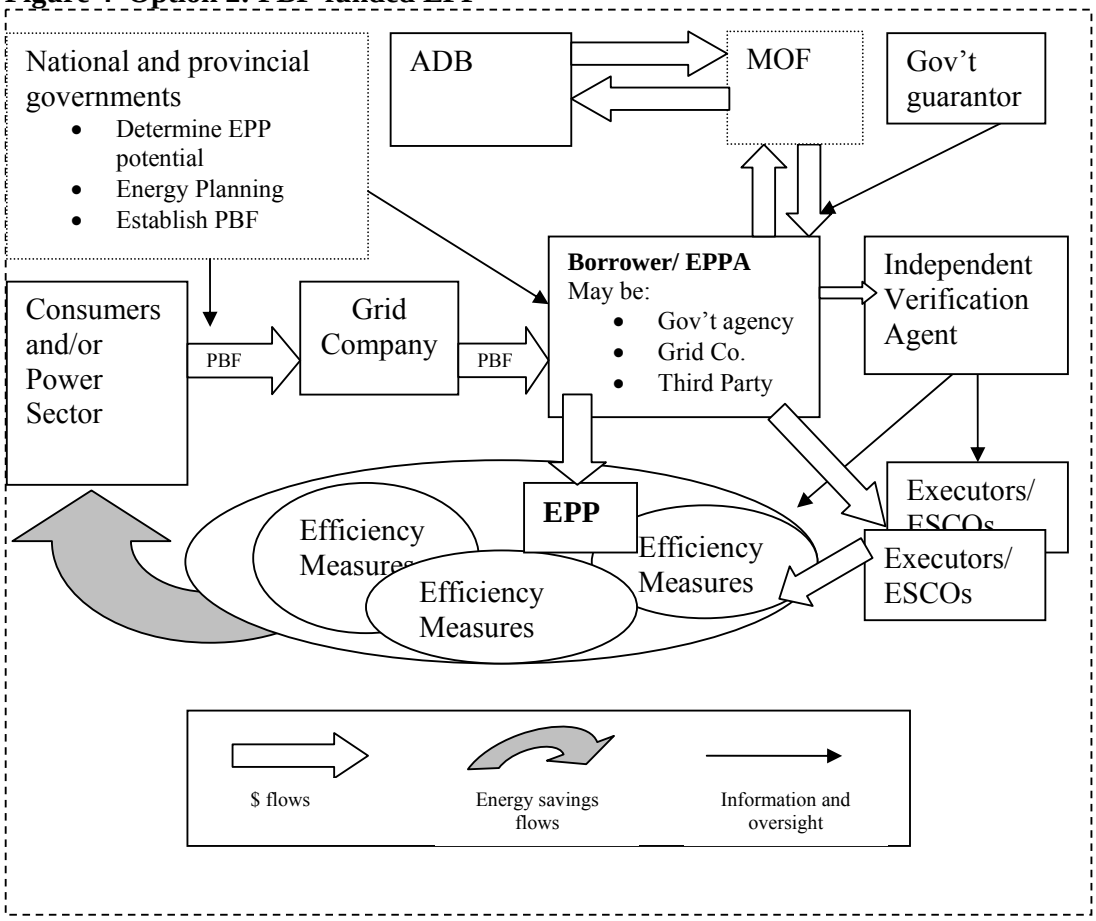
Under this option, EPPs are partially integrated in China's power sector reform. EPP-related costs are paid with public benefit funds (PBF) collected through a small, uniform system benefits charge (SBC) applied to electricity prices. This option includes several of the critical elements of Option 1.

[30] CEC/CPUC Energy Action Plan presentation on Loading Order Initiatives, presented at CPUC/CEC Joint Meeting on September 18, 2006. See http://www.cpuc.ca.gov/static/energy/electric/energy+action+plan/060918_eap.htm.

The basic elements of this option are the following:

- The energy efficiency potential of a region is assessed and the measures and programs to capture those savings are bundled into EPPs.
- The grid company or another entity designated by the government purchases the output of the EPPs, but only to the extent available under the allowed level of the PBF.
- EPP-related costs are included in electricity prices, but, unlike Option 1, the costs are recovered through a small uniform charge, referred to as a system benefits charge (SBC). Funds collected through the SBC are deposited in the PBF and dedicated to paying for EPPs or other energy efficiency activities. This approach to energy efficiency has been the subject of very extensive research in China. Its use has been strongly recommended.[31]

Figure 4 Option 2: PBF-funded EPP



3.2.1.1. Financial Structure

The distinguishing feature of Option 2 is the use of a PBF to fund energy efficiency. The institutional structural effect of Option 2 has two basic versions. In one version, the grid company continues to have a central role as it did in Option 1. In the second version the grid company is merely a collector of revenue, which is then passed on to

[31] See *International Experience with Public Benefits Funds: A Focus on Renewable Energy and Energy Efficiency*, Energy Foundation, 2003. http://www.efchina.org/FReports.do?act=detail&id=105.

other administrators to deliver the energy efficiency programs. The first version is very similar to Option 1, except that the amount of funds is predetermined through a political or regulatory process. This discussion therefore focuses primarily on the non-utility version.

In examining the non-utility version of Option 2, we will call the entity that administers the programs the EPP Administrator, or EPPA.

As shown in Figure 4, the borrower is the EPPA, and the EPPA's financial strength derives from the utility revenue stream committed to it. The EPPA would:

- Receive funds from ADB or other lenders and disperse them as needed for EPP program delivery;
- Ensure that the funds are properly accounted for, are spent only on those programs approved by the government, and are not diverted for other purposes;
- Collect the PBF funds from the grid company that are collected through the SBC on a schedule as needed to make payments to the lenders under the terms of the EPP loan; and
- Provide regular financial reports to the proper government agencies, ADB, and any other lenders on the financial status of the EPP program.

3.2.1.2. Government Oversight Structure

Government oversight is similar to Option 1. The main differences are as follows:

- The implementing agency may be a government entity or an entity created or directed by the government to fill the needed role.
- Government agencies, NDRC and perhaps MOF, will be required to set the level of the SBC and PBF.
- In order to set the proper level, the PBF should be based on an assessment of the available energy efficiency potential, how it relates to the province's or country's overall energy plan, the cost to achieve that potential, and the financing costs associated with funding that potential over a reasonable period of time. The reduced grid company role means a greater government role.

3.2.1.3. Delivery Structure

Under Option 2, the EPPA will either have to undertake the following tasks or the tasks will have to be divided between the EPPA and other capable entities:

- Development of detailed program designs and action plans to "construct" the EPP, based on scientific and realistic information about efficiency technologies and opportunities.
- Coordination with grid companies to identify locations on the grid that have transmission and/or distribution capacity constraints, in order to appropriately value and target investments that provide grid congestion relief in addition to deferring CPP requirements.
- Selection of one or more ESCOs, general contractors, equipment vendors, and non-governmental organizations to deliver the EPP's energy efficiency services to customers.
- Entering into performance-based contracts with the selected efficiency contractors, to ensure high-quality and low-cost delivery of the EPP efficiency measures.
- Preparation of regular reports on the status of the EPP program, energy and capacity savings, and any recommended improvements for review by the grid

companies, central and provincial and government officials, efficiency providers, and the lenders who are providing financing for the project.

3.2.1.4. Monitoring and Verification

The discussion of M&V in Section 3.1.1.4 applies equally to Option 2.

3.2.2. Needed Policy Reforms

This Option requires only two basic policy reforms: 1) central level approval of the funding mechanism and the related question of the size of the PBF and design of the SBC to collect the fund, and 2) creation or identification of the needed administrative institution (EPPA).

3.2.3. International Experience

There are many examples of PBF-funded energy efficiency.[32] Two of the best, Vermont and Massachusetts, are described below. Other examples are contained in Appendix C.

3.2.3.1. Vermont

Structure

Energy efficiency in Vermont is funded by a PBF and administered by a statewide Energy Efficiency Utility (EEU).[33] It is most similar to the non-utility version of Option 2, described above. State legislation gave the utility regulator, the Vermont Public Service Board (PSB), the authority to establish an SBC, since it is linked to the state's authority over the distribution system. The legislation also established a budget cap for the PBF created by the collection of the SBC funds. The PBF is used to fund EEU activities that replace the efficiency programs previously run by the electric utilities. The PSB approved a Memorandum of Understanding (MOU) signed by the state's electric companies and other stakeholders, which established the EEU process, initial budgets, and core programs.

The EEU is financed by a PBF, collected from customers through a per-kWh SBC by each electric utility and transferred to a fiscal agent. The fiscal agent is a contractor selected through a competitive bid process. Its job is simply to receive SBC funds from utilities and disperse them to the EEU and other parties as needed, up to approved budget levels. The PBF was initially capped at $17.5 million, about 3% of total electric utility revenues at the time. In 2005, the cap was lifted, and the recently approved 2006-2008 budget dramatically increased the funding. By 2008, the PBF, including the EEU budget, will exceed $30 million, about 5% of electricity bills.

By statute, electric utilities, working through the EEU, are instructed to procure all cost-effective energy efficiency. The activities of the EEU fulfill this requirement for

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[32] See, for example:

International Experience with Public Benefits Funds: A Focus on Renewable Energy and Energy Efficiency, CRS, RAP 2004. www.raponline.org/Pubs/China/ChinaPBFfinal.pdf, and

Who Should Deliver Ratepayer Funded Energy Efficiency? A Survey and Discussion Paper, RAP, 2003, http://www.raponline.org/Pubs/RatePayerFundedEE/RatePayerFundedEEFull.pdf

[33] For more information about the EEU, see http://www.efficiencyvermont.com.

most Vermont utilities.[34] In prior years, the PBF budget cap prevented the EEU from capturing all cost-effective energy efficiency in the state. Current budget levels reflect a new commitment to procuring cost-effective efficiency, although even the PSB acknowledges that the increased spending is still likely to be insufficient to capture all cost-effective efficiency. The PSB will take up this question again in 2008.

For a number of reasons, Vermont's regulators and legislators were unhappy with the performance of the state's electric companies in delivering efficiency services during the 1990s. Chief amongst their concerns was that the companies had little enthusiasm for taking actions that reduced their sales and profits. By establishing the EEU as a utility whose sole function is to administer efficiency, regulators eliminated this dilemma for the utilities—although the EEU's success in delivering efficiency still has the effect of reducing the utilities' sales of electricity.[35] Electric utilities are required to prepare Integrated Resource Plans that integrate anticipated savings from the EEU into the procurement planning process.[36] Efficiency is also a significant part of transmission and distribution planning activities, and the regulatory process is designed to ensure that demand-side options are routinely considered as solutions to congestion. Regulatory efforts are underway to provide utilities with better forecasts of EEU impacts and to increase EEU involvement in the planning process, both for procurement and for transmission planning activities.

Vermont utility regulators are required to use a competitive process to select one or more contractors to run the EEU. Bidding on the EEU occurs every three years. Once the EEU contractor has been selected, a three-year contract is developed between the regulators and the EEU implementer. This contract establishes annual energy and demand savings goals for the EEU, as well as other performance indicators. The EEU is required to consider geographic equity in program offerings, ensuring that all Vermont customers will have access to EEU programs. Currently, the EEU is required to commit a certain amount of "baseline" funding to equitably distributed programs, and target the remaining funding in high-growth and transmission-constrained areas.[37]

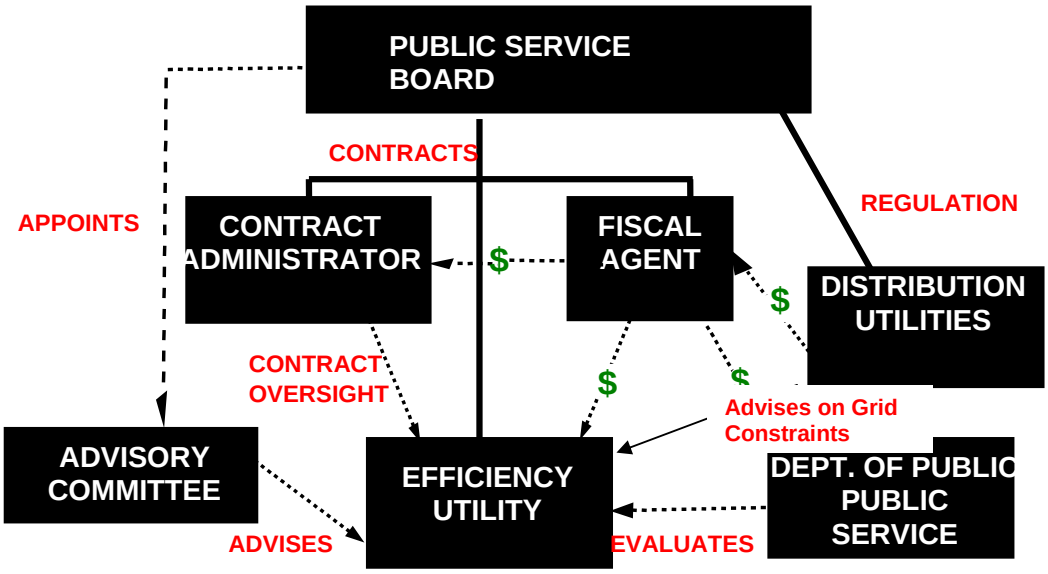
[34] One utility, the Burlington Electric Department (a municipal utility), implements the EEU programs in its service territory. There are special legal and programmatic reasons for this circumstance, but they are not germane to this discussion.

[35] For this reason, one utility proposed a revenue-decoupling mechanism, which the PSB approved at the end of 2006.

[36] Information about Vermont's IRP process can be found at http://www.raponline.org/Feature.asp?select=14#IRP%20Survey

[37] Currently, the Vermont legislature is considering revising the law that governs the EEU. A bill has been introduced that would, if enacted, subject the EEU contractor to performance-based regulation instead of performance-based contracting, thereby eliminating the need for regular competitive bidding but nevertheless retaining the link between the contractor's success at acquiring efficiency savings and its financial rewards.

Figure 5 Vermont EEU Structure



Programs
The EEU uses a market-based approach that recognizes that the work of procuring efficiency is continuous and requires developing long-term relationships with designers, distributors, and customers. Programs include the use of rebates, incentives to manufacturers, and education of retailers and service providers to overcome the barriers to investment in high efficiency products. There is relatively little electric heating and cooling in Vermont, and there are few large C&I customers, so there are relatively few savings to be found in single, large amounts. The focus is on achieving efficiency through a wide variety of small measures across all customer sectors.

Key Policies
Vermont's EEU has consistently met and exceeded savings goals, cost containment targets, and other performance indicators. The key policies that underpin this success are:

- The EEU's financial rewards are tied directly to its success in acquiring cost-effective energy efficiency.
- The market-based approach to program design has been particularly effective at removing customer barriers to efficiency.

As the EEU has demonstrated success, funding has increased.

Role of ESCOs
The company that currently operates is an ESCO, but, as the EEU, typically sub-contracts with other ESCOs and third-party contractors to install measures. With large C&I projects, the EEU may perform its own design services and then rely on contractors for the installation of measures.

Results
In 2005, the EEU spent $15 million and delivered over 57,000 incremental MWh of savings, providing a lifetime economic benefit of $37,000,000. The average cost of EEU savings was $0.035/kWh, or about 50% of the cost of power from a new conventional power plant.[38]

3.2.3.2. Massachusetts

Structure
In Massachusetts, energy efficiency is administered by the grid utility. It is funded through an SBC created by statute in 1998, when the state introduced retail competition in the electric sector. The SBC is currently set at 2.5 mills/kWh (that is $0.0025/kWh), which raises a PBF of about $120 million per year or roughly 2% of electricity bills. Electric utilities select and administer a portfolio of efficiency programs within their individual jurisdictions. Plans, budgets, and savings and performance goals are developed with input from a stakeholder collaborative and from expert consultants. They are submitted to the Massachusetts Division of Energy Resources (DOER), which reviews them for consistency with state energy goals and makes recommendations to the regulatory body, the Department of Telecommunications and Energy (DTE), for approval or modification. The DTE reviews the plans for cost-effectiveness and the appropriate use of competitive processes for program implementation (the programs are administered by utilities, but generally are implemented by ESCOs and other third party contractors—see *Role of ESCOs* below). Programs are evaluated by utilities and third party evaluators. The administrators earn incentives (financial rewards), which are approved by the DTE, when energy savings and other performance goals are met.

Programs
Utilities must offer efficiency programs to all rate classes that pay into the PBF, with a minimum expenditure required for low-income programs. Program approaches use multiple strategies, including rebates and discounted product prices, to improve overall appliance, building, and industrial process efficiency. They use incentives to get efficient products into the market, to improve market share, and to provide needed training. Utilities also provide educational and technical assistance.

Key Policies
There are three key policies that Massachusetts relies on to make its program successful:

- Efficiency programs are supported by appliance codes and standards.
- The state relies on collaboration among utilities, regulators, other stakeholders, and regional/national partners to assure strong program design and delivery.
- The opportunity to earn performance incentives mitigates the utilities' profit disincentives to procuring efficiency.

Role of ESCOs
Massachusetts has a statutory mandate to increase the competitive procurement of efficiency services. Because of this, many DSM programs are implemented by ESCOs and other third parties. According to the most recent annual report by the Massachusetts DOER, in 2002, 82% of total ratepayer-funded energy efficiency

[38] Efficiency Vermont 2005 Annual Report. See http://www.efficiencyvermont.com/stella/filelib/2005%20SummaryREVISED.pdf

expenditures were made to subcontractors that were chosen through competitive bidding processes. Only the costs for performance incentives and internal administrative expenses were not subject to competitive procurement.[39]

Results

In 2002, programs acquired 241 GWh in annual savings, and 3,428 GWh of lifetime savings. The average cost was $0.04/kWh (including participant costs). Over 2000 jobs were estimated to have been created. PBF funding of about $120 million and participant spending of about $50 million resulted in total participant lifetime energy savings of about $249 million.

3.2.4. The Pros and Cons of Option 2

There are nine major benefits of this EPP Option:

1. Under this option, the utility's role can be much more limited than under Option 1. At one extreme, the utility does little more than collect revenue used to fund EPP repayment. For example, under the Vermont approach, funds are collected by the utility and immediately transferred to a separate, non-utility entity. On the other hand, if and when appropriate, the grid company can be more involved, acting as the EPP administrator, as it does in Massachusetts.
2. The option can be as integrated and comprehensive as Option 1, if the level of the PBF funding is set high enough to procure all cost-effective efficiency.
3. It fits well with China's energy efficiency and environmental goals.
4. Substantial international experience demonstrates that it works well.
5. It can support China's policy to develop its ESCO industry.
6. It can be implemented easily at the early stages of power sector reform.
7. It overcomes many of the difficulties experienced with other financing options.
8. It gives the lender strong assurance that the debt will be repaid.
9. The size of program can be easily increased (or decreased) by regulators.

There are five drawbacks to this option:

1. To the extent the utility role is limited, other entities must be named to perform the functions that the utility would otherwise take on. Appropriate entities may not exist. Creating such entities, staffing them, and training the staff will take time and delay implementation.
2. It is likely that this option will yield fewer EPPs than Option 1, and the cost per EPP will probably be higher.
3. The potential for utilities to delay and defer investments due to net lost distribution revenues (i.e., margins) may become a problem if it is not addressed in advance.
4. This option requires several significant modifications to China's approach to power sector reform. However, power sector reform has progressed much more slowly than first expected. Very powerful and important interests must reach agreement before significant new reforms can proceed.
5. In China, responsibility for the various essential elements of this option will be divided among several key agencies and offices. Reaching agreement on the appropriate allocation of responsibilities may require leadership at higher levels or take more time.

[39] See Massachusetts Division of Energy Resources. 2004. "2002 Energy Efficiency Activities" at http://www.mass.gov/doer/pub_info/ee02-long.pdf

3.3. Option 3 – Government Funding

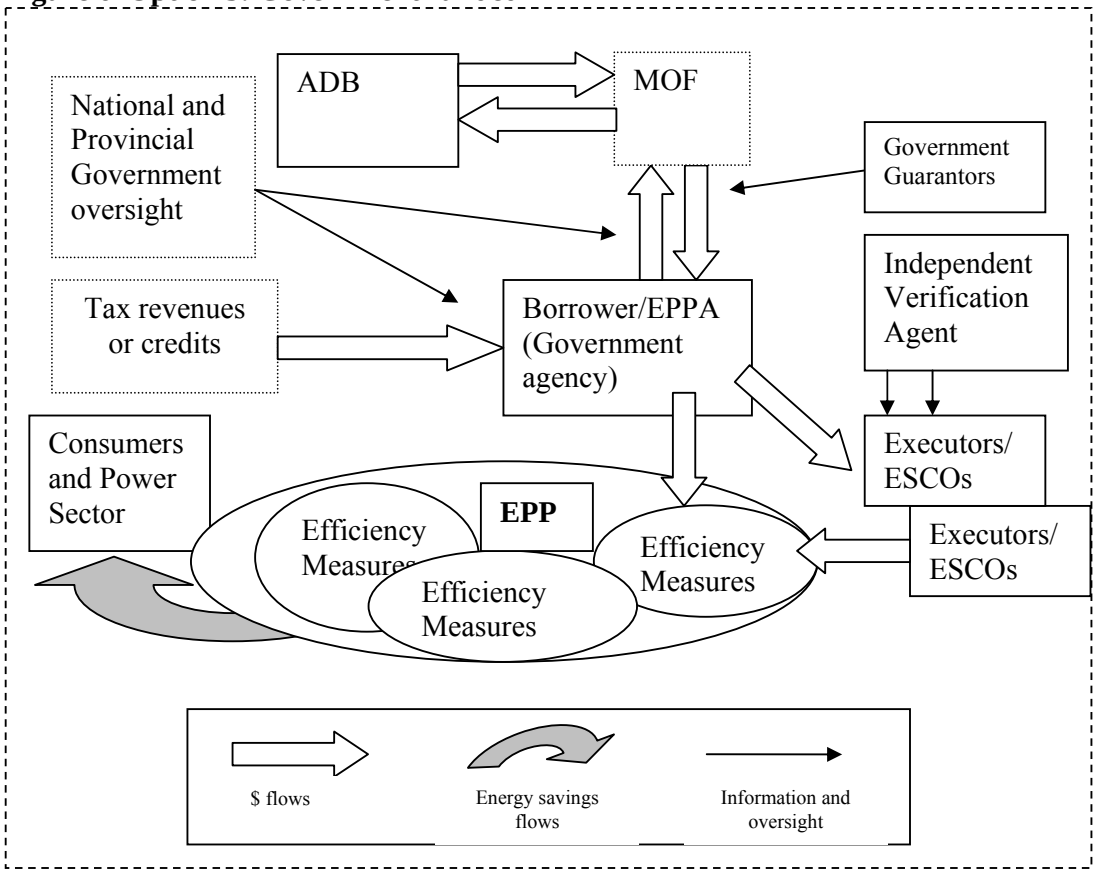
3.3.1. Description

Under this option, EPPs are less integrated with power sector reform. Energy efficiency is assumed under this option to be less of a utility function and more of a government function. There are three defining elements of this option:

- A government agency, or a public company designated by the government, oversees the identification of energy efficiency options that are bundled into an EPP.
- The agency or the designated public company works either directly with the customers or with energy efficiency service providers (such as manufacturers and ESCOs) to deliver EPP options and programs.
- EPP costs are paid by the government using existing general tax revenues or new sources of tax revenue such as energy or pollution taxes. A variation on this approach to funding is to offer tax credits to customers (presumably large commercial and industrial firms) that invest in high efficiency measures in their own facilities and can demonstrate that those investments yielded savings.

Under Option 3, the grid company may or may not be involved in the planning and delivery of EPPs. A public agency or company is set up separately as the EPPA to administer the planning and delivery of the EPP. Funding is allocated through the government budget process or comes from a designated source such as an energy or carbon tax. The EPPA then distributes the fund to end-users and ESCOs under the guidelines set up by the government.

Figure 6 Option 3: Government-funded EPP



3.3.1.1. Financial Structure

Under this option, the EPPA will be the borrower of the ADB loan, and will pledge the dedicated budget allocation and/or taxes to repay the loan. In the past, the China Energy Conservation Investment Corporation (CECIC) has served in a role similar to an EPPA; however, it has not acted in this role since the mid-1990s.

3.3.1.2. Government Oversight Structure

Government oversight in China under Option 3 occurs at both the national and provincial levels.

At the national level, the MOF must review and approve all financing involving the ADB or other multilateral lenders. Since ADB loans are backed by the central government, the central government will in turn require guarantees from the provincial government for the repayment of the loans.

In this instance, the ADB loan will be paid back from existing tax revenues or budget allocations in Guangdong; therefore, the provincial finance bureau needs to approve such EPP projects. Introduction of an energy tax or special allocation for energy conservation would be considered a major policy reform and thus would require approval by the provincial DRC as well.

3.3.1.3. Delivery Structure

The EPPA will, with assistance from technical experts, develop a portfolio of EPP programs for various targeted sectors and technology, based on the approved funding level. End-users typically submit applications to the EPPA to access the funding for their energy conservation projects or installation of qualified energy conservation technologies such as variable speed drives and waste heat recovery. Actual installations could be performed either by the end-users, EMCs, or third-party engineering firms.

NDRC has been working with the World Bank to promote ESCOs in China since 1998, under the support of the World Bank/GEF China Energy Conservation Projects. Under this option of EPP, ESCOs will play a critical role in the delivery of EPP. EPP will also help raise the awareness of performance contract, identify a stream of energy efficiency projects for EMCs, and help reduce the transaction costs for ESCOs.

3.3.1.4. Monitoring and Verification

The discussion of M&V in Section 3.1.1.4 applies equally to Option 3.

3.3.2. Needed Policy Reforms

Currently, there is no energy tax or budget allocation for DSM in China or Guangdong. Major policy reform would be required to introduce either (or both). However, there may be a limited amount of funding for energy conservation under the budget of provincial Economic and Trade Commission, but it probably would not be sufficient to support large-scale EPP installations.

From a policy perspective there are two types of government funding approaches: those that have no direct relationship to the EPP, and those that reinforce and support the EPP goals and purposes. The second approach is clearly better but either would support EPPs. Good candidates for targeting new taxes are described in Section 5.

3.3.3. International Experience

3.3.3.1. Korea

Energy efficiency activities in Korea are funded by the Ministry of Commerce, Industry, and Energy (MOCIE), and administered by the government-owned Korean Energy Management Corporation (KEMCO).[40] KEMCO is responsible for overseeing virtually every aspect of the nation's efficiency and renewable activities, from developing policy tools to conducting efficiency audits for customers to conducting research and development. Some activities are undertaken in conjunction with partners, such as energy utilities and ESCOs; other activities are overseen and implemented directly by KEMCO.

KEMCO is also responsible for implementation of DSM programs. In some instances, DSM is undertaken collaboratively with utilities; in other cases, KEMCO administers DSM programs independently from the utilities. DSM activities are targeted at large industrial customers, and KEMCO offers a wide range of services, including audits, technical assistance, rebates, incentives, and financing. Large customers are encouraged to enter into voluntary agreements with KEMCO, agreeing to participate in direct load control programs or to reduce greenhouse gas emissions.

In addition, KEMCO administers the Fund for the Rational Use of Energy, an account funded directly by MOCIE that is used primarily to provide financing for energy efficiency and renewable energy projects. The Fund is used both to encourage businesses to invest in energy efficiency and renewable energy, and to promote the use of ESCOs. In 2006, KEMCO plans to lend $629 million for energy-related projects. As the administrator of the Fund, KEMCO evaluates and approves the projects, and then recommend the projects to commercial banks for loans.

Below is a list of programs that KEMCO administers on behalf of the MOCIE:

- *Standards and labeling.* Minimum efficiency standards are established for certain appliances. Appliances and products are given efficiency ratings. Certain products are certified as "high efficiency" products.
- *Voluntary agreements.* Companies are encouraged to enter into voluntary agreements to decrease greenhouse gas emissions. A related program, "Energy Saving through Partnerships," encourages companies to share energy-saving technology and information with each other.
- *Manufacturer agreements.* Manufacturers are encouraged to design products that are energy-efficient.
- *Energy audits.* KEMCO provides audits (either free or for a fee) that identify energy savings opportunities. Technical advice and funding support may be provided following the audit.
- *Rational Use of Energy Fund.* Loans are used to support energy efficiency installations and measures, integrated energy supply, and the dissemination of new and renewable energy technologies.
- *ESCO support*. ESCO activities are encouraged through access to low-interest loans from the Fund, tax credits, and an annual government-sponsored "energy mart."

[40] For more information, see http://www.wrweb.com/escap-ngo-profiles/ngo-profile-kemco.htm and http://www.kemco.or.kr/english/index.asp

In this capacity, KEMCO serves as an aggregator of energy efficiency projects and programs, which add up to an EPP.

3.3.3.2. China

In the 1980s and 1990s, the Chinese government funded many energy conservation projects in industries through budget allocations and loan programs. These energy efficiency investments were classified into two categories: energy conservation capital investment and energy conservation technical renovation investments. Most of the funds were loaned to state-owned enterprises to invest in projects that would reduce wasteful energy consumption.

The energy efficiency capital investment projects were first managed by the former State Planning Commission (SPC) and then, beginning in 1988, by the China Energy Conservation Investment Corporation (CECIC). The efficiency technical renovation investment projects were managed by the former State Economic Commission (SEC) and later the State Economic and Trade Commission (SETC). These commissions have since merged into the National Development and Reform Commission (NDRC).

Both investment programs made use of financial incentives for customers, first in the form of state grants and later in the form of subsidized interest rates. For example, loans for energy efficiency capital investment were charged an interest of 2.4% in 1983 and, after 1986, rates that were 30% below the prevailing bank loan rates. There were tax benefits as well, e.g., a 50% reduction in import duties for equipment used in EE technical renovation projects.

At the height of the energy efficiency capital investment program, CECIC managed two billion RMB of government funds per year, often leveraging even greater amounts of investment from local governments and host enterprises. These energy efficiency investments included cogeneration plants and variable speed drive installations. CECIC provided technical review of the projects and recommended projects to the designated government banks for appropriate lending. This program was discontinued in 1996, as part of institutional reforms toward a more market-based economic model. Many of the tax benefits for energy efficiency investment were taken away as well, as part of 1994 tax reforms. Partly due to these changes, energy efficiency investment as a share of investment in energy industries declined sharply.[41]

As described in Section 2.1.2 above, very recent and positive DSM activity is taking place in Jiangsu and several other provinces. Currently, these pilot activities are government–funded, so they may be seen as being examples of Option 3. However, the goals of these pilots are to demonstrate the efficiency potential, establish institutional capability and experience with energy efficiency, and then adopt funding mechanisms that can be used to substantially increase the scale of the effort and sustain it.

3.3.3.3. United Kingdom

The UK experience with the Climate Change Agreements (CCA) and Climate Change Levy (CCL) may provide China with a useful model for the implementation of an

[41] Lin, Jiang. *Trends in Energy Efficiency Investments in China and the US,* Lawrence Berkeley Lab, 2005. http://china.lbl.gov/china_pubs-policy.html

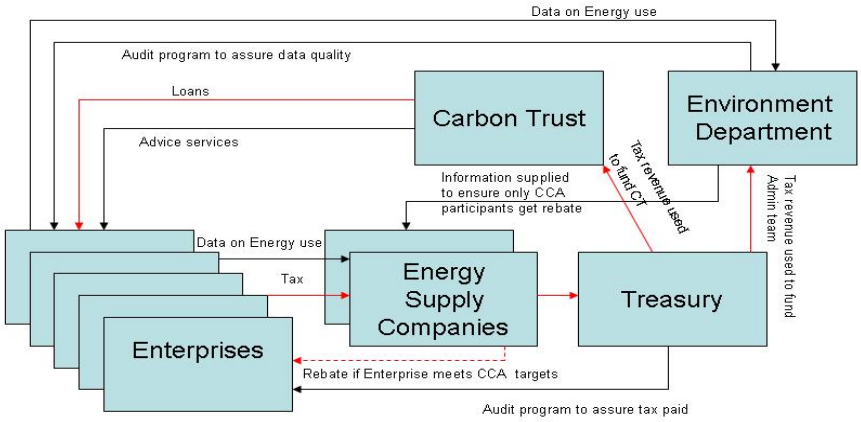
Option 3 EPP. This model focuses almost entirely on increasing demand-side efficiency at the level of the end-user.

Structure
The Climate Change Levy is a domestic tax on energy consumption. The rate of tax is set by the government (exchequer) and charged at the point of sale by the energy supply companies. The CCL was implemented as one component of a comprehensive restructuring of taxes. The program established a new agency, mandated to improve industrial energy efficiency by offering advice and educational services. This agency is known in the UK as the "Carbon Trust."[42]

The levy is equivalent to roughly 15% of the total billable amount charged by the supplier to the end user. Only non-domestic supplies are subject to the tax. Domestic users and fuel used for the generation of power are exempted. The tax is charged per unit of consumption, thereby providing a price signal to consumers, and forcing operators to either reduce their consumption of energy goods or face increased bills. At present, the rate of levy is 0.43 pence/kWh for electricity with variable rates on different commodities. The rate is to be increased in April 2007 for the first time since April 2001, when the levy went into effect.

Participation in the Carbon Trust's programs is currently limited to only the firms that are subject to the tax. Instead of collecting the tax and offering incentive payments to the firm based on energy efficiency achievements, the firms who meet aggressive efficiency targets are entitled to pay at a reduced tax rate, up to an 80% discount of the full rate. Thus, some funds never actually change hands. Tax bills owed to the government are essentially forgiven if energy efficiency targets are met. See 7, below.

Figure 7 Government-funded EPP in the UK



[42] See www.carbontrust.co.uk for more information.

Programs
All energy efficiency technologies and options are covered by the program. Energy efficiency targets are intended to capture all cost-effective energy efficiency. If the target is met, the rebate, or discount, is provided. If the target is not met there is no discount or rebate.

Additional incentives that complement the CCA program include a break on other taxes associated with investment in certain energy efficient technologies.[43] Technical advice and interest-free loans offered by the Carbon Trust to underpin certain types of investment have also helped to generate new investment.

For CCA participants, there is a system of self-certification in place, which means that only those companies who submit the relevant paper work to their energy supplier can obtain the discount, but the discount will only be granted if the company name and reference number are listed on the relevant website by the government department responsible for administering the scheme. In addition to this check, there is also a program of random audits to ensure that operators are only claiming discounts at the rate at which they are entitled.

Key Policies
The approach taken in the UK has been very successful in increasing energy efficiency in the industrial sector. The success has been due to the adoption of a policy framework that has the following attributes:

- Strong financial incentives;
- A voluntary agreement framework which sets out the obligations of operators in terms of aggressive but achievable energy saving targets;
- Technical advice;
- Low-interest loans and other allowances to support the installation of energy efficient goods and technologies;
- A requirement on operators to monitor and report energy consumption and implement energy plans;
- Technical expertise to identify anomalies in data reported to the government department responsible for the scheme; and
- A system of checks to minimize any risk of misreporting or fraud.

Experience in the UK suggests that if the tax were simply imposed without providing businesses an opportunity to reduce their tax burdens, many companies would simply resign themselves to paying the additional costs, rather than looking for ways in which they can achieve energy savings.[44]

Role of ESCOs
ESCOs are used widely in some industrial sectors and less in others. The CCAs are credited with creating new ESCOs and increasing business opportunities for existing ESCOs.

[43] See www.eca.gov.uk for more information.

[44] The Netherlands had a very successful similar program for the grid companies. Reductions of a particular a tax could be awarded after demonstration of energy savings through DSM activities that the grid companies funded.

Results
The Climate Change Levy, in conjunction with the Climate Change Agreements, has delivered ten times the estimated energy savings that would have been generated by the price elasticity effects of the levy alone. Although each company is only able to access additional capital up to the value of the rebate that they themselves are required to pay, it is clear that industry responds positively to an opportunity to avoid paying a tax and is willing to spend in excess of the value of the tax in order to do so.

The policy is estimated to have resulted in savings to date in excess of 28,000 GWh/yr and expected savings by 2010 in the region of 42,000 GWh/yr. In order to have met this additional demand by other means, the UK would have had to build in excess of 70 300-MW power plants.

Rather than offering a partial discount on a new tax mechanism as in the UK, any EPP developed in China could simply offer a rebate back to the end-user if the efficiency targets are met. The rebate could be a reduction in the level of an existing tax paid by the target enterprise/individuals, such as income or corporation tax.

3.3.4. Pros and Cons of Option 3

There are four major benefits of this EPP Model:

1. It requires no significant utility role and consequently no need for supporting power sector reforms.
2. It may fit well with reforms to China's fiscal and tax policies relating to energy and environment.
3. Interest rates may be lower if the "full faith and credit" of the government is pledged as assurance for the loans.
4. It can be used to support the development of the ESCO industry.

There are seven drawbacks to this model:

1. It will yield fewer EPPs, due to limited and potentially unstable government funding.
2. Success often depends upon additional incentives such as grants and concessionary loans.
3. Without adequate financial controls in place, there is a measurable risk of default (failure to repay) the loans in China.
4. Integration with overall power sector planning and investment may be limited.
5. Responsibility for the various essential elements will be divided among several key agencies and offices. Coordination among them might be difficult.
6. This is the only option of the four where consumers and/or the power sector are not directly connected to funding the EPPs. This disconnect may prove to be economically inefficient as time goes on.
7. Other entities must be identified to fulfill the essential roles. This may be difficult in some regions.

3.4. Option 4 – Participant Funding through an Energy Saving Fee

This option has received the greatest attention because it has been, from the early stages of this project, the preferred approach of the Guangdong and central governments. While the essential features of this model are those as earlier conceived, what is present in this final report is different is several important ways. These

modifications were developed in the work that followed the project's mid-term workshop.

3.4.1. Description

Option 4 operates on the assumption that the primary barrier to energy efficiency is consumer access to capital. The characteristic of this option that distinguishes it from the other three options is that only participating consumers pay for the energy efficiency investments over time, out of the savings in their utility bills that result from the reductions in their energy usage. A second feature, aggregation, further distinguishes this option from traditional loan-based or ESCO-based models that also recover the energy efficiency investment cost from participating customers. In traditional loan or ESCO approaches, each consumer is treated individually under a separate—and often unique–agreement. Under this EPP approach, the energy efficiency programs, investments, and repayment terms are aggregated and individual consumers are responsible for their pro rata share of the costs.

The basic structure is as follows:

- The EPPA solicits proposals from end-users and middle-user for energy efficiency projects of specified types.
- The proposals are reviewed for technical, economic, and financial merit. Accepted proposals are aggregated to form an EPP with the size and other characteristics desired. The cost and expected energy savings of the projects are summed to derive the total size and cost of the EPP.
- Individual loans are made to the participants but, for purposes of risk management and repayment, the participants are treated as a group. Loan repayment is structured as an "Energy Saving Fee" (ESF) equal to the average cost per kWh-saved for the aggregated EPP.[45] Each participant pays the same ESF multiplied by the kWh savings estimated for its particular project.[46]
- There are several useful versions of this option. Under all options, the ESF is included on the power bills of the participating customers; however, it is a separate charge and is not part of the electricity price. Funds collected by the grid company are immediately used to repay the loan, if the grid company is the borrower or the EPPA. If the grid company is not the borrower or the EPPA, it merely collects the ESF and forwards the collected funds to the actual borrower (a government-designated entity), which will then recycle or repay the loan.

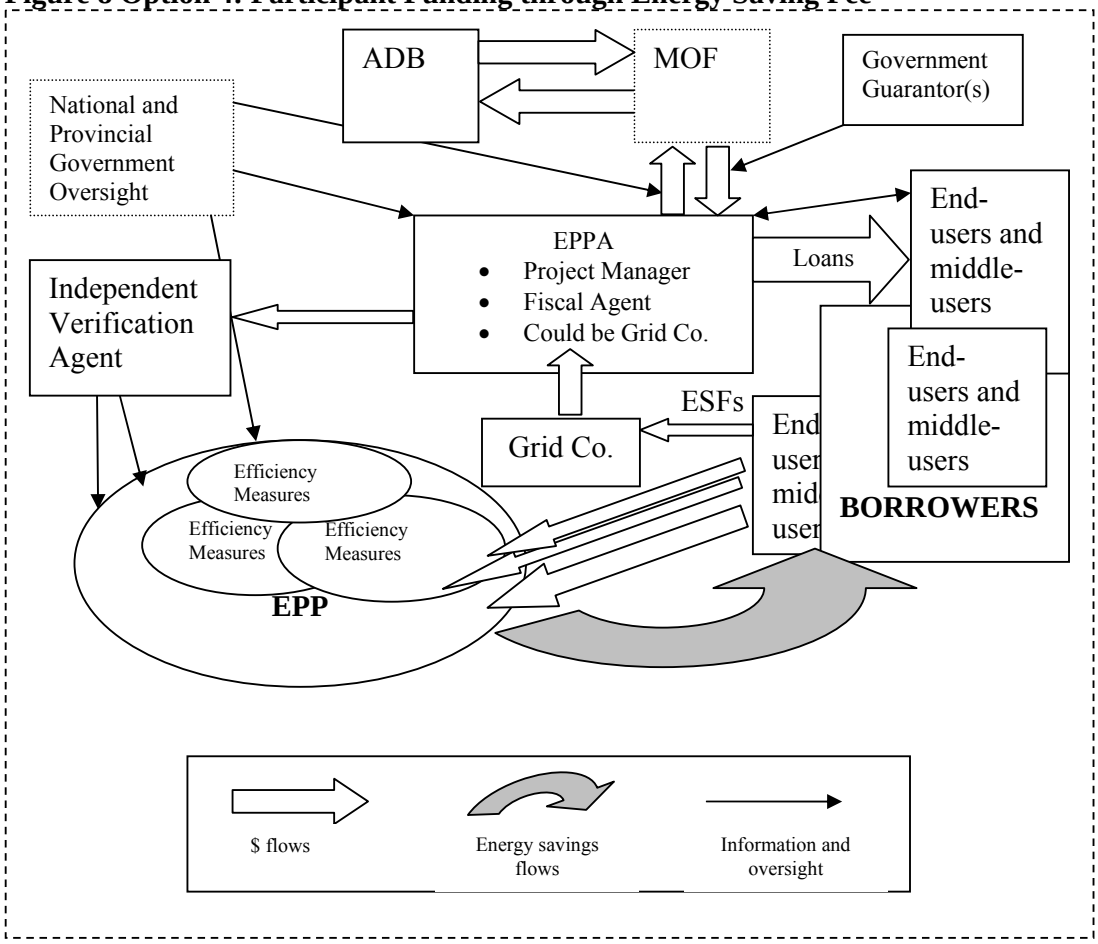
[45] The ESF could be set higher than the average cost to reduce the loan payback period. The ESF should be lower than the cost of a CPP and lower than the retail price to assure positive cash flow for the participating consumer.

[46] To account for differences in the cost-effectiveness and lifetimes of different projects, the duration of each participant's ESF can vary. For example, Participant A invests in motor efficiency improvements with a lifetime of 10 years and 100 MWhs per year of savings and Participant B invests in efficient lights with a lifetime of 3 years and 50 MWhs of savings per year. A and B both pay the same ESF per kWh saved. A's payments may be for 10 years and B's may be for 3 years.

3.4.1.1. Financial Structure

There are several possible financial structures for this approach. The simplest, which includes using the utility to collect the ESF from participating customers, is shown below.

Figure 8 Option 4: Participant Funding through Energy Saving Fee



3.4.1.2. Government Oversight Structure

Government oversight in China under Option 4 occurs at both the national and provincial levels.

At the national level, the MOF must review and approve all financing involving the ADB or other multilateral lenders. Since ADB loans are backed by the central government, the central government will in turn require guarantees from the provincial government for the repayment of the loans.

In the Guangdong case, the Guangdong Finance Bureau (GDFB) has the ultimate responsibility to repay the ADB loan, in the event that payments from EPP participants are insufficient. GDFB is working with Guangdong Development and Reform Commission (GDDRC) and Economic and Trade Commission (GDETC) to provide project oversight, including the approval of EPP framework, project selection criteria, monitoring and verification of project savings, and payment options. For some end-user classes, the provincial agencies will delegate the oversight function to municipal government agencies.

3.4.1.3. Delivery Structure

The EPPA will, with assistance from technical experts, develop a portfolio of EPP programs for various targeted sectors and technology, based on the approved funding level. Typically, end-users will submit applications to the EPPA to access the funding for their energy conservation projects or the installation of qualified energy conservation technologies such as variable speed drives and waste heat recovery. Actual installations could be performed either by the end-users, EMCs, or third-party engineering firms.

3.4.1.4. Monitoring and Verification

The discussion of M&V in Section 3.1.1.4 applies equally to Option 4.

3.4.2. Needed Policy Reforms

The attraction of Option 4 to Guangdong is that it requires no significant policy reforms. Including the cost of energy efficiency in electricity prices described in Option 1 or Option 2 would require a significant policy reform. We have suggested including the ESF on utility bills because doing so substantially improves the administration and risk-profile of this EPP option. An ESF on the bills of participating customers will not be considered an electricity price and thus may be put into practice without delay.

3.4.3. International Experience

3.4.3.1. United States

The US ESCO industry emerged in the 1980s in response to utility demand-side management (DSM) programs. The utility/ESCO partnership was reinforced when some utilities created unregulated ESCO subsidiaries as well. Since 2000, many US ESCOs have broadened their scope of business to include on-site generation, load management, and commodity procurement services, in response to restructuring and competition in the electric industry. Total annual project investment reached $2 billion in 2000. Most activity (~75%) is in the institutional sector (schools, universities, government, and hospitals). US ESCOs have been less successful in the private (e.g., industrial) sector. Lighting and HVAC measures are by far the most common US ESCO projects, due to the nature of institutional facilities and the easy replication of project design.[47]

ESCO experience can be summarized as follows:

- US ESCOs have been most effective at capturing efficiency in institutional and government markets. They have had limited success in industrial, commercial, and residential markets, and virtually no success with new construction. Chinese ESCOs have been successful in the industrial sector.
- ESCOs have been most effective and have focused their business efforts in those areas where aggressive utility-funded DSM programs operate and where they can enhance the project economics through leveraging additional grant funds and DSM services.
- The existence of utility energy efficiency programs has facilitated the start-up of new ESCOs.

[47] *Developing an Energy Efficiency Service Industry in Shanghai*, Jiang Lin, Charles Goldman, Mark Levine, Nicole Hopper (Lawrence Berkeley National Laboratory, February 2004).

- Most ESCOs tend to focus almost solely on large discretionary retrofit projects (early retirement of existing operating equipment) and tend to promote only the most cost-effective technologies, leaving behind numerous additional cost-effective opportunities.
- Many military bases have contracted for Resource Efficiency Managers (REMs) who are responsible for identifying potential savings in use or output of energy, water, wastewater, and solid waste. These positions are typically filled by companies that operate as ESCOs, and can then provide capital to fund the actual measures identified. The costs of the REMs are typically funded from the net operating cost savings they generate for the customer. Unlike other ESCOs, the REMs tend to identify and implement a large number of small-savings measures.
- ESCOs do not generally invest in long-term market transformation strategies that enhance overall societal cost-effectiveness by permanently changing practices and behavior, for example, through the promotion of efficient designs for buildings and appliances.

3.4.3.2. China

Since 1998, China has worked with the World Bank to develop an ESCO industry in the country.[48] The first phase of this collaboration came under the World Bank/GEF China Energy Conservation Project, which supported the establishment of three energy management companies (EMCs) in Beijing, Liaoning, and Shandong, and the demonstration of the ESCO-model for financing energy efficiency projects. The first phase was funded at roughly US$150 million, consisting of a GEF grant of US$22 million, a World Bank loan of US$65 million, US$7 million from China's SETC, $4.5 million from the European Commission, and US$54.3 million from the three EMCs.

The three EMCs offered one-stop energy efficiency services for their clients, including auditing, project design and engineering, and financing. They were paid under the shared-savings model, in which a portion of the cost savings created by the efficiency measure was assigned to the EMCs to pay for their services. By the end of 2005, the three EMCs had implemented over 400 efficiency projects with 348 different clients, with a total investment of 1.17 billion RMB (US$148 million). Their success demonstrated that the basic business model of ESCOs works in China.

However, for other aspiring EMCs in China, it has been extremely difficult to obtain financing for efficiency projects from commercial banks. This has led to the creation of a loan guarantee facility under the second phase of the World Bank/GEF China Energy Conservation Project. A grant from GEF was used to set up a Loan Guarantee Special Fund for Chinese EMCs. The objective of the Guarantee Fund is to facilitate lending by local commercial banks to Chinese EMCs. A local Chinese guaranty company was selected to manage this fund.

During 2004 and 2005, a total of 22 EMCs have used the guaranty fund to obtain financing from local banks for 52 projects. Total project investment reached 295 million RMB (or US$36.4 million). One of the major complaints from Chinese

[48] *Developing Financial Intermediation Mechanisms for Energy Efficiency Projects in Brazil, China, and India: China Country Report,* World Bank, 2006. http://3countryee.org/Reports/DraftCountryReportChina.pdf

EMCs about the guaranty facility is that its requirements for counter-guarantees are often as onerous as, if not more so, those of commercial banks. Thus, many EMCs see little value in seeking the services offered by the guaranty fund.

3.4.3.3. Washington State Energy Saving Performance Contracting (ESPC)

Distribution companies in the state of Washington in the northwestern United States are required by law to deliver energy efficiency programs under an integrated resource planning process. In addition, the state of Washington has also put in implemented the Energy Saving Performance Contracting (ESPC) program to reduce energy use in state-owned buildings, hospitals, and schools. The ESPC relies on ESCOs to deliver efficiency services.[49]

Structure

An independent, state-owned consultant (the "Energy Team") acts as a catalyst for project implementation by connecting qualified ESCOs with interested customers, overseeing installations, and facilitating project financing. Savings measures are financed by low-interest loans from the state treasury, and customers repay the loans out of the bill savings resulting from the efficiency measures.

Program

Interested customers are given energy audits and, if potential savings exist, an ESCO installs the desired savings measures. Savings measures must be cost-effective, which, in this instance, means that the projects must deliver enough savings to pay back any financing within ten years. Measures are designed to be installed without any up-front cost to customers: the initial costs of the installation are paid by the ESCO. Once the Energy Team has verified that the installation was successful, the customer obtains low-interest, tax-exempt financing from the state treasury. This financing is used to repay the ESCO and to pay a small fee to the Energy Team. If savings are not realized, the ESCO is responsible for repaying the customer. Often, customers are able to combine their participation in the ESPC program with utility DSM programs that provide financial assistance for installing energy-efficient equipment such as light bulbs and appliances, thereby further reducing the costs of installations.

Key Policies

- The ESPC Energy Team. Its staff includes engineers and other technical experts who can oversee installations and ensure that success is likely at each step in the process.
- State Financing. It is readily available through special programs with the state Treasury.
- Energy Team Funding. The Team's funding is dependent on fees from customers, allowing it to grow according to demand, rather than be dependent on appropriations from the state.
- The Focus on Institutional Customers. The ESPC Program is limited to government-owned buildings, schools, prisons, and hospitals.
- The Absence of Aggregate Program Goals. There are no MWh savings goals for the program as a whole, which means that ESCOs do not have the incentive to focus only measures that produce large savings. Instead, they can make money by finding and aggregating all cost-effective measures on site, regardless of their size (in savings).

[49] For more information, see http://www.ga.wa.gov/EAS/epc/espc.htm

- Cost-Effectiveness Requirements. Savings are restricted to measures that are cost-effective for customers and/or profitable for ESCOs; some benefits to the overall system may be missed.

Role of ESCOs
ESCOs conduct audits, implement installations, and develop a relationship with the Energy Team. They must pay back the customer if savings are not realized.

Results
Since 1986, over 7 million therms and nearly 155,000 MWh have been saved by the program. Cumulative savings have totaled nearly $49 million since 1986, and annual savings reached $11 million in 2005.

3.4.4. Pros and Cons of Option 4

There are four major benefits to this EPP Model:

1. It requires no significant utility role and consequently no need for additional power sector reforms to support it.
2. It can build on the Three-Country work.
3. It is based on substantial international experience.
4. It can be used to support the development of the ESCO industry.

There are eight drawbacks to this model:

1. In comparison to the other options, it will yield the fewest and most expensive EPPs.
2. ESCOs and end-users tend to focus on projects with very short payback periods, thus leaving many energy efficiency opportunities untapped.
3. Integration with overall power sector planning and investment may be limited.
4. It is primarily suited to only a subset of the wide range of energy efficiency opportunities available—e.g., retrofits in institutional buildings.
5. It fails to address some of the barriers identified in current energy efficiency financing approaches.
6. No coordination with the utility is required, and therefore no benefit is assigned to location-specific options that alleviate grid congestion.
7. It depends upon financial strength of the ultimate borrowers.
8. It relies on a loan-by-loan process, and therefore the transaction costs are high. This is another drawback that makes the program difficult to scale up to support broad deployment of energy efficiency resources.

Part A Chapter 4. Evaluation of EPP Options

We evaluated each option against a set of six criteria. They are:

1. **The ability of the option to overcome barriers**. The main barriers to EPPs were identified in Section 2.2 of this paper.
2. **The amount of achievable efficiency and its cost-effectiveness**. The ability to design and deliver cost-effective energy efficiency programs is directly related to the EPP's administrative and financial structure. The best policy options are those that allow for the greatest development of EPP potential at the lowest total cost.
3. **The ease of securing and administering financing**. Externally-financed EPPs will need to meet certain minimum financial and accounting standards, procedures and, safeguards. In particular, the borrower needs to be financially secure and must have a sound business plan to build the EPP and repay the loan. There must also be a well-designed plan to measure program savings.
4. **Integration with overall energy planning and investment**. One of the distinguishing characteristics of the EPP is its potential to allow greater integration of supply and demand-side options in the energy planning process.
5. **Replicability**. One goal of the project is to identify a set of policies that will allow China to build many EPPs throughout the country.
6. **Fit with China's other energy efficiency policies**. China has made energy efficiency a top national priority. The 11th Five-Year Plan specifically sets a target to improve energy efficiency by 20% by 2010. Toward this goal, China has been adopting a range of energy efficiency programs and policies.

In this chapter we describe each of the six evaluation criteria more fully and then provide our initial evaluation of how each option ranks in light of the criteria.

4.1. Ability of the Model to Overcome Barriers

As described in Section 2.2, there are several key barriers to greater consumer investment in energy efficiency in general and several that relate directly to EPPs. The more important barriers, listed in priority order are:

- The lack of an adequate and stable source of funding for DSM;
- The lack of grid company incentives, and the presence of strong disincentives, to invest in EPPs;
- Prices that fail to reflect the full cost of electricity, including the environmental damage costs, and "Split" incentives. ,
- The failure to reform the power sector in a way that fully integrates energy efficiency and other demand-side resources into it.
- The lack of capital for consumers and ESCOs;
- Limited knowledge of DSM opportunities among consumers; and
- The lack of a large and experienced ESCO industry;

Each of the four options overcomes the barriers to energy efficiency to a different degree. The following matrix describes how each fares with respect to each of the barriers enumerated in Section 2.2:

Table 3: Ranking EPP Options in Comparison to Barriers

Barrier	Ranking of Options	Comments
Lack of stable DSM funding	1, (2, 3), 4 Note: Options in ( ) are essentially ranked the same	This is the greatest barrier to energy efficiency. Option 1 has been rated the highest because its aim is to fully capture all cost-effective energy efficiency. Options 2 and 3 are limited by government decisions relating to funding levels. Option 4 is last because, in addition to funding limitations, the delivery mechanism limits EPP potential to certain types of energy efficiency options.
Grid Company incentives	1, 2, (3,4)	Only Options 1 and 2 have grid company involvement. Under either of these options successful implementation requires correcting existing grid company disincentives to energy efficiency. Options 3 and 4 addresses this concern by separating DSM investment from the utility entirely. Option 4 also separates DSM from the utility, but is likely to achieve a much lower level of DSM.
Improved Pricing and split Incentives	1, 2, (3, 4)	Only Options 1 and 2 specifically allows for integration of EPP funding with reinforcing price reforms
Integration with power sector reform	1, 2, (3, 4)	Option 1 ranks best because it specifically targets this problem. One version of Option 1 could be especially effective by integrating EPP purchases as a part of the market operator's demand response programs
Lack of capital	1, (2, 3), 4	Lack of capital takes several forms: • lack of capital for the consumer • lack of capital for the ESCO that might finance energy efficiency improvements • lack of knowledgeable lending institutions • lack of credit worthy borrowers. All of the options make more capital available. Options 1, 2, and 3 rank higher than Option 4 because Option 4 tends to be limited to larger industrial consumers and it still depends in large part on the credit worthiness of individual consumers. Option 1 is ranked highest because it likely provides the most new capital for energy efficiency.
Limited knowledge of DSM opportunities	(1, 2, 3), 4	All EPP options will require education and marketing of energy efficiency opportunities to consumers. Option 4 has been ranked last because the target group of participants will be mainly the largest consumers. The other options are all better suited to the full range of customers.

Lack of skilled ESCOs	(1, 2, 3), 4	ESCOs are promoted under all of the options. Under Options 1, 2, and 3, all or a portion of the ESCO's revenue stream comes from the grid company or other entity implementing the EPP. This essentially expands the ESCO's customer base, simplifies ESCO marketing, and reduces ESCO transaction and financial costs. As described in sections 3.1.3, 3.2.3 and 3.3.3 above, international experience shows these models have been major factors in ESCO growth and stability. Option 4 helps ESCOs but the benefits relative to the other options is minimal.

4.2. Amount of Achievable Efficiency and its Cost-effectiveness

The amount of achievable EPP potential is influenced mostly by whether the option readily includes the full range of energy efficiency technologies and applications. The answer is found by considering four factors, listed in priority order:

- Whether the option is limited by available funds;
- Whether the option can be used to address both retrofit applications and new construction;
- Whether the option is suited to all cost-effective energy efficiency options or only those having an especially fast payback period; and
- Whether the option can be used for all consumer classes

The EPP's cost-effectiveness is a function of these four factors also (especially the third). In addition, the costs of administering, evaluating, and overseeing the option will have an impact on an option's economics:

Testing the four options against these criteria, they rank as follows:

Table 4: Ranking EPP Options in Comparison to Cost-effectiveness

Criterion	Ranking of Options	Comments
Limited by available funds	1, (2,3,4)	Under Option 1, the funding level is restricted only by the ability to identify cost-effective EPPs. Funding under the others options may be limited by the combination of process of setting funding level or the scope of projects readily available under the option.
Applicable to retrofit and new construction.	(1, 2, 3), 4	Option 1, 2, and 3 can include retrofit and new construction program and all customer classes can be served. Option 4 works best in the retrofit situations. There is little or no experience with this model's use in new construction. Yet, in China, where new construction is a major driver of demand growth, some of the largest and lowest cost EPP potential is in the new construction market.
Able to achieve all cost-effective energy efficiency	1, (2, 3), 4	Option 1 is designed to achieve all cost-effective energy efficiency. As a result, the average cost-effectiveness of EPPs under Option 1 may not be higher than under other options, but the total savings will be greatest. The higher average cost impact is offset by the use of energy efficiency encouraging

		pricing which will yield significant energy efficiency at no cost attributable to the EPP. EPP administrative and transaction costs are lowest with Option 1 because of the centralized role of the utility. Loan-by-loan review is eliminated and many energy efficiency options are reviewed on a program level rather than an individual project level. Options 2 and 3 have many possible variations and it is possible that some Option 3 variations will perform better than other Option 2 variations. If the utility role in Option 2 is more limited—for example, the utility is merely a collector of funds that are administered by another entity—the overall performance and cost will depend on the nature of the entity filling the role. We are unaware of existing entities in China that are likely to have the skill and experience needed. It is possible that government funding though carefully targeted taxes and fiscal policies can be a driver of additional energy efficiency savings at no cost attributable to the EPP. This possibility is similar to the possibility under Option 1 of recovering EPP costs through targeted electricity price reforms.
Useable by all consumer classes	(1, 2, 3), 4	Option 4 is mostly limited to very large consumers. Although large users in China consume a great deal of energy and have large energy efficiency potential the approach leaves much EPP potential in the residential and commercial sectors untapped.

4.3. The Ease of Securing and Administering Financing

The main factors that influence this criterion are:

- Whether the borrower is financially secure and credit worthy;
- Whether a sound business plan exists to pay for the EPP and repay the loan; and,
- The number of financial intermediaries;

The following matrix sets out how well the options meet this objective.

Table 5: Ranking EPP Options in Comparison to Ease of Financing

Factor	Ranking of Options	Comments
Financially secure and credit worthy borrower	3, 2, (1, 4)	A government guarantee or dedicated funding source such as a SBC or levy, to support the EPPA will provide the highest level of assurance to lenders.
Sound repayment plan	1, 2, 3, 4	Dedicated and secure funding from SBC and government revenue offer better prospects of timely loan repayment than repayments from EPP

		participants.
Number of financial intermediaries	3, 2, (1, 4)	All options allow participation by ESCO and other lending institutions.

4.4. Improved Planning and Investment

China's planning and investment process does not expressly integrate supply and demand side options to meet energy needs in a least-cost manner. The existing planning process and recommendations for its improvement have been described in other papers and reports.[50]

Table 6: Ranking EPP Options in Comparison to Integration with Planning

Criterion	Ranking of Options	Comments
Integration with overall energy planning and investment.	1, (2, 3, 4)	The rankings reflect the fact that Option 1 is the only option that expressly includes improved integration with energy planning and investment. All of the other options would benefit from similar integration.

4.5. Replicability of the EPP

Guangdong was selected as the location of the EPP pilot because Guangdong is more advanced and innovative than other provinces in China. The success of the project will be a model to be copied in other provinces. However, ease of replicability of EPPs is determined by six factors listed below in order of priority. In addition, our evaluation of the replicability of each option assumes that the option under consideration is adopted. Thus, an option that may be unlikely to be adopted due to needed government reforms may nevertheless be easy to replicate IF adopted.

- Whether the end user will benefit by participating in the EPP project;
- Whether the entities responsible for implementing the EPP will benefit;
- Whether government develops and adopts more accelerative policies on the priority of energy conservation;
- Whether the entities involved in the option are present throughout China;

[50] See, for example:

Moskovitz, David, and Hu Zhaoguang. *Steps To Avoid the Historic Boom/Bust Cycle in Power Sector, Regulatory Assistance Project, 2004.* http://www.raponline.org/Pubs/China/Hu-Dmfinal.pdf

Scientific Energy Planning for China, Regulatory Assistance Project, 2006. http://www.raponline.org/showpdf.asp?PDF_URL=%22Pubs/Scientific%20Energy%20Planning%20in%20China%204-06.pdf%22

Feng, Fei, Roland Priddle , Leiping Wang, and Noureddine Berrah. *Sustainable Energy in China: The Closing Window of Opportunity, World Bank, 2007.* http://publications.worldbank.org/ecommerce/catalog/product?item_id=5990409

China's Power Sector Reforms, IEA, 2006. http://www.iea.org/Textbase/publications/free_new_Desc.asp?PUBS_ID=1697

- Whether the skills and capabilities in one province can be transferred to other regions; and
- Whether the needed skills are generally available in the business, government, and university environment, or need to be developed.

Table 7: Ranking EPP Options in Comparison to Ease of Replication

Criterion	Ranking of Options	Comments
Whether the end user will benefit by participating in the EPP project	(1, 2, 3), 4	This is the most important criteria because end users must see a benefit or they will not participate in the EPP. The ranking reflects the fact that Option 4 requires full participant funding of the cost of the EPP. This will result in the lowest level of participation.
Whether the entities implementing the EPP will benefit	1, (2, 3, 4)	It will be easiest to replicate EPPs if the entities with EPP responsibility see some direct financial or other benefit. The ranking reflects the fact that Option 1 specifically includes an element of electricity pricing reform to reward good performance at the company level. The remaining options are implemented by government entities and all of these options are equally capable of rewarding good performance at the individual level.
Whether government develops and adopts needed policy reforms	4, (2, 3), 1	Policy reform at the central level is needed to move beyond Option 4. The greater the level of reform, or the more the central government allows provincial government to experiment with funding and administration, the easier it will be to adapt and replicate EPPs to meet local needs. The ranking reflects the relative level of reform needed to implement the options.
Whether entities are present throughout China	1, (2, 3, 4)	EPP administration requires an entity (or entities) capable of 1) general administration and coordination; 2) program development, planning and budgeting; 3) program administration and management; 4) financial administration and management 5) program delivery and implementation; and 6) program assessment and evaluation. The ranking reflects the fact that grid companies are present throughout the country and have a large and skilled workforce.
Whether the skills and capabilities in one province can be transferred to other regions	1, (2, 3, 4)	EPP administration requires technical, economic, financial and administrative skills. Experience gained in one province can be used to train people in other provinces. Option 1 has been ranked highest because the regional nature of large grid companies may make skill transfer easier.
Whether the needed skills are generally	(1, 2, 3, 4)	EPP administration requires technical, economic, financial and administrative skills. The options have been ranked equally because the basic skills needed

available in the business, government, and university environment		are widely available

Our conclusion on the ease of replication is guided by asking the following question: If the government adopts the particular option and its associated policy reforms, how easy will it be for provinces to adopt and implement EPPs? Using the criteria listed above, Option 1 will be the easiest to replicate, although for reasons discussed in this report it is the option least likely to be adopted in the near term. In the near term, Options 2 and 3 are the most practical and both can be readily replicated throughout China.

4.6. Relationship of the EPP to China's Other Energy Efficiency Policies

China has announced a number of key energy efficiency polices and programs aimed at meeting its ambitious goal of improving energy efficiency by 20% by 2010. In some cases, the policies are very specific in their prescriptions and in others more general. In at least one case the policy is identified but still under review. Our evaluation focuses on seven stated policies, all of which are described in more or less detail in the State Council Decision Strengthening Energy Conservation Work, August 2006, (2006 # 28):

- Strengthen DSM: fully use available DSM, expand high energy efficiency technology, promote construction of EPPs, increase electricity efficiency;
- Implement pricing reforms including:
  - Energy-efficiency targeted price differentials
  - Surcharges for inefficient activities;
- Focus on the one thousand largest enterprises;
- Gain greater support from financing agencies for energy efficiency; increase financing for energy efficiency;
- Implement incentive tax policies for energy efficiency, make a catalog of energy efficient products and make proposals to adopt preferential taxes;
- Including energy conservation investment in government budgets; and
- Promote ESCOs.

All four EPP options fit reasonably well with existing and planned energy efficiency policies. The rankings below reflect our judgments about which options have the potential to produce the greatest number of cost-effective EPPs:

Table 8: Ranking EPP Options in Comparison to Other Energy Policies

Policy	Ranking of Options	Comments
1000 Enterprises	1, 2, 3, 4	The 1000 Enterprise policy is aimed at improving the energy efficiency of the top industries, but there is no specific method adopted yet by which this policy will be implemented. All of the EPP options are capable of targeting the industrial sector. The ranking reflects our conclusion that more EPPs can be delivered by Option 1 than by the options. Option 2 is next, followed by 3, and then 4.

Strengthen DSM	1, 2, 3, 4	China's stated policy is to promote and "fully use" DSM. The only specific DSM-related practice mentioned in the State Council Decision 2006 #28 refers to building EPPs. Thus, like the ranking for the 1000-Enterprise policy, our ranking reflects the relative ability of the options to deliver EPPs.
Price reforms	1, 2, 3, 4	Two specific price reforms have been mentioned. One, increasing the price differential between efficient and inefficient industries is a policy already in place for large energy-intensive industries. Expanding this to medium-sized manufacturing and assembly industries is an important next step. The other, surcharges for inefficient uses, is under consideration. In this case the ranking reflects more than the relative ability of the options to deliver EPPs. Option 1 specifically incorporates the types of price reforms mentioned as a means of raising needed revenue to pay for EPPS. In China, past price reforms, such as TOU prices, have raised on-peak prices but lowered off peak prices keeping average prices about the same. The result is to encourage load shifting but not necessarily energy efficiency. Price reforms of the type included in Option 1 can be very effective. Experience shows the energy efficiency gain of raising prices is about 10% of the energy efficiency gain of raising prices and using the funds produced by the price increase to fund energy efficiency directly as in the EPP.
Promote ESCOs	1, 2, 3, 4	All of the options support ESCOs because all of the options are expected to rely on ESCOs as one of the energy efficiency delivery methods. The rankings are consistent with international experience, which shows that ESCOs have done best when their ordinary business model is supplemented by utility programs. For some of the EPP options, ESCOs may deliver services to end users but payments for the ESCO services come from the utility in whole or in part. This greatly enhances the ability of ESCOs to market their services, reduces ESCO transaction costs, and expands the ESCOs' potential client base substantially
Tax Policies	3, 2, 1, 4	Tax policies can help improve energy efficiency, especially when carefully designed taxes are combined with strategic uses of the funds. The UK Climate Levy is the best international example of this two-pronged approach. Options 1, 3, and 4 are not inconsistent with energy efficiency-related taxes, but because Option 3 is a tax-based option we have ranked it most highly. Option 2 could be considered a tax on electricity in the form of an SBC.
Bank Loans	4, 3, 2, 1	Expanding the financing channels and causing financing agencies to increase loans to energy

		efficiency fits well with EPP Option 4. Because loans can be government funds, Option 3 is the next best fit. Option 2 includes a dedicated funding source which can support loan repayment.
Government Budget	3, 2, 1, 4	Making energy efficiency investment a part of the fiscal budget fits best with Option 3. Because an SBC can be the source of these government funds we rank Option 2 next.

Part A Chapter 5. Conclusion and Recommendations

5.1. Conclusion

Our basic conclusions are:

- EPPs can provide China with very substantial opportunities to improve energy efficiency and environmental performance;
- Significant EPP development **requires** the adoption of new central policy support;
- Some variation of Option 2, or a mix of Option 2 and 3, best fits China's conditions but this requires action by the central government;
- Significant EPP development **would benefit** from better integration and coordination between energy efficiency efforts and power sector reform and power sector regulation;
- Option 4 is a significant improvement over existing energy efficiency loan approaches and can be implemented without central level policy reform;
- There are policies available to provincial governments to substantially improve the performance of EPPs; and
- Option 4 is designed to allow easy transition to more powerful EPP options.

We have identified a range of policy options for EPPs. All but one of the options require central level government policy approval. But thus far, the government has not approved any of the EPP-related policy reforms even on a limited provincial pilot basis for use in Guangdong. Therefore, we designed one policy option that can be implemented at the provincial level without policy reform. This option is a step forward from traditional energy efficiency loan approaches that already exist in China. It provides a solid foundation from which other better policy models can evolve in a step-by-step fashion as central level government agencies align existing policies with efficiency goals.

The Guangdong pilot serves a second important function: it will establish and demonstrate the ability of provincial entities to design, build, and monitor the EPP and administer the funds in a transparent manner. Gaining experience in these areas will help encourage EPP development.

5.2. Major Barriers to Policy Reform

China is making substantial progress with energy efficiency policies such as energy efficiency equipment and building standards, and energy efficiency labeling, but very little progress has been made on policies supporting power sector DSM and EPPs.

Why has so little progress been made?

There are three basic barriers to policy reform: one relates to the lack of confidence that EPPs can be implemented in a technically and financially sound manner. This barrier is being addressed directly by the EPP pilot. A second can be viewed as being philosophical in nature and the third is rooted in recent power sector reform experience.

The EPP pilot in Guangdong and follow-up EPP activity at the central and provincial level is helping to address these barriers.

5.2.1. Philosophical Barrier

The philosophical barrier relates to how China views the roles of markets and government with regard to energy efficiency. There is a widely held view that the government's role in energy efficiency should be limited to activities such as standards, labeling, education, improving energy prices and tax reform, and that markets will take care of the rest. All of these steps are important and contribute to increasing energy efficiency, but many years of international experience have proven that large low-cost energy efficiency potential will remain even if these steps are taken. The market barriers to energy efficiency are too significant and varied in nature to be solved by standards, education, and information.

The experience of the US relating to the need for government policy intervention to support DSM and EPPs is very useful.[51] Energy efficiency programs of the type reflected in the EPP received a great deal of support until the mid 1990s when many states turned attention to creating a fully competitive wholesale and retail electricity market. The view in the US in 1995 was similar to the view now in China that power sector market reforms will deliver energy efficiency.[52] Gradually, it became clear from US and international experience that the market would not deliver energy efficiency and new models were needed.[53] Next, the California power crisis and similar lessons around the US and other countries showed the difficulty of creating and regulating these markets and the significant contribution energy efficiency can make.[54] Today, there is widespread agreement that EPP-type energy efficiency programs are proven and that they should be significantly increased and supported with government regulation and policies.[55]

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[51] The ADB has prepared a summary of the classic economic reasons for government policy intervention. See: Aashish Mehta. November 2004. *Technical Note: The Economics of Efficiency Power Plant Projects*, Asian Development Bank, and Anil Terway. *Building, Financing and Delivering Efficiency Power Plants in China: Turning Value into Money*, presentation at China Power Congress, Beijing, March 2007.

[52] See *Market Barriers to Energy Efficiency: A Critical Reappraisal of the Rationale for Public Policies to Promote Energy Efficiency,* Lawrence Berkeley National Laboratory, March 1996, http://eetd.lbl.gov/ea/EMS/reports/38059.pdf

[53] See *Ratepayer-Funded Energy-Efficiency Programs in a Restructured Electricity Industry: Issues and Options for Regulators and Legislators,* Lawrence Berkeley National Laboratory and American Council for an Energy-Efficient Economy, May 1998, http://eetd.lbl.gov/ea/EMS/reports/41479.pdf

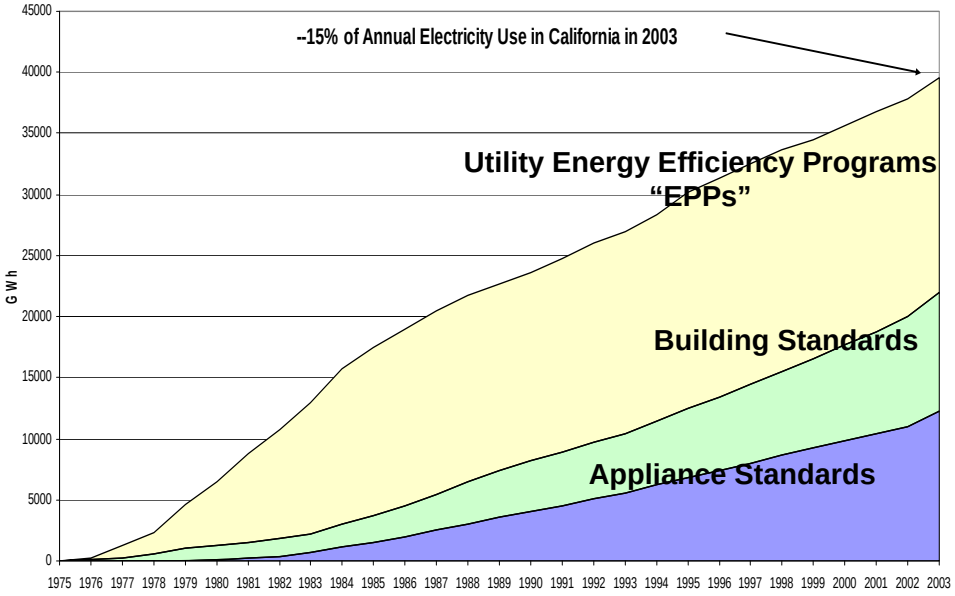
[54] *Regulation or Competition: The California Experience Shows Both Are Needed,* **Error! Main Document Only.**Comments at the International Symposium on Restructuring and Regulation of China's Electric Industry, hosted by the State Council Office for Restructuring Economic Systems (SCORES), The Regulatory Assistance Project 2002. Available at www.raponline.org

[55] See *National Action Plan for Energy Efficiency*, U.S. EPA, 2006. http://www.epa.gov/cleanenergy/pdf/napee/napee_report.pdf

International and Chinese experience shows that codes and standards, and tax and pricing policies help energy efficiency but they are not sufficient. For example, a 3% tax or fee added to electricity to encourage energy efficiency will have a positive, but small, effect on consumer investment in energy efficiency. What is much more powerful than the tax itself is what is done with the revenue. A 3% fee for energy efficiency added to electricity prices raises about 30 Billion RMB per year. Investing this 30 Billion RMB per year in EPPs will have a much greater energy efficiency effect than the 3% price change. Appliance and building standards are also helpful, but do not capture all the cost-effective efficiency savings available.

The following figure makes the point graphically. It shows the sources of electric energy efficiency savings in California. California has the most stringent building and appliance standards in the US. Energy and electricity prices in California are very high and well designed to encourage energy efficiency. Still, as the graph shows, more than 50% of the electricity savings achieved are through EPP types of programs. In short, the EPP concept is designed to deliver energy efficiency that will not be achieved by other measures.

California Electricity Savings from Energy Efficiency Programs and Standards 1975-2003



5.2.2. Power Sector Reform Barriers

One of the EPP options requires policy integration with power sector reform and the other three would benefit from integration. The benefits of integrating energy efficiency with power sector reform are significant. This fact was recognized by the International Energy Agency in its recent review of China's power sector.[56]

[56] See China's Power Sector Reforms: Where to next? IEA, 2006 http://www.iea.org/w/bookshop/add.aspx?id=288

China has made very significant commitments to power sector reform. In 2002, the State Council issued Decree #5 which sets the basic plan for power sector reform. The decree identified key tasks for power industry reform that focused primarily on activities associated with the creation of competitive markets: the separation of generation from transmission and distribution; the restructuring of generation and transmission companies; the establishment of bid-based dispatch and market operation rules, regional power markets, and regulatory oversight; improved pricing; and retail choice for large-volume (commercial and industrial) consumers.

Unfortunately, the power sector reform plans were made before energy efficiency became such a high national priority. Officials involved in power sector reform are so busy trying to implement the planned reforms that there is little time to consider energy efficiency related reforms.

Similar barriers to policy reform extend to needed reforms to electricity pricing. First, until the late 1990s there were many fees and surcharges imposed on electricity prices by central, provincial and local governments. Essentially all of these fees were eliminated as part of the power sector reform efforts and the separation of government and utility functions. Abolishing the fees was a major reform made with strong approval at the highest level of government. Today, any new fee receives a very high level of scrutiny. Although small new fees could provide significant environmental, economic, and energy benefits to China, it will take strong political leadership to make the necessary policy course corrections.

Second, many officials support the concept of raising prices to pay for energy efficiency but resist allowing the grid companies to keep the extra funds. Power companies are very large and executives are former high ranking government officials. To current government officials, electricity sector costs and prices are not transparent. Grid company costs, revenues, earnings, and profits are not examined when prices are set. Existing prices are not examined to determine whether they are properly based on actual costs. Prices are the result of incremental changes made in response to outside events, and social considerations. As a result, there is a lack of confidence in the level and structure of existing prices and many, including government officials, believe grid company profits are too high.

5.3. Needed Government Policy Support

Increased implementation of energy efficiency generally will require the adoption of new policies by the central government. This has been the conclusion of many recent studies by Chinese and international experts and is well known in China. Many of the same policy reforms will be needed to support EPPs.

One of the fundamental purposes of the EPP pilot project is to provide a conceptual framework that shows government officials what new policies are needed to support EPPs and how those policies can result in more investment in energy efficiency. Different EPP options require different types and levels of policy reform. As a general matter, the amount of policy reform varies with the strength of the EPP option. The more powerful the EPP option (in terms of the option's ability to deliver energy efficiency), the more reform is needed. Option 1

is the most powerful option and as described below it requires the greatest level of reform. Option 4 is the least powerful and it requires the least reform.

5.3.1. Option 1

Option 1 requires several major policy reforms relating to power sector reform, electricity pricing, and power sector planning and investment. These reforms are all highly desirable, but China's history and conditions make these policy reforms difficult in the near term. The policy reforms needed for Option 1 are described below.

5.3.1.1. Clarify Responsibility and Obligations of Key Power Sector Entities

A fundamental feature of Option 1 is that it integrates energy efficiency and EPPs in every major part of the power sector. Energy efficiency is treated as an energy resource able to meet consumer demand for energy at least as well as power supply. This means EPPs are considered equal to CPPs in meeting electricity demand and treated equally in power sector planning, investment, and pricing. Many current policies and practices in China do not consider EPPs equal to CPPs.

For example, let's compare two approaches of saving 25 million tce per year, one involving CPPs and the other involving EPPs. Closing existing small inefficient coal-fired power plants is a high priority government policy, saving energy and reducing pollution. The government has adopted CPP-related policies that are expected to close 50 GW of small coal-fired plants by 2010 and essentially replace them with 50 GW of larger, much more efficient units. The coal savings will be around 100 grams of coal per kWh. Annual savings may be 25 million tce. The average cost of replacing the capacity is about 35 fen/kWh, or the total cost of a new efficient coal plant. The average annual cost is about **3500 RMB/tce saved.** The same savings of 25 million tce could be created by 13 GW of EPPs at an average cost of 15 fen/kWh. The average annual cost is about **375 RMB/tce saved.**[57] And the EPP would deliver greater environmental benefits. The policy reforms supporting the CPP option are moving ahead. The reforms supporting the EPP option have not been adopted yet.

Why is it that the lower cost option with the better environmental outcome is not implemented? From a policy perspective, making EPPs equal to CPPs requires a re-examination and revision of the roles, responsibilities, and obligations of most of the major parts of the power sector: generators, grid companies, market operators and power sector regulation. The following table compares the roles and responsibilities under current conditions to the conditions needed to support Option 1. As shown, there is no change in the role of generation, but all the other roles change.

Table 9 Power Sector Roles and Responsibilities

	Current Conditions	Under Option 1
Generation (CPPs)	Generation has been separated from the grid companies. Obligations are to	No change

[57] Replacing 50 GW of small power plants with 50 GW of EPPs would save about 100 mtce at the same average cost of 375 RMB per mtce saved.

	produce electricity safely, efficiently and in compliance with all applicable environmental requirements	
Grid Company	Obligation is to buy and deliver electricity to consumers safely and efficiently. The "obligation to serve" imposed on US utilities means they must make all reasonable efforts to meet demand including buying very high–priced, peak power when needed. China's grid companies can choose to curtail load if they decide the price of power is too high.	Obligation is to meet consumer demand using the least-cost mix of (1) power from generators directly or through a market **and** (2) energy efficiency savings from EPPs and deliver both to consumers safely and efficiently.
Market Operator	Design and operate a competitive market in which generation (CPPs) competes to meet demand	Design and operate a competitive market in which CPPs **and** EPPs compete to meet demand
Power Sector Regulation	Oversee power sector to assure safe, reliable, efficient, and reasonably priced electricity	Oversee power sector to assure safe, reliable, efficient, and reasonably priced electricity **and** energy efficiency

5.3.1.2. Reform Electricity Pricing

Option 1 **requires** two pricing reforms and would **benefit** from a third. The required pricing policy reforms are (1) including the cost of EPPs in electricity prices and (2) changing pricing methods for grid companies so profits are not directly linked to sales. These two policies address the main barriers to utility interest in end-use energy efficiency. A third policy reform is a desirable variation on the first, but not essential. It is to recover a portion of EPP costs in retail electricity prices through price adjustments specifically designed to encourage energy efficiency and overcome known market barriers.

These pricing reforms can be addressed only by the central government. Provincial level government has no authority to act alone.

The pricing policy reforms needed to support Option 1 are described below.

5.3.1.2.1. Grid Company EPP Cost Recovery

Cost recovery has been the single largest barrier to energy efficiency in general and EPPs in particular. The costs of CPPs—indeed, the costs of all supply-side resources necessary to provide reliable and adequate service---are included in retail prices. Recent and proposed changes to price-setting methods make it easier to adjust retail electricity prices to account for changes in the cost of power supply. In contrast, there is no mechanism or procedure to include the costs of EPPs in power prices.

A central element of Option 1 is to treat EPPs and CPPs in the same manner, for price-setting purposes. But from the perspective of a grid company, under present policies, they are not equal. If the grid company buys power from a CPP, it can be confident that the cost of the purchase will be recovered from consumers. Yet, if the grid company meets demand by buying energy savings from an EPP, there is no opportunity to recover the cost.

We reviewed the regulatory practices of a number of countries and jurisdictions. Of these, those that have implemented some version of Option 1 include the cost of programmatic energy efficiency in electricity prices. See table in Appendix A. The typical practice for doing so is to simply include the costs of efficiency in prices in the same way that other resource investment costs are included—that is, as a component of the company's overall cost of service that is to be recovered in the retail kilowatt-hour and, as applicable, kilowatt charges that consumers pay. This is average-cost pricing and describes how it is done, for example, in California.[58]

Average–cost pricing of efficiency is perfectly appropriate. Consumers contribute to the cost of the resource in proportion to their usage levels, in the same way that they contribute to the costs of generation, transmission, and distribution. The more one uses, the more one pays. But there are alternative approaches to the recovery of EPP costs in prices that China may want to consider, for reasons of economic efficiency and fairness. No particular approach is a necessary element of Option 1, but some alternatives will produce better results than others. For example, one alternative to allocating EPP costs equally across all kWh sales is to include EPP costs in specific price structures expressly designed to encourage energy efficiency, to encourage consumers to participate in EPP programs, and to address market barriers. The following types of price structures would encourage energy efficiency the most:

- *Inclining Block Prices for Residential and Small Commercial Customers*. "Inclining block" prices are used widely where average prices are below marginal costs. Retail prices for most small users in China are below the marginal cost of production and well below full marginal cost (that is, marginal cost plus marginal environmental cost). Prices are closer to marginal costs for large users but still well below full marginal cost. With inclining block prices, the prices for incremental blocks of consumption increase as usage increases. Higher levels of consumption can be priced at marginal cost without increasing average power prices; some portion of the revenues associated with usage in the higher-price blocks can be used to cover EPP costs. For residential consumers, inclining block prices can also establish an

[58] This is also how it was done in most states prior to industry restructuring, and how it was done in Vermont before the creation of *Efficiency Vermont*.

initial low-priced block serving social development and universal service goals.

- *Hook-Up Fees*. The split-incentive problem (sometimes referred to as the principal/agent issue) is a substantial market barrier to energy efficiency in China. Building developers make energy-related design and equipment decisions and those who later occupy the building pay the electricity bill. Ordinary electricity pricing options can have a positive influence on end users that occupy the building but these prices have very little, if any, effect on the developer's energy related decisions. The problem can be addressed with hook-up fees. Developers are charged a one-time fee to connect to the grid. The hook-up fee is related to the size of the building load, with offsetting credits for meeting stringent energy efficiency standards. This is a good way to send price signals to developers and collect EPP-related costs.
- *Energy Efficiency-Related Prices*. China already sets prices for industrial consumers using inefficient processes higher than prices for similar consumers using an efficient process. EPP costs can be collected by expanding this pricing option to other customers and by increasing the price differentials.

Incremental revenues from these pricing elements may not be sufficient, by themselves, to cover the costs of EPPs, so some combination of average-cost recovery and targeted price element may be necessary. But, however it is done, the important point is that the EPP costs are recovered in electricity prices, just like the costs of all other components of the system that are needed to provide service to consumers.

5.3.1.2.2. Reformed Pricing Methods Regarding Sales and Profits

In theory, grid company sales reductions due to energy efficiency have no effect on their profits. Electricity prices are equal to marginal cost, energy efficiency results in decreased sales (or lower than anticipated sales growth), and the decreased grid company revenues are fully offset by decreased costs. The end result is that profits (revenue minus cost) are unchanged. In practice, however, this is not the situation. Prices are not equal to marginal cost, and regulatory practices, such as power price linkage schemes and balancing accounts, are used to assure that changes in power supply costs have little or no effect on utility profits. But sales reductions due to efficiency do impact profits.

Under China's current pricing methods, a utility that chooses to buy energy savings from an EPP instead of power from a CPP may lose money even if the direct costs of the EPPs are fully recovered in prices. Pricing policies can create perverse incentives. For example, during on-peak periods the grid company may buy power for a very high price, which in China may be as much as 0.60 RMB per kWh. But current TOU prices for on-peak use may be 1 RMB per kWh. This means for each kWh sold on-peak the grid company receives 0.40 RMB net revenues (price minus marginal supply cost). This is a very profitable sale, even though one might expect pricing policies to discourage grid company sales of peak power.

Next consider what happens if the grid company meets the same demand with energy efficiency from an EPP that costs 0.15 RMB. Several things happen. First, the company's gross revenue drops by 1.0 RMB because the kWh was not sold. Second, its cost goes down by 0.60 RMB because it did not have to purchase expensive power; however, this means that company's net revenue loss is 0.40

RMB (1.0 – 0.60 = 0.40 RMB). And, lastly, the company's cost goes up by an additional 0.15 RMB—that is, by the cost of the efficiency that saved the kWh, which is not included in prices or any balancing account. The grid company's total net revenue is a loss of 0.55 RMB (revenue loss less power cost saving plus energy efficiency cost). But even if the cost of the 0.15 RMB EPP is recovered from consumers, the grid company still loses 0.40 RMB per kWh saved. Additional ratemaking reforms are needed to assure that the utility's overall profitability is aligned with energy policy and is not harmed by cost-effective energy efficiency.[59]

This example considers only one kWh saved during the on-peak period. Determining whether an EPP helps or hurts grid company profits requires a more detailed analysis of prices, costs, pricing methods, and accounting practices. Based on current conditions, it is possible that an EPP will cause grid company profits to fall or to increase more slowly than anticipated even if direct EPP-related costs are included in power prices. However, with current cost and price structures, and expanding energy demand, net lost revenues are a much smaller problem than they are in the US. Indeed, net lost revenues may be zero.

Regardless of the actual outcome in any particular case, the uncertainty of the outcome means policy reform is needed to support Option 1. Policies relating to pricing methods should produce financial incentives for the grid companies that are consistent with energy efficiency and EPPs.

Two approaches have been used internationally to achieve this result: net lost revenue adjustments and revenue-based regulation. Net lost-revenue approaches reimburse the utility for net revenue lost as a direct consequence of investment in DSM. In other words, the grid company is reimbursed for anticipated revenues lost plus any direct EPP costs, minus the costs the utility avoided by not having to provide the electricity saved by the EPP. Revenue-based approaches "decouple" grid company profits from sales and set the utility's revenue (base revenue not including fuel and purchased power costs) at a specified level, *regardless of sales levels*.[60] Both approaches have been used in the US and elsewhere, but the lost-revenue approach has not worked well. It is not presently used in any jurisdictions that have robust DSM efforts. However decoupling mechanisms have been used for many years in California and have been adopted or are being considered in a number of other jurisdictions interested in maintaining utility viability while reducing barriers to energy efficiency.

[59] This divergence of practice from theory results largely from the difference between the short-run effects of efficiency and the long-run effect. In the long run, all costs of production (both capital and operating) are variable and therefore will be avoided by a reduction in demand. In the short run, however, a reduction in sales avoids variable operating costs, but not any capital costs. Since average retail prices more closely approximate the long-run marginal costs of production than the short-run costs (that is, they cover capital as well as operating costs), a reduction in sales means that the component of price intended to cover capital costs is lost to the utility. It is for this reason—i.e., recovery of unavoided capital costs—that ratemaking reforms such as "decoupling" and net lost revenue mechanisms are implemented to overcome the utility disincentives to end-use efficiency.

[60] For a full explanation and comparison of the two approaches see http://www.raponline.org/Pubs/General/disincentives6-94.pdf

5.3.1.3. Adoption of Improved Planning and Investment Process

Under Option 1, EPP investment is directed by an integrated planning process that scientifically identifies the least-cost mix of EPPs and CPPs that are required to meet customers' needs. California, Oregon, Nevada and Vermont are the best US examples of this approach.

China's current planning process is inconsistent with this approach and is not well connected to a rigorous and predictable investment approval process. Better policies in these areas will provide a transparent and predictable current opportunity for EPPs to compete against CPPs.

5.3.2. Option 2

Option 2 has many possible variations with different versions requiring slightly more, or less, policy support. We focus on a particular version of Option 2 in which

- public benefit funds (PBF) are raised through a small system benefits charge (SBC) on all electricity sales or generation, and
- the PBF and EPP-related activities are administered by a government controlled entity.

This Option requires only two basic policy reforms: 1) central level approval of the funding mechanism, and 2) creation of the needed EPP administrative institution. Option 2 can be as powerful as Option 1, especially if it includes some of the planning, adequate investment, and price reforms described under Option 1.

5.3.2.1. Creation of PBF Funded Though Electricity Prices

As described earlier, adding any fee to electricity prices requires central government approval. Option 2 requires the central government to approve a fee added to electricity prices. However, there is a key difference that makes this electricity price reform more likely than the similar reform under Option 1. With Option 2, the SBC is collected by the grid company but they do not keep it or control it in any way. The PBF funds collected through the SBC go to a special energy efficiency fund managed by a separate government or special purpose entity.

There is a substantial body of international experience with this policy. It has been studied extensively in China in connection with energy efficiency and renewable energy. The policy was adopted in China's renewable energy law. The policy and operational details of this approach were studied in depth by the EPP study tour participants.[61] They concluded that it fit China's situation well.

Implementing this policy for Option 2 also requires consideration of several related issues, the most important of which are the form of the SBC and size of the PBF.

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[61] See, *International Experience with Public Benefits Funds: A Focus on Renewable Energy and Energy Efficiency*, CRS, RAP 2004. www.raponline.org/Pubs/China/ChinaPBFfinal.pdf , and

Five Years In: An Examination of the First Half-Decade of Public Benefits Energy Efficiency Policies, ACEEE, 2004, www.aceee.org/pubs/u042.htm

- *SBC form*. The most common form of the SBC is a small surcharge on retail electricity rates on a uniform cents/kWh basis. In a few cases the SBC is collected at different levels from different customer classes (a higher fee for customer classes that receive more of the benefits), or through fixed monthly or annual charges per customer, (which also vary by customer class). It is also possible to collect the SBC as a charge added to transmission services or collected from generation.
- *Size of the PBF*. Under Option 1, the level of EPP funding is determined as part of the planning process with the goal of funding all cost-effective EPPs. International experience with Option 2 approaches shows that the amount of a PBF is generally a political decision that considers many issues. The PBF is never as high as needed to fund all cost-effective energy efficiency. In China, the process being used to establish energy efficiency goals and disaggregate the goals to different sectors is a logical basis to set PBF funding levels.

5.3.2.2. Creation of necessary administrative structures

EPP administration involves at least six activities: 1) general administration and coordination; 2) program development, planning and budgeting; 3) program administration and management; 4) financial administration and management 5) program delivery and implementation; and 6) program assessment and evaluation. Not all of these activities need to be performed by a single entity but the EPP model works best where there is a single technically and financially qualified entity capable of borrowing funds and responsible for "building and delivering" EPPs.
International experience shows there are three main options:

- Utility administration,
- Government administration through regional or central governmental agencies, and
- Use of an independent, non-governmental organization to administer the EPP.

The version of Option 2 that best fits China is to use existing and planned government entities to administer EPPs. Government policy to support this option is the creation and support of the needed government entities.

China's Conservation Law is in the final stages of consideration and is expected to be adopted soon. Based on recent drafts, the law will substantially increase the capability of the central and provincial governments to supervise and encourage energy conservation. The law will create a central and provincial government energy efficiency administrative structure that could fit well with the EPP concept. The best government action now is to assure the Conservation Law authorizes the various energy conservation supervisory bodies to act as the EPP administrators.

5.3.3. Option 3

Option 3 is very similar to Option 2. The only difference is that the source of EPP funding is directly from the government instead of from electricity prices. This option requires only two basic policy reforms: (1) central level approval of the funding mechanism, and (2) the creation of the needed EPP administrator. Policies relating to the creation of the EPP administrator are the same as discussed under Option 2 so they will not be repeated here. However, we will discuss funding approaches.

5.3.3.1. Government Funding Policies

From a policy perspective there are two types of government funding approaches: those that have no direct relationship to the EPP, and those that reinforce and support the EPP goals and purposes. The second approach is clearly better but either would support EPPs.

Funding EPPs from existing tax revenues such as existing income taxes, VAT, pollution fees, or part of the existing 1 fen/kWh construction fee included in electricity prices are examples of government funding approaches of the first type. Redirecting any of these existing taxes would provide the needed funding but it would not use tax policy to influence consumer investment in energy efficiency. Funding EPPs from existing government revenue is more a question of government budget priorities than it is a policy decision. For this reason it may prove a simple first step.

A more effective approach might be funding EPPs though new or increased taxes. This could raise the needed funds **and** provide incentives for energy efficiency. The use of tax policy to support and reinforce other national goals is common in China. The likely candidates are:

- New or increased energy taxes including raising the electricity construction fee, adding a new separate electricity tax or adding an energy tax to fuels used to generate electricity.
- New or increased pollution fees make sense because existing pollution fees are well below the cost of pollution and because EPPs yield very significant pollution reductions.
- New or increased taxes on inefficient buildings, products, or industrial processes have been proposed as a way to help achieve the 20% efficiency goal. This approach also makes sense for EPP funding. EPP energy efficiency programs are designed to fund part (sometimes all) of the incremental cost of energy efficiency investment. These types of energy taxes aimed at inefficient energy use will also encourage consumers to invest more of their own money, thereby reducing the cost of the EPP.
- Government fees and taxes now account for about 10% of electricity prices. These costs are avoided by industrial consumers that build their own generation. This policy is encouraging self-generation that is often inefficient and polluting. Extending the taxes and fees to industrial self-generation makes sense and can help fund EPPs.

All of these policy options have recently been studied in depth by Chinese researchers studying fiscal and tax policies. These approaches have been recommended to encourage energy efficiency and pollution reduction. [62] Combining these tax reforms with the use of the revenues to fund EPPs provides double benefits.[63]

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[62] A major study of the full range of tax and fiscal policies to support sustainable energy and energy efficiency was completed by Chinese researchers in 2005. See National Fiscal And Tax Policy Research For Clean Energy Development, CSEP, available in Chinese at http://www.efchina.org/csepupfiles/report/20061026952182l6.07221842673113.pdf/summary_report.pdf

[63] As mentioned earlier, the energy efficiency resulting from a tax or price increase is a small fraction, perhaps only 10% of the energy efficiency that can be achieved by direct investment in energy efficiency of the funds raised.

5.3.4. Option 4

Option 4 requires no significant policy reform at the central level but we recommend two reforms at the provincial level that can help EPPs.

5.3.4.1. On-Bill Collection of Energy Saving Fee (ESF)

First, we recommend that the Energy Saving Fee (ESF) be collected by the grid company through the electricity bill rather than collected as an entirely separate charge by the EPP administrator or their agent. Having the ESF collected through the electricity bill is within the authority of the provincial government because it is not considered a part of the electricity price. Collecting the ESF this way is not required, but strongly recommended because it offers four significant benefits. Moreover, we have identified no substantive or policy disadvantages to this approach.

On-bill collection provides the following benefits:

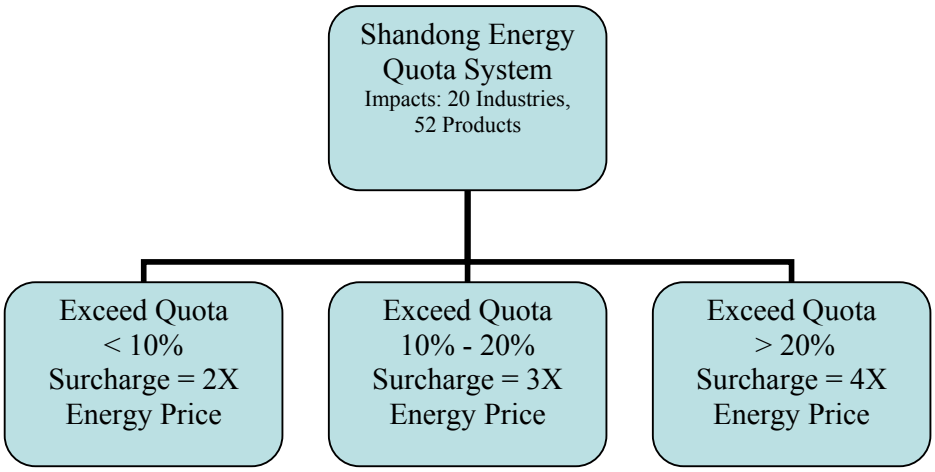
1. On-bill collection reduces collection risk. On-bill financing schemes have been in use internationally. Default rates for loans collected in this way are lower than those for other billing and collection options, especially when disconnection of electricity service for non-payment of electric service applies equally to non-payment of ESF charges. Participant agreement with this collection approach is a reasonable pre-condition to EPP program participation.
2. On-bill collection reduces transaction costs, especially when the EPP is scaled up to cover many more consumers. Grid companies already have billing and accounting systems established. Modifying these systems to accommodate collection of ESF charges will present some one-time costs but these are likely to be very low. We expect that the number of consumers participating in the EPP will be low at first but it can increase significantly over time. Leveraging the existing grid company billing systems rather than creating a new, large scale billing system will reduce billing and collection costs.
3. The risk and cost reductions offered by on-bill collection may be especially important for ESCOs. There are two levels of collection risk when ESCOs deliver energy efficiency services. The first level is the participating customer payment to the ESCO. The second level is the ESCO payment to the lender. If the participating customer defaults in its payment, the risk of the ESCO defaulting on its payment increases. ESCOs are relatively small. The cost of collection, billing and insuring against default risks is a significant barrier to ESCO development. On-bill collection can help reduce these risks and costs.
4. On-bill financing improves communication and marketing of EPP. The bill can be designed to show the estimated monthly cash flow savings and to show that the ESF is lower than the cost of supply.

Our long-term recommendation is for greater integration of EPPs with power sector reform and gradual movement to Option 2 or Option 3. Using on-bill collection with Option 4 creates a small but useful role for grid companies that may help educate grid companies about the opportunities that EPPs create for improved customer service. This will help as the EPP evolves to other models.

5.3.4.2. Coordinate Electricity Quota System with EPPs

Our second provincial-level policy reform recommendation is to coordinate the implementation of an electricity quota system with EPPs.

Shandong has implemented an energy quota system covering 20 industries and 52 products manufactured in the province.[64] They have set energy use (electricity and other fuels) quota levels. As shown below, consumers that exceed the quota level pay a substantial surcharge, as much as 400% of the energy price. The surcharge is paid to the Shandong Energy Conservation Supervision Center and is deposited in a special fund to be used for energy efficiency.[65]



Other provinces, including Guangdong, are currently in the process of designing similar energy quota systems. Coordinating the design of the quota system with the EPP can provide multiple synergistic benefits.

We do not have all of the details of the Shandong approach, but generally, they have chosen to set the quota levels relatively high. The levels of the surcharges are also very high. So, we expect relatively few consumers will exceed the quota but those that do exceed the quota will pay a very high surcharge.

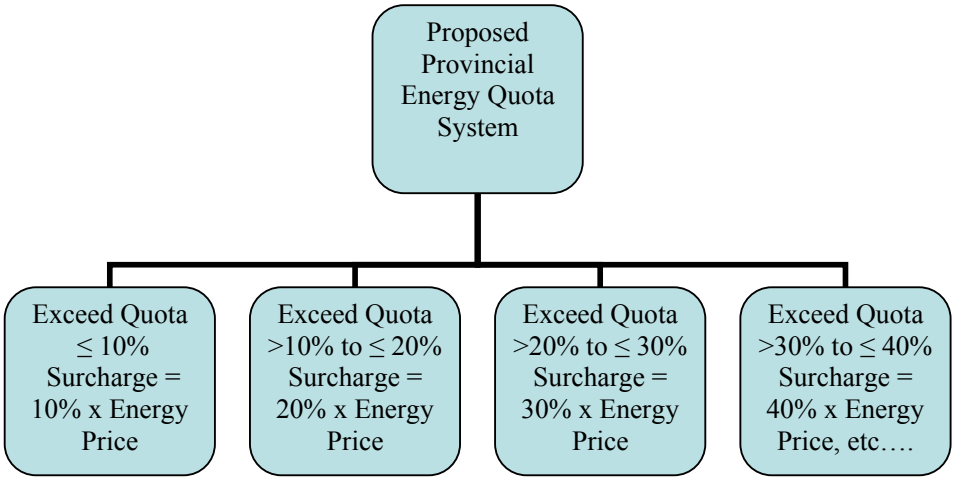
We suggest provinces implement a quota system but with a different policy basis. We believe almost every industrial consumer can improve their energy efficiency by 20% or more. Thus, we believe that the quota level should be set low enough to encourage almost all consumers to save energy. We suggest adopting a quota system coordinated with the EPP using the following principles:

- Set the quota level at a relatively low level so all but the most efficient consumers will exceed the quota. This means candidate participants in the EPP will be subject to surcharges.
- Set a graduated level of surcharges similar to Shandong but with surcharges starting at a much lower level. For example,

[64] The eight industries covered in the central government's differential pricing policy are excluded.

[65] Funding energy efficiency with fines on excessive use was common in China before 2000. It has also been used with success in Brazil. See Demand-Side Management in China's Restructured Power Industry: How Regulation and Policy Can Deliver Demand-Side Management Benefits to a Growing Economy and a Changing Power System, World Bank 2005 available at http://www.raponline.org/Pubs/China/Dec05ChinaDSM.pdf.

    - 10% fine for exceeding the quota by 10% or less, (Shandong's surcharge is 100%)
    - 20% surcharge for exceeding the quota by 10% to 20%,
    - 30% surcharge for exceeding the quota by 20% to 30%, and so on.
    - Note: the surcharges are applied to energy use in excess of the quota.
- Add the funds collected by the surcharge to the EPP fund, allowing the ESF paid by participating customers to be reduced.[66]
- Exempt EPP participants from the surcharges.[67]
- Review the quota level and surcharge levels periodically and adjust to optimize energy efficiency.



This approach has four reinforcing benefits and many positive features:

1. The surcharge creates a powerful incentive for consumers to join the EPP;
2. Using the surcharge to lower the ESF improves the cash flow to consumers, making participation more attractive;
3. The surcharge revenues can be used to shorten the term of the loan, allowing the funds to be recycled more quickly; and,
4. Adding surcharge revenues to the EPP funds allows the financing of more energy efficiency projects.

With this approach, the least efficient consumers contribute the most to the special EPP fund and these same consumers are strongly encouraged to participate in the EPP project. This approach is also consistent with China's "polluter pays" system, where polluters pay surcharges that go to a fund used to help install pollution control equipment. In this case, the fund will help decrease energy intensity.

5.4. Implementing EPPs in the PRC on a Broad Scale

[66] The EPP analysis tool in the Appendix to Part B provides a simple way to add the funds and see the effect of the ESF.

[67] According to present central government policy, consumers subject to the central government's differential pricing would also be exempt from the quota system. These consumers should be encouraged to participate in the EPP.

The January study tour confirmed for the Chinese participants the idea that some version of Option 2—programmatic third-party investment in EPPs, funded by a small fee on all electric sales—is likely to prove the most viable long-term approach to comprehensive end-use efficiency in China. Option 2 greatly reduces the transactional and administrative hurdles that Option 4, with its requirements for individual customer loans and pre-investment reviews, imposes. The model is well-tested and it has proven very successful in a number of jurisdictions, most notably the state of Vermont, where energy efficiency has met more than half of all load growth since the early 1990s.

Several features of Vermont's energy efficiency utility (called *Efficiency Vermont* but referred to here as the EPPA) make it especially well-suited to China. For these reasons, we have crafted Option 2 to more closely resemble it.[68] The approach is characterized by a single, centralized entity, the EPPA, that has both the technical expertise and, with the PBF funding, the financial capability to deliver EPPs. In China, this entity would act as the single borrower of funds to "build and operate" the EPP, thus eliminating the need for prior financial review of individual energy efficiency projects and loans. The EPPA would be responsible for achieving specified levels of savings in the aggregate, and thus would have a strong incentive to identify cost-effective efficiency opportunities (an incentive that could be enhanced with additional rewards for superior performance). Moreover, the EPPA would be subject to very stringent and transparent government oversight and public accountability requirements.

Because each EPP is the aggregate of many individual efficiency investments, it benefits from economies of scale and scope, thereby minimizing the average cost per-kWh of efficiency savings. As our analyses show, we expect that an EPPA in China will be able to "build and operate" EPPs for 15 fen/kWh—that is, for less than half the cost of a conventional power plant. *Efficiency Vermont* operates in essentially the same way and delivers savings at roughly the equivalent cost. Its funds are collected from all consumers on the basis of kWhs *consumed* (currently the charge is about 4% of the price of power); but payments out of the fund are paid on the basis of kWhs *saved*, today at about 3 cents per kWh (subject to verification and performance adjustments).

In addition, the EPPA can be structured so as to align its financial incentives very closely with its public policy objectives. To the extent that the EPPA achieves savings at a lesser cost than expected (or captures greater savings at the expected cost), it can be allowed to pocket all or part of the difference: in this way, it is rewarded for surpassing its performance targets. Savings are verified by independent third parties, assuring that only substantive performance is rewarded.

The EPPA can be a vehicle for related activities as well. It can receive funds from other sources and can deliver efficiency savings in addition to those of the EPPs. For example, government funds from pollution levies, electricity quota fines, other energy fees, or portions of the construction fee (currently 1 fen/kWh) could

[68] *Efficiency Vermont* is described in detail in Section 3.2.3.1.

be dedicated to capturing both additional electricity efficiency and non-electric (e.g., natural gas) efficiency.[69]

Option 2 requires no direct utility involvement. The utility's role can be limited to collecting the SBC funds and transferring them to the entity that will administer the monies and programs. The absence of greater utility involvement in the EPP does not mean, however, that the development of EPPs should be divorced from the utility's system planning process. It's very important that energy efficiency planning be coordinated with power sector planning. The analysis of energy efficiency potential, program design, and monitoring and verification rely on information collected by the grid company. The output of this effort—i.e., the expected savings from new investments in EPPs—is then fed back into the grid company's planning process through lowered demand forecasts and revised expansion plans.

Option 4 and the Guangdong EPP can be easily transformed at any time into the more powerful Option 2 approach (or Option 3). There are two primary practical differences between Options 2 and 4. Under Option 4, participating customers enter into loan agreements and repay the loans through the ESF, a per-kWh charge on their electric bills. Under Option 2, the EPPA is the recipient of the loan, which is repaid by all customers through a similar charge on their bills, the SBC. Expanding the charge funding the loan to all customers would require only a simple change to the program, as would a shift of the loan obligation from individual customers to the EPPA. At a minimum, integrating the electricity quota system as described above is a meaningful step toward a SBC.

There are strong public policy justifications for these changes. First, broad-based funding for efficiency resources, in the same way that supply-side resources are funded by prices charged to all customers, is consistent with China's long-standing policies of equity and economic efficiency. Under Option 4, all of the cost of the EPP is borne by participating customers, yet the EPP delivers substantial environmental and economic benefits—reduced air pollution, increased system reliability, reduced shortages, relief of congestion and other pressures on the transmission and fuel transportation systems, and lower overall market prices for electricity—that are enjoyed by all. When the collective good is improved in this fashion, it is appropriate that all customers contribute to the investment. Option 2 is an administratively simple and efficient way of realizing this principle.

To ease the transition, the move from Option 4 to Option 2 could be implemented through a phased approach. For example, the electricity quota system described above would set the quota at a relatively low level so most customers would contribute to the EPP. The least efficient customers would contribute the most. A second example would be having all or part of the 1 fen/kWh city construction fee earmarked for EPPs.

As suggested above, collecting the EPP monies through a charge (either an ESF or SBC) on electricity bills—that is, giving the grid company the duty of collecting

[69] The Vermont legislature is currently (spring 2007) considering whether to fund oil and propane end-use efficiency investments through an SBC charge on the sales of these heating fuels. If so, *Efficiency Vermont* will likely be given the responsibility of delivering those programs.

the monies—is a key element of both Options 2 and 4. It is the most efficient and transparent means of administering the cash flows. It also formalizes the relationship between the EPPA and the grid company, which is important for the purposes of information-sharing. In particular, changes in customer usage as a consequence of efficiency improvements can be tracked in part through the grid company's billing system. Information of this sort will be helpful to the effort of monitoring and verifying the savings.[70]

In the same way that centralized collection and dispersal of SBC funds by the grid company is administratively efficient, so under Option 2 will be the centralized delivery of EPPs by the EPPA. Resident in the EPPA will be all the technical, managerial, and financial capabilities necessary to the delivery of comprehensive efficiency programs to China's homes and businesses. By aggregating the individual customer loans into a single loan to the EPPA, transaction and overhead costs will be greatly reduced, and the EPPA's average cost per kWh-saved will be minimized. The implementing agent, which under Option 4 is charged with administering the individual loans and efficiency investments, can naturally evolve into the EPPA under Option 2—that is, into a single, expert entity dedicated to energy efficiency. From the very start, therefore, a critical objective of the program should be the creation, staffing, and training of an Implementing Agency whose ultimate responsibility will be the delivery of many EPPs in Guangdong, in other words, to act as the EPPA. This approach will be easily replicated in other provinces.

The EPPA can be structured in any of a variety of ways. A key factor in determining the EPPA's level of staffing will turn on the question of how much of the technical expertise in designing and installing efficiency improvements will be provided by employees of the EPPA or will be supplied by third-party contractors, e.g., ESCOs. There is no hard-and-fast rule about how to divide the tasks among the EPPA and independent contractors; each jurisdiction finds the balance that best suits its particular conditions. *Efficiency Vermont*'s staff numbers over 100 people; it retains in-house the engineering and design capabilities for large commercial and industrial efficiency investments. Residential measures are provided through appliance vendors, hardware stores, housing architects, and construction contractors. The Energy Trust of Oregon, in contrast, subcontracts all of its program delivery functions. In California and Massachusetts, the role of EPPA is assigned to the grid companies, who subcontract with ESCOs and others to install the measures in their service territories. Policymakers in both these states set goals for increasing third party implementation as more energy service businesses were formed. In the end, a certain amount of labor is needed to deliver the measures. How the tasks are apportioned between the EPPA and third-party contractors may have some effect on the total costs of the program, which should be considered in the final decision on EPPA structure, but, even so, efficiency's essential tasks cannot be avoided. The overall magnitude of program costs will not be materially affected by the organizational approach.

[70] Tracking changes in consumption through billing data is not a substitute for rigorous monitoring and verification activities, but it can provide general estimates of the magnitude and timing of savings. Billing data are, of course, useful to an assessment of the potential net impacts of efficiency on the grid company's revenues.

5.5. Central, Regional, and Provincial Actions

Moving forward to implement these EPP options requires coordinated actions from the central, provincial, and regional government agencies.

5.5.1. Central level

Findings from this study and the EPP study tour have illustrated that EPPs can be an effective approach to put energy efficiency on the same footing as the conventional power plants (CPP), and offer a range of options that would move China to a more scientific and rational model of long-term energy planning. The critical first step for the central government agencies is to choose one or more EPP options for provincial pilots. If Option 4 is chosen, as is the case in Guangdong, then the central government agencies need to encourage the pilot provinces to decide on an oversight and administrative structure for the implementation of EPPs.

If the options chosen are those other than Option 4, the central government agencies need to decide on both the funding mechanism and a minimum level of funding, which can be raised as the pilot projects gain momentum. The EPP study tour team has concluded that some variations of option 2 (Public Benefit Fund) would be the best fit for China. This has also been the focus of extensive studies by experts in China. Without such policy reforms initiated by the central government agencies, it would be difficult for provinces to adopt these EPP options.

The central government agencies also need to decide what institutions should be charged with implementation of EPPs and oversight functions, once public or tariff-based resources are used to support the building of EPPs. Given the lack of transparency in cost structure in China's electric utilities and inherent disincentives for utilities in energy conservation under the current revenue scheme, non-utility players may be better motivated to implement EPPs. However, there are few alternative institutions that are capable of this implementation role in China today. The Energy Conservation Law, which is under revision now, has called for a revival of local energy conservation service centers at provincial and city levels. These organizations can potentially be well-suited to implement EPPs, once their capacity is strengthened. It is important that the revision of the Energy Conservation Law authorizes local energy conservation centers to implement EPPs. In addition, such centers need to be adequately staffed and funded.

In addition to these steps, the central government agencies should integrate EPPs as part of overall energy and investment planning process, and initiate planned policy reforms that could benefit EPPs. These reforms include increasing pollution levies, optimizing tariff structure, incorporating environmental cost in energy prices, environmental dispatch, and other tax and fiscal incentives for energy conservation. The central government agencies should also support the development of monitoring protocols that document and verify energy savings associated with EPPs.

5.5.2. Provincial level

Once the choice of EPP options is made, preferably jointly by the central and provincial government agencies, the provincial agencies need to identify or create

an entity that would implement EPPs across sectors, the EPPA. The EPPA should have the necessary technical, managerial, and financial capabilities to identify, select, and implement projects across targeted customer classes, and manage the project portfolio and other subcontractors. Provincial government agencies also need to develop policies or rules that govern the operation of EPPs and the reward for EPPAs, and approve monitoring and verification plans.

In the Guangdong pilot, Guangdong Energy Conservation Center (GDECC) is the EPPA that would select and manage the installation of EPPs. In addition to overseeing GDECC, relevant Guangdong government agencies also need to decide on a mechanism to collect the ESF from participating customers.

Strengthening the EPP needs two provincial policy decisions:

- First, deciding to collect the ESFs through electricity bills in order to control default risks and reduce transaction costs. Relevant Guangdong government agencies need to ensure that the local utility would take on this collection function on behalf of the EPPA – GDECC.
- Second, implementing an electricity quota system to reinforce the EPP by lowering the ESF and encouraging consumers to participate in the EPP.

China's energy planning and investment process starts at the provincial level and is then incorporated in national plans. Thus, the provincial authority also needs to incorporate EPPs in provincial energy and investment planning processes.

5.5.3. Regional level

Grid companies are regional. SERC has regional branches that supervise the regional electricity market. If Option 1 is selected, SERC should ensure that EPPs are built into the regional electricity market and SERC's regulations. Actual EPPs are more likely to be built within a small geographic boundary, for example, within a province. Therefore, there may be little need for policy actions at the regional level.

5.6. Policy Priorities

The government should consider the following actions and policies as priorities in order to develop successful EPPs.

In the near future:

1. The central government agencies should first decide what EPP option or options to allow, what funding mechanisms the options will use, and what funding levels will be set.
2. If final decisions by the central government cannot be made soon, the government should promptly authorize additional provincial pilots based on one, or more, of Options 1, 2 and 3.
3. Provincial agencies need to decide who will be the local EPPA, address any capacity building needs, and determine an oversight structure to monitor the progress of EPPs. The provincial government should also adopt on-bill collection and electricity quota systems designed to support EPPs.
4. The central government should assure that the Energy Conservation Law and any other relevant laws authorize energy conservation supervisory agencies to perform the functions of an EPP administrator.

In the medium-term:

1. The central government should take steps to integrate EPPs into power sector reform plans, and power sector regulation, and electricity pricing structures.
2. Both central and provincial government agencies should integrate EPPs into their respective energy and investment planning processes.

Appendix A: Characteristics of International EPP Examples

State/Entity	Program Administrator	Funding Mechanism	Spending (% revenue)	Integrated with Long Run Resource Plan	EPP costs recovered in rates	Grid Company Incentives/ Shared Savings	Annual Cumulative Savings (% of annual retail sales) (2003)
OPTION 1			**(2005)**				
California	Grid Companies	Tariffs + SBC	3.0%[α]	Yes	Yes	Yes	7.5%
South Africa	Grid Company	Tariffs		Yes	Yes		
OPTION 2			**(2003)**				
Connecticut	Grid Companies	SBC	1.10%	Yes	Yes	Yes	7.8%
Massachusetts	Grid Companies	SBC	2.38%	No	Yes	Yes	5.8%
New York	Gov't Agency	SBC	0.8%	No	Yes	No	3.02%
Oregon	Third Party	SBC	1.71%	Yes	Yes	No	6.0%
Rhode Island	Grid Companies	SBC	1.9%	No	Yes	Yes	6.2%
Vermont	Third Party	SBC	3.0%[β]	Yes	Yes	No	4.8%
Wisconsin	Gov't Agency	SBC	1.39%	No	Yes	Yes	4.4%
Brazil	Grid Companies, Third Party, and Gov't Agency	SBC	1%[δ]	No	Yes	No	
Denmark	Grid Companies, Third Party	SBC		Not found	Yes		
Norway	Gov't Agency	SBC		Not found	Yes		

[α] These are 2005 levels with approximately 1.5% coming from SBC funding and 1.5% from investment recovered in tariffs. The percentage of spending from procurement funding is expected to rise incrementally through 2012 in order to meet savings goals established in 2004.

[β] The SBC was increased in 2006 to about 5% of revenue to accommodate increased EE procurement. New SBC levels are 5mils/kWh for residential customers, 4 mils/kWh for commercial customers, and 3 mils/kWh for industrial customers.

[δ] In addition, Brazil's government funds some EE programs.

Appendix B: 2006-2008 California Utilities Energy Efficiency Programs and Cost-Effectiveness

PG&E - Program Specific Summaries[71]				
Program Names	**Mass Markets**	**Agricultural and Food Processing**	**Fabrication, Process and Heavy Industrial Manufacturing**	**High Technology Facilities**
Short Description	This program is a new integrated approach to serve residential and small commercial customers with similar purchasing patterns, vendors, and approaches to energy use. Large commercial and industrial customers will be channeled through this program for some deemed savings measures.	Specialists in these areas will provide targeted services to agricultural and food processing customers.	This program serves the heavy industry market. The program will support energy efficiency project development through on-site facility audits, facility benchmarking and customized design assistance and engineering support as well as incentives for energy efficient retrofit and new construction.	This program offers high technology facilities energy specialists to provide a wide range of energy services including incentives for projects to improve energy efficiency in new and existing buildings.
% of IOU Budget (w/o EM&V*)	49.24%	5.72%	15.85%	1.99%
MWh	575,503	49,456	96,827	13,786
MW (Summer Peak)	96.21	8.2	21.01	2.99
Mtherms	2.7	1.92	9.24	0
TRC (w/o EM&V*)	1.66	3.28	3.11	1.93
Design & Delivery	The Mass Market program will use a variety of up stream, mid-stream and down stream approaches to involve all actors in this integrated market.	The program will use specialists from PG&E and third parties to facilitate delivery of a portfolio of energy services. It will include statewide elements along with specific components tailored to PG&E's customers.	The program will have statewide elements and customized support.	The program will incorporate statewide rebate elements as well as elements specifically targeted to and customized for PG&E's high technology customers.
Markets Targeted	Mainly residential and small commercial. Other programs may channel customers into the deemed savings component for certain measures, e.g., an industrial customer with a small item or limited number of items to replace (a motor) could participate in the Mass Market program, but mid-and large-sized projects at industrial sites are not the main targets for the Mass Market program.	Targets new and existing agricultural and food processing facilities. Both types of customers have high energy intensities where energy bills are large components in profit margins and both sectors have unique measures and systems that require experienced utility representatives.	Manufacturing and process industries such as printing plants, plastic injection molding facilities, lumber and paper mills, metal processing, petroleum refineries, chemical industries, assembly plants and water treatment plants.	Biotechnology, pharmaceutical plants, electronics manufacturing, cleanrooms, data centers, and telecommunications.

[71] From CPUC Decision 05-09-043, Attachment 3. See http://www.cpuc.ca.gov/PUBLISHED/Graphics/49863.PDF

Pacific Gas & Electric
Summary Table of Portfolio Cost-Effectiveness (2006-2008)

Costs and Benefits	SDG&E	SoCalGas	SCE	PG&E	Total
Total costs to billpayers (TRC)	$299,443,761	$225,381,390	$857,516,394	$1,341,473,455	**$2,723,814,999**
Total savings to billpayers (TRC)	579,619,963	318,003,849	2,367,984,783	2,153,115,608	**5,418,724,203**
Net benefits to billpayers (TRC)	280,176,202	92,622,459	1,510,468,390	811,642,153	**2,694,909,204**
Total PAC Cost	266,000,587	177,115,748	661,327,990	959,472,970	**2,063,917,295**
TRC Ratio	1.94	1.41	2.76	1.61	**1.99**
PAC Ratio	2.18	1.80	3.58	2.24	**2.63**
Cost per kWh saved ($ / kWh) (PAC)	0.0344	0.0246	0.0282	0.0335	**0.0302**
Cost per therm saved ($ / therm) (PAC)	0.1862	0.1666	-	0.2849	**0.2126**

Source: California Public Utilities Commission Decision 05-09-043. See http://www.cpuc.ca.gov/PUBLISHED/FINAL_DECISION/49859.htm

Appendix C: International Examples

Option 1 International Examples

South Africa

Structure

Energy efficiency has gained importance in South Africa as a consequence of increasing demand, rising prices, and looming capacity shortages, as well as a growing appreciation of efficiency's ability to support environmental and social goals. China and South Africa share some of these concerns, but South Africa's approach is also of interest because development of the ESCO industry is an important goal of its DSM strategy.

The DSM Fund, created in 2002, is funded by electric tariffs and used to support efficiency and load management programs. Eskom, the nation's major electric utility, manages the Fund and oversees the implementation of DSM programs.[72] DSM activities are designed to support goals set through Eskom's National Integrated Resource Planning (NIRP) process. The most recent NIRP calls for Eskom to save 4,255 MW over the next 20 years, with annual goals beginning at 152 MW and increasing over time.[73] Savings goals are designed to defer the need to build new power plants and are divided roughly equally between the residential and commercial/industrial sectors. Major DSM installations are implemented primarily through arrangements with ESCOs. Installations approved by Eskom will be funded, in whole or in part, by the DSM Fund.[74]

Programs

ESCO-installed energy efficiency and load management programs are offered to residential, commercial, and industrial customers, and include an arrangement in which savings are shared between the participating customer, Eskom, and the ESCO. Historically, Eskom's primary areas of focus were load management programs and lighting initiatives, but some recent ESCO installations have been comprehensive, involving heating, lighting, air conditioning, ventilation, water pumps, and other custom measures. Eskom also offers lighting initiatives, educational programs, and programs focused on energy savings in elementary schools. A current initiative is an agreement between the government, Eskom, and light bulb manufacturer Osram to provide 500 million compact fluorescent light bulbs to areas of Cape Town affected by power shortages.

Key Policies

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[72] In 2006, the National Energy Efficiency Agency was created to oversee energy efficiency programs. This move is designed to address Eskom's disincentive to reducing electricity use (since its revenues are based on sales). Eskom will continue to maintain oversight of its load management programs, as they reduce the company's financial losses during times of peak demand. The new agency is likely to make some changes in the regulatory oversight and administration of energy efficiency programs beginning in 2007.

[73] See http://www.wbcsd.org/web/publications/case/energy_efficiency_full_case_final_web.pdf and http://www.ner.org.za/documents/Energy%20Efficiency%20and%20Demand%20Side%20Management%20Policy.pdf

[74] For more information on Eskom's DSM programs, see http://www.eskomdsm.co.za.

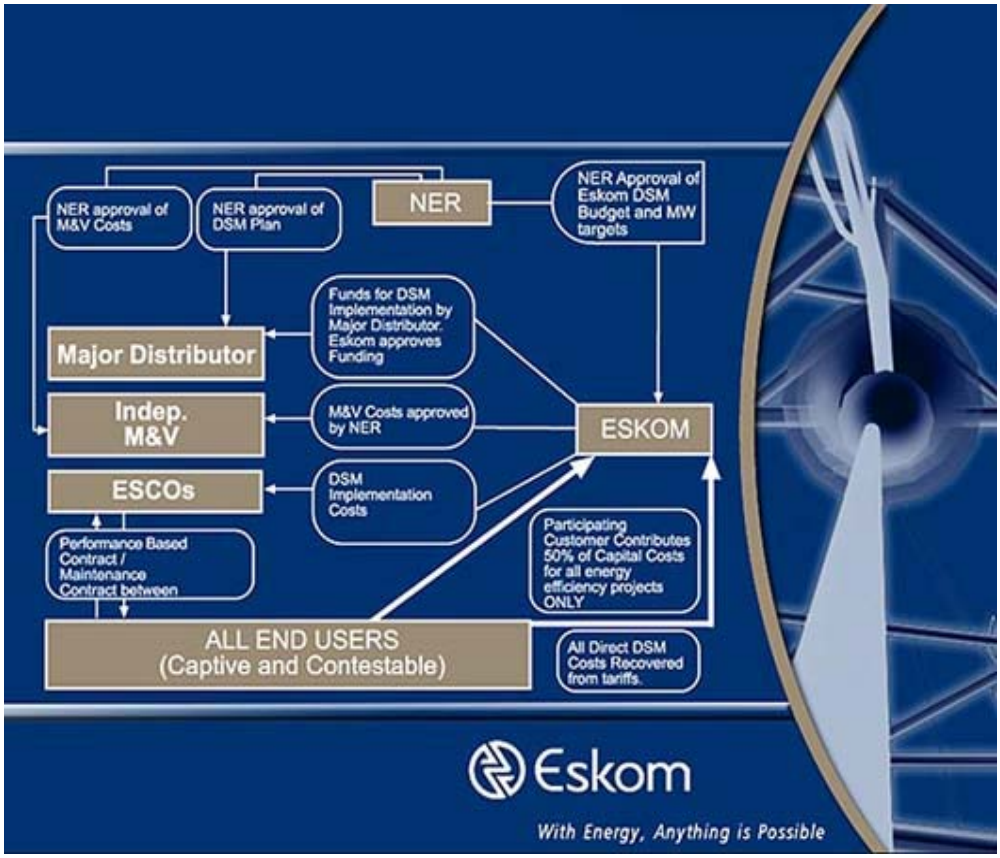
- Regulators and the utility recognize that energy and demand savings will defer the need to build additional power plants and transmission and distribution infrastructure, lower the increase in electricity prices, reduce emissions, and save water.
- Policymakers understand that the market, by itself, will not capture all cost-effective energy efficiency, and created the DSM Fund to support additional investments.
- Most DSM programs are designed to support the ESCO market.
- The shared savings arrangement was designed to provide incentives to each participant (Eskom/utility, customers, ESCOs) to participate.
- DSM has been a useful strategy for improving low-income consumers' access to electricity.
- The DSM Fund stimulates economic development, since a portion of funding for ESCOs is earmarked for black-owned businesses under the government's Black-Owned Enterprises policy.

Role of ESCOs

ESCOs implement most of Eskom's energy efficiency and load management programs. Eskom is responsible for pre-screening and approving projects to ensure that only projects with cost-effective savings potential are undertaken. Eskom maintains a database of qualified ESCOs and connects these ESCOs with customers. ESCOs conduct initial energy audits used to propose projects, and they implement the efficiency projects approved by Eskom.

Eskom provides full or partial financing for the installations. For demand response projects, Eskom pays 100% of capital costs. For energy efficiency projects, Eskom provides 50% of the capital costs, and the customer provides the other 50%. Projects are selected that will supply savings of at least 500 kW per project.

Eskom generally enters into a multi-year contract with the customer and ESCO to share the efficiency savings. Programs are designed so that savings will be sustainable and persist at least for the term of the contract. All savings are verified by an independent third party and compared to the baseline model of energy expenditures expected without the efficiency measures. This shared savings agreement is designed to allow Eskom to accumulate reserves for future efficiency and demand response programs.



Results
In 2004, ESKOM achieved savings of 197 MW. 114 MW were saved through energy efficiency and 83 MW were saved through load management.

One example of an ESCO-implemented project involved the Carlton Centre, one of the Southern Hemisphere's largest buildings. This comprehensive project included improvements in lighting, heating, ventilation, and air conditioning. Savings from the R5.6 million project are expected to reach 1.15 MW and 2.125GWh annually.

Option 2 International Examples

Brazil

Structure

Brazil allocates 1% of utility revenues to fund energy efficiency and research & development (R&D) activities, collected through a wires charge[75]. The 1% of revenues is divided between utilities and the CTEnerg fund, which is governed by an independent Board of Directors. In general, CTEnerg funds "public interest" projects that require more long-term financing and carry greater risk, while utilities fund projects with short payback times, as well as projects that offer maximum profit (or least loss) to the utility. Both utility and CTEnerg funds are split between efficiency and R&D. One result of this fragmentation of the fund's uses has been that programs are not integrated into planning, and synergistic opportunities are lost.

Brazil also has a government-funded efficiency program, Procel, which is administered by Electrobras, the federal energy holding company. Procel predates the 1% requirement, and manages programs in many aspects of electric consumption, including codes and standards, public education, and sector-specific efficiency programs.

Efficiency spending peaked during 1998-2004. Direct spending on efficiency has declined since 2004, although the system still benefits from earlier savings measures, particularly energy-efficient lighting, which is widespread in public areas and among domestic customers. (The current emphasis has shifted to research and development; in addition, some funds have been diverted by the government office of planning for other purposes.)

Programs

Efficient lighting, both public and private, has been the largest focus of Brazil's efficiency programs. Programs are also offered to residential, industrial, and commercial sector customers. Electric utilities design and implement (or outsource – see below) programs for industrial customers. Customers are then required to repay a portion of the investment in monthly installments, based on anticipated savings.

Key Policies

Role of ESCOs

Many utilities outsource individual efficiency projects to ESCOs. In these arrangements, typically the utility maintains the contractual relationship with the client, but the ESCO performs the actual installation.

Results

The utility portion of the 1% public benefits fund acquired savings of 499 GWh and 100 MW (less than 0.25% of demand) in the 2003-2004 cycle. (Results were not available for CTEnerg programs. Additional savings were obtained from Procel programs, but these savings are not subject to monitoring and verification.)

[75] For more information, see http://3countryee.org/public/WirechargeMechanismBrazil.pdf

Denmark

Structure
Energy efficiency programs in Denmark are funded in two ways. Electricity network companies collect the Public Service Obligation levy ("the levy"),[76] which is used to fund the companies' efforts to achieve the required minimum of 121 GWh of savings annually. In addition, residential and public sector customers pay an "electricity savings charge" equivalent to $US 0.01/kWh (DKK 0.006/kWh)[77]. These funds are administered by the Danish Energy Savings Trust ("the Trust"), which operates efficiency programs aimed at the public and residential sectors, as well as a variety of information and market transformation programs. The levy and the Trust are two elements of an overall energy policy that encourages carbon reduction and energy efficiency through a system of "green" taxes, subsidies, and voluntary agreements between industry and government.

The Trust is an independent organization, entirely funded by the electricity savings charge. Efficiency installations funded by the Trust are targeted specifically for the public and residential sectors, but other activities overseen by the Trust promote efficiency throughout all sectors. The Trust also works to promote the use of energy efficient appliances by working with manufacturers and retailers and offering rebates and incentives. Federal law requires that the Trust maintain minimal staff levels, and, as a result, the Trust's role is largely supervisory, with most activities implemented by outside consultants and organizations.

Programs
Public Service Obligation levies are used to fund energy audits, which the energy companies must provide free of charge to customers. Audits are mandatory for all new residences and for a certain percentage of commercial and industrial customers annually.

Most of the Savings Trust's programs are targeted toward the public and residential sectors. A major focus is on the conversion of homes from electric heat to either district heat or natural gas. Other programs focus on energy efficiency installations in public buildings, promotion of energy efficient appliances, and lighting and ventilation initiatives. The Trust also promotes efficiency by offering information and advice and overseeing voluntary energy savings agreements with commercial and industrial customers.

Key Policies
- Energy Trust activities are just one of many policies aimed at reducing greenhouse gas (GHG) emissions.
- The country has instituted a system of taxes and other incentives to promote acquisition of energy efficient resources.

Role of ESCOs

[76] Energy Efficiency Programs and Services in the Liberalised EU Energy Markets, Wuppertal Institute. Available at:
http://www.wupperinst.org/energieeffizienz/pdf/BEST_background_document.pdf.

[77] From Act No. 1209 of 27 December 1996. See
http://www.ens.dk/graphics/Publikationer/Laws/Act_no_1209_Lov_om_elsparefonden.pdf

ESCOs are used to carry out all Savings Trust installations. ESCOs and other entities may propose projects for approval and funding by the Savings Trust.

Results[78]
A 2004 analysis of the Saving Trust's activities predicted that cumulative lifetime benefits of the Trust's activities-to-date would total 15,000 GWh. Annual savings from 2007 programs were expected to total 1,000 GWh. Energy company audits have resulted in approximately 2.2 TWh of savings annually. The Trust's fuel-switching programs have resulted in annual savings of around 248 GWh.[79]

Massachusetts, Cape Light Compact

Structure

The electric sector restructuring legislation passed in Massachusetts in 1997 allowed municipalities to aggregate for the purposes of obtaining power supply and energy efficiency services. The Cape Light Compact ("the Compact") was thus formed, and it presently serves all 21 towns in the Cape Cod area and the island of Martha's Vineyard. The Compact currently:

- Aggregates into a single purchasing entity the region's municipalities to negotiate electricity contracts and develop renewable energy resources.[80] It then supplies power to those who choose it, in a competitive retail market;
- Acts as consumer advocate for all of the area's electric consumers (close to 200,000), and
- Provides low income, residential, commercial and industrial energy efficiency programs, and energy education programs for the entire region.

Delivery of energy efficiency programs involves the local distribution utility (NStar), the Compact, third-party vendors, and consumers. The utility collects a state-mandated $.0025/kWh efficiency system benefit charge (SBC) in rates. The Compact plans and manages the programs, using SBC funds proportionate to area electric consumption. Consumers request the programs, and vendors implement them.

The Compact has a six-person staff of energy professionals governed by a Board of Directors, and funded by a small portion of the SBC funds. Each of the 21 towns appoints a board member. The Compact staff develops program plans and submits them as a courtesy to state regulatory agencies.[81] The Compact issues Requests for

[78]Rambøll Management, *Evaluation of the Danish Electricity Saving Trust.* 2004. See http://www.ens.dk/graphics/Energipolitik/dansk_energipolitik/energisparepolitik/elsparefonden/Evaluation_of_electricity_saving_trust.pdf

[79] Energy Efficiency Programs and Services in the Liberalised EU Energy Markets, Wuppertal Institut Available at: www.wupperinst.org/energieeffizienz/pdf/BEST_background_document.pdf

[80] The Compact is interested in long-term supply contracts and ownership of renewable power projects, but has encountered various barriers. The Compact is exploring the formation of an energy-related cooperative, to address these issues. See *Cape Light Compact Cooperative Investigation Study*, September 2006, at: http://www.capelightcompact.org/pdfs/060920a%20CLC-CoopStudy-Phase%20I%20FINAL%20executive%20summary.pdf

[81] Distribution utilities must submit plans to one state regulatory agency for program and budget review, and another for review of cost-effectiveness and use of third-party vendors and determination

Proposals (RFPs) for third party vendors to implement programs. Successful vendors are listed on the Compact's website. All electric consumers in the Compact's territory are eligible for the programs, even if they don't buy electricity supply from the Compact. The Compact participates in regional efforts with the Northeast Energy Efficiency Partnership and/or other utilities when beneficial to consumers in the Compact's territory.

NStar estimates, based on forecasted electric demand, the SBC fund total for the Compact's territory for the coming year. NStar then sends the Compact a flat monthly payment (total divided by 12). There is a true-up process by the end of the first quarter of the following year, once actual annual demand figures are known. The Compact pays vendors for program implementation, but does not enter into shared savings contracts.[82]

Programs[83]

- The Residential ENERGY STAR® New Construction Program provides home buyers, home builders, and construction trade allies with technical assistance and financial incentives to increase the efficiency of homes that are newly built or undergo major renovations.
- The Residential MassSAVE Program provides all interested residential customers with energy savings education, home energy audits, and financial incentives for numerous electric and non-electric efficiency measures, including financial support to switch electric space heating systems to more efficient systems that use other fuels.
- The Residential ENERGY STAR Products and Services Program seeks to increase the availability and use of ENERGY STAR qualified lighting and appliances, including: clothes washers, room air conditioners, dehumidifiers and refrigerators.
- Residential High Efficiency Central Air Conditioning Program ("MA COOL SMART" with ENERGY STAR), which was introduced in the Spring of 2004, promotes the purchase and installation of ENERGY STAR qualified central air conditioning systems in new construction and market conversion of older heating, ventilation and air conditioning ("HVAC") units. The program also is designed to increase the number of trained technicians in the state and to improve the quality of installations.
- The Low-Income Single Family Program provides low-income customers in single-family dwellings with assistance in purchasing and installing efficient lighting, appliances, and weatherization measures.
- The Low-Income Multi-Family Program provides owners and managers of low-income multi-family dwellings with assistance in purchasing and installing efficient lighting, appliances, and space heating measures.

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of performance incentives. The Compact does not request performance incentives and is not required to submit plans and budgets for review. However, it chooses to meet the same requirements as utilities regarding cost-effectiveness, low-income benefits, program scope, use of third party vendors, etc.

[82] See http://www.capelightcompact.org for information about the Compact's history, goals and organization.

[83] Program descriptions and results are taken from *The Cape Light Compact 2005 Annual Report on Energy Efficiency Activities*, which can be seen at http://www.capelightcompact.org/pdfs/2005%20DOER-CLC%20Annual%20Rpt%20Combined%20FINAL.pdf

- The Low-Income New Construction Program provides low-income housing development agencies, weatherization assistance program ("WAP") providers, and residential construction trade allies with incentives to increase the home energy rating of new low-income housing.
- The Commercial and Industrial New Construction Program provides technical assistance and financial incentives to increase the efficiency in the construction, renovation, and/or remodeling of all commercial, industrial, government, and multi-family housing facilities.
- The Medium and Large Commercial and Industrial Retrofit Program provides technical and financial assistance to medium and large commercial and industrial ("C&I") customers seeking to do discretionary replacements of existing operating equipment and processes in their facilities with high-efficiency alternatives.
- The Small Commercial and Industrial Retrofit Program provides technical assistance, financial incentives, and direct installation services to small C&I customers to replace existing operating equipment and systems with high-efficiency equipment.
- The Government Agencies Program provides technical assistance and financial incentives to all government facilities, including municipal, state, and federal facilities.
- The Commercial and Industrial Products and Services Program seeks to increase the availability and use of more efficient motors, lighting designs, and HVAC systems.

Key Policies

- Efficiency programs have a stable, long-term funding source.
- Program planning is comprehensive, responsive to community needs, and accountable to consumers.
- Programs must be cost-effective, with a benefit/ratios (under the total resource cost test) of at least 1.0. They have generally been 2.0 and higher.
- All customer sectors are eligible for efficiency services. Low-income programs are guaranteed a minimum investment.
- Third-party vendors are used to deliver programs. Independent third parties are used to measure and verify savings.
- Education programs are used to advance an energy efficiency and renewable energy ethic.
- Economic savings, competitive benefits, and environmental protection are goals of the program.
- The Compact is non-profit and does not use program funds for incentives.

Role of ESCOs

The staff of the Cape Light Compact manages the overall program. Third-party vendors, including ESCOs, are chosen to implement programs through a competitive bidding process. Successful vendors are chosen to implement one or more programs, and sign one-year contracts with the option to renew for another year. Vendors are paid for services, but, as previously mentioned, do not contract for shared savings with the customers or Cape Light Compact.

Most of the successful vendors have been large regional or national companies, such as RISE Engineering or Honeywell. They often hire and train local employees, creating jobs in the area. The Cape Light Compact has had some bad experiences

with smaller ESCOs that inflated savings or claimed to have installed measures when they had actually mailed them to customers. Separate third-party evaluations verify and measure savings, and provide feedback to the Compact regarding program and vendor quality.

Results

Despite significant growth in the Compact's territory, improvements in energy intensity have kept total electricity consumption close to constant over the past five years. In fact, electric consumers in the Compact's territory reduced total consumption by 3 - 5% in calendar year 2006 compared to calendar year 2005. The number of consumer accounts has grown from 158,000 when the Compact began offering services in 2001 to almost 200,000 in 2006 and yet overall consumption has stayed flat.[84] See Table __ for the most recent year's results.

Cape Light Compact: Savings and Expenses for 2005		
Total Costs	$5,144,998	
Program Implementation Costs	$4,197,512	
Annual Savings	12	GWh
Lifetime savings	119	GWh
Summer Demand	1.87	MW
Winter Demand	2.77	MW
Total Resource Cost Test	2.36	Benefit/Cost
Total Costs include program implementation costs, measurement and verification expenses and customer contributions.		
Source: *The Cape Light Compact 2005 Annual Report on Energy Efficiency Activities*, which can be seen at http://www.capelightcompact.org/pdfs/2005%20DOER-CLC%20Annual%20Rpt%20Combined%20FINAL.pdf		

Norway

Structure

Energy efficiency programs are administered by Enova[85], a government-owned non-profit entity. Enova was established in 2001 to manage Norway's Energy Fund, which is used to finance energy efficiency and renewable energy projects. Initial funding came from government grants. Current funding, however, is provided by a levy on electricity tariffs of 1 Øre per kWh (about $0.001 US$). In 2005, Enova's budget was NOK 788 million (about 120 million US$), including funds spent on efficiency, wind energy, and heat energy. Enova is governed by a contract with the Ministry of Petroleum and Energy.

Programs

Programs are focused on industry, commercial buildings, new construction, and outdoor equipment (including electricity used for transportation). Enova has broad leverage to develop rebates and other incentives to encourage efficiency. Residential

[84] Personal communication 8 November 2006 between Kevin Galligan, Energy Efficiency Program Manager at Cape Light Compact, and Catherine Murray, Research Director at the Regulatory Assistance Project.

[85] For more information, see http://www.enova.no/

efficiency programs are a small portion of overall efficiency programs. All programs are required to be cost-effective over the lifetime of the measure (10 years for efficiency programs, 20 years for wind and heat projects).

Key Policies

Role of ESCOs

Results
In 2005, Enova funded 186 projects, for an "energy result" of 2 TWh. Projects included 585 GWh of new wind power, 409 GWh of new heat energy, and a reduction of 999 GWh from energy efficiency programs. Overall for the period 2001 to 2005, Enova contracted for energy results of well over 6.6 TWh, of which 2.8 TWh came from energy efficiency programs.

Appendix D: Report from the January 2007 EPP Study Tour

Learning from California's 30 Years of Unchanged Electricity Consumption Per Capita And Quadrupled Growth Of GDP:
Study Report on America's Efficiency Power Plant Policies and Practices

In January 2007, a group of 12 government and industry representatives[86] embarked on a study tour to learn about U.S. policies and experiences with Demand Side Management (DSM) and Efficiency Power Plants (EPPs), in order to promote research and pilot project implementation in China. The group engaged in in-depth exchange with the California Public Utilities Commission (CPUC), California Energy Commission (CEC), Pacific Gas and Electricity Corporation (PG&E), Vermont Energy Efficiency Utility (VEEU), Lawrence Berkeley National Laboratory (LBNL), Nexant (an energy services company), and third party and consumer representatives; the group also went on three site visits. On the basis of this study tour, as well as local conditions in China, the group carried out a symposium, continued research, and formulated recommendations on how to further promote DSM and improve energy efficiency in China.

1. Study Background and Purpose

Within the category of DSM projects, EPPs are "built" when the energy saved through more energy-efficient equipment and processes equals the quantity of electricity provided by a conventional power plant, accompanied by reduced pollutant emissions. Conceptualizing energy savings as a "power plant" provides a more tangible description for energy efficiency, simplifies supply- and demand-side comparisons, and brings the cost advantages of DSM into focus in energy supply selection.

Research and pilot projects are urgently needed to promote DSM through administrative and market mechanisms, and to reaching energy conservation and pollution emission reduction targets. Also needed is enhancement of the "portability" of pilot projects to other regions, through overall systems design and supporting measures. Therefore, the relevant departments of State Development and Reform Commission and Ministry of Finance signed an agreement to cooperate on EPP research with the Asian Development Bank (ADB) in 2005, with policy research was divided into central and local levels. Guangdong was selected as the site for primary development of EPPs, supported by ADB loans, in early 2007. Guangdong also signed an agreement for technical assistance on project preparation technical assistance with ADB. The relevant parties are now working to build an EPP equivalent to one 300MW power station in Guangdong, using 100 million dollars of loans.

Such work has gained the attention of leaders at various levels of government. For instance, the "State Council's decision on strengthening the energy conservation work" (issued on the 28th [2006]) requires that China "promote the building of

[86] Including the State Development and Reform Commission (NDRC), Ministry of Finance, State Electricity Regulatory Commission (SERC), Guangdong Provincial Development and Reform Commission, Guangdong Finance Hall, Guangdong Economy and Trade Commission, State Grid Corporation of China, South Grid Corporation, Guangdong Grid Corporation and Guangdong Haihong Transformer Corporation

efficiency power plants and improve service efficiency of electric energy". In January 2007, Premier Wen Jiabao and Vice Premier Zeng Peiyan emphasized the importance of a state-run special report on an EPP project in Jiangsu. Ma Kai, director of the National Development and Reform Commission (NDRC), also emphasized EPPs at a conference in 2007.

After careful inspection of the various sites, the group decided that focusing on the approaches of California and Vermont would be most helpful for achieving real gains in China. Since the oil crisis in the 1970s, California has emphasized improving energy efficiency and DSM, proving able to maintain constant electricity consumption per capita with quadruple growth of GDP; in the rest of the U.S., electricity consumption increased by an average of about 50% during the same period. Representing two typical patterns, California uses power companies as the main body of implementation, Vermont—the first state to propose and implement EPPs—relies on non-profit institutions.

2. Study Observations

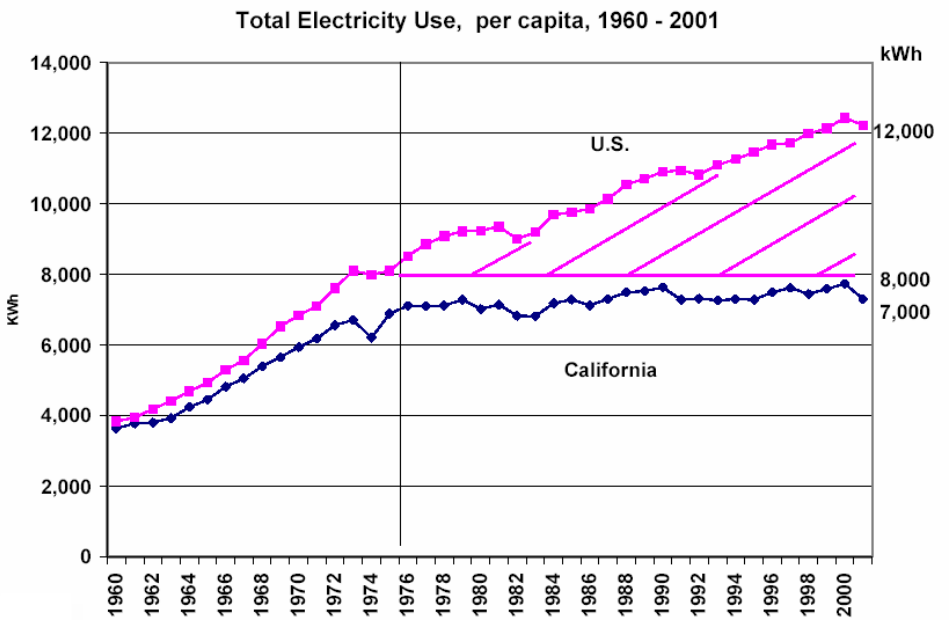
Two-thirds of states in the U.S. are developing DSM with participation greatest along the coasts; among these states, California was the first to develop DSM, and has met with the most success. Coal-producing states in the central United States have lower participation rates.

2.1 California's experiences

California is located between latitude 32 degrees and 42 degrees north, by the Pacific Ocean, with a total area of 411,100 square kilometers, and total population of 36.13 million at the end of 2005. In 2005, California's GDP reached 1.62 trillion dollars, the largest in the U.S., and equivalent to the aggregate Chinese economy.

2.1.1 California' DSM effectiveness

After the world oil crisis occurred in the 1970s, the economy in California was seriously affected. Since then, to ensure energy security and slow energy demand, California government has unremittingly carried out energy efficiency projects. Through these efforts, California has formulated the principle that DSM is the preferred method to meet electricity demand, followed by demand response (similar to interruptible load), renewable energy, and finally, conventional fossil fuels. In the last 30 years, as stated previously, California's economy has quadrupled, and per capita electricity consumption has remained basically unchanged; during the same period, per capita electricity consumption in the United States increased almost 50%.



(Figure 1: The map of per capita electricity consumption growth contrast between California and the United States since 1960)

During the 2000~2001 energy crisis in California, the state suffered power shortages due water shortages, soaring natural gas prices, and serious deficiencies in the electricity market system design. The California government used DSM measures to reduce summer peak load by 10%. While keeping sustained economic growth, total electricity consumption in the whole society has decreased by 6%. What is particularly worth mentioning is that the average cost of these measures was only 0.03 dollars per kilowatt-hour, which was about one-third of the average cost of power construction during the same period. Meanwhile, such measures allow the avoidance of 50 ~ 160 hours of power cuts per year.

Table 1 DSM implementation input and effectiveness in California during the power crisis of 2000~2001

	Project quantity	Total investment	Electricity saving at the first year	Electric power saving	Investment cost during the life of project
Unit	Unit	Ten thousand dollars	MWh	MW	$/kWh
DSM project	218	89300	4,760,184	3,389	0.03

(Source: Global Energy Relationship, California study briefs)

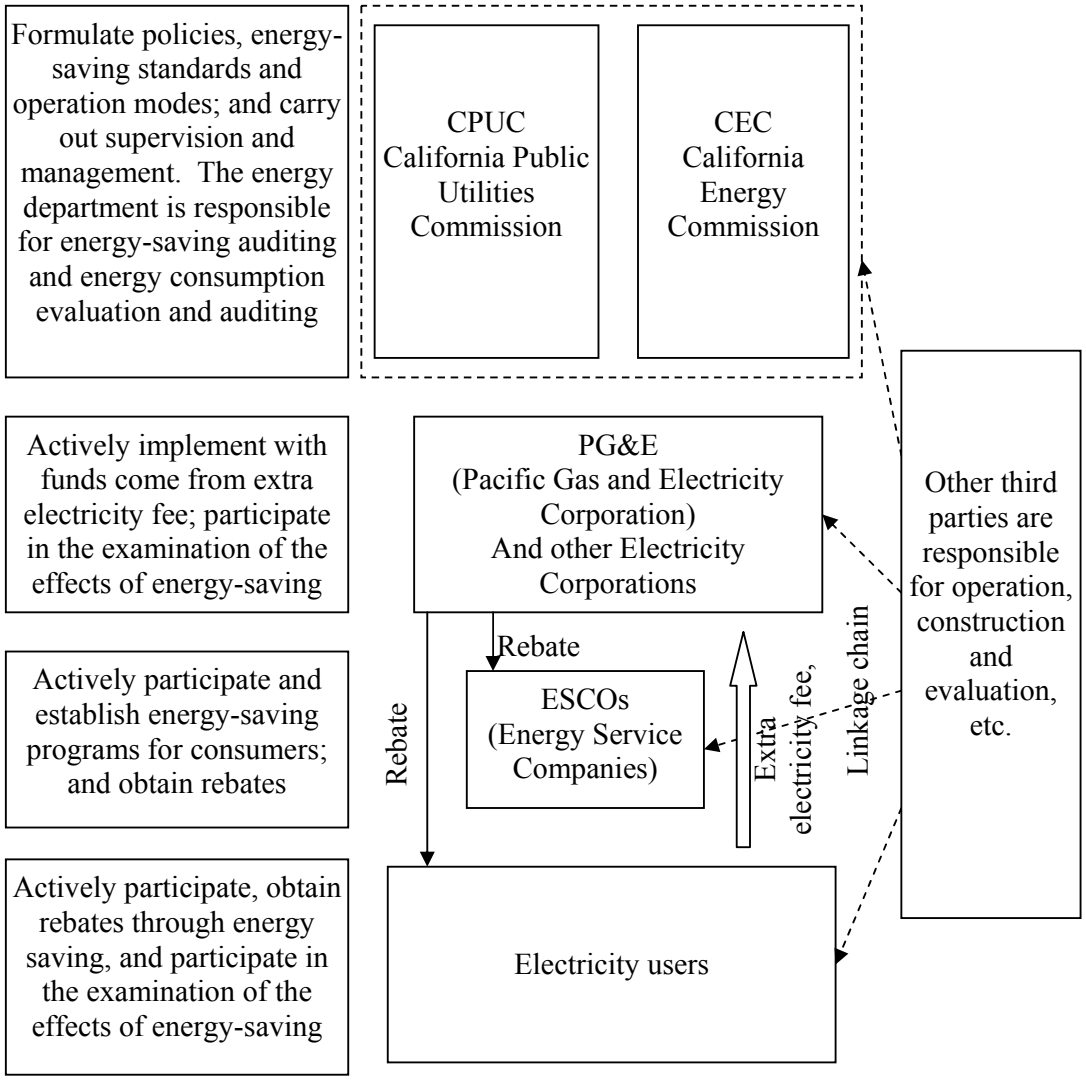
The efforts during these years has had the following effects:: (1) since 1975, California has depended on implementing energy efficiency standards for buildings and electric appliances, reducing the energy costs for residents and enterprises in California by 56 billion dollars; (2) these experiences formed the energy service industry, which employs 30,000 people; (3) California's cumulative electric load has been reduced by 12 million kilowatts, accounting for about 15% of the total electric load and equivalent to reducing or postponing the building 24 large power plants, saving 40 billion kilowatt-hours of electricity consumption every year, and reducing greenhouse gas emissions by about 17%.

2.1.2 Implementation mechanism and patterns

California mainly depends on power companies to carry out DSM. California Public Utilities Commission formulated the "Decoupling policy" in the 1980s, specifying that the profits of power companies were to be based on the rate of return on fixed investment. Thus, business profits and other such indicators are mainly dependent on assets and costs, and are unrelated to electricity sales. The California Public Utilities Commission (PUC) authorizes the costs and investments of power companies, and then adjusts electricity prices to achieve a certain return on their investment. Meanwhile, power companies can obtain additional rewards for effectively improving energy efficiency. For instance, in 2004, due to the outstanding energy efficiency improvements, PG&E received rewards greater than the return on investment.

The required funds for DSM in California come mainly from electricity surcharges, which are about $600 million every year. The funds are mainly used for product and project rebates, technology development, systems design, etc. Supported by these funds, more than 200 types of energy efficiency projects have been launched in California.

Responsibility is divided as follows:



(1) CPUC and CEC are responsible for formulating the rules, designating funding structure, supervising and managing. With planning periods of 10 years, they

implement adjustments every two years using integrated resource planning. CEC establishes departments to study new technologies and new standards, and is responsible for the promotion and the introduction of energy-saving technologies and products, as well as the establishment of new standards.
(2) As the implementation bodies, power companies are responsible for the implementation of energy efficiency projects. DSM funds come from electricity surcharges, which are managed by government departments. Power companies depend on Energy Service Companies (ESCOs) which can facilitate the opening of markets or implementation of energy efficiency projects. Of PG&E's 20,000 employees, 600 are engaged in energy efficiency work.
(3) As the main participants, Energy Service Companies (ESCOs) spur the opening and explore the potential of markets, and benefit from rebates along with consumers. ESCOs design energy efficiency programs based on their own experiences and potential consumer needs , which are implemented by third parties. The energy-saving effect of energy efficiency projects can be verified by the CPUC, CEC, consumers, power companies and others. During this study, we visited NEXANT, of which 75% of business comes from government-related energy-saving projects, illustrating the importance of government support for the development of energy efficiency service industries.
(4) Consumers cooperate with ESCOs, or directly participate in public energy efficiency projects (with energy-saving lamps, for instance), and benefit from rebates. For commercial projects, governments usually give rebates that shorten the payback period to less than two years.
(5) Important third party participants include consulting firms, construction and building enterprises, etc., which are mainly responsible for consultations, construction, building and evaluations for energy efficiency projects. CPUC, CEC, power companies, ESCOs and consumers may cooperate with such third parties. For instance, NEXANT is developing energy conservation projects in oil refining enterprises, relying on third parties familiar with the oil refining enterprises and processes to design better programs and develop a better market for energy-savings.

2.1.3 Future energy-saving goals

In June 1, 2005, Governor Arnold Schwarzenegger of California signed Executive Order S-3-05, which establishes carbon dioxide emission reduction targets: by 2010, emissions must be cut to 2000 levels; by 2020, emissions must be down the levels in 1990; by 2050, levels must be 80% below 1990.

During 2006-2008, California will invest two billion dollars (from the electricity surcharges) in energy efficiency, and help the residents in California to reduce energy charges. The investment will be mainly used for the following: to meet more than half of future electric load growth, and avoid the construction of three large-scale (0.5 million kW) power plants; by 2008, to reduce more than 300 tons of greenhouse gases every year, equivalent to the one-year emissions of 650,000 cars; to save more than 2.7 billion dollars of net value for users; and, by 2009, to reduce user bills by 2% on average.

2.2 Vermont's practical experiences

Vermont is situated in the northeastern United States, with a total area of 25,000 square kilometers, with an economy ranking 43rd in the United States. By the end of 2005, the population was more than 0.6 million, ranking 48th in the United States. In 2005, Vermont's GDP was over 20 billion dollars.

Vermont established the Vermont Energy Efficiency Utility (VEEU) in 2000. VEEU is the implementation body for energy efficiency work, responsible for the

supervision and management of energy efficiency projects. Now it has more than 100 employees, and is the first energy efficiency agency in the United States. Its funds come from electricity surcharges, known as a Public Goods Charge. In recent years, through developing DSM, Vermont has reduced about 50% of the growth of its electric load, and has made good return on investments. Therefore, the state government supports further Public Goods Charges, which now account for 3.5% of electricity fees, ranking first in the United States.

Responsibility is divided as follows
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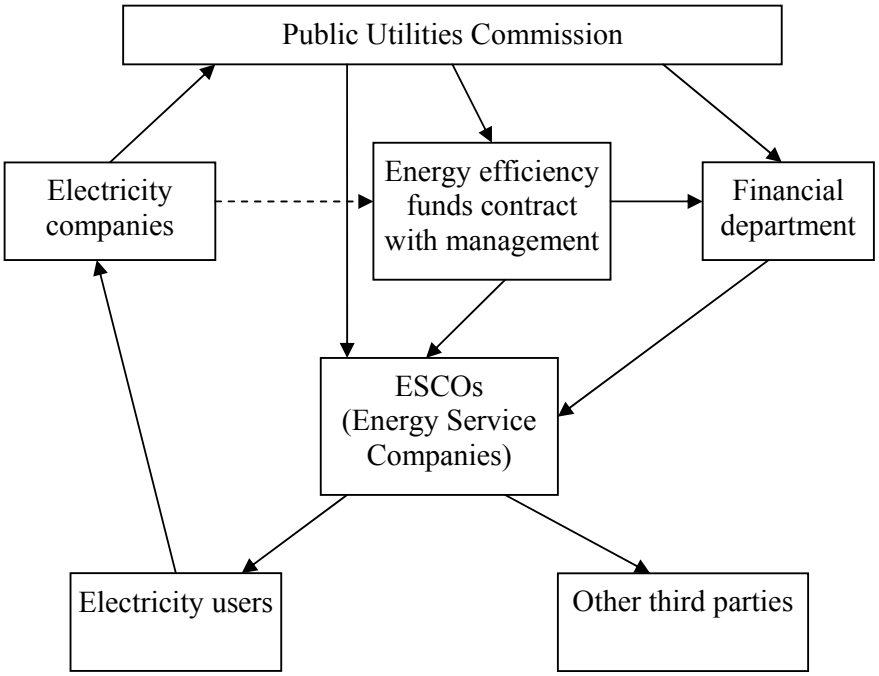


(1) The Public Utilities Commission is responsible for formulating the rules to implement energy efficiency projects, designating funds sources and carrying out supervision and management. They cooperate with Energy Service Companies to promote the development of energy efficiency projects.
(2) Power companies are responsible for charging electricity fees and providing load management and other information for the energy efficiency contract management agency.
(3) As the implementation bodies, Energy Service Companies actively open up and explore the potential of markets. They sign energy conservation contracts with the Public Utilities Commission, implement energy efficiency projects, and benefit from rebates.
(4) Consumers cooperate with Energy Service Companies or participate in public energy efficiency projects (such as by using energy-saving lamps, etc.), and benefit from rebates.
(5) Third parties include consulting firms, and construction and building enterprises, and are mainly responsible for the consultation, construction, building and evaluation of energy efficiency projects.
(6) The energy efficiency contract management agency is the agency responsible for supervision and management. They manage the contracts between the Public Utilities Commission and Energy Service Companies, and supervise and manage the funds disbursement from financial department to Energy Service Companies. The energy

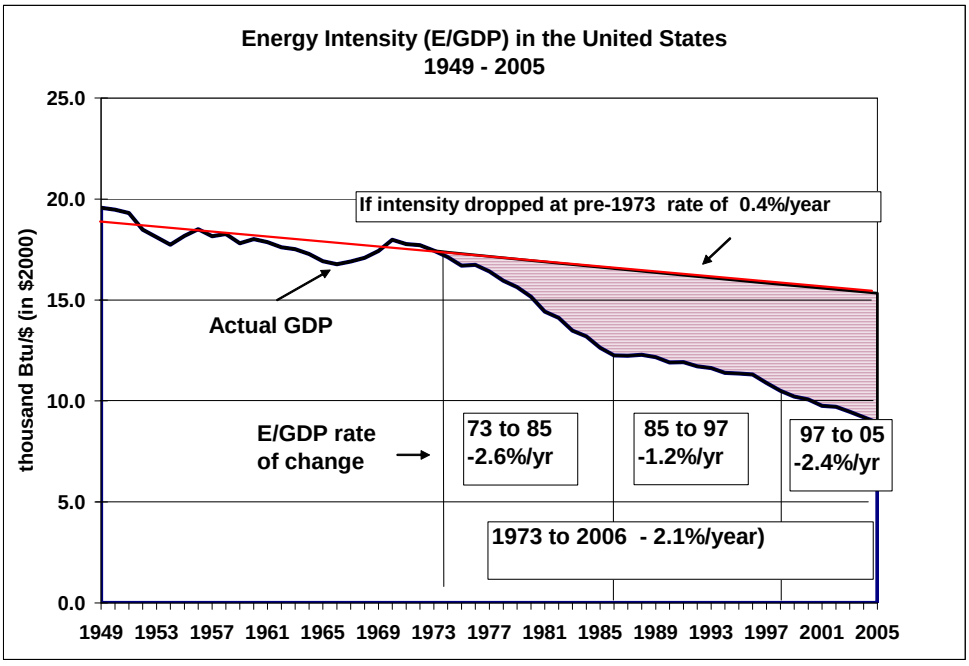
efficiency contract management agency takes data from the power companies, have developed a software platform, monitor the electricity consumption of the majority of users, explore energy-saving potential, study energy efficiency programs, and provide consultation for the Public Utilities Commission.
(7) The financial department is responsible for funds disbursement to ESCOs, and is subject to the supervision of the energy efficiency contract management agency.

3. Study Insights

During this study, we developed close contacts and a deeper understanding of energy efficiency through in-depth discussion with many parties, including the policy-making parties (CPUC and CEC), the policy-implementing parties (EVVU and PG&E), project implementation parties (Nexant) to the end-users, from high-level decision makers to low-level operators.

3.1 Many countries have formulated energy conservation and emission reduction targets, and made real gains.

LBNL showed us that in addition to China, there are more than 20 countries and regions in the world that have formulated energy conservation and emission reduction targets. For example, the Netherlands has made the target that the energy efficiency in 2000 must be 20% from 1989, and exceeded the target with energy efficiency, achieving a 22.3% reduction. From 1973 to 2006, the United States has realized annual energy consumption per unit of GDP reduction of 2.1% and cumulative reduction of energy consumption of 50%. The U.S. has also formulated the target that greenhouse gas emission per unit of GDP should be reduced by 18% by 2012.



(Figure 2: the map of energy consumption per unit of GDP in the United States from 1949 to 2005)

3.2 Good system design and external conditions are the foundation for energy conservation and emission reduction

In the process of the mining and use of fossil resources, the environments are polluted and natural resources are consumed, with negative social externalities. The benefits of energy conservation and emission reduction are shared by the entire society, with positive social externalities. For individuals, investment in energy conservation can

be seen as spending money primarily to benefit others, with a longer payback period. Moreover, consumers may be short of reliable information on energy-saving technologies and products, lack specialized knowledge on the energy-saving changes, and face financing difficulties; even in developed countries, market failures widely exist in the energy-saving fields. Therefore, these countries depend on system design, and convert the external costs of environmental pollution and resource consumption into internal costs through taxes, fees and other methods. They convert the external benefits of energy conservation and emission reduction into internal benefits through rebates, public purchasing and other methods, and depend on a carrot-and-stick approach to promote energy conservation and emission reduction. Primary measures include the following:

3.2.1 Set up funds or special funds for publicity training, rebates, loans assessment, etc.

About half of the states in the U.S. have set up public benefit funds, mainly settled by electricity surcharges. These states are mostly located in the east coast or west coast, where the economy is relatively developed, and the sense of environmental protection is strong. Among these states, California raises the largest amount of funds, reaching an average of 500 million dollars/year in recent years; Vermont has the highest expropriation proportion, reaching around 4.5%. In addition, in the last couple of years, five or six central states that have started similar work. Internationally, 30 countries have established such funds, including developed countries, such as the United States, Britain, France, Germany, as well as developing countries, such as Brazil, India, and Thailand.

3.2.2 Establish an implementation organizations and systems involving the government, non-profit institutions or grid corporations

In addition to the government departments that formulate policies and regulations, states also have special organizations to ensure the effective use of funds. Vermont set up the Vermont Energy Efficiency Utility (VEEU), including about 100 employees; New York State has one government agency; California mainly depends on implementation by grid corporations, and PG&E has about 600 employees engaged in DSM-related work. These agencies employ consulting firms, engineering units and other companies to provide energy efficiency services for the public. It is estimated that after 30 years, California now has about 30,000 people working on energy efficiency, accounting for about 1‰ of the total population, and this not only promotes energy conservation and emission reduction, but also forms an important component of the service industry, and addresses the problem of unemployment.

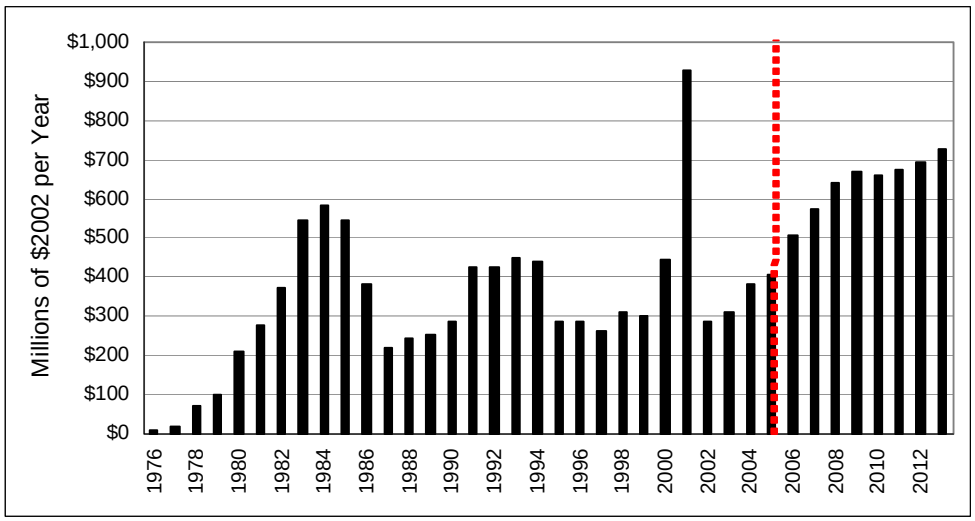
3.2.3 Establish a good auditing supervising system and energy-saving computation standard, and ensure implementation

In the process of study, we observed that for the entire process of the project (e.g. selection of projects, transfer of funds, effect identification) independent third parties supervised enterprises , consumers, and government agencies, in order to ensure the effectiveness of implementation and the efficiency of projects and of the use of funds. California uses five percent of public benefit funds for auditing, and has developed standardized evaluation and testing tools for consistent management.

3.3 The cooperativeness of grid corporations is mainly dependent on the system guarantees

California depends on grid companies to implement DSM, to initial surprise of the study group. Through talks with the general managers, department managers and frontline staff at CPUC and PG & E, the group came to understand that it is benefit

adjustment mechanisms that make grid companies willing to engage in such efforts. In the early 1980s, California started to decouple company profits from electricity sales and implementing fixed rates of return on investment; in other words, profits are independent of electricity sales. CPUC oversees assets and costs, on the basis of which it calculates profits. CPUC then depends on electricity prices to adjust. During the mid-1990s, California carried out reform of the electricity system, and implemented a mechanism of price competition to supply power to the grid, which did not include the DSM and which led to a sharp decline in investment. After the power crisis, however, California refocused on the role of the demand side, leading to rapid growth in investment. Now, if grid corporations can surpass the energy efficiency requirements of the CPUC, the rate of return increases further: for each dollar saved, grid corporations receive 0.25 dollars. DSM personnel indicated that just a few years ago, companies ignored this benefit, believing the policy to be unprofitable; during the past two years, however, as the rewards of energy efficiency came to exceed even the main business profits, companies reversed their behavior. In the United States, there are now seven states that have implemented decoupling, and there are eight states who are considering such a move.



(Figure 3: California energy efficiency investment map for 1976-2012; projected values are included for years after 2006)

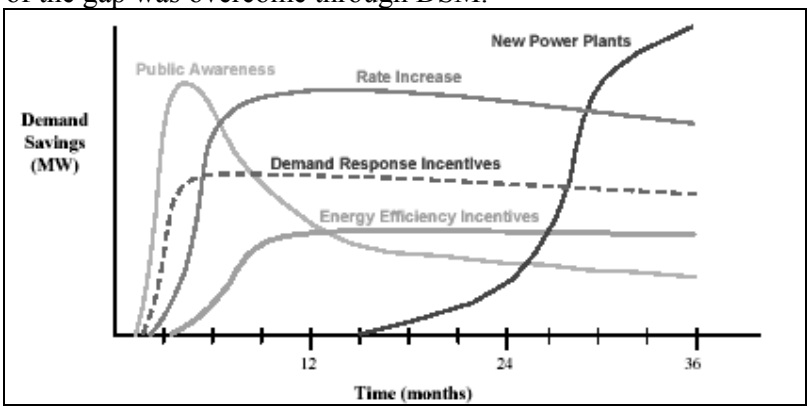
3.4 The government plays a decisive role in the improvement of energy efficiency

According to LBNL, ESCOs grew as California improved energy efficiency in the 1970s, and these companies continued to develop as the government continued to carry out energy efficiency services. The vice president of Nexant also indicated that 75% of their business has ties to government funds, and that without the conditions provided by the government, it would be very difficult to develop. Therefore, the division of labor and cooperation between administration and private sector is as follows: administrative forces establish regulations and systems, and improve the macro-level environment, such as by providing rebates to increase the investment value of energy efficiency projects; these benefits are gradually realized in the market. For example, without government rebate, the payback period for high-efficiency motors and lighting is very long, unless government rebates can shorten the period and therefore induce consumers to make the desired switch and thus to create business opportunities. Whether in the United States or Europe, the government is very important and plays a decisive role in efforts to improve energy efficiency.

3.5 Demand-side resources often have cost advantages, and should be considered as the primary option

When California considers electricity supply and demand, primary consideration goes to DSM projects, followed by renewable energy, and finally, conventional thermal power units. Although energy-saving equipment sometimes has longer investment payback periods, service life is often longer, and there are continuous energy conservation and emission reduction benefits that are considerable over the life-cycle of the product. Over the 30 years in which energy efficiency has been implemented, California has reduced the maximum electrical load by 12 million kilowatts, or 15%; now, California saves 40 billion kilowatt-hours of electricity each year. In addition, to meet the same demand, the cost of EPPs is usually about one-third to one-half that of new power plants, which has also proven to be the case for EPPs in Jiangsu and Guangdong.

In addition, DSM measures often have more immediate effects. During the energy crisis, California depended on DSM to reduce electricity demand by more than 5 million kilowatts. A few years ago, China also was short of electric power, and more than 70% of the gap was overcome through DSM.



(Figure 4: Time needed to take effect by various demand responses)

Note: from light color to dark colors, the curves respectively represent the following measures: demand response incentives (dotted line), public awareness, energy efficiency incentives, rate incentives, and new power plants.

Source: California Energy Commission

3.6 Formulating and promoting energy efficiency standards is very important

For electrical equipment, buildings and factories, the United States has implemented the Energy Star program, to formulate and promote energy efficiency standards and labels. In the last 15 years, two billion products have been sold under the Energy Star standard. With these energy-saving products, consumers saved 12 billion dollars of energy costs in 2004, and reduced about 20 million kilowatts from electricity load. Now, in Europe, the Energy Star program has also been launched. American experts forecast that if the new energy-saving standards for Chinese refrigerators and air-conditioning are fully implemented, after 10 years, the annual electric quantity saved by these equipments will equal the electricity produced by Three Gorges Dam.

3.7 Improving energy efficiency needs long-term, painstaking work, tailored to local conditions

The diversity of energy efficiency-improving technologies and the different characteristics of consumers' needs shape the diversity of the energy efficiency projects. Over 30 years, California has launched more than 200 kinds of energy efficiency projects, and among them, 38 kinds of projects have been implemented in the entire state, while other projects have been implemented in some regions, or are

aimed at certain consumers. Different types of projects have different rebate standards, with relatively independent implementation methods. These experiences have been aggregated to inform long-term processes. Moreover, publicity efforts are comprehensive and detailed, covering different languages, relying on simple energy computation calculation table, and including such measures as telephone counseling, questionnaires, and door-to-door services. Each state is attentive to local conditions for energy efficiency implementation, with varied agency set-up, management processes, and implementation bodies.

4. The policy suggestions for DSM work

After electricity shortages in past years, DSM has made considerable progress; however, there are still many shortcomings:

- First is the lack of funds and protection. Besides Hebei, Jiangxi, Shanxi, Jiangsu, Fujian and Shanghai, other regions have not established special DSM funds. Moreover, these funds are often temporary, seriously restricting the development.
- Second, organization agency is imperfect, and implementation remains weak.
- Third, the development of DSM is mainly dependent on administrative measures, and practices are one-dimensional. As funds and staff are insufficient, the main focus of current work is on load management, and depends on administrative measures. However, lack of compensation for end-users and inadequate economic incentives affect the establishment of long-term mechanisms.
- Fourth, implementation mechanisms are insufficient to mobilize all parties to fully participate. On the one hand, DSM reduces the rate income of Grid Corporation, and as investment does not see reasonable compensation, the willingness of the grid corporation to participate is affected. Furthermore, as incentive policies are not in place, end-users are also not especially willing participants. .

To carry out DSM in China, the group has the following recommendations:

4.1 The government should play a stronger role to improve energy efficiency

The government should use further administrative measures to strengthen energy efficiency requirements. When formulating binding targets, layouts and other macro-level guidance policies, the government should simultaneously develop and implement incentive policies and punitive measures, strengthen publicity training, formulate standardized procedures, and determine computation methods and reasonable evaluation criteria, in order to properly cultivate market development

4.2 Speed the establishment of incentive mechanisms

- First, the government should establish funding for DSM. One approach is to set up financial special funds; another approach is to set up funds through surcharges such as an extraction of 0.1-0.2 cent/ kWh for DSM; DSM costs can also be figured into power supply costs. Doing so would provides funding guarantees to facilitate the long-term and effective development of DSM, to fund publicity training, rebates, establishment of standards, privileged credit, and the setting up of guarantees. Funds could be modest at initial stages and be gradually increased to match the fund, project management and development of human resources.
- Second, tax relief, accelerated depreciation, pre-tax expenses lists and other incentive policies are needed to speed up the promotion and

application of energy conservation, energy storage, load management and other technologies and equipments.

- Third, flexible pricing policies are needed to regulate the difference between peak and valley electricity demand periods. China needs to establish peak and valley price linkage mechanisms on the supply side and demand side in order to expand the price difference between peaks and valleys; to expand the difference between prices during shortages and periods of electricity abundance; to establish seasonal prices; to expand the scope of the implementation; to study and formulate peak pricing and interruptible pricing; and to increase differential pricing.

4.3 Construct a robust organization system

China should build up DSM implementation agencies, to ensure the implementation of DSM policies and measures. The implementation agencies could rely on such options as reform of existing energy-saving monitoring agencies, establishment of DSM guidance and display centers, transformation of electricity providers into energy service providers, or the establishment of an energy intermediary service market and energy intermediary service companies.

4.4 Strengthen the system of standards and assessment

To carry out DSM layout and establish detailed action plans, it is necessary to assign energy saving targets for each region, industry and key enterprise. China needs to improve mandatory energy efficiency standards as soon as possible; improve a DSM target assessment and examination system; establish a comprehensive system for energy efficiency data statistics; develop a support system for energy efficiency testing technology and statistics management; and construct a system to provide real-time quantification and assessment of energy efficiency and DSM efforts.

4.5 Further promote application of energy efficiency labels

China needs to strengthen the implementation of the "Energy Efficiency Labels Management Methods", and put forth more catalogs of products suitable for "Energy Efficiency Labels Management Methods" as soon as possible. The product catalogs should establish minimum energy efficiency standards; products that fail to meet minimum energy efficiency standards should be prohibited from production and sale.

4.6 Increase the role of the Grid Corporation

Global energy security and climate warning problems have become increasingly prominent, and market-oriented reforms have revealed many problems, such as the conflict between economy and security, laxity of energy efficiency management, and so on. As a result, some countries in Europe and the United States have changed their approach towards the role of power industries to that of improving energy efficiency and strengthening energy security. Meanwhile, along with improving awareness among electricity industries, we should also change the grid testing system, putting greater emphasis on social responsibility and social services, such as improving energy efficiency and providing high-quality services. Measures such as pricing system design or prices should be used to compensate Grid Corporation’s investment in energy efficiency, thereby capitalizing on its management experience, access to information and technology, and enhancing its enthusiasm for energy conservation and emission reduction.

4.7 Strengthen the publicity, training and human resources, and further develop international exchanges

China should use varied publicity strategies to publicize the concepts, significance, role, technology and products of DSM; to publicize successful cases; and to provide consumers with technical information and experiences with DSM. There is also a need to improve training of the relevant personnel in the government, power enterprises and consumers.

5. The implementation suggestions for speeding up the Guangdong EPP projects

5.1 Speed the deployment of technical assistance projects and preparations for loan projects

According to the "Decision of the State Council on the per capita GDP energy consumption targets plan in each region during the '11th Five-year'", Guangdong Province should reduce per capita GDP energy consumption by 16% during the 11th Five-year Plan. As the target in 2006 has not been reached, the pressure for energy conservation will be greater from 2007 to 2010. Meanwhile, Guangdong's total energy use ranks as advanced in China, but efficiency ranks only 14th, and its electricity demand has continued to grow rapidly n recent years. Therefore, it is urgent to carry out EPPs in Guangdong Province.

Now, the State Development and Reform Commission, Ministry of Finance and the ADB have given much support to the Guangdong EPP pilot projects, and Guangdong itself has a relatively mature market environment and financial management foundation; moreover, the Guangdong provincial committee and government are highly attentive to these projects, with close cooperation from relevant departments. Therefore, conditions for carrying out pilot projects are ripe. It is suggested that the relevant parties should invest more time and energy, speed up the progress of work, and strive for the completion of the projects first phase of preparation, project selection and evaluation in the third quarter of 2007.

5.2 Enhancing the role of the government in EPP projects

Energy conservation is systematic work that should be actively led by the government, with the participation of the entire society. Guangdong authorities should speed up the development and improvement of relevant supporting policies, particularly reward and punishment measures, to create a policy environment for saving energy and reducing waste. It should enrich the related human, financial and material resources, thereby enhancing research capacity, innovation and implementation. In the process of assisting with technical assistance, it should finish the project study and implementation programs, as well as the design and verification studies, which form the basis for proposals and implementation policy recommendations. .

5.3 Establish provincial re-lending mechanisms

The payback period of investment in energy conservation projects and the loan cycle for EPPs differ from ADB cycles; therefore, it is necessary to establish provincial re-lending mechanisms.

5.4 Gradually implement various projects according to the "easiest to hardest" principle

Since China is short of the mechanisms and policies for the implementation of EPPs, it should carry out the development of the Guangdong and ADB projects according to the existing policies, system environment and actual situations in Guangdong. Different patterns should be identified based on various types of projects, with efforts to establish various types of operations mechanism and lending patterns for energy

efficiency projects. When a project is mature, it should be immediately implemented. Preferential promotion should be given to projects that have reliable technologies and that have clearly improved energy efficiency and have guaranteed loan recovery. Where implementation is more difficult, needing greater policies support or entailing higher investment risk, small pilot projects should be carried out first, to be gradually expanded in the future.

This report submitted by the study group on America's Efficiency Power Plants, March 10, 2007