China Energy Service Company (ESCO) Market Study

EMCA

IFC International Finance Corporation
World Bank Group

Foreword

Reducing poverty and addressing climate change challenges are two of the most important missions for the World Bank Group today. They are also inextricably linked. Without responding to the threat of climate change it is much harder to tackle global poverty. Helping countries grow sustainably can lead to significant advances in business competitiveness, as well as lowering energy demand and avoiding greenhouse gas (GHG) emissions.

IFC, as a member of the World Bank Group, focuses on private sector development in emerging markets, helping developing countries achieve sustainable growth by financing investment, mobilizing capital in international financial markets, and providing advisory services to businesses and governments.

In China, IFC provides climate-friendly development and market-based solutions through investment and advisory services. One of the key tools IFC uses is Sustainable Energy Financing (SEF). Investment in energy efficiency and renewable energy projects makes sound business sense. One of the barriers to this business has been lack of knowledge and expertise. As such, Energy Service Companies (ESCOs) can play a key role in helping this market grow. This sector has been growing rapidly in China. By the end of 2012, there were over 2,000 registered ESCOs. ESCOs financed projects worth about CNY55 billion in 2012, in a market where financing requirements are estimated to be CNY165 billion per annum, and growing quickly

Further scaling up of SEF projects can help the Chinese government achieve the energy efficiency and emissions reduction targets defined in its 12th Five Year Plan. To this effect, China's Ministry of Finance (MOF) recognized the role that local banks can play growing SEF, leading to the private sector delivering large reductions in GHG emissions. MOF asked IFC to establish a program to catalyze this market, which resulted in the creation of an innovative SEF program named the China Utility-based Energy Efficiency Finance (CHUEE) Program, launched in 2006. Through IFC's partner banks, the CHUEE program has achieved an annual GHG emissions reduction of over 19 million tons. Of those projects financed by the program, 28 percent have been implemented by ESCOs.

It is expected that ESCOs are going to play a bigger role. In order to support the growth of this market, IFC partnered with the ESCO Committee of China Energy Conservation Association (EMCA) to undertake a review of the ESCO market, its current situation, and barriers faced during its different stages of growth in order to design the most suitable financing and service products to accelerate its healthy development.

The report provides a comprehensive overview and recommendations to assist financial institutions with forming partnerships with ESCOs. While the study focuses on China's ESCO market, the ESCO experiences gained in China can facilitate engagement in a rapidly emerging global market that is playing an increasingly important role in energy efficiency financing.

I am confident that it will be of real value to public and private sector partners in this space. Here I want to introduce the report to those who are interested in and devote themselves to energy efficiency business, and recognize IFC and EMCA for developing this important body of reference in this exciting new area.

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List of abbreviations:

EPC	Energy Performance Contracting
GEF	Global Environment Facility
WB	The World Bank
ESCO	Energy Service Company
NDRC	National Development and Reform Commission of China
MOF	Ministry Of Finance of China
MIIT	Ministry of Industry & Information Technology
IFC	International Finance Corporation
KfW	KfW Entwicklungs bank
EMCA	ESCO Committee of China Energy Conservation Association
CHUEE	China Utility-based Energy Efficiency Finance Program
CBRC	China Bank Regulatory Commission
GHG	Greenhouse Gas
AFD	Agence Française de Développement
I&G	China National Investment & Guarantee Co Ltd
CSR	Corporate social Responsibility
TRT	Top pressure recovery turbine-generator
HTAC	High temperature air combustion
CCPP	Combined Cycle Power Plant
R&D	Research and Development
EPCP	Energy Performance contracting project
SME	Small and medium enterprise
SOE	State Owned Enterprise
PE	Private equity
CO_2	Carbon dioxide
NOx	Nitrogen oxide
tce	ton of coal equivalent
toe	ton of oil equivalent
EE	energy efficiency
MECS	MacDonald-Miller Energy Capital Solutions
SPV	Special purpose vehicle
CEEF	Commercializing Energy Efficiency Finance
OBR	on-bill repayment
CDQ	Coke dry quenching
FYP	Five Year Plan
FI	Financial Institutions
PBL	project-based lending
ESF	Energy Savings Funds
M	million
CNY	Currency of China Yuan
SEF	Sustainable Energy Finance

Executive Summary

Climate Change is one of International Finance Corporation's 4 business pillars, and IFC's investment and advisory services activities need to make a contribution to greenhouse gas (GHG) emissions' mitigation. Fossil fuels consumption in 2004 contributed 56.6% of the global anthropogenic global GHG emissions based on IPCC AR4. In 2011, global energy-related CO_2emissionsincreased by 3.2% to reach a record high of 31.2 Gt. Energy and economic analyses, including those in the *World Energy Outlook*, underscore that improving energy efficiency is among the cheapest of the large-scale CO_2 reduction options. IFC has made efforts to promote sustainable energy financing, which includes energy efficiency and renewable energy, especially in countries where fossil fuels dominate and energy supply is in shortage.

Energy Service Companies (ESCOs) in China are poised for rapid and sustained growth. The ESCO industry has a well-established track record of success. It has gained market acceptance and increasing government policy and financial support. Annual investment in ESCO projects for the whole industry was over CNY 42 billion in 2011 with over 100 ESCOs investing more than CNY 50 million each. The whole industry now has at least 378, 000 employees. In 2011, for the first time in its history, the total value of output of the industry reached the CNY 100 billion mark, amounting to CNY125 billion. Year-on-year growth was a remarkable 49.5%. However, the industry is still in its early growth period as the technical, economic, environmental and commercial market potential of ESCOs in China remains far larger than what it has achieved to date. ESCOs in China are both capital intensive and capital constrained. As such, they represent a compelling opportunity for IFC to meet its climate investment goals in terms of economic returns, market size, emissions reductions and development impact.

The market drivers for ESCO industry growth are deep, broad and institutionally well founded.

- The fundamental economics and business case for EE investments in China are very attractive, as EE projects' simple payback periods (annual energy cost savings divided by total capital cost) of two to three years or less remain common for a range of efficiency measures.

- EE investment in China is being driven by consistent Government policies and multi-year energy savings targets designed to achieve China's energy security and climate goals. Innovation in ESCO development and EE finance has been supported by international development finance institutions, including the World Bank, IFC, Asian Development Bank, and bi-lateral organizations such as the French ADEME and the German KfW.

The 11th Five Year Plan established a target to reduce the energy intensity of GDP by 20% during 2006-2010.[1] These targets have devolved from the central government to provincial and city governments and state-owned enterprises. The central and provincial governments have further established energy savings incentive funds to offset a portion of EE investment costs.[2] The focus of EE investment has mainly been on large industry, including industrial EE projects for waste heat recovery in industries such as cement, coking, steel and petro-chemical. Enterprise energy savings targets were often achieved with one single project.

- The 12th Five Year Plan (2011-2015) targets a 16% reduction in energy intensity of GDP, and a similar target is expected for the 13th Five Year Plan (2016-2020). To achieve these new targets, industry will be challenged to implement deeper EE investment projects, e.g., with motors and controls, and EE investment must expand more into the commercial, government/institutional buildings and other sectors. National and provincial expenditures for Energy Savings Funds (ESF) and incentives are growing, from one-time capital subsidies of CNY 250 per annual ton of coal equivalent of energy savings to as high as CNY500 – 600 per annual ton of coal equivalent of energy savings in Beijing and Shanghai municipalities.

- Government policies, including recent 2010 and 2012 directives specifically support the ESCO industry as a market-based delivery mechanism for EE investments and a principal means to achieve national energy savings targets. ESCOs enjoy favorable accounting treatment for energy performance contracting (EPC) transactions, have access to government energy savings incentive funds for their projects and, through the China Bank Regulatory Commission's (CBRC) "green credit" bank regulation policies, allowances for commercial banks to treat energy performance contracting revenues as part of the security for their EE loans. Local governments (provincial and municipal) are continuing to innovate in the EE finance field with new programs supporting EE investment. Jiangsu Province, for example, is using some of its ESF funds as loan loss reserves to provide credit enhancement with the Bank of Jiangsu for EE financing, modeled after IFC's CHUEE program.

EMCA was formed as the ESCO industry association of China in 2003 as part of the World Bank Energy Conservation Promotion Project Phase II program, supported by the Global Environment Facility and the World Bank. EMCA

[1] A 19.1% reduction is reported achieved for the 2006-2010 period, some by sectoral change in the economy (relative reduction in industry and increase in services as a percentage of GDP), but mostly by EE investments, especially in industry.

[2] For the 11th Five Year Plan central government incentives were set CNY 200 per annual ton of coal energy equivalent savings for enterprises located in eastern China and CNY 250 to those in western China. This translates to approximately 15-20% of typical EE project investment cost. Provincial governments have added their own incentives.

knows the ESCO industry well and used a two-stage questionnaire survey and follow up interviews to gather data for this study. 2,339 ESCOs are now registered by the central government, each with minimum registered capital of CNY 5 million. Almost 72% of these were established within the past 5 years. Total registered capital of the 2,339 ESCOs currently is about CNY37.95 billion. The registered capital of 1,357 ESCOs is below CNY10 million (about USD 1.58 million), representing 58% of all ESCOs. In 2011, total bank loans used by ESCOs reached CNY 7.79 billion (approximately US$ 1.23 billion), representing only about 21% of total ESCO EPC project financing. However, collected statistics also show that only 18.4% of ESCOs had access to bank loans. EMCA member ESCOs now total over 900 companies. 446 ESCOs responded to the first questionnaire to provide data for this study and a second survey was conducted of 200 ESCOs selected from 446 ESCOs. In depth interviews were conducted with 30 ESCOs.

The main aim of this study is to promote follow-up action that can lead to replicable IFC investments of sufficient scale and with high development impact. Recommended investment strategies are discussed in Section 8 and include (a) direct investments in ESCOs and energy efficiency equipment manufacturing companies; (b) investment in one or more specialized EE project finance company(s); (c) partnership with local governments on EE project development and finance programs; and (d) further support for IFC partner financial institutions to expand their ESCO lending. Next steps to develop each recommended strategy are outlined and in many cases are tied to specific marketing partners and investment opportunities that have been qualified at a preliminary level.

1 Current Status of Energy Utilization & Energy Conservation in China and the Role of the ESCO Industry[3]

Abstract: From 2001 to 2011, energy consumption in China grew at an annual average growth rate of 8.3%. In 2011, China's total energy consumption reached 3.48 billion tce, greater than that of any other country. At present, China is in a period of industrialization, urbanization, internationalization and information-orientated development. China has witnessed continuous and rapid economic development, with the GDP climbing at an annual average rate of 10.48% since 2001 The Chinese Government has set a firm target to have shaped a well-balanced and prosperous society by 2020, for which an expanding energy service is essential. To accomplish this, the modes of economic development and the efficiency in energy utilization must be transformed; its improvement is therefore paramount.

As part of China's specific policies to promote energy efficiency, it is well recognized that market-oriented mechanisms must play an important role. The EPC system has an active part in the three major energy-savings related policies: structural adjustment, technological innovation and improvement in management. In 2012, the promotion of EPC was listed as one of the major energy-saving initiatives for the Twelfth Five-Year Plan period. High attention is given to supporting the further development of the ESCO industry, including optimizing the operating environment, stimulating demand, and promoting the market. EPC will play a more active role in achieving China's ambitious energy efficiency and emissions reduction targets.

Energy is an important material necessity for both human survival and development as well as an indispensable resource for modern social activity. Energy security is an important part of national security and also a crucial factor of international geo-economics and geo-politics. As a result, various factors urge all countries to attach great importance to energy supply. In 2010, China's primary energy supply amounted to 2.99 billion tce; 126 times that at the foundation of the P. R. C. and 4.8 times that at the early stage of reform and opening-up period. As for energy utilization in China, this is characterized by rapid growth, huge amounts, low per capita consumption and coal as a primary energy source. From 2001 to 2011, the annual average growth rate of energy consumption in China reached to 8.3%, 1.8 times of that in the first 20 years of

[3]Data sources: <The Eleventh Five Year Plan>,<The Twelfth Five Year Plan>,related materials of Energy Research Institute of NDRC and EMCA.

reform and opening-up period. Total energy consumption increased to 3.48 billion tce in 2011 from less than 1.4 billion tce in 2000, witnessing a rise of 2.01 billion tce within about 11 years. Such growth rate is far higher than that (2.5%) of the whole world during the corresponding period. China has overtaken the United States to become the country with the highest energy consumption.

Rapid growth in China's energy consumption is tightly related to its economic development. At present, China is in period of industrialization, urbanization, internationalization and information-orientation development. Such rapid development releases huge economic vitality and boosts the construction of infrastructure. Since 2001, China has witnessed continuous and rapid economic expansion, with annual average growth rate attaining 10.48%. Furthermore, the Chinese government has set a firm target to have shaped a well balance and prosperous society by 2020, for which an expanding energy supply is essential. Comparing expectations for the next 10 years against the past 10 years, the growth rate of industrial energy consumption may slow down but traffic, buildings and civil infrastructure energy demand will grow rapidly. This will result in a possible continued rapid growth rate in China's energy demand over the next decade. China's economic level is to keep up with other developed countries like the United States and Japan. However, China does not desire to follow their development patterns, but aims to transform modes of economic development and energy utilization. For this purpose, the Chinese government works on the basic state policy of 'develop, save energy and give priority to energy conservation'; energy conservation is the way forward for China's sustainable development.

In the last 10 years, especially in the Eleventh Five-Year Plan period, the Chinese government made great efforts to promote energy conservation and emissions reduction by comprehensively utilizing legal, economic, technical and administrative methods. During this time, the government put forward an energy conservation target to reduce energy consumption per unit of GDP by 20% by 2010. This was compared with 2005 and a carbon intensity control goal to reduce carbon emission per unit of GDP by 40%-45%. In 2010, China's energy consumption per unit of GDP decreased by 19.1% compared with that of 2005, basically achieving the energy-saving objectives. During the same period, China's annual incremental of GDP exceeded CNY 4.54 trillion, representing a soaring growth rate. As a result, total energy consumption increased drastically, witnessing an annual average of 200 million tce. However, the pre-existing energy elasticity of GDP growth coefficient of 1.04 decreased to 0.59 in the last stage of the Eleventh Five-Year Plan period; in this sense, the conflict between energy supply and demand has been mitigated and the ascending trend of energy consumption changed during this accelerated development period of China's industrialization and urbanization progress.

In recent years, the Chinese government successively issued a series of incentive policies, rewarding methods and local governmental agencies at provincial and municipal levels also taking appropriate measures to achieve their energy savings goals. Additionally, central and local governments invested a huge amount of financial funding in this field, effectively motivating and driving all social sectors to implement energy conservation and emission reduction projects. In the first four years of the 11th Five-Year Plan (FYP) period, energy efficiency investment increased at an annual average growth rate of more than 200%. This resulted in an annual average growth rate of energy consumption of 6.6%, while the growth rate of national economy attained 11.2%, greatly facilitating the maintenance of stable and rapid economic development, and forming a more sustainable energy investment pattern through the injection of government funds and active participation of all social sectors.

During the 11th FYP period, the Chinese government successively offered various special finance incentives and financial subsidies including:

- Incentive funds for energy efficiency retrofit projects
- Financial subsidies for promotion of high energy efficiency products
- Central financial incentive funds for eliminating outdated and energy inefficient industrial methods
- Financial subsidies for the promotion of high-efficiency lighting products
- Special national bond funds for supporting implementation of major EE projects and demonstration projects
- Incentive funds for heat metering and EE retrofit of existing residential buildings in China's northern heating regions
- Energy-saving subsidies for office building of governmental organization and large-size public buildings
- Financial incentive funds for EPC projects, with accumulative funds applied in energy conservation and efficiency-improvement amounting to CNY 101.6 billion

At the end of the Eleventh Five-Year Plan period, additional special financial incentives were also granted for EPC projects.

Originating in countries with developed market economies in the 1970's, the EPC mechanism is a service and market-oriented energy conservation investment system to implement energy-efficiency projects using market-based means. After an EPC contract is concluded, the ESCO will provide the end-user with an energy conservation audit, financing and innovation service. It will then recover investments and obtain reasonable profits through sharing in energy-saving benefits.; In this way, the energy consuming enterprises will have a decrease in energy operating expense and technological risks associated with such renovation. This package of services including financing makes the EPC mechanism attractive as a practicable means to implement energy-saving measures.

In the mid-1990s, as China's economic transition accelerated, the EPC mode was introduced into China by cooperation between the Chinese government and international organizations. Through more than ten years of introduction, demonstration and promotion, professional ESCOs have continuously increased in number and their service scope has expanded into several sectors including industry, building, transportation and public institutions. ESCO energy-saving delivery capacities have grown rapidly which has aroused great attention from Chinese governmental organizations at all levels, gaining wide acceptance by all energy consuming enterprises. Being greatly supported and aided by favorable national policies, the ESCO industry uses the EPC mechanism as an important part of energy efficiency and environmentally-friendly industries. From this it effectively facilitates a large quantity of energy efficiency projects using viable, economically and technically feasible means driven to all economic sectors. So far ESCOs have become the main force of China's energy conservation and emission-reduction sector.

The EPC mechanism plays an active role in the three major energy-savings related policies: structural adjustment, technological innovation and management enhancement. Promotion of EPC and development of the ESCO industry, as a powerful measure facilitating energy-saving and green-house gas emission reductions, is becoming a new burgeoning industry boosting domestic demand, improving employment, and also an objective means for establishing a resource-efficient and environmentally-friendly society. To speed up the EPC process, the General Office of the China State Council, in April 2010, forwarded the "Circulation of the Opinions on Accelerating the Implementation of Energy Performance Contracting to Promote the Development of the ESCO Industry", which was jointly issued by the NDRC, Ministry of Finance, State Administration of Taxation, and the People's Bank of China. This policy offered a series of supportive measures for EPC projects such as favorable tax treatment. It also put forward the aim that by the end of 2012, the Chinese government will support and cultivate a number of professional ESCOs, develop and expand a number of comprehensive large-size ESCOs and create an energy-saving service market with vitality, unique features and good order. By 2015, China will establish a mature energy-saving service system, professional ESCOs will further expand in number, service capacity will be further strengthened and service scope widened. EPC will serve as one of the primary methods to implement energy-saving projects. In 2012, EPC promotion was listed as one of the major energy conservation key projects in the 12th FYP. With continuous support from financial subsidies ,gradual effective implementation of tax exemption policies and a new government initiative for "10,000 Enterprises' Energy conservation Action", along with supporting policies from local governments and with commercial banks launching new financial products for EPC projects, a "golden market" is being created for ESCOs. We are convinced that ESCOs and EPC will play a more

active growing role in achieving China's ambitious energy-saving and emission-reduction targets.

2 Background and Objective of the Study

Abstract: The national industrial association of China's ESCOs– The ESCO Committee of the Energy Conservation Association (EMCA)--was entrusted by IFC to implement the "China ESCO Market Study" project. The project is intended to help IFC to explore appropriate strategies for the practical support of China's ESCO industry. Also it was designed to ease the financing difficulties of the ESCOs and actively support the development of a number of outstanding ESCOs in improving their efficiency of energy usage in China. This would therefore help mitigate carbon dioxide emissions leading to climate change.

As the contractor for the Study, EMCA used systematic methodologies to carry out the project, including literature research, desktop research, two questionnaire survey rounds, field work and site visits, interviews, Porter's five forces analysis, PEST analysis, SWOT analysis, and other methodology. The main work of the project included efforts to:
1) gain a deeper understanding of the Chinese energy conservation service market development and financing situation of ESCO; 2) complete in-depth analysis of the various types of energy industry's demand for ESCOs, driving forces and obstacles; 3) complete an in-depth analysis of the current situation, the barriers faced by ESCOs and the development trends of the ESCO market; 4) screen a number of strong potential ESCOs, assist IFC and its CHUEE partner, financing institutions to establish strategic cooperative relations with potential ESCOs; 5) identify feasible financing models for ESCO involving IFC and CHUEE partner banks; 6) highlight the current and potential key sectors/technologies/products that IFC and its CHUEE partner banks should focus on; 7) provide opinions and observations on key areas where innovation in technologies and/or new business models are most likely to occur, or have begun to show great promise.

2.1 Background and Objectives of the Study

Defined in China's new "General Technical Rules for Energy Performance Contracting" (National Standard GB/T 24915-2010), issued by China's National Standardization Management Committee in August 2010, energy performance contracting is explained as "an energy conservation service mechanism ,whereby an energy service company and energy user entity contractually agree on the energy savings target of an energy conservation project, the energy service company provides necessary services for realization of the energy savings target while the energy user pays for the energy service company's investment and

reasonable profit from the energy savings ”.

Such companies, which mainly use the EPC model to implement energy efficiency projects for the host enterprises, are called an Energy Service Company, abbreviated as ESCO.[4]

With EPC projects investment in 2011 totaling more than US$ 6.7 billion[5], the business volumes of China’s ESCO industry are now on par with those of the ESCO industry in the United States. With remarkable growth in its past 16-year history, China’s EPC business is playing an increasingly important role as a vehicle for aggregating multiple energy efficiency projects with developing contractual practices, business models and market approaches that are distinctly adapted to the Chinese market. After a series of key incentive policies were issued by the Central Government in 2010 with financial rewards, tax relief and two other measures, the government and energy consuming enterprises have paid increasing attention to the EPC mechanism. The ESCO industry is now posed for continued sharp growth in the coming years, especially during the period of the 12th and 13thFYP periods.

Despite the rapid market expansion, ESCOs face multiple constraints that prevent them from achieving further improvement such as problems associated with applying the various incentive polices, the weakness of ESCO’s overall capacities and finances, host enterprise’s creditworthiness and difficulties for them to arrange financing for their projects. Financing is the burning question for ESCOs to develop more energy efficiency projects in China. IFC has seen the ESCO business undergo development and growth, and is keen to continue supporting China’s ESCO sector to significantly contribute to the country’s medium-term energy and carbon intensity reduction targets. This study of China’s ESCO market intends to enable IFC to craft a strategy to support its partner banks and scale up its own investment in energy efficiency in China working with ESCOs.

According to the Study TOR, it has the following objectives: (a) to gain a deeper understanding of the current ESCO market; (b) to estimate the market growth and developmental impact potential and finance gaps facing each major classification of ESCOs; (c) to identify opportunities to forge strategic partnerships between selected ESCOs and CHUEE partner financial institutions; (d) to address market barriers that could be removed within the short term.(e) to broadly consider all three business modes of EPC that develops, installs, and arranges financing for projects designed to improve the energy efficiency and maintenance costs for industrial, building and other commercial and public facilities. The Study work includes:

[4]The conceptions of EPC and ESCO in this final report are consistent with GB/T 24915-2010.
[5]Data sources: <CHINA ESCO INDUSTRY DEVELOPMENT REPORT 2011> by EMCA.

a. Perform an overall review of China's ESCO sector;
b. Perform demand-side analysis;
c. Perform supply-side analysis;
d. Identify opportunities to forge strategic partnerships between selected ESCOs and CHUEE partner FIs;
e. Identify sector needs in the areas of market development, technical capacity building, policy reform, information dissemination or other barrier removal intervention.
f. Given the recent growth of certain types of energy efficiency goods and services in China, highlight key sectors/technologies that IFC and its CHUEE partner banks should focus on at the current time.
g. Provide opinions and observations on key areas where innovation in technologies and/or new business models are most likely to occur, or have begun to show great promise.

2.2 Methodologies

2.2.1 Methodologies

With the aims of this study and the background discussed above in mind, the study is conducted with the following methodologies:

➢ Literature research /Desk research

At the first stage of the project, through literature research and desk research as well as research in the database of EMCA, an overall review of China's ESCO market would be formed. This overview will cover both a brief historical background of the ESCO market and a broad description of the current state of China's ESCO sector.

➢ Questionnaire and survey

As a following step, the questionnaire and survey will be employed towards the targeted stakeholder groups including ESCOs, financial institutions such as banks and guarantee companies, and industries that have demand for energy efficiency service etc. to obtain first-hand information to perform required analyses.

➢ Field visits & interviews

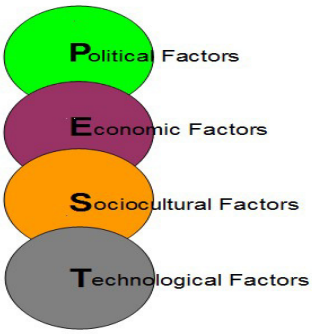
Following the questionnaire and survey, an interview was conducted to the selected stakeholders of the above mentioned three groups.

Site visits were arranged to perform detailed interview to the selected ESCO companies or big industries. This method allows more specific questions being asked to the interviewee, at the same time, it also allows the interviewee to provide more detailed answers relating to his/her company's unique situation. Information collected from interviews and site visits form the solid basis of the

analysis.

➢ PEST analysis &SWOT analysis

PEST analysis stands for Political, Economic, Social and Technological analysis. It describes a framework of macro-environmental factors used in environmental scanning. Through PEST analysis, an overview of different macro-environmental factors that a company has to take into consideration can be drawn. It is a useful strategic tool for understanding market growth or decline, business position, potential, and direction for operation. SWOT analysis is a structured planning method used to evaluate the strengths, weaknesses, opportunities and threats involved in a business venture.



These two analytical tools help to conduct an in-depth analysis of ESCOs' inherent characteristics at this stage and the external environment facing the industry in a structured way. Conclusions from the analysis support recommendations for CHUEE partner banks as required in this project.

2.2.2 Kick-off the Project

EMCA convened related personnel proposed to participate in project execution from its individual departments to kick-off the Project, introducing the purpose, output, work contents, completion time, execution methods, personnel, coordination of teams and support from experts. The project team were given a full, clear, explicit understanding of the Project, for forming a uniform awareness of aims, strategy and plans, and for effectively reducing the deviation in understanding and executing the planned tasks.

2.2.3 Detailing of the work plan

Based on the understanding of project objectives, the Project team formulated a detailed and organized work plan after discussion with IFC, assigning all persons in charge of the specific work and relative execution time, and ensuring mutual coordination, support and promotion of team members. The detailing of the work plan mainly included time arrangement, work content, planned outputs

and persons in charge. The team members shall play individual roles, ensuring effective project execution, coordination of members and team stability.

2.2.4 Literature research, establishing systematic document database

Document research is the first step in work execution, providing information for clarifying and planning the development history, status and future trend of energy conservation service industry in China, and providing the basis for the follow-up work.

The project mainly investigated and analyzed such key objects as the ESCOs registered by the NDRC/MOF from the first to the fourth batch and those recommended by the MIIT from the first to the second batch. EMCA, as the supporting organization with experts performing, recording, and recommending work for ESCOs, had obtained much first-hand information, and organized relevant information of over 2,500 ESCOs through collecting and recording data.

2.2.5 Questionnaire investigation

The development of questionnaire investigation was one of the most important working methods in the project's execution. Through the issuance and collection of questionnaires, EMCA sought basic information on various types of ESCOs, the general state of financial institutions involved, data for further analyzing the financing status of ESCOs, finding ESCOs with financing needs and potential, analyzing barriers and seeking solutions for expanding ESCO financing and investment. According to the proposed objectives of the project, the team developed questionnaires focusing on ESCOs and financial investment institutions.

For ESCOs, the project team designed two rounds of questionnaire surveys. The first round was mainly about collecting basic information, attracting as many enterprises as possible to participate and obtaining as much basic information about the enterprises as possible, then forming the basic analysis database of the actual status of the ESCO industry. Based on the first round questionnaire investigation, about 200 enterprises were selected from those involved as the targets of the second round of survey. The second round investigated these competent enterprises and the questions were more penetrating. Some questions even involved core data filled by the deputy general manager in charge or the chief financial officer who had to complete priority information for the subject enterprises. Based on the second round survey, 30 enterprises were selected for field interviews and in-depth research, and then finally 10 enterprises were selected for key analysis.

1) The first round questionnaire investigation

The first round directly investigated the basic scale and technical strength of the enterprise, orientation of its business, business scope, related industry experience, maturity and overall operation situation. Through further analysis, it was possible to indirectly estimate the financing needs of the company, as well as its technology application and duplication capacity, ratio of business and profit and profitability. Through two years data comparison, in a combination of registration capital and company foundation time, it was possible to judge the current business scale, operation stability, development potential of the enterprise, as well as its position in the industry based on the industry judge rules, so as to find out the investment potential to the enterprise.

EMCA collected 479 questionnaires from the first round, with 446 qualified responses. The Project Team recorded all the information and carried out preliminary analysis of the ESCOs' financing status.

For selecting the ESCOs for the second round questionnaire, 446 enterprises were scored and ranked based on their registered capital, scale of business revenue, invention and patent, number of projects executed, with the highest score almost 900 and the lowest about 100.

2) The second round questionnaire investigation

The results of the second round questionnaire were screened to select enterprises for interviews and another two purposes: 1) for recommending the enterprises to IFC partner banks for project debt financing, the main screening conditions were the scale of business, registered capital and number of projects executed, whether there was any future equity investment demand and possibility and 2) for recommending potential equity investment enterprises to IFC's Investment Service, with screening conditions including the scale of business and registered capital, possibilities for future equity investment and IPO. The second round questionnaire process finished with 138 returned questionnaires.

2.2.6 Investigation and interview with financial institutions

To address ESCO financing barriers and needs, more details of existing ESCO financing activities of financial institutions were obtained. Promoting financial institutions to get actively involved in ESCO finance is hungrily required. For that, more than 20 various financial institutions were interviewed, respectively, in order to know whether they have any special financial products currently offered to ESCOs or if they have experience of successful EE projects financing cases. Meanwhile, we sought to find out the obstacles and barriers keeping them from getting more involved in ESCO financing, the incentive polices they required issued by the authorities, their security requirements for ESCO financing, new

financing products with possibly secured by such as the lien of project future account receivable, newly introduced SME private bonds and asset securitization.

2.2.7 Field investigation on key ESCOs

Based on the first and the second round questionnaires, the project team has given composite scores to enterprises which have completed the questionnaires on aspects such as registered capital and scale, annual sales and income scale, equity structure, the main type of EPC projects and proprietary intellectual property rights, etc. In order to better know and understand actual operating conditions, the future development demands of ESCOs and to screen the top ten potential IFC cooperative ESCOs, the project team visited ESCOs with higher scores among the three ESCO-concentrated areas: Beijing, the Yangtze River Delta and the Pearl River Delta. These visits were carried out by three teams. The first team went to Shanghai and Hangzhou to investigate 12 ESCOs, and the second team went to Guangdong Province and Hunan Province to investigate 10 enterprises. The third team visited almost 10 enterprises in and around Beijing. In total, more than 30 enterprises have been investigated and a visit record for each enterprise was made to screen and select the top ten ESCOs for further analysis for potential IFC cooperation.

3 The History and Current Situation of China's ESCO Industry

Abstract: This chapter focuses on the history and current status of EPC development in China. The EPC mechanism was introduced to China by an international cooperation project between the WB/GEF and the Chinese Government in late 1990s.The project phase I established three pilot ESCOs and explored the feasibility of EPC mechanism in China; phase II established an "ESCO loan guarantee mechanism" and national ESCO industrial association – EMCA. With the establishment of EMCA, EPC in China entered a stage of promotion. In 2010, the State Council released "Guidance to Promote Energy Performance Contracting and Enhance the Development of ESCO Industry", indicating that the ESCO industry had officially entered a stage of full-scale development.

2011 was a milestone for ESCO development since the launching of EPC in China. The total value of business output of the industry reached the CNY 100 billion level for the first time, amounting to CNY 125 billion. Year-on-year growth reached a high rate of 49.5%, with 378, 000 people working for the industry. The EPC project investment increased from CNY 28.7 billion in 2010 to CNY 41.2 billion, an increase of 43.45%, generating annual energy-saving capacity of 16,483,900 tce. The business of Chinese ESCOs covers three major areas: buildings, industry, and transportation (municipal street lighting).The most of EPC projects are implemented in the industrial sector. Contract types include the shared energy saving mode, guaranteed energy savings mode, and energy management outsourcing model. ESCOs also are gradually being differentiated into technology-based, market-based, and capital-based types.

With the world's highest population, China has been facing an energy supply problem and increasing energy demand has long been a top issue for its development agenda. Given China's current speed of rapid industrialization and urbanization, imbalance between energy supply and demand is becoming a concern. At the same time, climate change has become one of the largest global issues. GHG emissions from China have been rising significantly since the 1980s and by 2010 China overtook the U.S. as the country with the greatest GHG emissions. Energy conservation and emissions reduction are now of great importance to China.

While public policy is a key aspect to induce different market players in fighting climate change, the private sector must also play an important role in taming the increasing energy demand of the country as well as leading the economies along a low carbon development route.

In this context, ESCOs are expected to play a large role to meet China's ambitious targets toward low carbon development. ESCOs function as non-banking financial institutions that provide market channels for energy efficiency finance coupled with installed technical solutions, especially in cases where a performance risk guarantee or project finance flowing through an energy savings shared contract is involved.

Because of ESCOs' unique advantages combining technical and financial services, including guarantees of energy savings, their role is valuable in catalyzing new energy efficiency investments, particularly among industrial and commercial customers.

3.1 Historical background of the ESCO market in China

The Introduction of an energy performance contracting (EPC) model to China stemmed from a study entitled "A Research on Issues and Options in GHG Emission Control in China" supported by WB and GEF in 1992-1994. One of the most important conclusions from the research showed that there were plenty of potential energy conservation projects in China with good economic and environmental benefits employing mature and proven technologies. However, various market barriers commonly existed and these potential projects were prevented from being implemented in scale, resulting in waste of valuable energy resources and polluting the environment.

The Chinese government and WB then reached the consensus that managing and operating success models for energy conservation in China required innovation, as China's economic system had been transitioning from the planning system to the market system. It was deemed necessary to introduce and promote the EPC model in China as it has unique advantages in combining technical and financing services as well as its success in many other countries.

The birth and growth of China's ESCO industry in its early stages depended heavily on the support from Government and international development institutions.

In 1995-1996, for the first time in China, the World Bank and the Government agreed to mobilize technical and financial assistance to attempt to introduce and develop energy performance contracting.

Definition of Energy Performance Contracting and Energy Service Company

- **Energy performance contracting, EPC**

  A performance-based an alternative financing mechanism to accelerate investment in a cost effective way, with which ESCO conducts a comprehensive energy audit for the facilities, designs and constructs an energy efficiency project and arranges the necessary financing. The ESCO guarantees that the improvements will generate energy cost savings sufficient to pay for the project over the term of the contract. After the contract ends, all additional cost savings and the project property accrue to the end user.

- **Energy services company, ESCO**

  A profit-oriented commercial business party providing a broad range of comprehensive energy solutions to energy consuming enterprises, including energy auditing, designs and implementation of energy savings projects, retrofitting, energy efficiency, energy infrastructure outsourcing, power generation and energy supply, risk management, and even financing.

From 1998 to 2006 the China Energy Conservation Promotion Project Phase I was implemented while supported by the Chinese Government, WB and GEF. One of the achievements of project phase I, was to establish three pilot ESCOs in Liaoning province, Shandong province and Beijing municipality i.e. Beijing Yuanshen Energy Conservation Technology Co. Ltd., Liaoning Energy Conservation Technology Development Co. Ltd. and Shandong Energy Saving Engineering Co. Ltd. These three companies achieved considerable development during phase I. By the end of the project in June 2006, the three companies in total implemented 475 projects for 405 clients with a total investments amounted to CNY 1.3billion. Through implementing those projects, three pilot ESCOs realized a net profit of CNY 420 million, while at the same time, net profit generated to clients from these projects reached 8-10 times that of ESCOs'[6].

Not only were the financial results encouraging, these projects also showed strong social and environmental benefits. According to the statistics from the Project Management Office of the China Energy Conservation Promotion Project, these pilot projects achieved a 1.51 million tce per year energy saving capacity (approximately 5.32 million ton CO_2/a).

A World Bank report in 2011[7]indicates that the first Energy Conservation Project had a major advantage compared with some other projects internationally, aiming to support ESCOs in that it provided the ESCOs with a dedicated, large line of credit from the start plus grants for a portion of project capital costs. It allowed the ESCOs to focus almost exclusively on the key challenge of making the

[6]China Energy Conservation Project Implementation Completion Report, World Bank, 2007

[7]China'S ESCO Industry: Saving More Energy Everyday through the Market, World Bank, 2011, by Sun Xiaoliang, Zhu Lin and Robert. P. Taylor.

new mechanism work.

The other point indicated is that strong and steady central government support was vital for development of the nascent ESCO industry. As a new business model introduced from abroad, the ESCO model faced numerous problems in its initial stage. Some stemmed from lack of familiarity with the idea in the market place. Some stemmed from difficulties in the financial and legal regulatory systems to categorize the business. At one point, each of the three pilot ESCOs had reported their accounts using a different business classification: one as a service company, one as an equipment vendor and another as a financing entity. Some local authorities even declared that the energy performance contracting business was illegal. If there was no support from the central government, which put in resources to research and solve these institutional difficulties, the ESCO industry would not have flourished during this period and later on.

Though encouraging results were achieved, the barriers were also wide and obvious. The two biggest constraints faced were the lack of practical knowledge and understanding of how to operate the business model, both among ESCOs and host enterprises and lack of access to capital to finance projects.

China's Second Energy Conservation Project (2002-2010)

The WB and Chinese government jointly decided to implement the China Second Energy Conservation Promotion Project, aiming at furthering the achievement of the first China Energy Conservation Promotion Project as well as to address its major constraints.

With support of this Phase II Project, the ESCO Committee of China Energy Conservation Association (EMCA) was founded at the end of 2003. It is a new legal entity operating as a sub-association of the China Energy Conservation Association. Since its establishment, EMCA has played a key role as the focal point for promoting the energy performance contracting concept to all parts of society. It has prepared training manuals, designed and delivered training courses, organized workshops for government decision makers, interested companies and banks. It has also researched key problems facing the industry, developing and promoting solutions while assisting its members in expanding business and looking towards cooperation and partnerships.

EMCA has been the association for the ESCO industry; its membership has increased from 59 companies in 2004 when it was founded to 720 members by the end of 2011.[8]

International experience shows inadequate access to financing is a leading

[8]From EMCA statistics

problem in ESCO development in almost all countries.[9] Under the China Second Energy Conservation Promotion Project, the EMC (Energy Management Company, the former name for ESCOs in China) Loan Guarantee Program was initiated and operated by the China National Investment and Guaranty Company (I&G), the biggest guaranty company in China, with GEF and government support.

US$22 million was placed in a reserve account with the Ministry of Finance and dedicated to the ESCO loan guarantee program. This was to help cover the risks of default on I&G guarantees on commercial loans from Chinese banks for energy performance contracted energy efficiency projects.

During 2004-2009, 42 ESCOs obtained loans via this guarantee program involving 148 projects. Total investments to these projects accounted for CNY 909 million, in which CNY 516 million were guaranteed loans by the program. Implementation of these projects formed an energy saving capacity of 589,000 tce per year (approximately about 376,800t CO_2/a). [10] It is fair to say the development of EPC model and ESCO sector in China is the result of international cooperation.

3.2 Current status of China's ESCO sector[11]

3.2.1 Number of ESCOs and employees

According to EMCA statistics, by 2011, there were 2,339 registered ESCOs operating in China, employing 378, 000 employees. The scale of the industry has expanded significantly.[12]

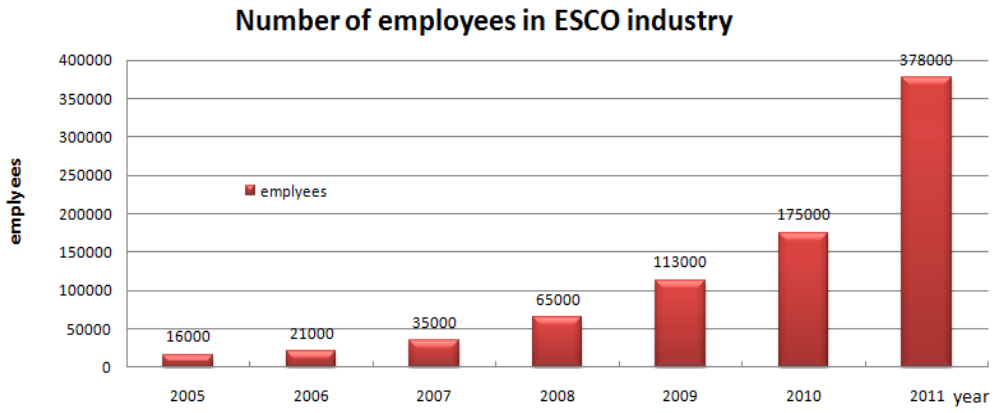


Figure 1 Number of employees in ESCO industry

Data Source：EMCA Statistics

[9] http://www.worldenergy.org/documents/esco_synthesis.pdf
[10] Completion report for WB/GEF China Energy Conservation Promotion Project
[11] Data of this section comes from EMCA.
[12] *2011 Annual Report on Chinese Energy Saving Service Industry*, EMCA, 2012

3.2.2 Total value of output (revenue) of ESCO industry

As the number and scale of ESCOs expanded, the total value for the output of the industry has grown. In 2011, for the first time in its history, the total value of output reached a new level of CNY 100 billion, accounting for CNY125 billion. Year-on-year growth reached a high rate of 49.5%.

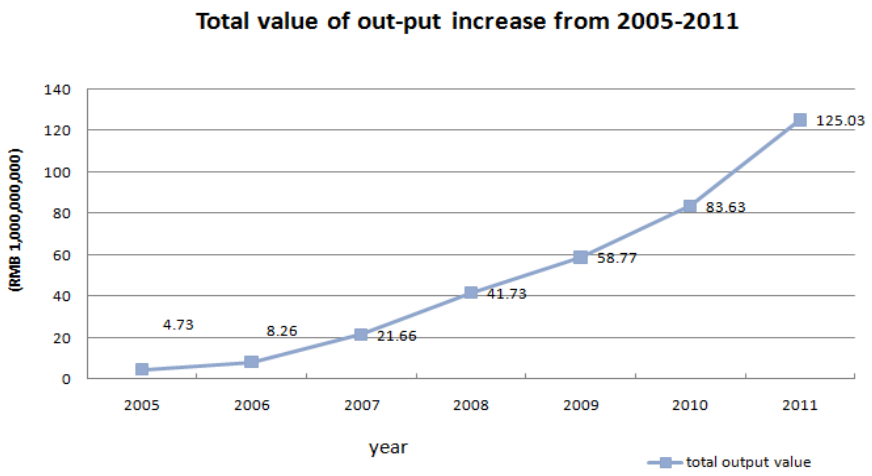


Figure 2 Total value of out-put increase from 2005-2011

Data Source：EMCA Statistics

3.2.3 Timing of establishment of ESCOs

Despite the rapid growth of ESCOs in China, it is still a fairly young industry. In 2010, the Chinese NDRC started to register ESCOs. It defines an ESCO as a company with its core business in the energy conservation service such as energy conservation assessment, design, retrofits and operation. By the end of 2011, 2,339 ESCOs had been registered with NDRC/MOF in four batches. Many were newly established companies for example, 1,116 companies were set up in 2010 and 2011, account for 47.71%. Most ESCOs (71.57%) were established within the past 5 years.

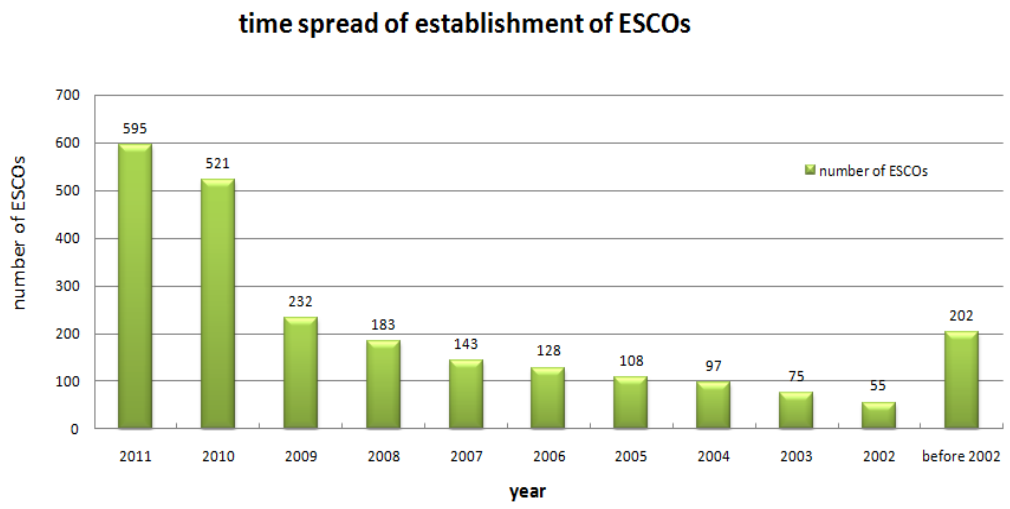


Figure 3 Timing of establishment of ESCOs

Data Source：EMCA Statistics

3.2.4 Scale of registered capital and total assets of ESCOs

According to the statistics of the EMCA, the total registered capital of the 2,339 ESCOs currently in China is about CNY 37.95 billion. Though the absolute capital seems significant, the average capital enjoyed by each ESCO is not remarkable anymore. Among 2,339 ESCOs, 1,357 companies' registered capital is below CNY10 million (about USD 1.58 million), representing 58% of all ESCOs. Only 73 companies have registered capital more than CNY 60 million (about USD 9.5 million), accounting for only 3.12% of all ESCOs.

Distribution of total assets of ESCOs shows a similar shape as registered capital. 1,127 ESCOs (about 48%) have total assets of less than CNY 10 million; while 209 companies(about 10%) have total assets greater than CNY60 million.

ESCOs are growing rapidly in China, while the industry is still in its early stage of development. Individual company's scale is small in general and most ESCOs can be categorized as SME or even micro enterprises.

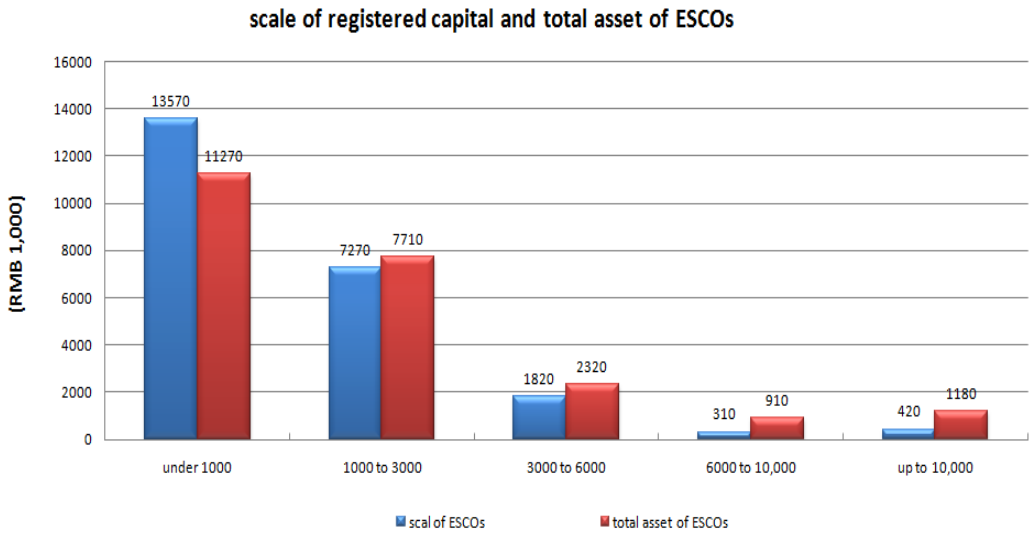


Figure 4 Scale of registered capital and total asset of ESCOs

Data Source：EMCA Statistics

3.2.5 Total investment in EPC

According to EMCA's statistics, in 2011, 2,339 registered ESCOs invested in a total of CNY 35 billion (about US$5.5 billion) in EPC projects. Among them, 63% of ESCOs had EPC projects of less than CNY 5 million (US$790,000), while less than 5% of ESCOs had investments above CNY 50 million (US$7.9 million).

Interestingly, these 5% of ESCOs completed the majority of ESCO industry investment in 2011, accounting for 65.59% of the total. All together these big companies invested CNY 23 billion (about US$3.6 billion). If we put this figure in average, it means each company invested CNY 200 million (about US$31million) in 2011 only. These figures below show clearly the imbalance in investment in Chinese ESCOs. This 5% is over 100 ESCOs and represents a good set of candidate ESCOs for IFC to target for its EE and ESCO investment scale up strategy.

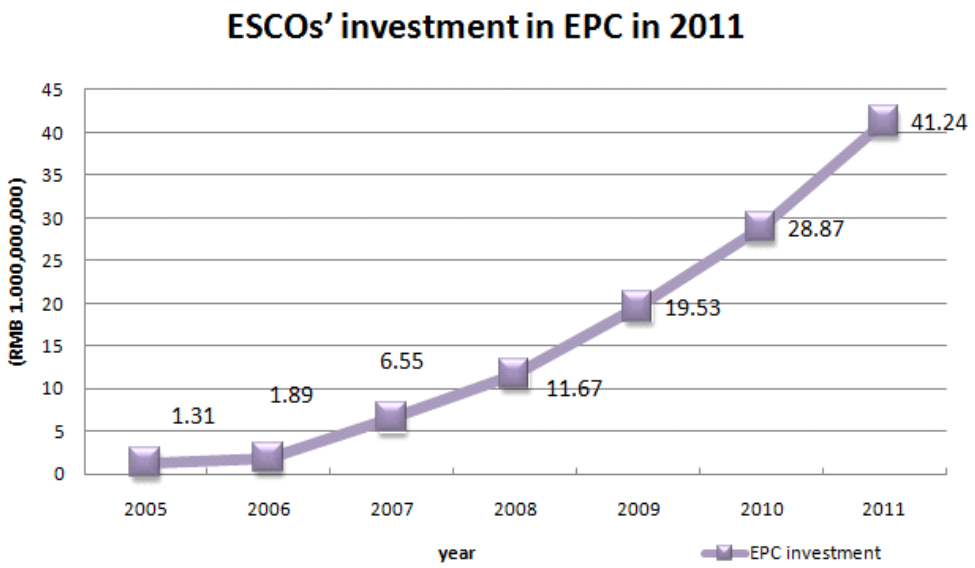


Figure 5 ESCOs' investment in EPC in 2011

Data Source：EMCA Statistics

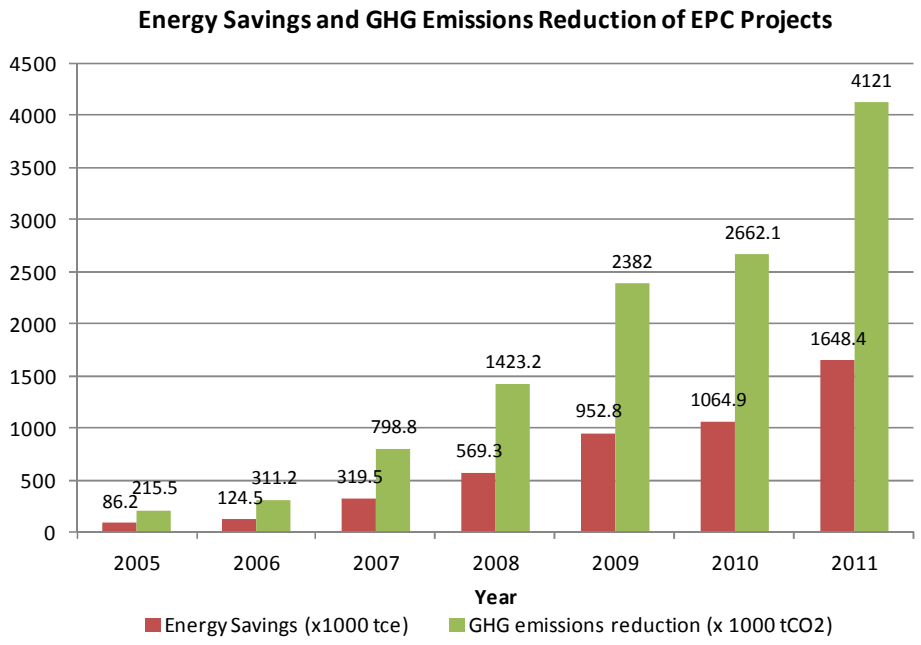


Figure 6 Energy savings and CO_2 Emission reduction of ESCO Projects

Data Source：EMCA Statistics

3.2.6 Bank loans used by ESCOs

In 2011, total bank loans used by ESCOs reached CNY 7.79 billion (approximately US$ 1.23 billion), representing only approximately 21% of total ESCO EPC project

sources of funds. Statistics show only a small portion (18.4%) of ESCOs had access to bank loans. At the same time, the scale of the loans was also not big; the average scale was about CNY 15.86 million. 50% of ESCOs who had access to bank loans obtained credit of less than CNY 5 million (about US$790,000 million). Only 2% of ESCOs, 36 companies, enjoyed credit above CNY 50 million in 2011. These 36 companies actually borrowed CNY 5.1 billion in 2011; CNY 142 million per company on average. This data indicates good prospects for expanding bank lending to ESCOs in their EE projects, provided that security issues can be satisfied.

This data also indicates that many ESCOs have financed their projects with close to 100% equity; one investment strategy is to provide take-out financing, lending against or purchasing (perhaps similar to factoring a long-term receivable) these existing ESCO projects that are generating revenues. Such projects, if sufficiently aggregated, are appraisable and providing financing against them would help ESCOs replenish their capital. Several banks are already providing this type of ESCO EPC project receivables based financing. See Section 7 for this discussion. These recommendations and investment strategy matters are also discussed in section 8.

3.2.7 Summary

Overall, ESCOs in China have experienced rapid growth since the EPC model was introduced into China by international organizations in the 1990s. Its success was due largely to support from international organizations for example, the World Bank, IFC, GEF and the Chinese central government. From this strong base, the industry is still growing very quickly. According to EMCA's statistics, there were about 3,900 companies[13] providing energy conservation services throughout the country by 2011. It shows that apart from those 2,339 registered ESCOs, there are still a number of companies providing certain forms of energy conservation service to the market though they are not necessarily named as ESCOs.

The level of investment of the industry has also grown significantly. However, it becomes obvious that the industry is experiencing imbalance in development when one looks into the more detailed financial and investment data. This imbalance reflects the relatively high portion of ESCO investment relying on equity and difficulties, though growing capacities, of ESCOs to access bank loans. On one hand, many ESCOs are newly-established SMEs or even micro enterprises and their investment scale is fairly small, thus they lack access to bank loans. On the other hand, a small portion of larger ESCOs have established healthy project portfolios and have demonstrated the capability to invest in large scale EPC projects with support from the financial industry for example, commercial banks. However, even these larger ESCOs have financed a large portion of their projects

[13]EMCA statistics.

with equity and hence represent good opportunities to provide takeout financing for existing portfolios.

4 Demand analysis of ESCOs from the energy consumption side

Abstract: This chapter analyzes demands for ESCO services from energy users. Client demands result from several drivers, including: 1) economic benefits from rising energy prices; 2) the introduction of technical support and professional services; 3) increasing success in project implementation thus reducing energy saving risk; 4) mobilization of project funding support and sharing the investment risk; 5) dealing with export barriers and actively controlling carbon emissions and 6) demonstration of social responsibility and establishment of "green reputation". The energy conservation binding targets of the 12th Five Year Plan are disaggregated to each province, which also strengthens the needs energy service by energy-using companies.

The "EPC Promotion Project" listed under "Energy Conservation and Emission Reduction of 12th Five-Year Plan", calls for achievement of 60 million tce during the five year period through investment of CNY 250 billion in energy performance contracting and the ESCO industry output of CNY 300 billion. Based on EMCA's 2011 statistics, contract amounts in the building, industry and communication sectors are expected to be about CNY 45 billion, 246 billion, and 18 billion, respectively. This chapter also lists the EPC mechanism in key industries, technology trends and growth potential, and the constraints faced in the further expansion of demand for energy services from energy users.

4.1 Demand drivers for ESCO solutions

China's ESCO business has experienced rapid growth in recent years and is still growing rapidly. If we look into a bit more detail of its history, it would not be difficult to see various drivers influencing it. Below we will look at these drivers from political, economic, technical and social environmental perspectives.

4.1.1 Political Driver

Energy conservation and emissions reduction have been listed on the Chinese government's agenda since 2004[14]. Domestic binding targets on energy conservation and emissions reduction were clearly quantified in both the 11th Five Year Plan (2006-2010) and 12th Five Year Plan (2011-2015). As stated in the Twelfth Five Year Plan, published in 2012, energy consumption per CNY ten thousand national GDP will have to reduce to 0.869 tce (calculate by price as in

[14] China Energy conservation medium and long term Special plan, 2004

2005) by the end of 2015[15]. Assuming China's GDP will reach CNY 80 trillion by the end of 2015; this target means that there will be a 16% reduction in energy use compared to the 103 million tce of energy consumption in 2010 and a 32% reduction compared with 2005. Considering the Chinese economy is still growing at a relatively high speed, this target is very ambitious.

To achieve this very challenging target, each province has been allocated quantified energy conservation and emissions reduction targets throughout the period of the 12th Five Year Plan. These targets then were disaggregated and devolved to entities/enterprises which consume energy in their daily operation. Those entities/enterprises which consume large quantities of energy were made a special focus of local governments to achieve their targets.

At the same time, as Chinese industry is developing in an energy intensive mode, energy consumption of industries accounts for more than 60% of total national energy consumption. Achieving energy saving targets requires a big improvement in energy efficiency in the industrial sector.

The political pressure to meet the annual energy conservation and emissions reduction target has become one of the key drivers of energy consumption entities to pursue the support of professional ESCOs. In this regard as, provincial and municipal governments are potentially strong and active partners for scaling up EE investment.

4.1.2 Economical driver

As prices gradually increase, energy has become a larger portion of the operational costs of enterprises in recent years. These increases provided incentives for enterprises to look for ways to improve energy efficiency reduce energy cost and keep up their market competitiveness. Through implementing EPC projects, especially under Shared Savings Contracts, energy consumers can share benefits from saved energy bills while the ESCO finances and takes most risks of the project. After completion of the contract, the energy consuming enterprise can take all energy saving benefits afterwards and take over full beneficial use of the energy saving equipment. Hence the ESCO is a means for energy consumers to reduce energy costs and increase energy efficiency with relatively low risks and at the same time generate extra cash-flow.

Most companies focus on their core business. Even those big companies like oil, gas, iron and steel companies won't have the plenty of budget to invest in energy saving projects. Instead, they are more willing to put their limited funds into maintaining and expanding their core business. Businesses have an incentive to use ESCO services because the ESCO will invest in the energy saving project and

[15] The 12th five-year plan of Energy conservation and Emissions reduction

take investment risks accordingly, which means small investment risk and optimized cash-flow for the host entity.

As a market based mechanism, economic incentive is the key demand driver for the ESCO and its service.

4.1.3 Technology driver

ESCOs as professional energy saving companies are also welcomed for their technical expertise. In reality, though many energy consumers have realized the importance of saving energy and have plans to introduce energy saving projects, they lack the technical expertise to identify appropriate technology, estimate energy savings and assess the cost-benefit of energy saving investments. Lack of expertise commonly exists in all kinds of energy consumers, especially public entities like schools and hospitals.

ESCOs in turn have all the required technical expertise so that they can provide professional service to energy consumers including: energy audits, energy saving project design, project financing, implementing, staff training, operations services, extended equipment warranties, savings monitoring and verification and savings guarantees. These services help the host entity identify, analyze and develop energy savings opportunities and implement solutions accordingly, and hence reduce the technical risks.

ESCOs' specialized capacities to implement energy saving projects ensure that their projects will be more efficient and reliable compared to projects implemented by the host entity. As ESCOs are also investors, they are fully incentivized to investigate all aspects to control project risks. This is particularly important in operating and maintaining equipment in the operations stage of the project. Many energy consuming entities can often succeed in purchasing and installing highly efficient equipment but then lose sight of operation and maintenance afterwards. As energy savings derive from daily operation and proper maintenance of highly efficient equipment, ESCOs' service often better ensure success of the energy saving project.

4.1.4 Social and environmental Driver

Social and environmental benefits are also one of the key drivers in ESCOs' service, though its force is not as powerful as political and economic forces at the moment. Companies, especially industrial companies, acquire ESCO services to implement energy saving projects to meet the supply chain social/environmental performance requirement from their clients, for example, Wal-Mart. Some companies have published their CSR (Corporate Social Responsibility) reports and highlight their energy savings projects as part of their social image.

4.2 Impacts of key policies on various sectors and players

June 2000, an Announcement on further EPC promotion throughout China by the former State Economic and Trade Commission was promulgated for the first time to promote EPC national wide. In the 2007 revised Energy Saving Law, EPC was added. In April 2010, the NDRC/MOF/Central Bank/Tax Bureau published a Circular on further supporting ESCO development and promoting EPC in which support for ESCO and EPC expansion was clearly stated in four aspects: governmental financial rewards; tax incentives; improvement on accounting rules and improvement on financing.

In June 2010, the MOF and NDRC published a circular together announcing the decision to arrange CNY 2 billion in 2010 to support ESCOs to implement EPC projects in various sectors such as industries as well as building and transportation sectors. Influenced by the central government, local governments also published local policies to promote ESCOs in their regions.

In December 2010, the Ministry of Finance and Tax Bureau published detailed financial incentives for ESCOs who can meet the criteria. These incentives include:

- Exemption from corporate income tax for first three years;
- A 50% reduction in corporate income tax for a further three years;
- Exemption from sales tax VAT ;
- In NDRC circular published in 2010 to promote ESCOs development, it clearly stated that ESCOs "provided service on energy saving assessment, financing and implementation, effectively reduced risk on financing energy saving projects and risk on technology of the energy-consuming entity. It was therefore a well incentivized energy-consuming entity, making it an effective method in promoting energy efficiency. "[16]

Under those policy arrangements, ESCOs can be subsidized directly by both the central government and local government for their eligible EPC projects. These incentives and subsidies in turn make the ESCO services more attractive to the end-users both economically and socially.

For those energy consuming enterprises, various binding energy saving targets have largely stimulated their interests to obtain ESCOs' special services. The two relevant major documents here are the 12th Five year Plan on Energy Conservation and Emissions Reduction and also Measures on assessing the ten thousand entities in achieving the energy conservation target. The Plan has set the nation's energy conservation and emissions reduction target from 2011-2015. To make sure these binding targets are achieved, the targets are disaggregated to each province, then to individual cities, counties and major energy consuming

[16] http://www.sdpc.gov.cn/zcfb/zcfbqt/2010qt/t20100408_339332.htm

entities. Those in major energy consuming entities particularly feel more pressure to take action to meet the binding target.

In the Measure published by the NDRC, achievement of an entity's target is incorporated in provincial government's assessment in 2011 and 2012. This puts pressure on the provincial government's shoulder to support entities not just industrial companies but also public institutions for example schools and hospitals, in terms of capacity building, resources and other support to achieve their respective targets. At the same time, policies on adjusting industrial structure and the market entry of certain industries are also having some positive impacts on stimulating demand.

4.3 Demand from key sectors

Previous research shows that ESCOs are active in different sectors depending on the country[17]. In the USA, ESCOs have focused and especially succeed in serving public and institutional sector customers. In China, the most active and promising sectors for ESCOs we have analyzed in this report are the industrial, building and transportation sectors.

EMCA collected and analyzed 874 [18]EPC projects implemented in 2010-2011. The industrial sector represented the major part this business demand, accounting for 82% of total investments and 83% of total energy savings. The building sector followed at 15% of the total investment and 16% of energy savings. The transportation sector was only 3% of total investments and 1% of energy saving.

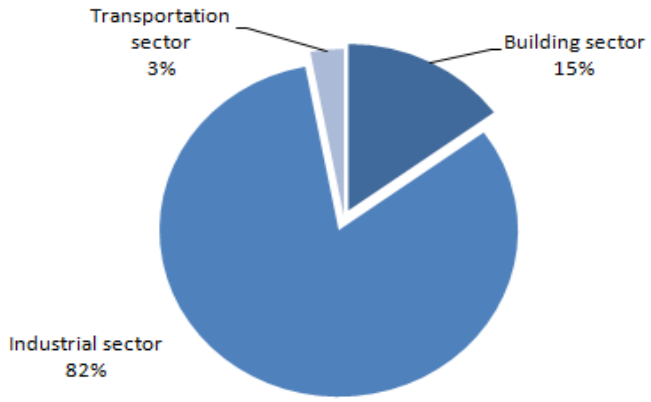


Figure 7 Shares of EPC investments and energy savings in different sectors in 2010-2011

Data Source：EMCA Statistics

Assuming that the total energy saving potential in the 12th Five Year Plan

[17] http://www.worldenergy.org/documents/esco_synthesis.pdf
[18] Data sources: EMCA.

(2011-2015) is 6000 tce[19], proportionally, we can estimate the energy saving potentials in different sectors are as below.

Table 1Estimation of energy saving potential in different sectors during 12th Five Year Plan

Sector	Investment Demand percentage (%)	investment demand (CNY billion)
Building	15	37.5
Industrial	82	205
Transportation	3	7.5
Total	100	250

Note: the investment demand up to CNY 250 billion comes from the 12th five year plan (the reading-book version). *Data Source：EMCA Statistics*

To look further into the actual technologies employed in the above mentioned 874 EPC projects, the chart below shows the distribution of major technologies in terms of investment amount.

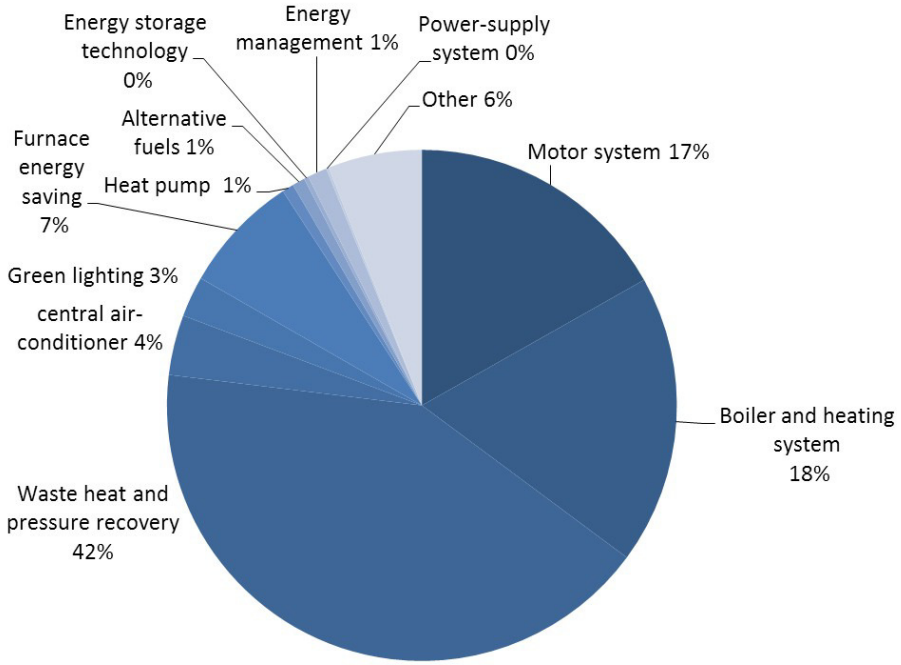


Figure 8 Technologies distribution of EPC projects in 2010-2011 in terms of investment amount.

Data Source：EMCA Statistics

The Study team believes that the above mentioned technologies will continue to expand in the coming years. At the same time, there are still many technologies to be employed and play a role in the sector. Table 2 lists a batch of these

[19] The 12th five-year plan of Energy conservation and Emission reduction, Chapter EPC Promotion Project

technologies and their energy saving potentials as well as financial demand before 2015.

Table 2 Potential technologies to be employed in EPC[20].

Technology type	Energy-saving amount percentage（%）	Energy-saving Potential（1,000 tce）	Investment demand（CNY billion）
Variable Speed Control	20%	12,000	50
Central air conditioning intelligent control technology	4%	2,400	10
Dry-type TRT	3%	1,800	7.5
CDQ	3%	1,800	7.5
Sintering machine waste heat power generation	3%	1,800	7.5
Blast furnace and furnace gas recycle	5%	3,000	12.5
High temperature air combustion（HTAC）	5%	3,000	12.,5
CCPP	2%	1,200	5
Cement kiln pure low temperature waste heat power generation	5%	3,000	12.5
Glass furnace waste heat power generation	4%	2,400	10
Blast furnace blast dehumidification	3%	1,800	7.5
Energy monitor and management	2%	1,200	5
Heat pump	1%	600	2.5
Oxy –fuel	2%	1,200	5
Green lighting	3%	1,800	7.5
Furnace energy saving	8%	4,800	20
Boiler and heating system	13%	7,800	32.5
The new high efficiency and energy saving Membrane polar distance Ionic membrane electrolysis technology	2%	1,200	5
Cottrell control	1%	600	2.5
Screw expander	2%	1,200	5
Dynamic harmonic suppression and	2%	1,200	5

[20] Analyzed by EMCA and Consulting Company of CECEP.

reactive compensation			
Steam exhaust and condensate closed heat recycle	2%	1,200	5
Other	5%	3,000	12.5
Total	100%	60,000	250

Note: the energy saving potential up to 60 million tce and the investment demand up to CNY 250billion come from the 12th year plan (the reading-book version).

Data Source：EMCA Statistics

4.4 Current business models and key contract terms

There are three major types of EPC contract models in general that although the characteristics of each type are similar in many respects to those bearing the same English name, the Chinese categorization cannot truly be used interchangeably with categorizations in other countries.

Energy Savings Shared type: ESCOs provide the project financing and are compensated by their client from a portion of the energy cost savings resulting from the project. The assets created by the project are owned by the ESCO until contract completion and are then usually transferred to the client without additional charge at that time.

Energy Savings Guaranteed type: the host entity will provide the project financing for themselves and own the asset. The ESCO provides service on design and implementation and at the same time, guarantees the energy savings from the project. To be considered a proper energy performance contracting, failure to achieve the guaranteed energy savings committed must have direct consequences and penalize the ESCO.

Outsourcing of the Energy Management system type: This allows ESCOs to invest and develop the project within the host entities' facilities, own it and operate throughout the contracting period. ESCO's compensation could be agreed when signing the contract or linked in one way or another to the energy savings achieved or energy delivered for example, for a waste heat recovery project.

EMCA's data shows that in 2010-2011, 66% of EPC contracts are applying Energy Saving Shared model; Energy Savings Guaranteed Contracts followed at 20%; 6% are outsourcing of energy management system and others accounted for 8%.

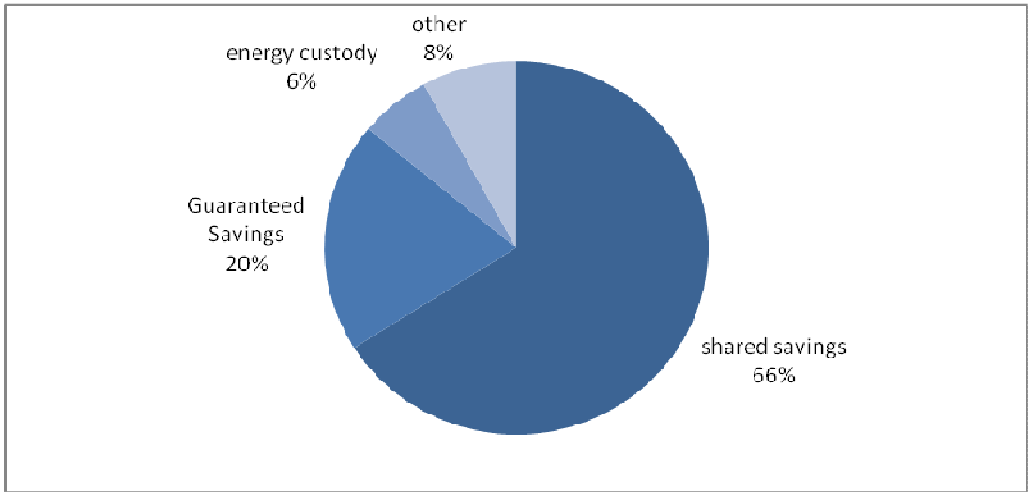


Figure 9 Contract types distribution of EPC contracts in 2010-2011.

Data Source：EMCA Statistics

Energy Saving Shared contracts clearly took the majority. As ESCOs take both credit risk and performance risk in this model, the Energy Saving Shared model leaves the host entity with the least risks and financing burden and is therefore welcomed by host entities. Also, the energy saving shared model is currently the only one recognized for the Government's new energy performance contracting financial incentives. For these reasons, EMCA took the view that this model is likely to expand further in the future and will become more standardized. Recommendations for upgrading Energy Saving Shared EPCs to better support project-based lending are discussed in Section 8.

EPC contract periods are from 3-20 years, with 3-8 year contract terms being the most common.[21] EMCA estimates the EPC contract periods will increase steadily in the future. This will be in parallel with capacity improvements of ESCOs to provide services and because projects are getting more sophisticated as the easier and more straightforward projects have already been developed as low-hanging fruits after more than a decade of development.

EMCA's analysis of 2010-2011 EPC contracts also revealed the contract investment size in different sectors. On average, the EPC project investment size in this two year period averaged CNY13 million (about US$ 2 million). The table below shows the average contract size in each sector.

Table 3 Average EPC contract investment size in 2010-2011

Sector	Average contract size （CNY million）
Building	6.02

[21] EMCA's industry survey in 2012

Industrial	16.53
Transportation	12.58
All average	12.96

Data Source：EMCA Statistics

4.5 Projected contract volume in each key sector

As calculated earlier, energy efficiency investment demand of each sector during the 12th FYP is estimated as industrial sector CNY 246 billion, building sector CNY 45 billion and transportation CNY 18 billion. It is expected that percentage of the building sector will become larger and grow faster than the other two sectors in the 12th FYP.

Back in the 11thFYP period (2006-2010), big cities like Beijing and Shanghai had taken various approaches to deal with highly polluting and huge energy consuming industries. This included shutting industries down, decommissioning old inefficient equipment, employing more advanced technologies or relocating industries outside the cities. Industry has contributed to the largest portion of these cities' achievement of energy conservation and emissions reduction targets in that period.

To meet the target of the 12th FYP, sectors now face an unavoidable concern and must be the focus both in terms of the amount of buildings in those mega cities and the high potential in energy saving for older ones. EPC is probably the most suitable market mechanisms to develop energy saving in the building sector compared to other existing ones like carbon trading. It is sensible to estimate that the demand for energy saving and EPC projects in the building sector will grow considerably in the coming years.

4.6 Trend and growth of certain sectors or technologies

4.6.1 Key Industries

4.6.1.1 Steel industry

The energy conservation and emission reduction technologies which are most popular and developed vigorously in the steel industry are as follows:

1. Pre-iron energy conservation and emission reduction technologies: Low temperature sintering technology, sintering gas desulphurization and deNOx technology, mini-pellet sintering technology, chain grate-rotary kiln pellet technology, technology for cycling of pellet waste heat, high temperature and high pressure coke dry quenching technology, coal moisture control technology, stamp-charging coking technology, waste plastic re-using for coke oven and blast furnace, high efficiency coal injection for blast furnace, blowing technology for dehumidifying of blast furnace, dry dedusting technology for blast furnace,

Twin preheating technology for hot air furnace/blast furnace, and iron-containing dust process technology for rotary hearth furnace.

2. Energy conservation and emission reduction technologies for steel making and rolling: Coal gas dry dedusting technology of converter, negative energy steel making technology of converters, waste heat recycling and utilization technology for waste heat of electric furnaces, regenerative combustion technology, low temperature rolling technology, on-line heat treatment, comprehensive utilization of scale produced in steel rolling process.

3. Comprehensive energy conservation and emission reduction technologies: Combined Cycle Power Plant (CCPP), dust suppression technology of stock yard, dual membrane process for sewage treatment and reuse, energy management center and optimized regulation technology, comprehensive utilization of metallurgic slag, comprehensive sewage treatment technology, comprehensive utilization of waste heat and waste pressure.

4.6.1.2 Building material industry

The energy conservation and emission reduction technologies which are most popular and vigorously developed in the building material industry as follows:

1. Cement: Popularize such technologies as low-temperature and waste heat power generation, frequency control, vertical mill, roll squeezer, flue gas deNOx.

2. Plate glass: Popularize such technologies as comprehensive utilization of waste heat of melting furnace, oxygen-fuel combustion, high temperature pre-calcining of mixtures, flue gas desulphurization and deNOx.

3. Architectural ceramics: Popularize such technologies as dry-milling, plastic extrusion molding of ceramic tile, once-firing, etc. It is also included that the innovation for energy conservation and emission reduction of such equipment as ball mill, drying tower, kiln, etc.

4. Sanitary ceramics: Popularize such technologies as high pressure grouting, etc.

5. Wall materials: Popularize such technologies as waste heat utilization for tunnel kiln of sintered brick, frequency control for blower of kiln.

Nonmetallic ore: Popularize separation and purification technology for low-grade ores.

4.6.1.3 Petrochemical industry

The main energy conservation measures for key products of the petrochemical industry are as follows:

1. Ethylene: Optimize the structure of raw materials to get a lighter raw material. Support the energy conservation innovation of ethylene producing enterprises, so as to realize an optimized energy utilization of production systems. The comprehensive energy consumption of ethylene production should be reduced to 0.857tce per ton of product by 2015.

2. Aromatics: Optimize the operation process to realize reasonable utilization of steam energy. Reduce the fuel consumption of heater by reducing its payload and increasing its thermal

efficiency. Popularize the use of new and high efficiency catalyst (absorbent) to improve energy utilization efficiency of the device and the economic benefit.

3. Synthetic material and monomer: Carry out technical innovation of energy conservation for production units of polyethylene, polypropylene, caprolactam, and acrylonitrile, ethylene glycol and so on to reduce the consumptions of steam, water and raw materials and to improve their energy efficiency. Develop and produce new type and model of synthetic resin, rubber and fiber with energy saving and environmental friendly features.

4.6.1.4 Chemical industry

The main energy conservation measures for key products of the chemical industry are as follows:

1. Synthesis ammonia: Optimize the structure of raw materials to realize a diversified material supply for ammonia producing. Support the energy conservation innovation of nitrogenous fertilizer producing enterprises. Accelerate the indigenization process of packaged technical equipment, such as large synthesis ammonia producing equipment by using pulverized coal as its raw material. By 2015, the comprehensive energy consumption of synthesis ammonia production should be reduced to 1.35tceper ton.
2. Caustic soda: Push forward the indigenization of membrane used for caustic soda producing by ion-exchange membrane process. Support the energy conservation innovation of caustic soda unit by new electrolyses with membrane polar distance and ion-exchange membrane. By 2015, the comprehensive energy consumption for producing caustic soda (ion-exchange membrane process accounting for 30%) should be reduced to 0.33tce per ton.
3. Soda ash: Strengthen the adjustment of product mix. Increase the proportion of productive capacity of heavy soda ash and dry ammonia chloride. Encourage large and medium enterprises to adopt measures for improving utilization efficiency of thermal energy, such as combined use of thermal and electricity energy and multi-stage utilization of steam, etc. By 2015, the comprehensive energy consumption for producing soda ash should be reduced to 0.32tce per ton.
4. Calcium carbide: Push forward the annexation and reorganization of calcium carbide industry. Encourage the enterprises to move to the original place of resources and energy sources. Promote rational development of layout and structure of the industry. Accelerate the innovation of internal combustion furnace and improve the level of technical equipment. By 2015, the comprehensive energy consumption for producing calcium carbide should be reduced to 1.05tceper ton.
5. Yellow phosphorus: Strengthen the recycling of tail gas. Popularize deep purification. Produce C1 chemicals with high technology and high additional value. Replace wet dedusting technology with dry dedusting. Strengthen the construction of research and demonstration projects for comprehensive heat and slag utilization of melted phosphorus slag.

4.6.1.5 Building Energy Conservation industry

The key energy conservation tasks and agenda for the building construction industry are as follows:

1. Energy conservation supervision of newly-built buildings.
2. Energy conservation innovation of existing residential buildings.
3. Energy conservation supervision of large public buildings and energy conservation innovation of high energy-consuming buildings.
4. Large-scale application of renewable energy sources on architectural field.
5. Popularization of green buildings.
6. Energy conservation of rural buildings.
7. Popularization and application of new materials.
8. Industrialization of architecture and residential buildings.
9. Application of green lighting.

4.6.1.6 Public institution

The key energy conservation tasks and agenda for public institutions are as follows:

1. Building and its energy-consuming system ■ Strengthen the energy conservation supervision, green building and energy conservation innovation in the process of construction. ■ Carry out energy conservation innovation for key energy-consuming equipment, such as power distribution equipment, air conditioner, heating equipment, lighting equipment, lift, drinking water equipment, etc. ■ Strengthen equipment of measurement instruments. Accelerate innovation for measurement of heat supply. Disseminate information on energy source management. ■ Carry out low-cost and cost free energy conservation management. Promote the establishment of market-based mechanism for energy conservation innovation of public institution buildings.
2. Ancillary facilities – Data center and canteen
3. Cars for public affairs
4. Utilization of new energy and renewable energy
5. Water conservation and comprehensive utilization of resources

4.6.2 Current EPC key industry/ energy conservation technologies[22]

1) Waste Heat Recovery for Power Generation Technology

The additional generators by waste heat put forward in the 12th FYP of Energy Conservation and Emission Reduction have a total installed capacity of 200GW and are mainly for steel, building material, chemical, independent coking, coal seam gas and non-ferrous metal industries. ESCOs will focus on projects of generation by waste heat from steel and building material industries.

- Steel industry

Coke dry quenching (CDQ): This technology can cool red coke by heat exchange of cooled inert gas with fiery red coke in a CDQ shaft to avoid waste of waste heat and water resource and reduce severe contamination to the atmospheric environment by dust and flue gas. Hot inert gas can be sent to a waste heat boiler for heat exchange and steam produced in such a boiler can be sent to steam pipeline or used for power generation. During the 12th FYP period, 32 CDQ units will be installed, leading to the CDQ production capacity predicted to reach 96 million tons, and the CDQ rate up to 85%. Calculated in 0.06tce for each ton of coke, it will form an energy conservation capacity of about 1.95 million tce, requiring an investment of about CNY 6.8 billion.

Top pressure recovery turbine-generator (TRT) is a technology to turn pressure energy and heat energy of blast furnace top gas into electrical energy by turbine generation unit and one of the most important energy conservation measures for iron making. According to different furnace top pressure, each ton of iron can generate power of about 20-40 KWh. Both dry dust collection and wet dust collection methods can be employed for TRT dust collection. If the former is employed, the power generation can increase about 30%. During the 12th FYP period, among blast furnaces larger than 600m^3, 80 blast furnace dry dust collection and dry TRT units will be constructed or reconstructed. As the recovery of power per each ton of iron is 35 kWh, it will form an energy conservation capacity of about 1.6 million tce, requiring an investment of about CNY 3.2 billion.

Power generation engineering of full-burning gas boiler and combined cycle power plant (CCPP): Full-burning blast furnace gas boiler generation technology can generate electricity through steam turbine generator unit driven by steam produced in boiler taking surplus gas from iron and steel enterprise as the fuel gas. It mainly includes three core equipment types, i.e. boilers, turbines and generators. As an important gas buffer user for iron and steel enterprises, it can fully and efficiently recycle various surplus gases from such enterprises. Meanwhile, with it, coal handling and pulverizing system and bottom ash and

[22]Data from EMCA and Consulting Company of CECEP.

dust collection system for general thermal power plants are not required. CCPP technology mixes the by-product coal gas from blast furnace of an iron and steel enterprise which has been purified and boosted in a dust collector with the air purified and boosted in an air filter and sends the mixture to the combustion chamber of gas turbines for combustion. The produced high pressure and high temperature flue gas carries expansion works directly in the gas turbine and drives the generator to finish single cycle power generation. The high temperature gas exhausted after expansion work of the gas turbine is sent to the water-heat boiler to produce high-medium pressure steam, and then the produced steam is sent to the steam turbine to work, drive the generator for generation and finally form the CCPP system. In the system, both boiler and turbine can provide steam and constitute the waste heat power generation system in a flexible way.

Utilization of surplus gas from iron and steel enterprises and the construction of full burning gas high temperature and high pressure generator unit: Enterprises with a capacity more than 5 million tons/year shall use surplus gas and construct the CCPP generator unit. During the 12th FYP period, 30 full-burning gas boiler generation projects and 10 CCPP generator units will be constructed, forming an energy conservation capacity of 2.8 million tce and requiring an investment of about CNY 14.5 billion.

Sintering waste heat power generation technology: It utilizes waste flue gas to produce steam via heating pipe/device or waste heat boiler, so the produced steam can drive the turbine unit for generation. In China, there are four kinds of generation technologies for sintering waste heat power generator unit, i.e. single pressure waste heat generation, dual pressure waste heat generation, flash waste heat generation and afterburning waste heat generation. Waste heat recovery from flue gas produced by each ton of sinter can generate electricity of 20kWh, and the comprehensive energy consumption reduction per each ton of steel is converted into 0.008tce. During the 12th FYP period, 100 sintering waste heat power generator units will be established, forming an energy conservation capacity of 2 million tce and requiring an investment of about CNY 6.3 billion.

Regenerative combustion technology: With a regenerative flue gas recovery unit, it can alternately switch over air or fuel gas and flue gas and make them flow through heat accumulator to reach the maximum sensible heat of high flue gas recovery, lower the temperature of exhausted flue gas, raise the temperature of combustion medium or fuel gas, so as to reduce fuel consumption. By utilization of low-heat value gas, it also can efficiently reduce fuel consumption, NO_x emission concentration and CO_2 emission. During the 12th FYP period, 170 heating furnaces will be subject to regenerative innovation, forming an energy conservation capacity of 1 million tce and requiring an investment of about CNY 900 million.

Power generation engineering of rotary furnace waste heat: It directly uses low pressure saturated steam produced from gas duct waste heat for generation. The whole system is composed by a gas duct steam production system, energy storage system and steam turbine generator system, etc. During the 12th FYP period, 60 power generator units of rotary furnace waste heat will be constructed, forming an energy conservation capacity of 0.5 million tce and requiring an investment about CNY 3 billion.

- Building material industry

Cement Production Line Waste Heat recovery for Power Generation: It turns the waste heat of exhaust gas from the head and the end of cement kiln into electricity, which effectively increases the utilization rate of energy during cement production, and reduces energy consumption and environmental pollution. At present, the power generation per each ton of clinker is generally between 37-42 kWh in a pure low temperature waste heat power generation project. Waste heat recovery power generation can provide over one third of total power demand of cement factory. Therefore, the technology can bring obvious energy conservation benefits. There were about 200 new dry method cement lines built before 2007 and will be used for construction of about 160 waste heat power plants during the 12th FYP period. The total installed capacity of such plants will reach 1,280MW. About 6.9 billion kWh outsourcing power, equal to energy conservation capacity of 2.35 million tce, will be reduced. An investment of about CNY 9.4 billion is required.

Generation technology by waste heat of glass: It recovers waste heat energy of exhaust gas from glass melting furnace via waste heat boiler, sends steam to steam turbine for expansion work and turns the heat energy into mechanical energy, so as to drive the generator for generation. During the 12th FYP period, innovation with float glass melting furnace waste heat power generation technology shall be implemented, accounting for 40%. About 30 supporting waste heat power plants shall be constructed for about 80 float glass product lines with the capacity of 400t/d. The total installed capacity of such plants is 230MW. About 1.4 billion kWh outsourcing power, equal to energy conservation capacity of 0.51 million tce will be reduced. An investment of about CNY 1.6 billion is required.

2) Optimization of motor control mode

High Voltage Frequency variation technology: It adopts technologies such as cell series multilevel technology or technology of IGBT element directly connecting to high voltage frequency converter in series, etc., realizes high output capacity of variable frequency speed control system (power factor>0.95) and eliminates electrical network harmonic pollution. For medium/high pressure and high-power fan and pump, it can bring obvious power saving and

consumption reduction (the average power saving ratio is higher than 30%). In order to achieve high efficiency operation of the system, innovation shall be emphasized on numerous and widely used independent systems driven by medium-sized and small-sized motors. Such comprehensive innovation can increase the operation efficiency of fan/pump systems by 10-20%, reaching the equivalent operation level of developed countries. During the 12th FYP period, the capacity planned to be reconstructed is 60 million kW, forming an energy conservation capacity of 58 billion kWh and requiring an investment of about CNY 72 billion.

- **Energy efficiency innovation in existing buildings**

During the 12th FYP period, energy conservation innovation shall be completed for 400 million m^2 existing residential buildings in the northern area and 50 million m^2 public institutions in areas with hot summers and cold winters, as well as 120 million m^2 public organizations, in order to achieve the energy conservation capacity of 6 million tce.

1）Innovation of heat metering and the heating systems of existing buildings: During the 12th FYP period, totally 315 million m^2 of residential houses in the northern heating area of China shall be subject to indoor heating and temperature control and heat metering innovation.

2）Innovation of envelop enclosures: Envelop enclosures of residential houses in the northern heating area of China and areas with hot summers and cold winters shall be subject to energy conservation innovation, including insulation innovation for thermal bridges such as walled bodies, roofs, doors and windows, staircases and balcony fence-slabs and air conditioning boards so as to increase the energy utilization ration of existing buildings. The innovation area totals as 275 million m^2.

3）During the 12th FYP period, government organizations shall be subject to energy conservation innovation for public buildings, with an innovation area of 60 million m^2. In addition, other public buildings such as commercial and public buildings shall be subject to energy conservation innovation, with an innovation area of 60 million m^2.

- **Traffic and transportation**

Retrofit engineering from oil to electric power for port rubber-tired container gantry crane (RTG): It changes the RTG supplied by diesel generator unit into that powered by electricity, which not only reduces energy consumption and operation cost, but also the local air pollution and improves environmental quality. The innovation of “Electricity changed from oil” engineering shall be implemented for 1,600 port RTGs all over the country which are worthy for innovation. Old equipment with high energy consumption and low efficiency

shall be replaced by intelligent-controlled electric machinery with low energy consumption and high efficiency. This will therefore improve the overall technical level and operation efficiency of the equipment. After the innovation, the energy consumption can be reduced by more than 30% and 120,000 tce can be saved. The total investment is about CNY 400 million.

4.7 Barriers in expanding demand

Although there is a big potential for the demand for ESCOs' services to increase, there are still various barriers that limit their expansion. For example, the Government's energy saving financial incentives encourages not only energy saving projects implemented by ESCOs, but also promotes projects implemented by end-users as long as their projects meet the certain criteria. Some energy consuming companies which have the technical and financial capacities may prefer to develop their in-house capacity and implement energy saving projects themselves to obtain the government's financial incentives rather than to use ESCOs. This in turn will limit demand for ESCOs' services.

Lack of advanced and reliable technologies to be employed by ESCOs could be another barrier. Most ESCOs are using mature, proven technologies, for example, the retrofitting of old motor systems, lighting systems and boilers. Lack of experience with new advanced technologies may limit ESCOs to develop new markets where there are still big energy saving potentials. On the other hand, ESCOs' technical capacity limits to acquire more sophisticated technologies and systems also exist. This would be further explored in the next section.

Furthermore, it is also observed that particularly in the industrial sector, many companies, especially those big companies who would be big clients for ESCOs, have institutional barriers that make it difficult for ESCOs to sell their services and projects. Those companies usually have a fairly complex organization structure --- different departments, reporting lines and budgets. These can make it difficult for ESCOs to access the correct decision makers and get support from higher management.

In addition, some industrial companies do not allow ESCOs to check their core industrial processes due to fears about protecting their trade secrets, specialized knowledge and concerns of avoiding production interruptions.

5 In-depth Development Analysis of China's ESCO Industry

Abstract: This chapter includes in-depth analysis of ESCOs registered by NDRC/ MOF in their first four registration batches and of the first round of EMCA's questionnaire survey on ESCO development. Since November 2010, 2,339 ESCOs have effectively registered. The registered capital of those ESCOs totals CNY 37.95 billion, an average of CNY 16.23million per ESCO. Almost half of the ESCOs were established in 2010 and 2011.The total investment value of energy performance contracting projects by these registered ESCOs was CNY 35.05 billion, which equals an average project investment of CNY 14.98 million; 431 enterprises got bank loans that accounting for 18.43% of the total with the number of loans amounting to CNY 7.795 billion.

From the questionnaire given in the first round of 446 enterprises, most of them are private and more than 50% of them have one or more patents for inventions. There are 167 high-tech enterprises, accounting for 39% of the total. The enterprises which operating incomes have less than CNY20 million in 2011 account for 73%; The waste heat and pressure utilization projects, motor system energy conservation projects and energy system optimization engineering are the most popular project lines in energy service. The contract period of about 75% projects are less than 5 years and the average payback period of 71% EPC projects are less than 3 years. The development of the ESCO industry has a great connection with China's overall economy and regional economic development. The more developed regions are North, East and South China, where the number of ESCOs, market scale, financing, and management levels in those regions have more advantages than other areas. This chapter analyses the ESCO industry from different aspects, such as enterprise which has operated more than 20 projects; and those whose operating incomes are more than CNY 20 million.

5.1 Information of registered ESCOs in China[23]

In order to promote the development of the ESCO industry with supportive financial subsidy, the NDRC and MOF started to register ESCOs officially in 2010. To be registered as an ESCO, a company has to meet certain criteria. For example, its core business shall cover energy auditing, diagnosis, design, retrofit and operation, its registered capital should exceed CNY 5 million, it has competent technical professionals and personnel on implementing EPC projects, etc. So far, four rounds of registration have been conducted and 2,339 companies have been registered. The objective in registering ESCOs is to confirm the number and

[23]Data sources: name list of 1-4 batches of registered ESCOs by NDRC and MOF and analysis by EMCA.

eligibility of ESCOs who can apply for the specified subsidies.

There were 1,116 ESCOs founded in 2010 and 2011, which makes up 47.71% of the total 2,339 registered ESCOs. The operating periods of two thirds of ESCOs are less than 5 years within which, part of ESCOs do not have actual project experience, refer to Figure 3.

The Gross Assets of 2,339 ESCOs are CNY 80 billion, the average assets are CNY34.19 million among which, 1,127 ESCOs' assets are less than CNY 10 million, accounting for 48%. 1,898 ESCOs' assets are less than CNY 30 million, accounting for 81%. Only 11% are higher than CNY 50 million. The scales of ESCOs are relatively small which cannot attract significant interest from financial institutions.

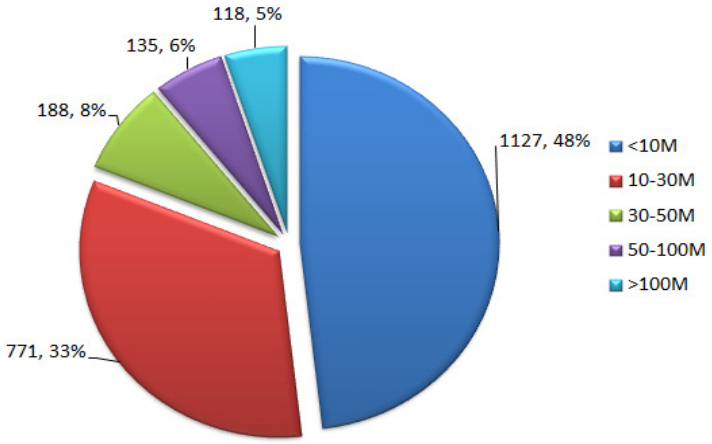


Figure 10 Scale Distribution of Gross assets of ESCOs

Data Source：EMCA Statistics

The total investment of EPC projects of 2,339 ESCOs amounted to CNY 35.08 billion, which equals an average investment per ESCO of CNY 15 million. There are 676 ESCOs which have not carried out any EPC project, accounting for 28.91%; 1,490 companies', investment in EPC projects was less than CNY 5 million, accounting for 63.7%; 1,849 companies' investment in EPC was less than CNY 10 million, accounting for 79.05%; EPC project investment by the top 112 ESCOs was more than CNY 50 million, accounting for 4.79% of ESCOs. Figure 12 shows that 1,849 companies' investment in EPC was less than CNY 10 million, the total investment was CNY 4 billion, accounting for 12.53%, the average was CNY 2.378 million; 112 companies' investment in EPC was more than CNY 50 million, the total investment was CNY 23 billion, accounting for 65.59%, average was CNY 0.2 billion.

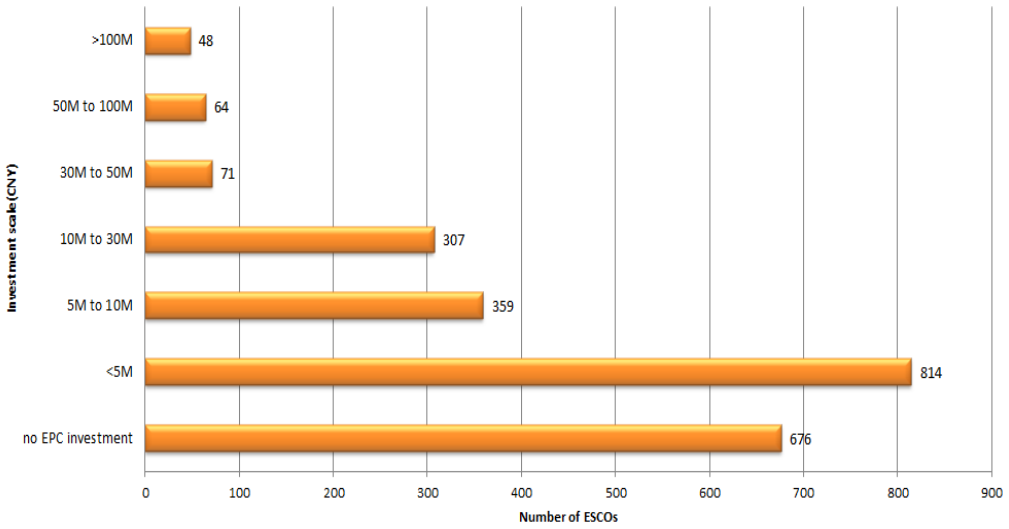


Figure 11 The investment situation of EPC in ESCOs

Data Source：EMCA Statistics

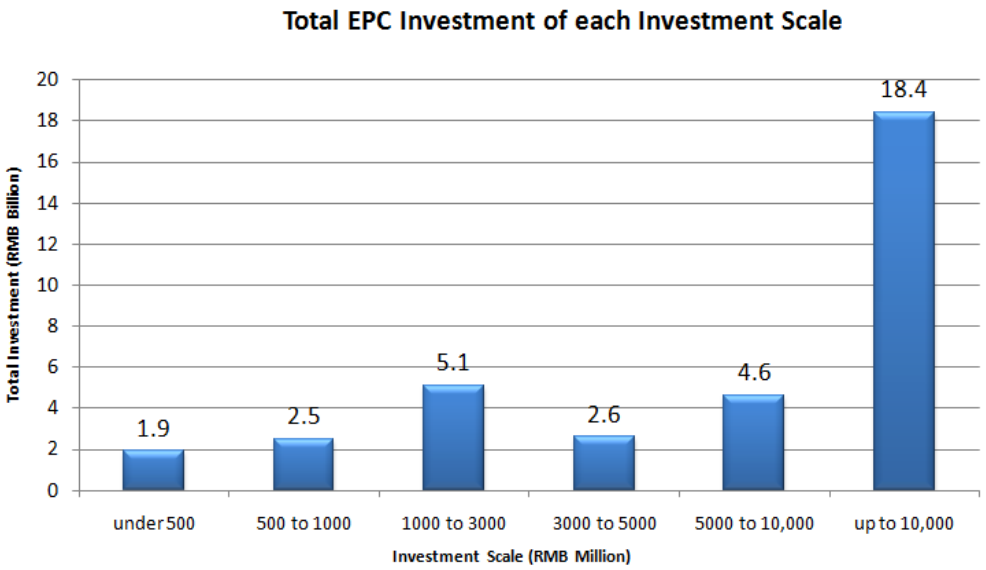


Figure 12 The investment situation of EPC in ESCOs

Data Source：EMCA Statistics

The total number of loans obtained by ESCOs in 2011 is CNY 7.795 billion. Among 2,339 registered ESCOs, 431 ESCOs used loans, representing only 18.43%. 215 of these companies had loans less than CNY 5 million accounting for 49.88%, with these loans totaling CNY 454 million, averaging CNY 2.11 million per company; 36 companies have received loans of more than CNY 50 million, with total loans amounting to CNY 5 billion, with an average of CNY140 million.

It is obvious that there is a big gap between the loans disbursed and demanded, it means big efforts needed from FIs and ESCOs for sustainable EPC project financing.

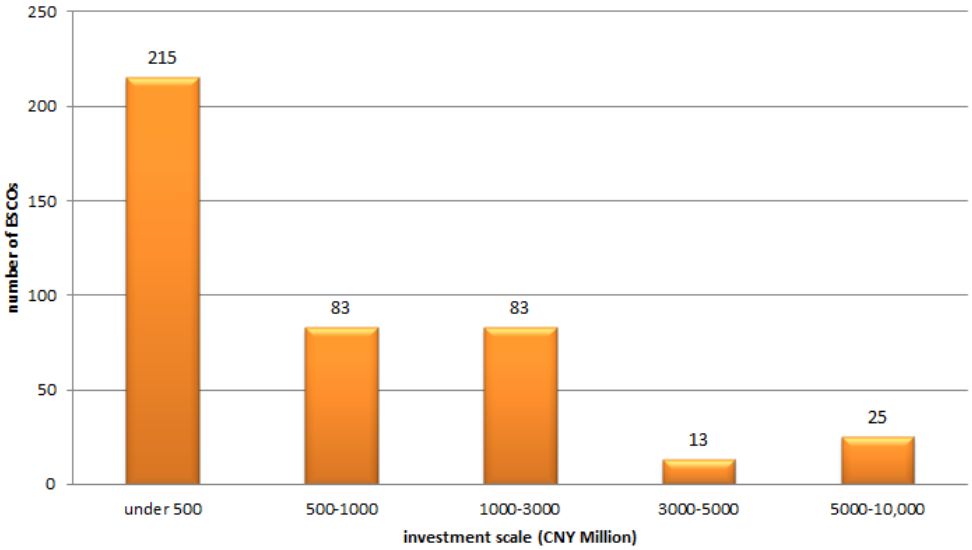


Figure 13 Number of ESCOs gained loans

Data Source：EMCA Statistics

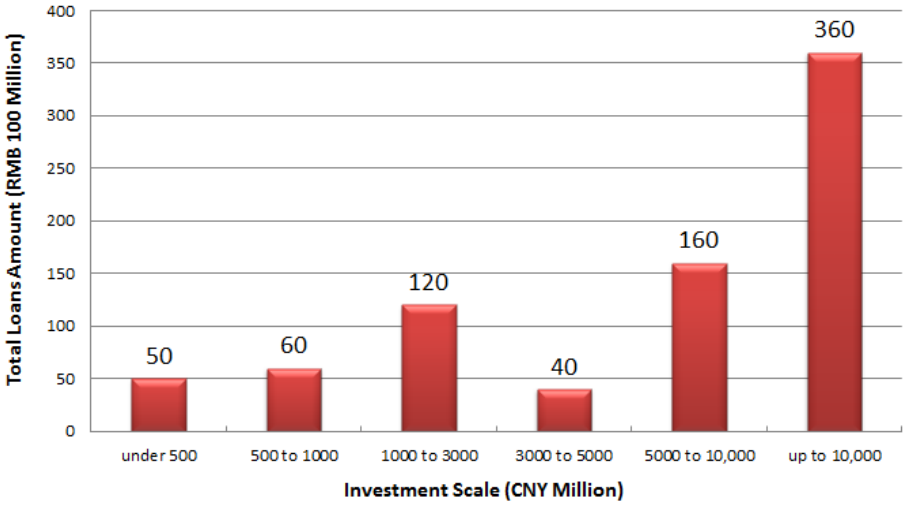


Figure 14 The loans situation of ESCOs

Data Source：EMCA Statistics

5.2 Analysis on development status of ESCOs via questionnaire[24]

To understand the current financing information of ESCOs and search for ESCOs which have potential for IFC equity financing and cooperating with CHUEE bank financing, the Project team organized two rounds of questionnaire surveys and then made detailed analysis of 446 enterprises, submitting the first questionnaire survey in terms of registered capital, quantity of energy efficiency projects, growth of operating income, patents, and investment payback period. (Currency involved in the

[24]Data sources: EMCA's analysis based on the first round questionnaires.

analysis below is CNY).

5.2.1 Analysis of overall conditions

5.2.1.1 Analysis of hi-tech enterprises

Based on received 425 effective answers of questionnaires, there are 167 high-tech enterprises, accounting for 39% of the total interviewed. There are also 130 non-high-tech enterprises accounting for 31%, 128 which were applying for High-Tech Enterprise, making up 30% of the total. It is revealed from the data that high-tech enterprises and enterprises applying for High-Tech Enterprise accounts for 70%. To support and encourage improvement of high-tech industries, the Chinese government offers qualified knowledge-intensive and technology-intensive enterprises with preferential policies in respect to tax exemption, tax deduction and tax refund. With supportive policies, high-tech enterprises enjoy more advantages than common enterprises in terms of industry background, status, development potentiality and market demand, attracting great attention from investors engaging in different industries. High-tech enterprises in the energy-saving service industry are intensive, indicating enormous development potentiality.

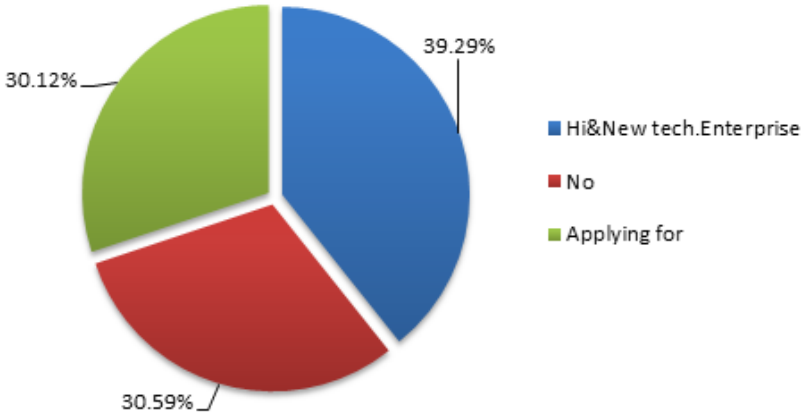


Figure 15 Proportion of hi-tech enterprises

Data Source：The Study Questionnaire and Survey

As for patents, valid data is offered by 446 enterprises, according to which, 97 enterprises possess no patent, accounting for 22%. 349 enterprises possess one or more patents, accounting for 78%; With respect to patent type, 225 enterprises have patents for invention, accounting for 65% of the total enterprises possessing patents and 50% of the total interviewed enterprises. 304 enterprises possess patents for utility models, making up 86% of the total, 70 enterprises enjoy design patents, accounting for 20%, 204 enterprises possess both patents for invention and patents for utility models, accounting for 58%, 56 enterprises have both patents for invention and design patents, accounting for 16%, 69 enterprises have both patents for utility

models and design patents, taking up 20%, 56 enterprises have patents for invention, patents for utility models and design patents, accounting for 16% of the total.

Most of the enterprises in the ESCO industry have one or more patents, with a generalization of design patents and patents for utility models manifesting within the technology intensive features of this industry. They also highlight the important role of technological innovation in industrial development.

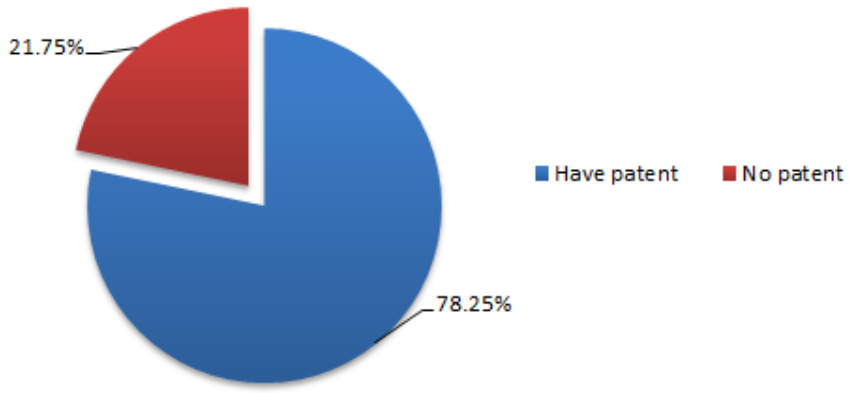


Figure 16 Patent information

Data Source：The Study Questionnaire and Survey

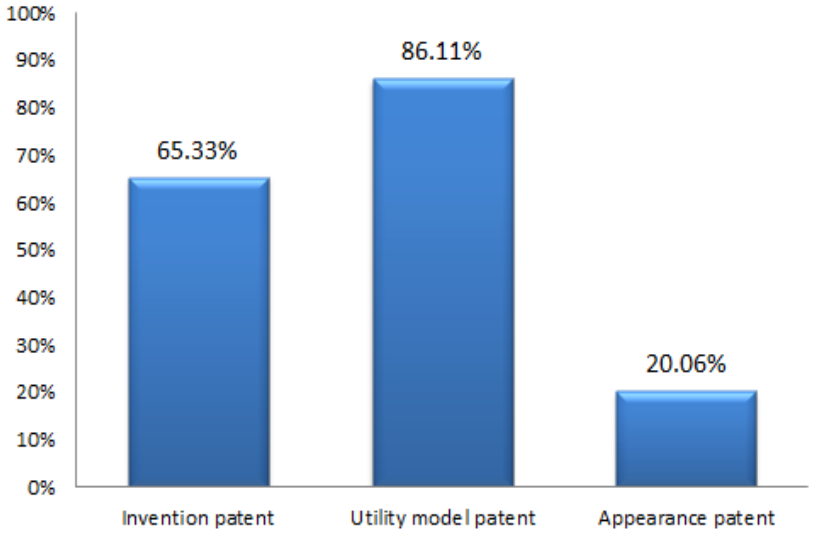


Figure 17 Proportion of patent type

Data Source：The Study Questionnaire and Survey

5.2.1.2 ESCO Operating income

As for operating income in 2010, valid data is offered by 372 enterprises, according to which, the number of ESCOs with operating income being below CNY 5 million, CNY 5 million to 10 million, CNY 10 million-20 million, CNY 20 million-50 million, CNY 50

million-100 million and above CNY 100 million, respectively, is 145, 93, 51, 31, 37 and 15, respectively accounting for 39%, 25%, 14%, 8%, 10% and 4% of the total interviewed enterprises. As for operating income in 2011, valid data is offered by 399 enterprises according to which the number of energy-saving service enterprises with operating income being below CNY 5 million, CNY 5 million-10 million, CNY 10 million-20 million, CNY 20 million-50 million, CNY 50 million-100 million and above CNY 100 million respectively is 116, 108, 69, 40, 48 and 18, respectively accounting for 29%, 27%, 17%, 10%, 12% and 5% of the total interviewed enterprises.

It is revealed from the data above that the ESCOs with an operating income below CNY 10 million in 2010 accounted for 64% of the total enterprises and those with an operating income below CNY 20 million make up 78% of the total. ESCOs with an operating income in 2011 below CNY 10 million accounts for 56% of the total, and those below CNY 20 million accounts for 73%, representing a year-on-year decrease compared with 2010. Operating income on the whole in 2011 is obviously higher than that in 2010. Operating income in 2011 is obviously higher than that in 2010. This can be revealed in that the proportion of enterprises with an operating income below CNY 5 million of such enterprises to the total have decreased compared with the same period of last year. Also both the number and proportion of the enterprises within other operating income ranges have increased compared with 2010, particularly the number with an operating income in 2011 below CNY 10 million and 20 million has obviously decreased compared with last year. On the other hand, the number of enterprises with an operating income in 2011 above CNY 20 million, 50 million and 100 million has increased compared with the last year. It can therefore be concluded that ESCOs are witnessing eye-catching growth in operating income. Furthermore, the base of ESCOs with revenues greater than CNY 100 million is 15 and those greater than CNY 50 million comes to 52 in total; these are significant sets of opportunities which EMCA can further assess (and already has, to a limited extent) for potential IFC corporate and/or project investment. Some of these ESCOs have larger parent companies, also, which may offer certain recourses or pathways for secured investment.

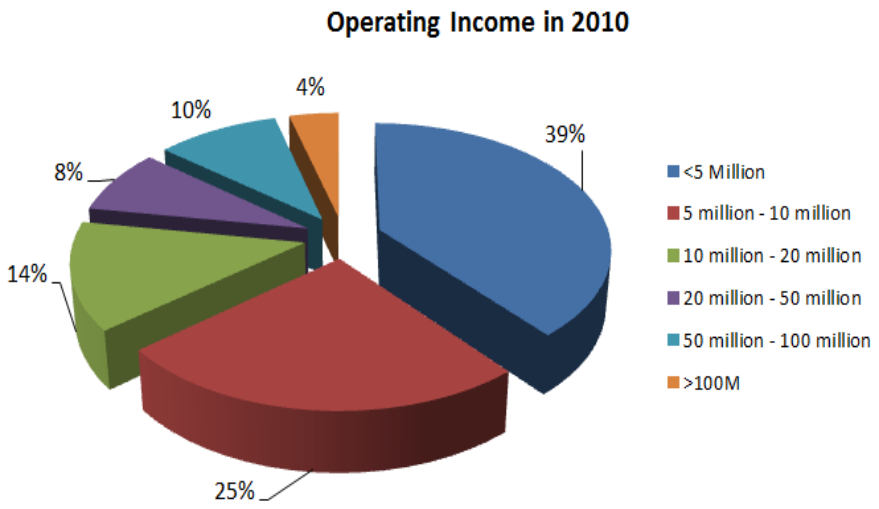


Figure 18 Operating incomes distribution in 2010

Data Source：The Study Questionnaire and Survey

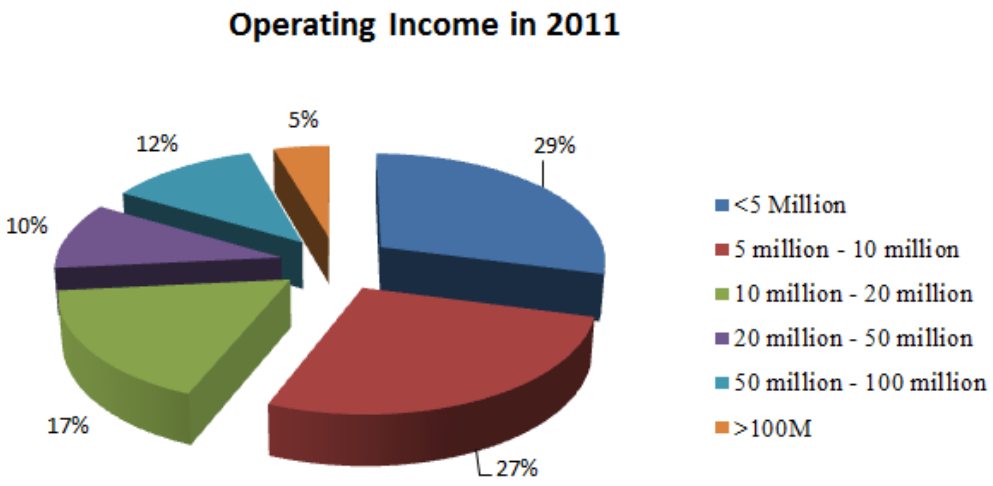


Figure 19 Operating income distributions in 2011

Data Source：The Study Questionnaire and Survey

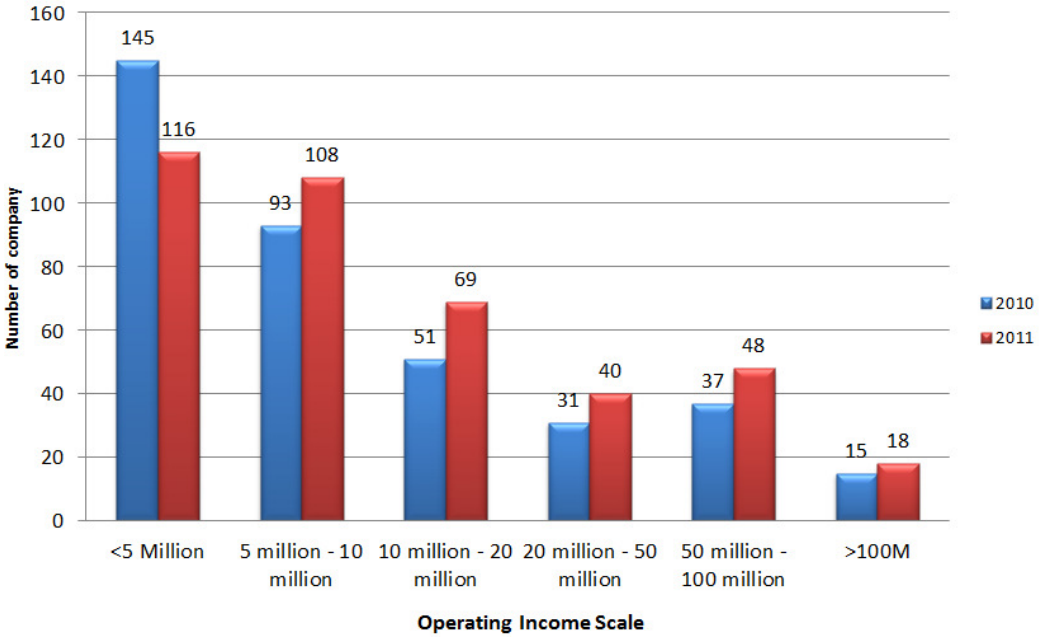


Figure 20 Distribution proportion of operating income in 2011

Data Source：The Study Questionnaire and Survey

5.2.1.3 Main EPC project types

As for main business types, valid data is offered on 446 enterprise questionnaires, according to which, the number of enterprises carrying out coal-fired industry boiler and furnace renovation, regional co-generation, waste heat and pressure utilization, oil conservation and substitution, energy saving of motor system, energy system optimization, energy saving in buildings, environment-friendly illumination, government energy saving, energy-saving monitoring and technology service system establishment respectively is 153, 62, 208, 31, 223, 203, 172, 186, 147 and 161, accounting for 34%, 14%, 47%, 50%, 46%, 39%, 42%, 33% and 36% of the total number interviewed. Additionally, 37 enterprises have other types of business, accounting for 8% of the total. This data reflects the current relative concentration of the 11th FYP generation of EE investment in a discrete set of economic, proven EE technologies and systems. Thus the potential to both deepen and broaden EE investment can come from this base.

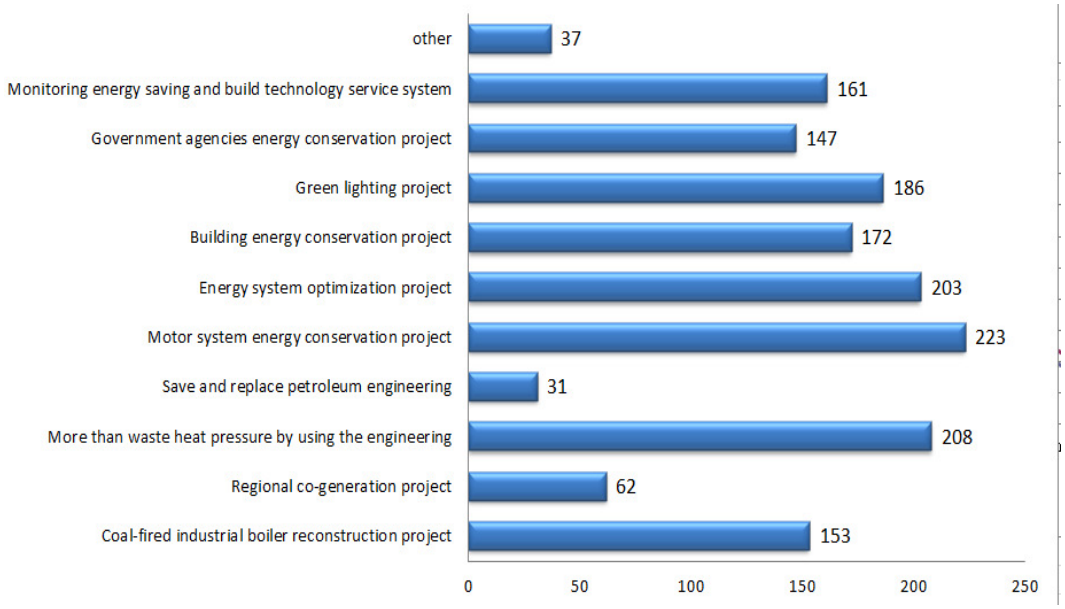


Figure 21 Number of enterprises corresponding to various business types

Data Source：The Study Questionnaire and Survey

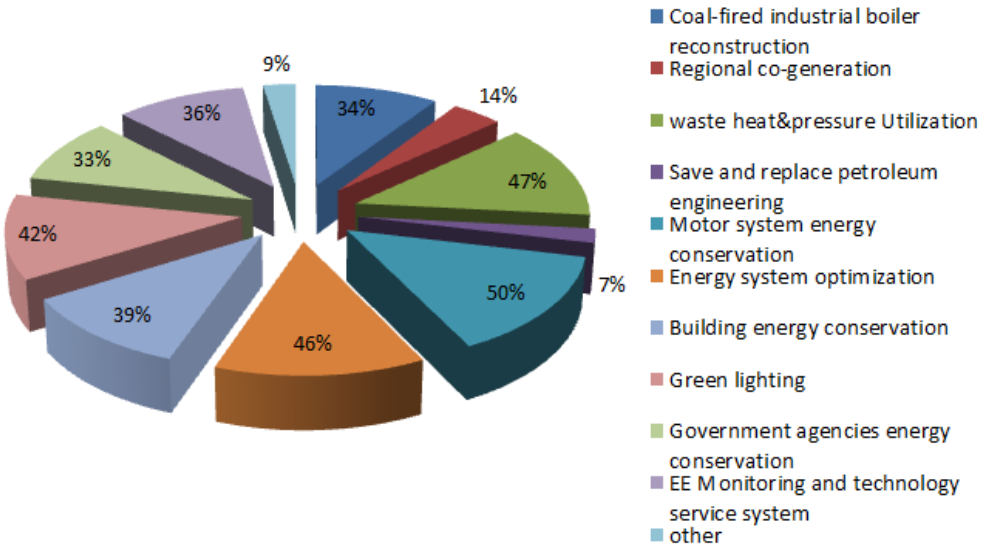


Figure 22 Main business types

Data Source：The Study Questionnaire and Survey

5.2.1.4 ESCO staff

As for employee size, valid data is offered from 431 questionnaire responses, according to which there are 229 ESCOs with staff of 50 persons or below, accounting for 53%, 104 ESCOs with staff of 50-100 persons, accounting for 24% of the total and 7 ESCOs with staff exceeding 1,000 persons accounting for 2% of the total. The ESCOs with staff of 50 persons below account for more than half of the total ESCOs and the enterprises with staff of 100 persons below account for 75% of the total, which indicate that ESCO is relatively small in size.

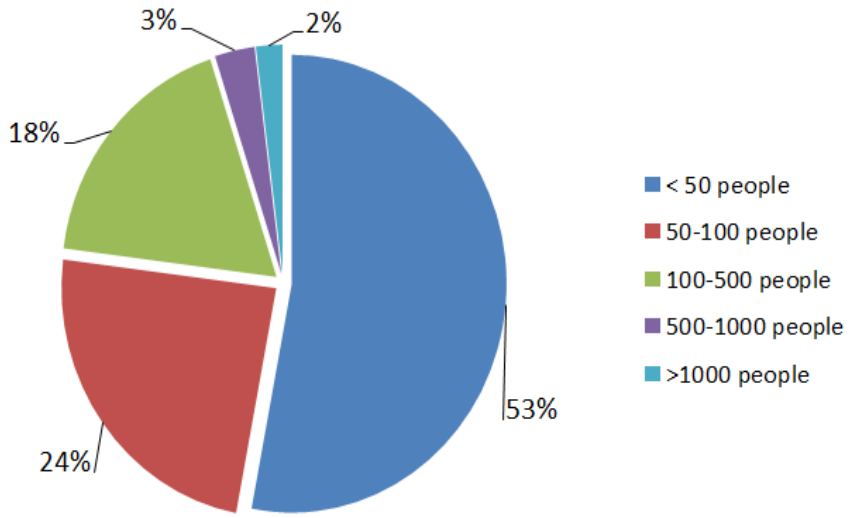


Figure 23 Employee size distribution of ESCOs

Data Source：The Study Questionnaire and Survey

5.2.1.5 Regions with Booming ESCO Business Operations

Regarding regional distribution of ESCO clients, 446 enterprises provided valid data, according to which ESCO clients located in North and East of China account for 35%; those in Central and South of China, 26%; and those in northwest and southwest of China, 23%. In addition, 35 enterprises have overseas business, accounting for 3% of the total. At present, the economically developed regions of China are the major target client areas of ESCOs, reflecting regional concentration and orientation of the economy. For ESCOs, their customer area is not limited to the place where their enterprise is located or a specific target area. In fact, ESCOs' customer areas tend to be expansive by sector or specialty, often working with local marketing and contracting partners.

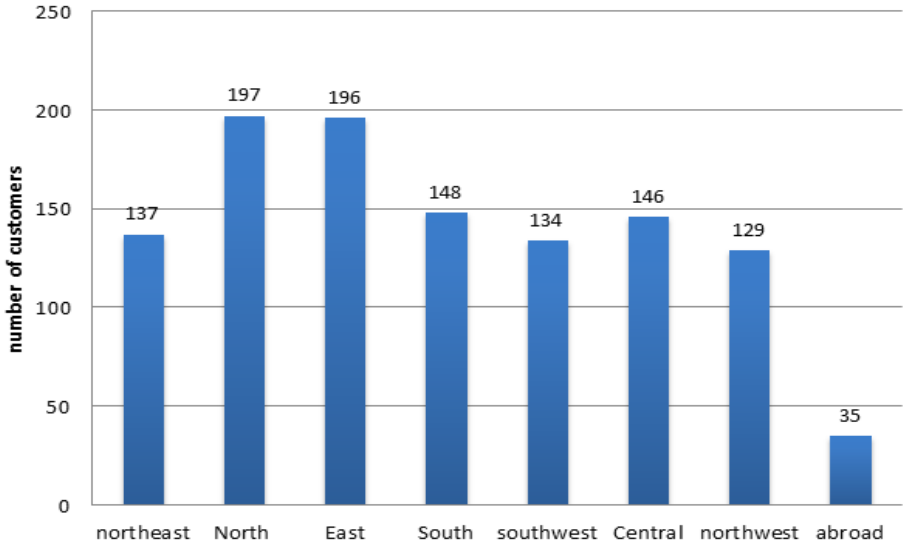


Figure 24 Regional distributions of host enterprises

Data Source：The Study Questionnaire and Survey

5.2.1.6 Average EPC projects contract term

As for the average contract term of EPC projects, valid data is offered from 446 questionnaires, according to which 72 enterprises have less than 3 years of contract term accounting for 17% of the total, 242 enterprises witness 3-5 years of contracts accounting for 57% and 113 enterprises with more than 5 years of contract term account for 26%. It is indicated from the data above that an average contract term of 75% of the total EPC projects is less than 5 years, reflecting that the payback period of the projects undertaken by energy-saving companies currently stay at a relatively low level, so the industry enjoys sound profit margins.

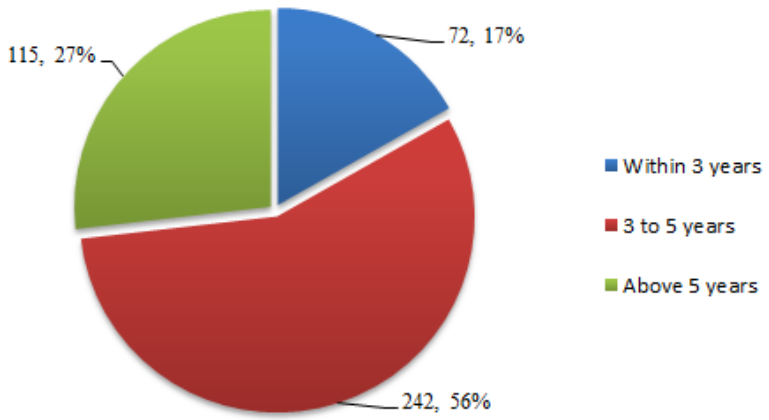


Figure 25 Average contract term of EPC projects

Data Source：The Study Questionnaire and Survey

5.2.1.7 Average payback period of EPC projects

As for the average investment payback period, valid data is offered by 446 papers. According to the data, 127 enterprises have less than a 2-year payback period accounting for 30% of the total, 175 enterprises have a 2-3 year payback period accounting for 41%, 103 enterprises have a 3-5 year payback period, accounting for 24% and 20 enterprises have more than a 5 year payback period accounting for 5% of the total. It is revealed from the data above that most of ESCOs have a less than 3 year average investment payback period in terms of EPC projects amounting. This measure shows sound economic efficiency of EPC projects which is favorable to ESCOs for rapid payback, more profits, sustainable development, which is therefore good for host enterprises. Short payback periods also facilitate the obtaining of external financing. Mechanisms to support deeper EE investment, with longer payback periods are also important considerations.

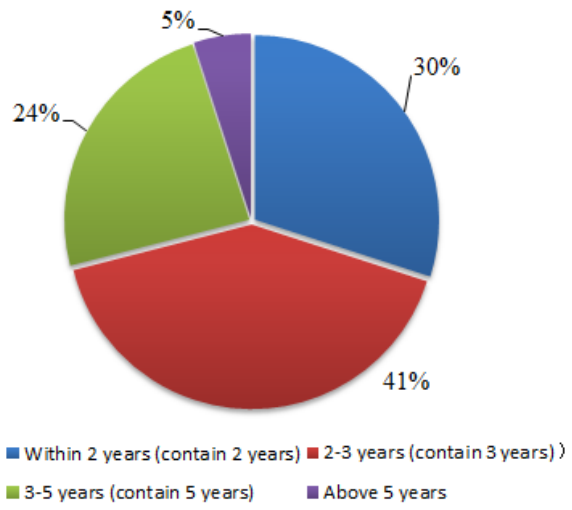


Figure 26 Average payback period of EPC projects

Data Source：The Study Questionnaire and Survey

5.2.1.8 Average investment amount of EPC projects

There are 18 enterprises focusing on EPC projects with an investment of less than CNY500,000; 149 enterprises implement projects with investment CNY 1-5 million; 96 enterprises work for projects with investment ranging between CNY 5-10 million; 75 enterprises contract with investment ranging between CNY 10 and 50 million, and 22 enterprises deliver projects with investments exceeding CNY 50 million. The enterprises with an average project investment amounting to less than CNY 50 million accounts for 81%, showing that the average investment amount of ESCOs' EPC projects still stay at a relatively low level.

With the increasing strength of ESCOs, more and more companies have capacity to implement large-scale industrial energy-saving projects, and comprehensive building energy efficiency projects with higher investment demand.

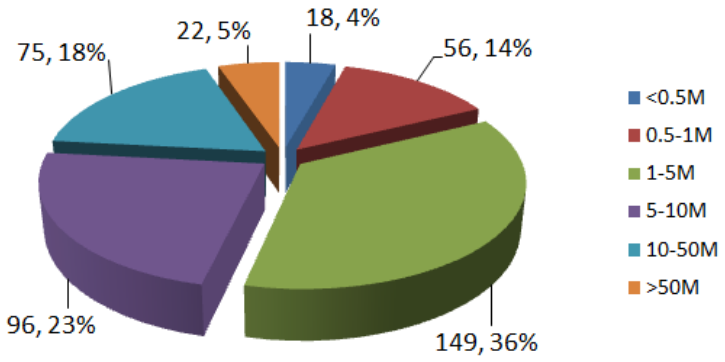


Figure 27 Average investment amount of EPC projects

Data Source：The Study Questionnaire and Survey

5.2.1.9 Number of executed EPC projects of ESCOs

By analyzing the valid data from 446 enterprises, 6 enterprises have not undertaken any projects, 196 enterprises have executed 5-10 contracts, 54 enterprises have executed 10-20 contracts, and 54 enterprises have executed more than 20 contracts. Special financial products to promote ESCO business launched recently by several commercial banks only cater to the ESCOs which have undertaken EPC projects. The existing EPC project experience not only represents the operation capability and strength of the ESCOs, but also the ESCOs share via completed EPC projects which can provide support for applying for funds for future EPC development. To be accepted by clients is one of the key factors for ESCO EPC mechanism and its development.

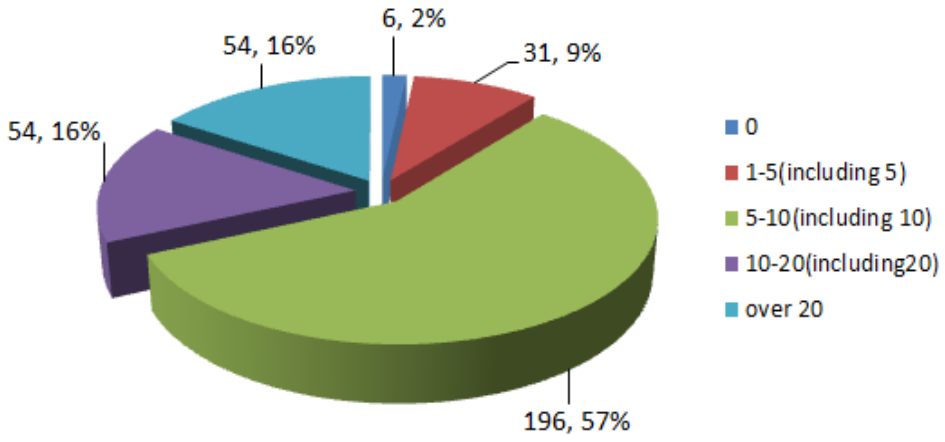


Figure 28 Number of executed EPC project contracts

Data Source：The Study Questionnaire and Survey

5.2.2 In-depth analysis of key indexes

Based on some key indexes of the interviewed enterprises, EMCA draws relations by cross analysis in order to obtain deeper understanding of the investment and financing status of ESCOs.

1) Analysis of financing status of ESCOs possessing patents for invention

For ESCOs, powerful technological strength plays a critical role in the development of practicable energy-saving technologies, production of standard energy-saving products and the provision of scientific energy-saving technical resolutions. Furthermore, many investment capitals are inclined to make investments in the enterprises enjoying independent core technologies and products. Among the 446 enterprises participating in the first questionnaire survey, 225 enterprises have invention patents, 121 enterprises are nominated as high-tech enterprises, and 60 enterprises are applying for the title “High-Tech Enterprise”. High-tech enterprises make up 54% of the total which indicate that the patent for invention is favorable for applying for the title “High-Tech Enterprise”.

According to the total operating income in 2010, 44 enterprises witnessed more than CNY 100 million of the operating income. This proves that the ESCO enterprises enjoying independent core technologies and products will witness a more rapid growth rate compared with integrated enterprises.

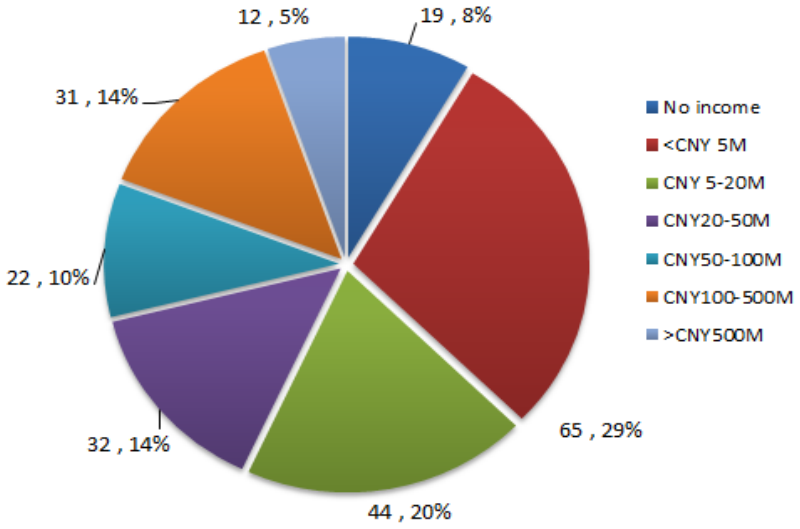


Figure 29 Operating income distributions of ESCOs possessing patents for invention in 2010

Data Source：The Study Questionnaire and Survey

Referring to the figure below for operating income in 2011, 57 enterprises have more than CNY 100 million of operating income, representing a year-on-year increase of 30%. Compared with 2010, 72 enterprises witnessed a leap in operating income in 2011, accounting for 32% of the total 225 enterprises.

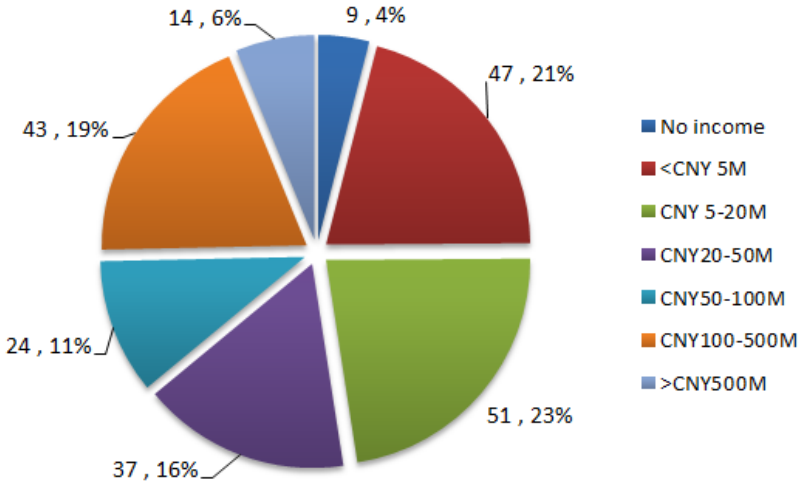


Figure 30 Operating income distributions of ESCOs possessing patents for invention in 2011

Data Source：The Study Questionnaire and Survey

Among 225 ESCOs with invention patents, 164 obtained external financing in addition to their own equity funds, which shows that invention is the most key factor for ESCOs to apply for outside financing. For most small ESCOs, however, it is still difficult to access to external financing.

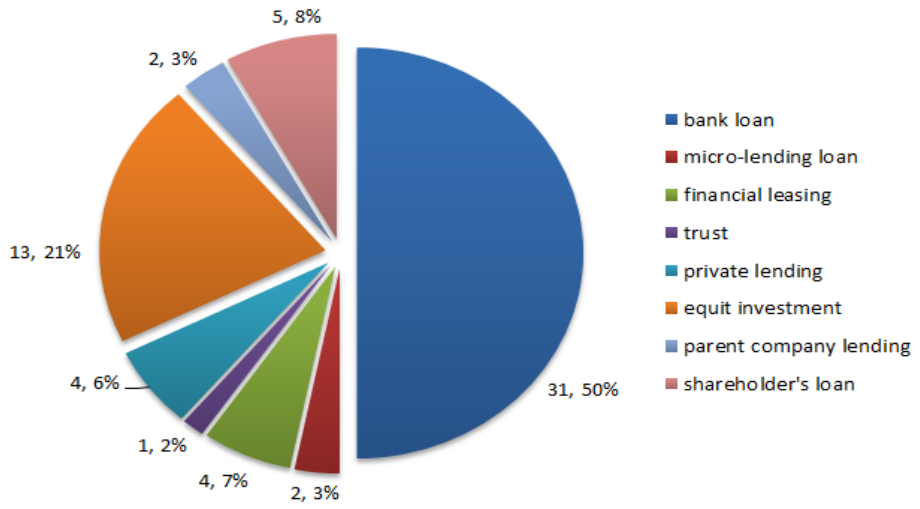


Figure 31 Financing obtained by ESCOs possessing patents for invention

Data Source：The Study Questionnaire and Survey

2) Analysis of financing status of ESCOs having executed more than 20 EPC projects

The ESCOs that have executed more than 20 EPC projects The ESCOs that have executed more than 20 EPC projects boasting powerful strength in terms of technology, capital, market and project risk control, are excellent enterprises in the ESCO industry. According to this questionnaire, there are 54 companies having executed more than 20 EPC projects accounting for 12% of the total 446 enterprises. Their features are as follows:

It is indicated from the diagram below that the ESCOs that have executed more than 20 EPC projects that have been running for more than 5 years so they accumulate abundant project operation experiences, boast powerful risk control capability and enjoy improved brand awareness. Also, a few newly incorporated companies signed more than 20 EPC project contracts under the powerful support from their parent companies.

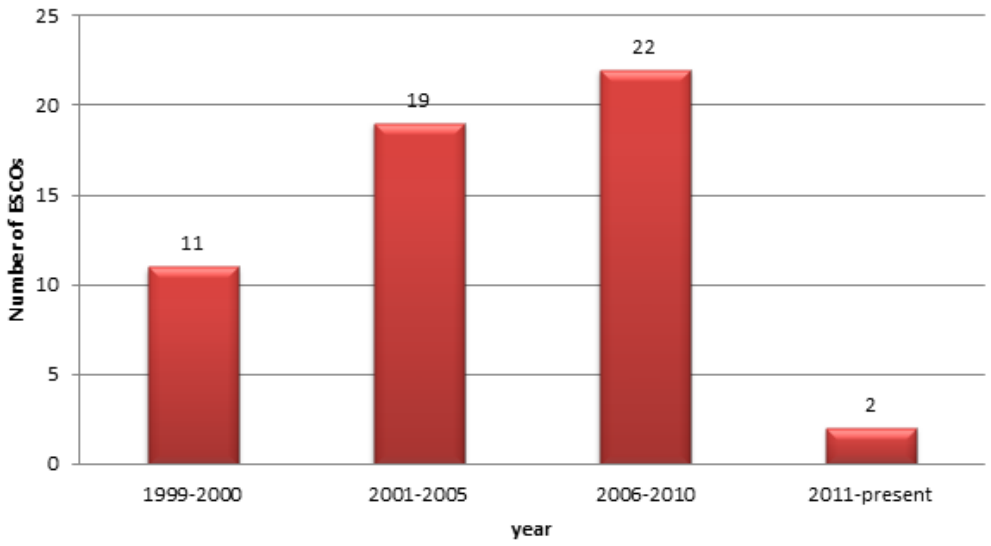


Figure 32 Timing of ESCOs having executed more than 20 EPC projects

Data Source：The Study Questionnaire and Survey

Regarding registered capital, the ESCOs having executed more than 20 EPC project contracts enjoy more obvious market advantages than other ESCOs, especially for those ESCOs with registered capital exceeding CNY 20 million.

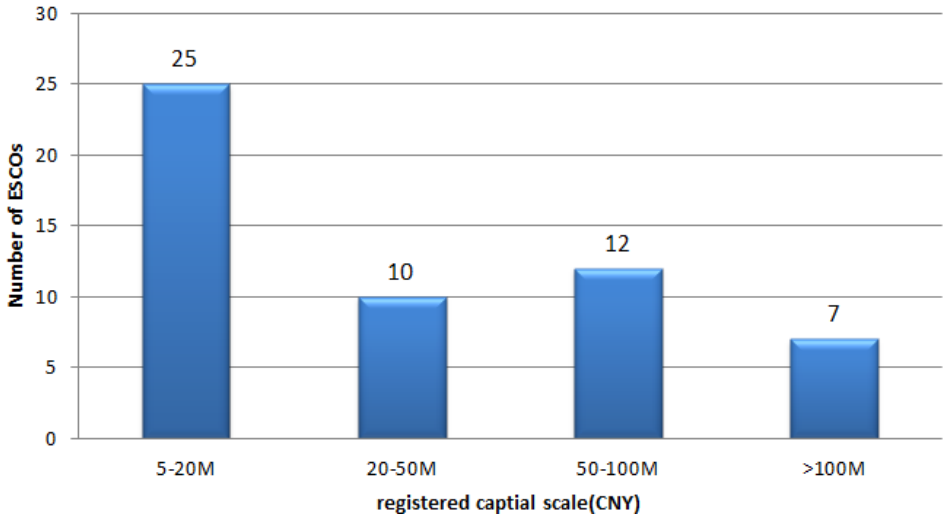


Figure 33 Registered capital scale of ESCOs with more than 20 EPC projects

Data Source：The Study Questionnaire and Survey

As for main EPC project types, the business of ESCOs mainly focuses on motors' energy efficiency, governmental buildings' energy saving, and green lighting, etc. The Investment demand of these projects usually is small, so ESCOs undertaking these projects rely on mainly their own capital, even if they have good financing capability. Furthermore, such projects are featured by applying mature technology with low technical risk. Other industrial energy efficiency projects such as waste heat and

pressure recovery and utilization, although they need high investment, are favorable to a lot of ESCOs for their high amount of energy savings and proven technology application and controllable risks.

Figure 34 Main business sectors of ESCOs with more than 20 EPC projects

Data Source：The Study Questionnaire and Survey

As for patent information, 45 enterprises possess patents accounting for 83%, 30 enterprises have patents for invention which is a greatly higher than the average rate. Among these 54 enterprises, there are 36 high-tech enterprises, making up 67% of the total, representing a majority. There are 10 enterprises applying for certification of high-tech enterprise.

With respect to operating income, among those enterprises having executed more than 20 EPC projects, 12 enterprises have witnessed more than CNY 100 million of operating income in 2010.

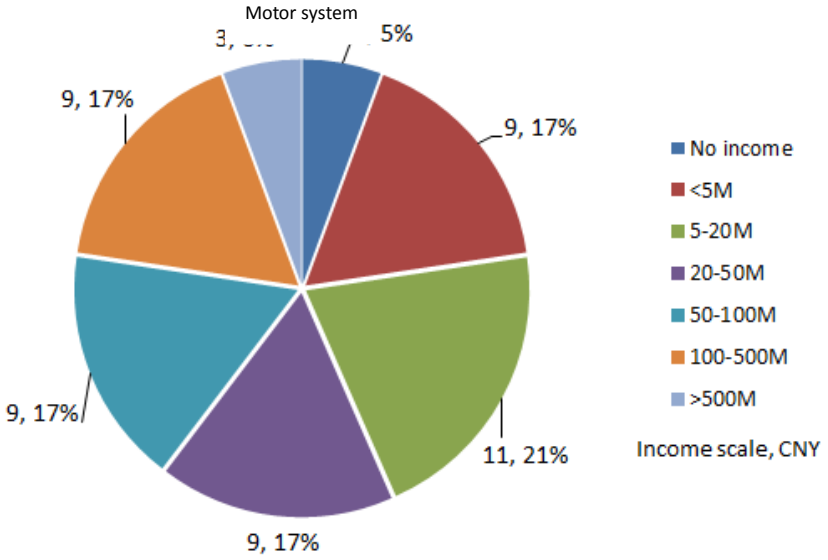


Figure 35 Total operating income of ESCOs with more than 20 EPC projects in 2010

Data Source：The Study Questionnaire and Survey

19 enterprises witnessed more than CNY 100 million of total operating income in 2011, accounting for 35% of the total, representing a year-on-year increase of 37%. Through comparison between total operating income in 2010 and 2011, 21 enterprises witnessed leap growth, accounting for 39%. These enterprises enjoy strong development potentiality through years of project experience accumulation, showing sound growth tendency.

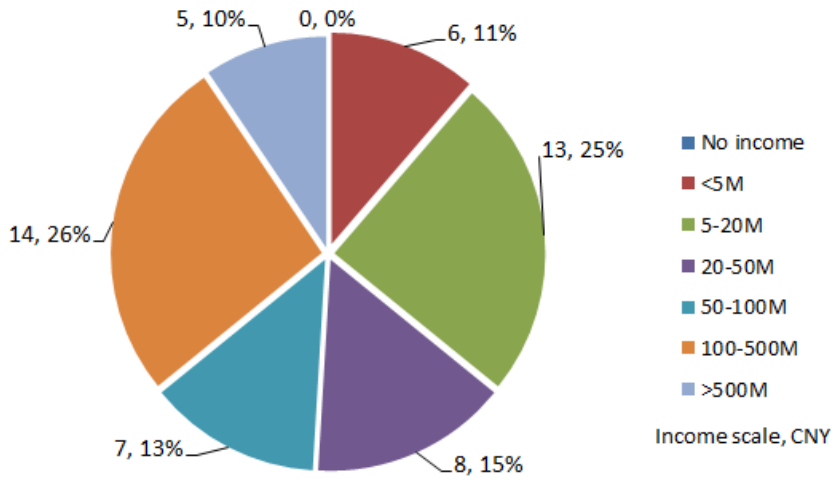


Figure 36 Total operating income of ESCOs with more than 20 EPC projects in 2011

Data Source：The Study Questionnaire and Survey

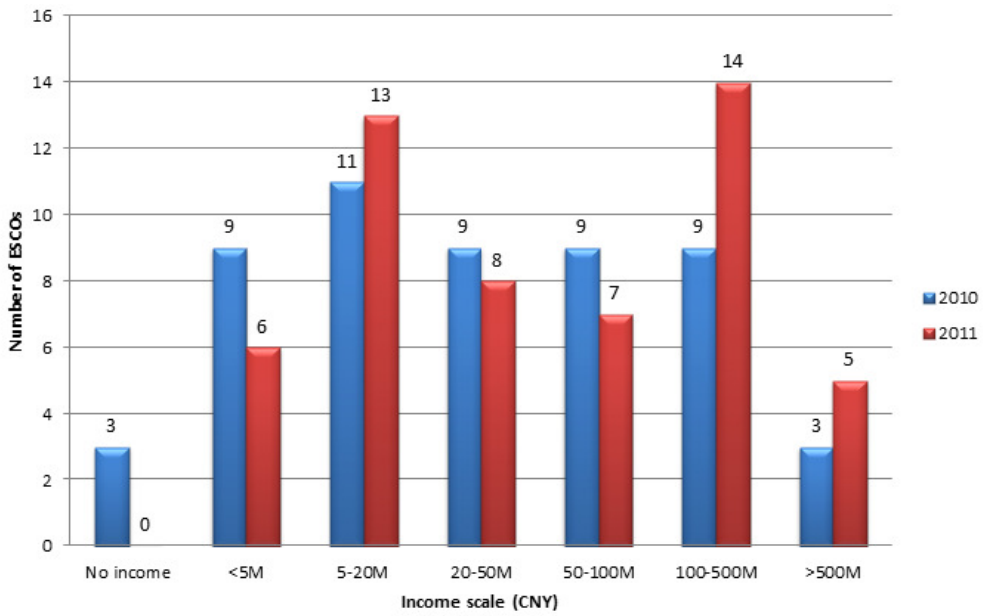


Figure 37 Comparison of Total operating income of ESCOs with more than 20 EPC projects in 2010 and 2011

Data Source：The Study Questionnaire and Survey

With respect to financing channels, among these 54 enterprises, bank loan is the major financing mode, followed by trust and equity investment. 15 ESCOs undertook EPC projects only relying on own equity funds, accounting for 19%, please see Figure 39 for detail distribution information. According to the figure, the enterprises have executed more than 20 EPC contracts enjoy more advantages than other enterprises In terms of financing channels, 74% of these enterprises once obtained external

financing.

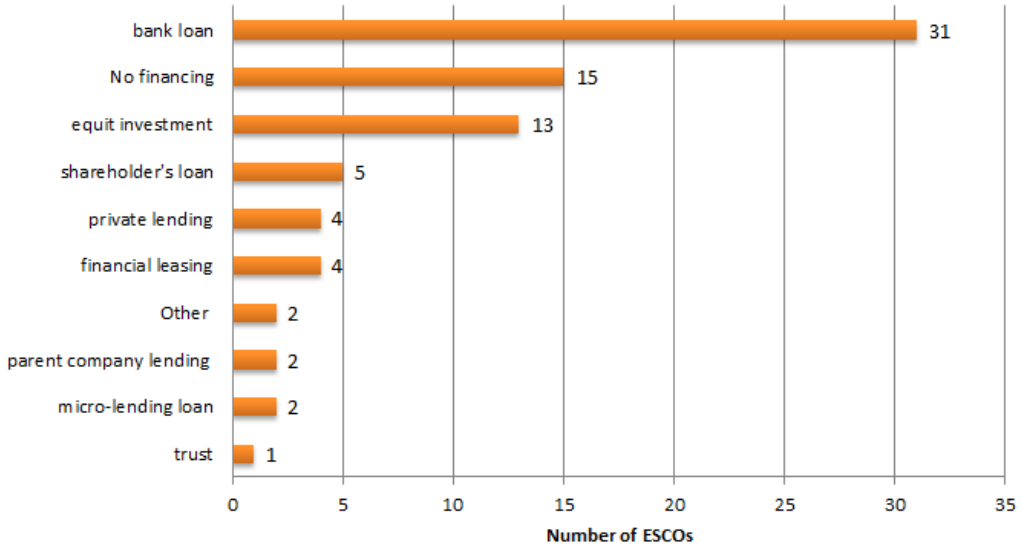


Figure 38 Financing types of ESCOs with more than 20 EPC projects

Data Source：The Study Questionnaire and Survey

3) Cross-span growth analysis for enterprises with an operating income of above CNY 20 million and above 50 million

It can be seen from the operating income data from the 445 questionnaires received that in 2010, the number of enterprises with the operating income above CNY 20 million was 134 accounting for 30%; the number above CNY 50 million was 83 accounting for 19%. In 2011, the number of enterprises above CNY 20 million was 175 accounting for 23%, with a year-on-year growth rate of 31%; the number of enterprises with an operating income above CNY 50 million was 106 accounting for 23% of the total number with a year-on-year growth rate of 27.71%. In addition, the survey data shows that in 2011, 135 enterprises achieved leap growth, accounting for 30% of the 445 ESCOs.

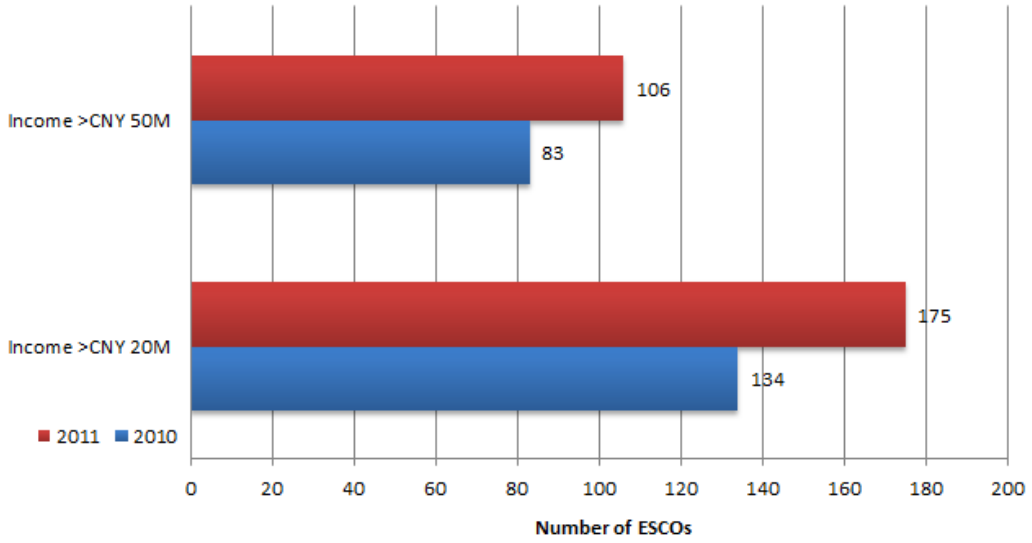


Figure 39 Quantity of enterprises with operating income above CNY 20 million or above 50 million or with leap growth

Data Source: The Study Questionnaire and Survey

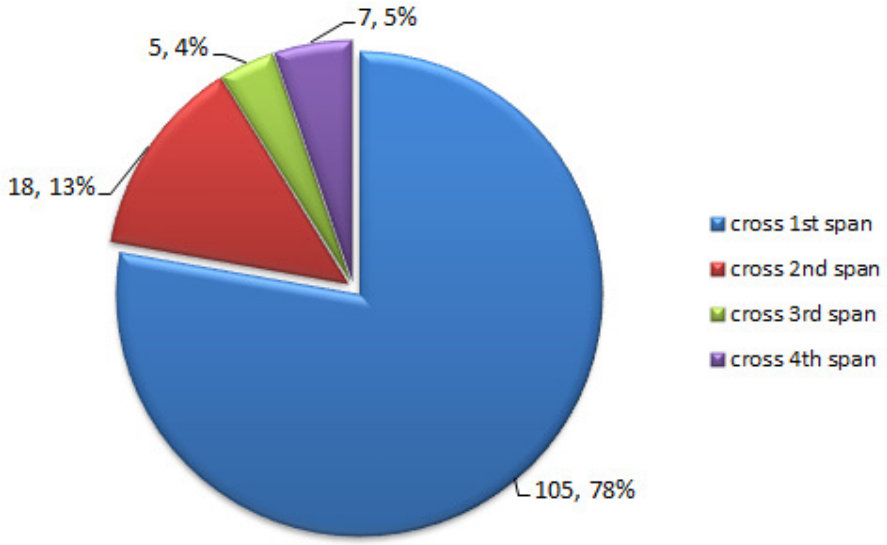


Figure 40 Proportion of enterprises with leap growth

Data Source: The Study Questionnaire and Survey

In 2010, 90 enterprises with the operating income above CNY 20 million were mainly located in East and North China, accounting for 67% of the total number; followed by 32 enterprises located in South and Central China, accounting for 25%, i.e. about 90% of large scale ESCOs were located in the economically developed areas. In 2011, the number of enterprises with an operating income above CNY 20 million increased sharply to 121 and such enterprises were also mainly located in North, East and South of China.

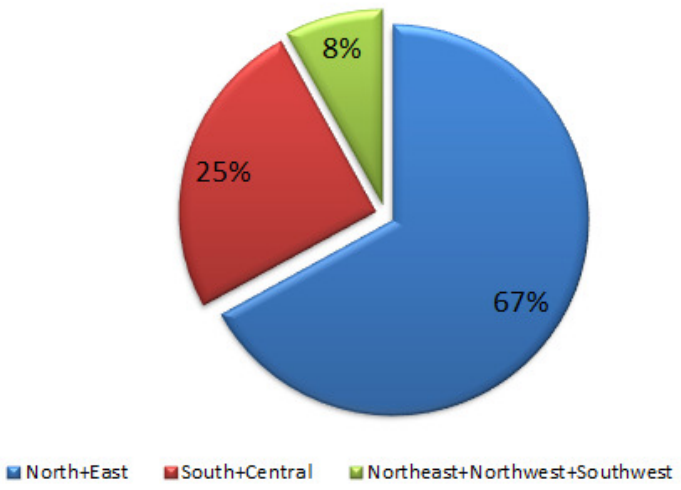


Figure 41 Regional distributions of enterprises with an operating income above CNY 20 million in 2010

Data Source：The Study Questionnaire and Survey

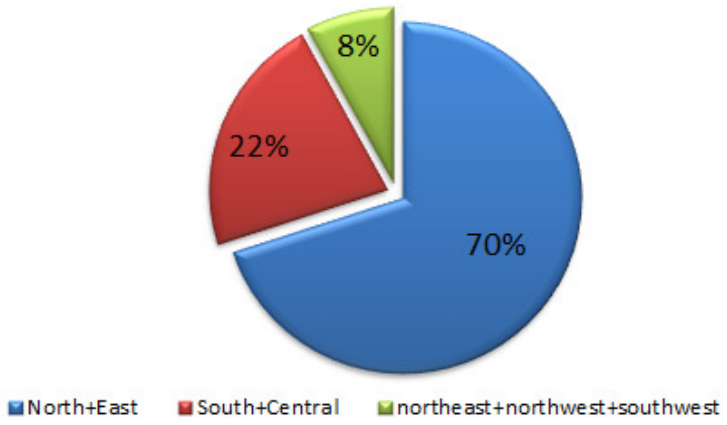


Figure 42 Regional distributions of enterprises with an operating income above CNY 20 million in 2011

Data Source：The Study Questionnaire and Survey

The ESCO industry development has much to do with the development of China's overall economy and regional economy. Thanks to the developed economy, both North and East China have great advantages in terms of ESCO market size, availability of financing and host customer awareness and incentives to implement EE projects.

Above all, customers are relatively concentrated in the economically developed regions. People and companies in these regions have certain economic consciousness and can accept and recognize the market-oriented energy-saving mechanism to a

great extent. This has been reflected in certain regional clustering and economic orientation, thus to a certain extent explaining the reasons for the distribution of ESCOs to a certain extent. Moreover, due to the characteristics of the ESCO industry and the fact of most of ESCOs are SMEs, they face limited capital resources and financing barriers during their development, which may require hungrily great financial support from financial institutions. But ESCOs implementing EPC projects in economically developed regions have received better financial service as most of China's financial institutions have branches in East, North, Central and South China, which provide necessary financial services to boost the development of these ESCOs.

Among the enterprises with cross-span growth with an operating income above CNY 20 million or 50 million, most of them were established before 2010, where the number of enterprises with an operating income above CNY 20 million reached 111 in 2010 and 135 in 2011 respectively. The number of enterprises with an operating income above CNY 50 million reached 70 in 2010 and 83 in 2011, respectively.

Enterprises with the operating income above CNY 20 million or 50 million or with cross-span growth were mostly established before 2010. They have gained certain project experience, recovered part of the funds, passed the critical stage of growth, built a stable customer base, accumulated certain amount of capital and therefore have a certain income advantage. By contrast, many companies established after 2010 are unable to achieve substantial growth in operating income during the first two years due to late establishment, lack of market and project experience, or because the newly approved project is under the investment stage and has yet to wait for the payback period, especially due to financing or payback difficulty faced by energy service companies.

Enterprises with the operating income above CNY 20 million all had a registered capital between CNY 10 million and 100 million in both 2010 and 2011. The number of such enterprises reached 96 accounting for 74% of the total in 2010 and reduced to 60% of the total in 2011. Those with the operating income above CNY 50 million all have a registered capital between CNY 20 million and 100 million. The number of such enterprises reached 60 accounting for 76% of the total in 2010 and increased to 70 accounting for 68% of the total in 2011. Most enterprises with cross-span growth have registered capital below CNY 50 million. The number of such enterprises reached 114, accounting for 85% of the total, where 36 of them have a registered capital below CNY 5 million, accounting for 27% of the total.

It can be seen from the above data that the amount of operating income is positively correlated with the registered capital, for example, the registered capital of enterprises with the operating income above CNY 50 million is significantly higher than that of those with the operating income above CNY 20 million. Generally speaking, enterprises with higher operating income have a strong registered capital base. Such a case is particularly applicable to the ESCO industry since it requires

ESCOs to invest a lot of money in the earlier stage and a certain payback period is set for the invested money which means it may not be paid back in a short time. Financial support is then necessary especially when the enterprises face multiple projects. Therefore, strong financial support is also an important factor determining whether the ESCOs can survive and develop successfully. Registered capital is always a main factor reflecting the enterprise's financial strength in the earlier stage and thus its amount has a certain positive correlation with the operating income.

According to the survey results, for any enterprise with an annual operating income above CNY 20 million, 50 million or with cross-span growth, the private capital is the main source of capital shares. Among the enterprises which record an annual operating income above CNY 20 million, in 2010, 86 of them were privately-funded enterprises accounting for 74% of the total and in 2011, 117 were privately-funded enterprises accounting for 75%. Among the enterprises which recorded the annual operating income above CNY 50 million, in 2010, 50 of them were privately-funded enterprises accounting for 70% and in 2011, 68 were privately-funded enterprises accounting for 70%. Among the enterprises which were successful in cross-span growth, 105 are privately-funded enterprises, accounting for 80% of the total. The ESCO Industry is still dominated by privately-funded enterprises. However, thanks to the state policy support in recent years, the number of state-owned son-ESCOs or such companies with the state-owned background begins to increase dramatically, but they are still in their infancy. Once they find the suitable commercial mode and field, they will grow and rise more noticeably.

Of these enterprises with an annual operating income above CNY 20 million, 50 million or with cross-span growth, most of them have employees fewer than 500. The percentage of such enterprises to the total number, accounted for more than 80% in 2010 and 2011. The majority of the enterprises with over 500 employees have their own productivity of core products. ESCOs are not characterized by production capability; instead, they are technical service-oriented, particularly focusing on the integration of resources, so massive labor intensive arrangement is not required.

This data further reflects several key criteria for selection and due diligence assessment of specific ESCOs as prospective investees for IFC and its partner financing institutions, indicating a strong ESCO industry set from which to choose.

6 Macro Policy Environment and Development Obstacles Facing the ESCO Industry and Analysis of Solutions

Abstract: This chapter focuses on analysis of the policy environment for ESCOs, industry development obstacles and counter measures. The EPC mechanism was introduced in 1998 as a market-oriented energy-saving mechanism to promote energy-saving projects in China. Government support and positive promotion efforts have made a big contribution to the achievements made since then.

The "Energy Conservation Law of the People's Republic of China" notes needs to "promote Energy Performance Contracting". This indicates that the implementation of EPC has achieved a formal legal status in energy conservation work. Released in 2010, the State Council's "Guidance to Promote Energy Performance Contracting and Enhance the Development of the ESCO Industry" highlights the importance of EPC development and supports the ESCO industry development in four specific ways, laying the foundation for financial incentives, tax exemptions, accounting rule clarifications and an improved financing environment. The promulgation of GBF [2010] No.25 document marks a milestone in China's demonstration and promotion of the EPC mechanism and has great practical and strategic significance in supporting the growth of ESCOs, and promoting a better and faster development of the energy-saving service industry.

As they implement EPC projects, ESCOs need to bear technical risks, financial risks, implementation risks, credit risks among others. Accordingly, ESCOs need to have high project implementation capacity, and capabilities to control and mitigate the various risks. ESCOs face many technical, management, market and financial challenges. Moreover, ESCOs in different development stages face different development issues. This chapter provides comments and suggestions on how ESCOs might crack the problems of financing, how construction of credit system might be strengthened, needs to further improve policy support to strengthen the capacity building of ESCOs, how energy-using companies might become better motivated to save energy, and ideas on strengthening energy service market development, publicity, promotion and pilot projects.

6.1 Relevant supporting policies for the ESCO industry

6.1.1 EPC has gradually won government approval.

Since its introduction into China in 1998, the EPC mechanism, as a market-oriented energy-saving mechanism for promoting energy-saving retrofit projects, has gradually become more mature and developed. The achievements made in EPC are highly attributed to the attention and promotion of the government.

First, the former Department of Resources Conservation & Environment Protection of the State Economic and Trade Commission, as the designated department of energy-saving work of the country at that time, issued the 'Announcement concerning Further Promoting EPC in China' in June, 2000. This was when a nationwide promotion of EPC was first put forward. Due to an imperfect energy-saving policy environment, low awareness of energy consumption companies and the promotion of EPC still being in its initial stage, the Announcement only made a small impact. Only a small number of professional energy-saving service companies that started to adopt this market mechanism to implement energy-saving innovation projects were established in response to the policy. Most of these energy-saving service companies were small and micro businesses with small scale and low competence. Technology integration capacity and financing capacity were the main obstacles to their development.

With the progress of the World Bank/GEF Chinese Energy Conservation Promotion Project Phase II, increasingly more ESCOs have been established in China, and embodied diversified development. Among these ESCOs, some were transformed from energy-saving equipment providers, some from engineering and facility sales companies and some were established by large enterprises. The continuous growth of ESCOs, saw that the EPC mechanism was popularized, enlarging the influence of EPC. ESCOs typically build on a core competence in engineering, turn-key construction, EE equipment and technology, project development and operations services and then augment their core capacities through partnerships with others to assemble and offer a complete service package to customers.

The unique superiority of the energy performance contracting mechanism and its important role in energy saving has drawn special attention from the State Council and all ministries and commissions. From 2001 to 2006, the State Council and all the departments successively issued multiple documents regarding energy saving, without exception, putting forward the EPC model. For example, the Circular of General Office of the State Council on Resource Saving Activities issued in April 2004 put forward the promotion of a new energy saving mechanism that meets the requirements of the market economy; the Medium-Term and Long-Term Special Planning for Energy Conservation issues by the NDRC in November 10, 2004 put forward the promotion of a new energy-saving mechanism based on a market mechanism; the Energy Saving Action Plan for 1,000 Enterprises issued by the NDRC and four other ministries and commissions on April 7, 2006 laid the emphasis on promoting EPC; the Opinions on the Implementation of the Top 10 Major Energy Saving Projects during the Eleventh FYP Period issued by the NDRC and seven other ministries and commissions in July 25, 2006 put forward the promotion of the EPC market mechanism; the Decisions of the State Council on Strengthening Energy-saving Work issued by the State Council on August 6, 2006 put forward the establishment of the energy-saving services system. Relevant departments also

continue with the research and establishment of guidelines for accelerating the energy-saving services system construction, promoting energy-saving technology service organizations at all levels to change mechanisms, create new modes, widen service scope and enhance service capacity and quality. These factors are accelerating the EPC model and boosting the energy-saving technology transformation of enterprises.

6.1.2 Legal guarantee of the promotion of EPC management

The EPC mechanism is playing an increasingly important role in energy-saving work. On October 28, 2007, the amended Law of the People's Republic of China on Energy Conservation officially included "supporting the promotion of the EPC mechanism". It means that the promotion of EPC management in energy-saving work has officially acquired legal status, and has been approved by the law. Meanwhile, it guaranteed the legal protection of the establishment of preferential policies for the obstacles and problems related to the promotion of EPC management, as well as research on the promotion of EPC.

Regulations on Energy Conservation by Public Institutions passed in the 18th Executive Meeting of the State Council were put into force on October 1, 2008. This meeting put forward that public institutions be allowed to adopt EPC management methods of entrusting energy-saving service institutions for energy-saving diagnosis, design, financing, transformation and management operation. This created conditions for ESCOs to use the EPC method to perform energy-saving transformation in public institutions.

6.1.3 Establishment of EPC management policy

The Comprehensive Work Plan for Energy Saving and Emission Reduction issued by the State Council on June 3, 2007 put forward that the Guidelines on Acceleration of the Development of the ESCO industry and was formulated to promote development of the ESCO industry. It mandated creation of an energy-saving services market, accelerating the promotion of the EPC model.

With persistent efforts made, the ESCO industry and EPC mechanism have finally been embraced in the establishment of substantial supporting policy. On April 2, 2010, the State Council forwarded the Opinions on Expediting the Implementation of EPC for Promoting the Development of the ESCO Industry (GBF [2010] No. 25) jointly issued by the National Development and Reform Commission, the Ministry of Finance, People's Bank of China and the State Administration of Taxation. It put forward the importance of accelerating the EPC model and actively promoting the energy-savings service industry from a strategic height. Meanwhile, the Opinions also made clear the development goal of the ESCO industry, and supported four different aspects relating to the development of EPC business: financial incentive, taxation support, perfecting accounting policies and improving financial services.

The promulgation of GBF [2010] No.25 document marks a milestone in China's demonstration and promotion of the EPC mechanism for over ten years and has great practical and strategic significance in supporting the growth of ESCOs, and promoting better and faster development of the energy-saving service industry.

In order to fully implement the GBF [2010] No. 25 document, relevant policy implementation documents were promulgated in the last year of the "Eleventh FYP". On June 3, 2010, the Ministry of Finance and the National Development and Reform Commission jointly promulgated the Notice on Interim Measures of Issuing Financial Incentive Fund Management for EPC (CJ [2010] No. 249). In this notice, the central government decided to allocate CNY 2 billion of its financial funds in 2010 to support ESCOs using an EPC management method to perform energy-saving transformation in areas such as industry, construction, and transportation, as well as in public institutions. This decision set a precedent for using China's special incentive funds to encourage ESCOs to implement EPC projects; under the active promotion by the central government, local governments also started to establish relevant policies and take measures to promote a local EPC mechanism, providing ESCOs that conduct EPC management projects with capital rewards. On December 30, 2010, the Ministry of Finance and the State Administration of Taxation jointly promulgated the Notice on Policy Issues of Value-added Tax, Business Tax, and Business Income Tax for Promoting the Development of the ESCOs Industry (CS [2010] No. 110). This notice regulated that for qualified EPC projects implemented by ESCOs; "Income Tax Exemption for the First Three Business Years and 50% Reduction for the Next Three Business Years" will be adopted, bringing unprecedented tax preferences for ESCOs.

The first result following the quick and successive issuance of policies on EPC is the increase in the number of ESCOs. According to statistics, by the end of 2011, there were more than 3,900 companies engaged in providing energy-saving services, among which nearly 1,000 were newly established in 2011 and 695 registered by NDRC/MOF. The second result lies in that greater importance has been attached to the EPC by local governments of all levels, financial organizations and energy-consuming companies. Local governments of all levels have successively issued supporting policies for EPC; financial organizations have strengthened the research and provision of "green credit" products, and energy-consuming companies are now starting to research how to harvest both energy saving and profits through EPC. With good results continuously arising from the implementation of various policies, the energy-saving industry is increasingly larger and stronger, with the energy-saving service system becoming increasingly mature.

These policies particularly indicate the potential for IFC partnerships with local governments to promote, develop and finance EE and EPC project investments. They reflect substantial incentive resources being devoted by government and the breadth of growth potential of this industry.

6.1.4 Project of EPC Promotion is incorporated in the 12th Five-year Plan

The energy-saving and environmental protection industry has been rated number one among the seven major strategic emerging industries in China and has become another new economic growth point and focus of emerging industries. Under the background that the ESCO industry represented by EPC is regarded as a powerful tool for the market mechanism to promote energy saving and emission reduction, and with the great encouragement offered by various State policies, ESCOs are emerging like bamboo shoots after spring rain, by experiencing rapid development all around the country.

The Twelfth Five-year Plan for Energy Saving and Emission Reduction discussed and approved by the Executive Meeting of the State Council on July 11, 2012 specifically outlines that the Project of EPC shall be included on the list of key EE projects. It is required by the Key Project of EPC that the implementation and observation of the Notice on Opinions on Expediting the Implementation of EPC for Promoting the Development of the ESCO Industry issued by the NDRC and forwarded by the General Office of the State Council (GBF (2010) No. 25) be well enhanced; the ESCOs be guided to strengthen technological research and development, service innovation, talent cultivation and brand building; to improve the financing capabilities and to continuously explore and improve the business model, the large key energy-consuming companies be encouraged to make themselves professional ESCOs by taking advantage of their own technological strength and management experience; the key energy-consuming companies be supported to realize energy-saving retrofits through EPC; that public institutions take priority to adopt EPC for energy-saving renovation; that the provision of financing support for EPC projects be enhanced with financial organizations, like banks, being encouraged to offer flexible and various financial services to these projects; and for third-party certification and evaluation organizations to be actively developed. It is also required that a near perfect energy-saving service system will have been established with over 2,000 (and up to 20 key, leading) ESCOs by 2015. This is estimated to produce a total industrial output value of up to CNY 300 billion and will involve up to 500,000 employees. It is also expected to establish an energy-saving capability of 60 million tce during the period of the Twelfth Five-year Plan. The implementation of this key project is a blueprint for development prospects, targets, and approaches of EPC and clearly denotes the development direction of the energy-saving industry. An important point to note is that many ESCOs, including relatively new ones, are subsidiaries or affiliates of larger industrial and parent companies; parent company support may be available in some cases to support ESCO and EPC project financing.

The Ministry of Industry and Information Technology of the People's Republic of China issued the Twelfth Five-year Plan for Industrial Energy-Saving on January 4, 2012. Meanwhile the Ministry of Housing and Urban-Rural Development of the

People's Republic of China released the Special Plan for Energy-saving in Buildings in the Twelfth Five-year Plan Period on January 9, 2012. The Ministry of Transport of the People's Republic of China, disclosed the Twelfth Five-year Plan for Energy-saving and Emission-reduction in Road and Water Transportation on June 27, 2011. The former Ministry of Railways of the People's Republic of China, announced the Twelfth Five-year Plan for Railways Energy-saving on March 27, 2012. Lastly, the Government Offices Administrations of the State Council released the Twelfth Five-year Plan for Energy-saving in Public Institutions on August 30, 2011, rating the promotion of EPC as one of the key works. This indicates that the EPC with its unique advantages has become an important tool for ministries and commissions of all levels to promote energy-saving work, and will serve as one of the main approaches for energy-consuming companies to implement energy-saving retrofits during the Twelfth Five-year Plan period. Meanwhile, we will see a group of ESCOs of relatively large scale and comparatively rapid development during the Twelfth Five-year Plan period.

6.2 Analysis on development challenges that will confront ESCOs

With a series of uncertainties for the development of both industry and companies, the ESCOs may face the following four types of foreseeable challenges during the development:

6.2.1 Technical challenges

With the availability of new energy-saving technologies, new materials, new equipment and new techniques to the market, ESCOs have more choices of better and reliable technologies applications to their EPC projects. But ESCOs are still facing the challenges to choose well-developed, proven and stable technologies to avoid technological risk, are not able to ensure whether the various new technologies can stably and reliably produce the energy-saving results with reasonable risks. Technical challenge and risks still exist to most ESCOs. The costs and economics of different selected energy-saving technologies vary. Based on specific energy-saving and retrofit projects, the various technical packages will produce different results. Therefore, ESCOs are confronted with the difficult decision in R&D direction and technical selection. If the company fails to take a lead in the industry in terms of R&D capability and is constantly innovating, its technology may be knocked out by the market. Meanwhile, ESCOs relying on outstanding technologies face more challenges in the selection among various types of technologies, and must also seek new commercial modes to adapt to new market needs and business developments. Some ESCOs are affiliated with energy research and design institutes and universities, so channels exist to continually assess and disseminate information on new technologies. However, a huge amount of economic opportunities exist for ESCOs by applying proven energy savings technologies for their business.

6.2.2 Management challenges

In the process of development, ESCOs face challenges arising from investment failures due to mismanagement. As they gradually expand to larger areas and increase in the number of large projects, these companies are challenged to synchronously improve their project management skill, project operation and risk control capabilities of project managers and their whole operations teams; if they falter, the promised energy-saving effects for projects may not be achieved in a stable manner, imposing adverse impact on the overall operation of the company because no or less energy saving effect means no or less share of benefits. Sometimes, failure of a project may harm many other associated projects previously conducted, like dominoes. Project management challenges can be further divided into four categories:

1) Construction challenges. ESCOs must complete projects within the time defined in the contracts and achieve the promised energy-saving effects in order to get clients payment as expected. In case the actual construction period considerably exceeds the scheduled time, the interest cost will be very high, more importantly the investment recovering delays. For some projects with seasonal operation features, the delay will cause several months of postponement of the project test run and commissioning, and acceptance, as the result of energy savings benefits.

2) Equipment challenges. If operation conditions of relevant energy-saving equipment installed are not able to perform well as expected, although equipment manufacturers guarantee equipment performance and quality, ESCOs will still have to bear additional costs for settling relevant problems and possible loss of energy savings benefits.

3) Energy saving challenges. Achieving prospective energy savings is a main factor for ESCOs to get investment paid back and expected profits from projects.

4) Employee challenges. The energy-saving service industry is a technology and intelligence and talent intensive industry with a high dependence on senior technical talents. ESCOs have high dependence on core technical talents, therefore to maintain the stable technical team and resources is critical important for ESCO's sustainable development. As ESCO's assets and business increases rapidly, more high quality resources requirements are needed to maintain healthy growth of ESCOs. In addition to financing investment demand, urgent need of senior staff including technical, R&D, management and sales talents are of core necessity. Experience shows that although ESCO companies have much flexibility in their staff treatment mechanism, good talent introduction systems and a near perfect incentive mechanism, there is uncertainty and challenge in recruiting and maintaining the right talents.

5) Legal challenges. Companies will encounter various legal risks in a risk investment or private equity financing. Since complicated priority terms and

documents are often involved in equity financing, if companies do not carefully understand the appeal and true intentions of risk investment or private equity financing investors, ESCO companies may face potential legal issues.

6.2.3 Market challenges

In view of the broad prospects of the domestic energy-saving service market, with implementation of national financial incentive policies and preferential tax policies, there will be more and more ESCOs set up, which can be seen from the increase in the number of registered ESCOs in recent years. Mature foreign ESCOs are entering and rapidly expanding the market, especially professional ESCOs established by large energy consuming enterprises. These may bring certain monopoly to the industry sector. When more and more competitors are entering the energy-saving service market, competition in the industry will be inevitably intensified. If existing ESCOs cannot make use of their own advantages to find the right target market and business mode and grow quickly, they will face increasingly fierce challenges from the industry. This will be the result of a decrease in gross profit margin and the impact on profit capabilities of the companies.

6.2.4 Financial challenges

During ESCOs' actual operation, improper financial handling or heavy tax burdens may exist due to various uncertainties and ambiguities of policies, which may specifically include:

Uncertainty of preferential policies: ESCOs with qualifications can enjoy relevant national financial incentive and preferential tax policies. If ESCOs cannot maintain such qualifications at all times, they may not enjoy the benefits of relevant policies. Besides, if there are changes in the implementation of relevant policies, on the one hand, cash flow and profitability of ESCOs will be affected, and on the other hand, the structure of the entire industry may also be affected.

Bad accounts receivables: Since EPC projects require ESCOs to finance, build, and operate energy efficiency systems in customers facilities, and ESCOs get investment paid back by sharing the energy savings created by the projects, and the cycle of such projects is always long, in case customers' operation conditions or persons in charge change, or the enterprise or some equipment face the risk of demolishing, ESCOs may face challenges relating to bad accounts receivables. For existing domestic client enterprises, especially SMEs, the overall credit level is still relatively low. If such things happen, there will be difficulty in the recovery of ESCOs' accounts receivable of, which will have some impact on the operation of the companies.

6.3 Analysis on challenges faced by ESCOs at different stages

6.3.1 Newly-established ESCOs

1) Weak financial strength

The typical characteristics of newly-established ESCOs in their beginnings are limited registered capital and no credit record, which results in difficulty in getting loans from banks in the early stages of development. For a long time, "difficulty in financing" has been one of the main obstacles that prevent ESCOs from flourishing. The market mechanism of EPC requires ESCOs to become strong in financing. Since the payback period of ESCOs' projects is comparatively longer than the engineering project as a contractor or equipment supplier, it will be hard for ESCOs to survive if ESCOs are not able to raise the necessary funds for project's operation. It is extremely difficult for newly-established ESCOs to raise funds from financial institutions such as banks, so they have to rely on their progressive capital accumulation or the support by inviting direct funds such as angel investment and venture capital in the first 2-3 years to keep the companies growing.

2) Low reputation and cognition

EPC has high requirements relating to the ability of ESCOs. Even if ESCOs provide all or part of their project funds and take most part of the project risks, they can hardly get attention and interest from energy consumption enterprises due to the fact they lack project experience, and low reputation and cognition.

3) Lack of capacities

ESCOs are required to be capable of exploiting markets, controlling risks, energy consumption auditing, project designing, project financing, integrating technologies, engineering, confirming energy-savings, training staff, managing operations, etc. The capacities of energy-saving services specifically exemplify the core competitive strength of ESCOs, which directly determine the profit earning of ESCOs. Newly-established ESCOs usually lack proper understanding of EPC and relevant policies. During EPC they are often not capable of conducting energy auditing, making innovation plans, identifying customers' credit and communicating with them. In addition, they lack efficient energy-saving technology and exceptional technicians, meaning that they encounter a long business development period in the initial stage and incomplete contract provisions affecting compliance, all of which force newly-established ESCOs to improve their capacities.

4) Imperfect business model and ambiguous market segmentation

Some of the newly-established enterprises with the support of certain major energy consumption enterprises or certain types of energy-saving technology/product suppliers have clear market development direction and targeted specialized sectors. However, those newly-established ESCOs with little support, lack of experience, immature business models and undefined target market, fumble in the aimless business development, therefore seldom success.

5) Risk control capacity

ESCOs operate and manage their service in line with the mechanism of EPC. They implement energy-saving project for their customers, with exerting great efforts to finance projects and guarantee the amount of energy-savings. In return, their customers pay for the investment and profits of ESCOs by energy-saving benefit while ESCOs undertake most of the risks in implementing energy-saving projects. When ESCOs are providing energy-saving services in line with the mechanism of EPC, reasonable returns may come with high risks taken. Therefore, the capacity of risk control of ESCOs is directly related to their own benefits gains, their survival and development. The risks that ESCOs often face may be classified into client/customer risk and project risk. Since the environment of good faith in the Chinese market is yet to be matured, the risks coming from customers become the main risks of ESCOs, including the risks in customers' credit, operation and contracts between ESCOs and their customers. ESCOs need to pay attention to lesson learning in order to, continuously improve their risk control capacity.

6.3.2 Growing ESCOs

1) Lack of core competitive strength for sustainable development.

At the present stage, the entry barrier of the ESCO industry is low, resulting in different service standards among ESCOs. Many growing companies are not competitive enough to always have an upper hand, which could be reflected in the companies' small size, weak comprehensive quality of personnel, chaotic internal management, less competitive technology involved in products and inferior capacity of thorough and sustainable R&D. Many of these companies may see a temporary boost to business after intense market competition, but as their technologies fade out of time and the R&D fails to follow up, they find hard to survive. There are quite a few "technological" ESCOs wandering in the development phase of "small but all-inclusive companies", due to lack of continuous technological innovation. They are confronted with being eliminated out of the market for the lack of strengthening competition.

2) The capacity to constantly acquire energy-saving technologies and products

Market demand is the driver for ESCOs to select energy-saving technologies and products, which are the critical carriers for ESCOs to provide energy-saving solutions to their customers. For a potential energy-saving project, ESCOs usually conduct a detailed energy audit on the energy usage system involved in the project according to systematic energy-saving methods to determine the main factors that influence system operation efficiency and energy consumption. ESCOs also take the technicality of whole systems into consideration; select one or several appropriate energy-saving technologies and products to improve project performance in order to ensure the pre-defined energy savings are met. Therefore, it is very important for the sake of continued growth to know how to acquire high quality energy-saving technologies and products. ESCOs need to have capability to find and acquire new

technology, broaden and enhance the technical services.

3) High costs of project exploitation and maintenance

With the progress of the capacities accumulation, some ESCOs start their business development at the local area and commence their presence all over the country, breaking the market area limitation of "doing business, surrounding nest only". The business area of the energy-saving service is extended and strengthened. Since their projects are distributed across a broad span, it means more human resources; materials and financial support are needed, causing problems such as high costs of business exploitation in the prophase and of project maintenance in later stage. ESCOs need to find business development partners and post- project operation and maintenance to control operational expenses.

4) Lack of brand influence

Growing ESCOs have only been established for a short time, and have a reputation in a limited market area. And they likely use standardized products in their few projects, with their lack of experience and competitiveness seeing them facing failure to compete with other big ESCOs.

5) Sensitivity to economic climate

Some ESCOs focusing on industrial energy saving are greatly influenced by the economic climate of industry sectors' client works. This is especially true to those companies that are excessively concentrated in a certain industry, such as steel and construction materials, constraining the rapid development of growing ESCOs to a certain extent.

6.3.3 Matured ESCOs

1) Imperfect policies and laws

Up until now, there have been no established market-oriented incentive mechanisms for energy-saving investment and corporate energy savings, nor the compulsory policies, regulations and rules, preventing the sustainable development of matured ESCOs. For instance, the lack of ESCO industry access standards, the fair evaluation standards for energy-saving performance and service level leads to a chaotic operation of ESCOs and bad competition among them; the lack of a monitoring system of energy savings associated with EPC and the lack of a complete energy saving service assessment system, have all prevented the industry from sustaining healthy and rapid development.

2) Shortage of high-end professionals

Energy saving service is a burgeoning and booming industry. ESCO industry is hungry for high quality professional talents to meet the high speed expansion of the industry. The enormous talent gap has already become another bottleneck restraining the industry development. The disciplines covered by the energy saving service industry

vary, including engineering, equipment, economy, financing, law, marketing and management, and the industry requires professionals ranging from researchers, technical experts, project managers, service representatives and marketing experts. However, the ESCO market is still in its initial development stage, and the shortage of talents, especially the lack of high-end professionals such as project manager and financial manager, has challenged the stability and further expansion of matured ESCOs.

3) Intense industrial competition

Enormous business opportunities and better profitability compared to other industries in the energy saving service market would have enticed more and more companies to ESCO business. In the rapid development of the ESCO industry, it is inevitable for unorganized competition to occur, which to some extent has prevented the entire industry from healthy and sustainable development. Like any other emerging industries, new issues, problems, and challenges rising from industrial development must be analyzed and solved during the procedure to allow the industry to maintain healthy development. ESCOs shall, during their development, actively adjust their marketing strategy in time to deal with the transition of unorganized competition and immaturity.

4) Lack of capital operation experience

Many ESCOs which have strength and sustainable development potential lack the professional understanding and perception of how to appropriately and timely invite direct funds from the outside to rapidly reinforce their enterprises business operation. Especially leaders with strong technical background usually are not skillful to invite external funds and how to cooperate with external funds, which hurdles the rapid development of the companies.

In addition, the common challenges faced by any ESCO in its developing stage are:

1) Difficulty in financing. On one hand, while most ESCOs have less tangible assets as lien, it is difficult for them to receive financing when evaluated with traditional appraisal rules or procedures; on the other hand, there is not enough stimulating effect of existing policies on financial organizations, which lack the understanding and recognition on EPC and the ESCO industry, commonly resulting in blocks in financing channel of ESCOs.

2) Difficulty in payment collection. Firstly, ESCO customers' awareness and acceptance of EPC and their integrity to pay ESCO's service based on energy savings are determinants for ESCO model success. The customers make payments under contracts directly in time influences the operation and survival of ESCOs. At present, the creditability mechanism in China is not yet mature and poor creditability is common. The poor creditability of customers may include: from the project start the customers deliberate in concealing actual information to lure the investment of

ESCOs; during the implementation of contracts, the customers try to hide or transfer the benefits from the energy savings of projects by various means; as competition in the ESCO market intensifies, other ESCOs may have made more favorable offers, causing the customers to default and descend to work with other ESCOs; the customers may delay the payment of energy saving profit to ESCOs intentionally; the new management of the customer companies may be unwilling to carry out the contract signed by the former management team. It is a necessity to assess the creditability of customers before working with them.

3) Inappropriate, unorganized and unreasonable measurement and verification of the amount of energy savings. Whether the expected amount of energy savings can be achieved after the project completion is the main risk influencing ESCOs to make profits from projects. Due to the unorganized measurement and verification of the amount of energy savings, there might be disputes against the customers in respect to the amount of energy savings after the projects are completed, which prevent ESCOs from recovering investment and profit or delay the payment. In addition, since the authority and impartiality of the third party energy saving assessment agencies shall be adopted by ESCOs, assessment agencies and customers so as to avoid the possible disputable opinions on the measurement standard and acceptance of the amount of energy savings.

4) Influences of customers' operation and industrial policy caprice. Once the customers' operation goes worse, profitability deteriorates, production scale shrinks, and energy consumption decreases, causing the amount of energy savings and benefits to decrease, ultimately meaning the ESCOs' profits reduce. The contract period of EPC projects are usually more than one year, so issues such as the prospects of industry of the customers work in, and the orientation of state policies are risks for ESCOs to collect payment in time.

6.4 Countermeasure analysis of industrial development obstacles

6.4.1 Breakthrough of financing predicament

Suggestions are listed as below for the largest predicament faced by current ESCOs, difficulties in financing.

(1) Improving understanding between ESCOs and financial institutions, familiarizing companies with rules of the business model, and solving the problem of information asymmetry. Financial institutions shall provide financing-related consulting service to ESCO companies, establish relevant consulting departments for ESCOs and EPC projects, and help and guide companies to improve financial regulations and credit statuses to meet requirements of banks and other financial institutions. ESCOs need support from the government and banks to overcome their financing shortage. More importantly, they have to adapt themselves to the financing environment through self-improvement.

Financing institutions including banks are also market and commercial-oriented entities which have their own rules, regulations and operation requirements. It is normal for them, under the guidance from related government policies, to set up some approval standards relating to financing and loaning. Different ESCOs have different foundations and strengths, and are in different development stages. Regular communications and mutual training activities are necessary for both of them to understand each other so as to guide and support ESCO companies in different development stages grow healthy.

(2) Banks and non-banking financial institutions shall voluntarily delve into the energy service industry. They need to be educated on and master characteristics of the industry and related government policy orientation, be familiar with energy-saving products and technologies, learn different characteristics, status quo and other related information of different ESCOs, organize capacity building activities, like "Capacity training of financial institutions' employees for energy-saving posts (green credit)" depending on relevant organizations. On this basis, banks and non-banking financial institutions shall design and develop financing services and match loans or financing products appropriate to characteristics of EPC projects. They should also strive to explore financing operation measures and financial instruments for EPC projects, and provide feasible channels and approaches for the financing of EPC projects. For example, commercial banks like Shanghai Pudong Development Bank, Industrial Bank, PingAn Bank and Bank of Beijing have embarked on related business with account receivables mortgage loan, using receivable revenues of EPC projects to solve the problem of ESCOs' difficulty in taking out loans because their light assets cannot be used as a pledge. This is a promising mechanism for securing loans to ESCOs and allowing ESCOs to capitalize projects based on project assets and revenues.

(3) ESCOs need to initiate their operation mode and improve profitability. On the issue of increasing their own capital, ESCOs can release their potential from their own operation and management. For example, ESCOs possess products and own technologies can organically combine and coordinate sales of energy-saving products and service projects, adjust scales and the proportion of the two sides to a good extent, and then use sufficient sales income to offset upfront input and to meet needs of the subsequent operation of EPC projects. Under necessary conditions, it is suggested that enterprises with self-owned energy-saving service products jointly invest to form a professional energy-saving technology service company, benefiting from technological capacities, and product and capital advantages from each of its shareholding organizations to operate energy-saving service projects. In this way, sales of energy-saving products of each shareholder are promoted, capital for operation of energy-saving service projects increased, and more capital can be raised by increasing registered capital or going public to solve capital problems faced by ESCOs. Furthermore, specially-assigned personnel shall be arranged by ESCOs to

study financing policies and related financing products, to maintain contact with financial institutions and follow up, formulate long-acting, sustainable financing plans and schemes.

(4) The government shall establish special guarantee funds suitable for EPC projects. Currently, energy-saving funds provided by central and local governments are limited to technological upgrading projects implemented by energy consuming enterprises, not yet to ESCOs which are capable of generating profit repeatedly and enlarging energy-saving reinvestment. Therefore, government energy-saving funds shall be managed to bring EPC projects and ESCOs into their support scope, and be allocated a part to guarantee EPC projects and ESCOs when they apply for loans and financing from banks and other financial institutions, or directly providing loans and financing capital for them.

The government can take more measures on this issue, like establishing specialized guarantee funds for energy-saving projects, building up pilot funds and relevant operating organization for industry development. It can also set up and perfect intermediate systems for acquiring loans and financing capital of banks and other financial institutions by using guarantee funds. The government shall make itself responsible for building up a long-acting, effective and stable guarantee financing system. Meanwhile, the government shall allocate design and rationally supervise the use of a special fund to ensure efficiency in their use. By establishing an energy-saving special fund and the fund coming into use, the government can lead society in energy-saving financing. At the same time, the government shall perfect its credit guarantee system for ESCOs and EPC projects establish and improve risk control and repayment mechanisms of credit guarantee institutions, and take many forms to enhance capital strength of guarantee institutions, and promote guarantee and risk resistance capacities.

(5) Perform a matching function between financial institutions and ESCOs, building on the platform and collaborating with other industry associations, encouraging cooperation between the two sides.

To solve financing difficulties of ESCOs, the government needs to spur on market-based financing guarantee institutions, and banks need to change their traditional practices and increase their technical skills. ESCOs need to improve their conditions for financing and strengthen their operation capacities. The professional industry association needs to play its role as a platform, matching needs between capital and ESCOs, push each sort of financial institution further into the energy-saving service industry and other related industries. What is more important is that the professional industry association, relying on its background advantages, can organize ESCOs with powerful strength to establish bonding companies, financial leasing companies and investment funds focusing on the energy-saving service industry. Because it has a good understanding of the industry and master related technologies, the professional industry association can function better than similar

financial institutions in other industries operating businesses which are closer to the actual needs of ESCOs. Joint multi-party efforts are the key to fostering and establishing a standardized and market-based energy-saving service industry, effectively exploiting the benefits and characteristics of the EPC mechanism in the long run, and pushing the Chinese national policy of conserving energy and reducing emissions.

6.4.2 Strengthening the development of a credibility system

EPC projects recover costs and make profits from beneficial results in the future. If clients default on payments or fail to pay on time, this poses considerable investment risks for both ESCOs and financial institutions. For the difficulty of payment return to ESCOs and a clients' lacking in business integrity, we suggest that a development of guarantee and integrity systems be strengthened to safeguard legitimate rights and interests of ESCOs. Specific suggestions are as follows:

(1) Building a strict reputation system

We suggest that a "white list" shall be developed to contain names of enterprises with good reputations chosen by a relevant industry association, and ESCOs be encouraged to preference performing energy-saving EPC projects for enterprises in the list. Names of enterprises with bad reputations shall be put into the "black list" and those enterprises criticized. Even professional credit information systems of banks can be pushed to set up a black list for those enterprises which default on payments. This step has a wider influence and will add default costs of those enterprises.

(2) Establishing a deposit system

We suggest that the energy-saving competent department set up a "Guarantee fund for EPC projects" ("Guarantee fund"). If non-reputable customer enterprises refuse the payment of energy-saving benefits, the "Guarantee fund" will be refunded to ESCOs and such customers will be listed on the "black list" for claim of debt.

6.4.3 Improving supportive policies

On April 2, 2010, the Notice on Opinions on Expediting the Implementation of EPC for Promoting the Development of the ESCO Industry (GBF [2010] No.25) issued by the NDRC and three other national ministries and commissions was forwarded by the General Office of the State Council. The document stresses that policy measures include carrying out tax supportive policies and going further to improve financial services to push the development of the ESCO industry. In December 2010, the "Notice on Policy Issue of Value-added Tax, Business Tax and Business Income Tax for Promoting the Development of the ESCO Industry" was enacted by the Ministry of finance and State Administration of Taxation.

During a year's practice, the enacted policies were welcomed by a vast number of

ESCOs, and made a major push for the development of the ESCO industry. ESCOs, however, during the actual applications of different tax exemption or reduction, ESCOs encounter different hurdles, which may prevent them from enjoying preferential policies on taxation; on the other hand, there is still a lack of specific detailed regulations in financial supportive policies.

Therefore, it is necessary to further study implementing regulations of taxation preference policies and financial supportive policies to accelerate their introduction and implementation.

6.4.4 Strengthening capacity building of ESCOs

1) Solving quantity problems

The present ESCO industry is developing at a high speed, but talent problems in the industry are still noticeable. Particularly since 2010, problems like a lack of industrial talents and a shortage of quantity and quality of employees in ESCO companies have been seriously restricting development of ESCOs and the whole industry. The key to solve these problems is to train industrial talents. The newly launched "Training Project for Talents of the ESCO Industry during the Twelfth Five-year Plan Period" is essential to industry development. By implementing this project, a great number of EPC related talents will be trained and put into the ESCO industry, to ease the problem of lacking talents. Meanwhile, fostering of other related market players like financial institutions, legal agencies, and third-party energy efficiency measuring and monitoring institutions is another key component for the industry development.

2) Solving quality problems

The "Twelfth Five-year Plan" period will be an important period for the development of the ESCO industry and higher requirements will be put forward on energy-saving service. Becoming integrated energy-saving service providers will be one of the development directions for ESCOs. For provision of integrated energy-saving service, ESCOs will invest and provide services to the project at the same time but more importantly, they are able to integrate energy-saving technologies. ESCOs need to be able to apply their own technologies, and outsourcing and utilizing others' proven technologies to deliver best energy saving services to their customers. Integration ability of energy-saving technologies also directly determines ESCO's core competence and beneficial profit margins. It is a systematic project to implement EPC projects, needing professional talents in aspects like assessment, auditing, project design, service and training, financing arrangement and contract negotiation, and legal consulting.

6.4.5 Motivating energy-saving positivity of energy consumption enterprises

Governmental organizations can use multiple measures like monitoring energy-saving targets, exerting accountability system to factories which are able to achieve their energy-saving target, using energy price leverage role and giving financial incentives

to energy-saving technical upgrading projects, strengthening monitoring of energy consumption, implement monitoring of industrial energy consumption quotas, building up an energy consumption reward and punishment system, and urging enterprises to seriously invest energy-saving activities. Governmental organizations take the step of combining "carrots and sticks" to encourage enterprises to pursue energy conservation work, promote their positivity and social image, and help them to create green GDP.

6.4.6 Strengthening development of the energy-saving service market

Though the EPC mode is vigorously promoted by governments at all levels, some energy consuming enterprises inwardly see the mode just as provider of energy-saving technologies and capital. It is hard for them to recognize the essence of the "service" from a deep level. At the same time, in front of large enterprises, ESCOs are usually vulnerable groups lacking voice. For such reasons, ESCOs tend to be passive when developing their market and negotiating with clients alone. Therefore, relevant institutions can organize excellent model enterprises in the industry to form a group to cooperate with energy consumption enterprises. Through related EPC promotion, energy consuming enterprises can aim to receive an accurate understanding of energy-saving service. And thereby, will cooperate positively with ESCOs and use a multi-win mode in their energy-saving work.

6.4.7 Strengthening public awareness

Since 2010, a great number of ESCOs has been emerging throughout the whole country. 2,339 ESCOs registered use various advanced and useful technologies to implement EPC projects for energy consuming enterprises, effectively boosting the work of energy conservation and emissions reduction, advancing promotion and application of advanced technologies, resulting in great benefits.

Therefore, we suggest governmental and trade organizations and other relevant institutions strengthen the promotion of top ESCOs, energy-saving technologies and successful cases of EPC projects. They compile and publish related books about EPC operation, solicit and select high quality cases, and hold promotion fairs for top companies, technologies and cases.

Along with "the12th 5-year Plan" 10,000 Enterprises EE Program, we suggest that EPC demonstration work be carried out in relevant industries and regions, "Top EPC Demonstration Projects" be selected in each industry and region, a group of demonstration and key projects be announced, top ESCOs, and that individuals and financial investment institutions that make outstanding contributions be encouraged and rewarded. In addition, those that achieved outstanding results be helped to apply for rewards like the "Significant Science and Technology Achievement Prize" of the Ministry of Industry and Information Technology and the National May 1 Labor Medal.

7 The Status of ESCO Financing and Future Financing Needs

Abstract: This chapter focuses on the status of ESCO financing, reasons for financing difficulties, and the likely scale of future financing needs for the ESCO industry. In comparison to 3-4 years ago, there has been significant promotion of financing channels and mechanisms for ESCOs recently. Top Resource Conservation Engineering Co., Ltd became the first IPO company in the ESCO market; Shenzhen Coolead Industry Co.Ltd. issued SME private bonds; and the use of financial leasing is gradually growing. Banking financial institutions are the largest financing source for ESCOs aside from the use of their own funds. According to the first questionnaire, 202 ESCOs have successfully received bank financing, accounting for 47% of the total, which is much higher than the average status of the whole industry. Over the past few years, this proportion has increased steadily, as the overall scale and capacity of ESCOs has increased and banks have become more interested. Since 2011-2012, Bank of Beijing, the Export-import Bank of China, SPD Bank, Industrial Bank, and Ping An Bank have launched special EPC financial products and accepted EPC project's future account receivables as a security mortgage. This helps ESCOs obtain bank loans and alleviate their financing problems.

According to the analysis of the first round of questionnaires, the shared savings of EPC projects are expected to require a total investment of nearly CNY 125 billion during the 12th Five Year Plan. In case 40% of these funds are from the banks and other financial institutions, financial demand will exceed CNY50 billion.

This chapter presents the practices of banks, guarantee companies, leasing companies, fund companies and other financial institutions on the energy service market, the products of those financial institutions, and future development of and needs for ESCO financing .

7.1 Status of ESCO Financing

Based on the study Team's analysis on the financing status of ESCOs, a certain breakthrough has been achieved in the financing channels and models for the ESCO industry as compared with those 3 to 4 years ago. TRCE (Top Resource Conservation Engineering Co., Ltd) became the first ESCO IPO enterprise focused on the Energy Performance Contracting business, and has paved the way for other ESCOs with intention to IPO; Coolead (Shenzhen Coolead Industry Co., Ltd) successfully issued the "SZSE No. 001 SME" Private Bond, while the proportion of such models of financial leasing is also gradually growing. But banking financial institutions are still the main funding sources for ESCOs besides their equity funds as mentioned in section 5. In view of the first 430 effective questionnaires of the study, 202

enterprises have obtained bank financing, with a proportion of 47%, which has increased to some extent as compared with the preceding year. It is not only due to the promoted overall scale and capacity of ESCOs on one hand, but on the other hand is also due to the concerns and active involvement of different banks, especially commercial banks.

7.1.1 Analysis of Reasons Why ESCOs Have Difficulties with Financing

At present, most ESCOs are still SMEs, and mostly privately-owned SMEs; equity funds are inadequate; their capital reserve is limited and less fixed asset and available conventional mortgage/guarantees are limited; some of them have only been established a relatively short time, without record in the bank system and lack of knowledge and information relating to financing; EPC projects involve applications of several varieties of technologies or products; services cover different areas such as industry, building and transportation and production processes. The solutions are much more complex than conventional production expansion projects; the scale is small and scattered and the project period is also relatively long; energy-consuming enterprises are observed with problems of contract performing credit which leads to the difficulty to having accounts receivables paid in time. Expanding equity capital investment in ESCOs and expanding project-based lending makes ESCOs self-strong in financial condition, then taking the EPC projects equipment as pledge and project revenues as mortgage can make ESCOs obtain debt financing, can be one feasible way to address these constraints.

As per analysis of financial institutions: the national authorities have not formulated enough incentive policies for different financial investment institutions; since ESCOs are still in their initial period of development and are small in scale as a whole, financial investment institutions are not so active for involvement in the area; without adequate comprehension and understanding of such concepts of energy efficiency, emission reduction and EPC, most bank loan officers don't have relevant knowledge and understanding about the ESCO model and its concept; due to asymmetrical information, financial institutions lack relevant technical capacity to identify technical risks and to judge the technical feasibility of projects, fail to make any appropriate risk evaluation and work out any proper means and measures for risk control; seldom banks have specialized credit management system and loan supervision system for SMEs including ESCOs, and most financial institutions don't have dedicated and innovative financial products applicable to ESCOs and EPC projects.

According to the analysis on the first round of questionnaires on financing barriers, only have 123 ESCO enterprises not yet obtained any finance from banks. However, among 446 replies from ESCOs, 322 enterprises, being 72% of the total, claim difficulties in financing. 45% of enterprises have been financed more than once, but they have still great barriers in receiving financing. During the field survey and communication with enterprises, it has been observed that a significant portion of

enterprises viewing no difficulties in financing are the subsidiaries of state-owned enterprises or stock listed companies; the enterprises being financed but encountering difficulties have mostly obtained finance through the pledge of personal housing property of enterprise owners and personal guarantee to banks. The first reason of difficulties in financing based on the questionnaires is "financial institutions do not understand the energy service industry and energy performance contracting and are not so active". The next reason is "lack of guarantee and no collateral from enterprises, ESCOs are a small size".

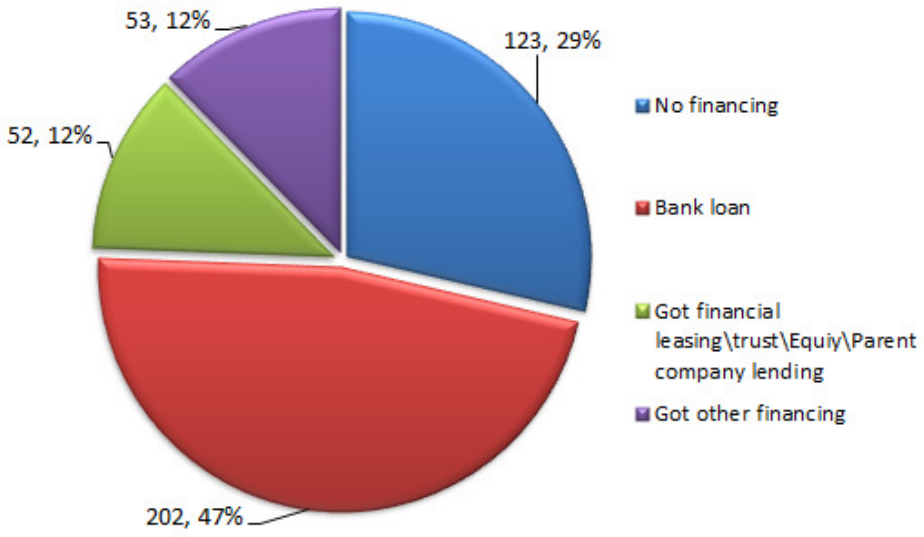


Figure 43 The financing barriers of ESCOs I

Data Source：The Study Questionnaire and Survey

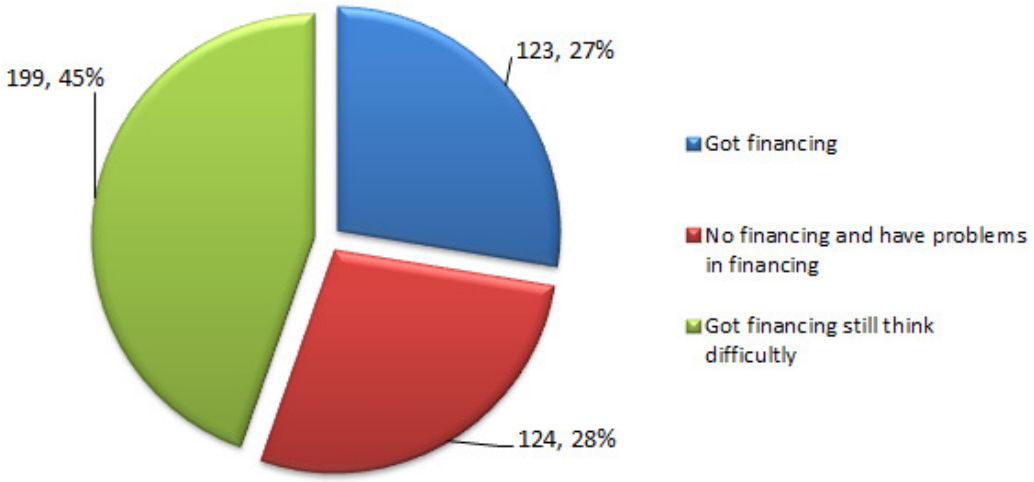


Figure 44 The financing barriers of ESCOs II

Data Source：The Study Questionnaire and Survey

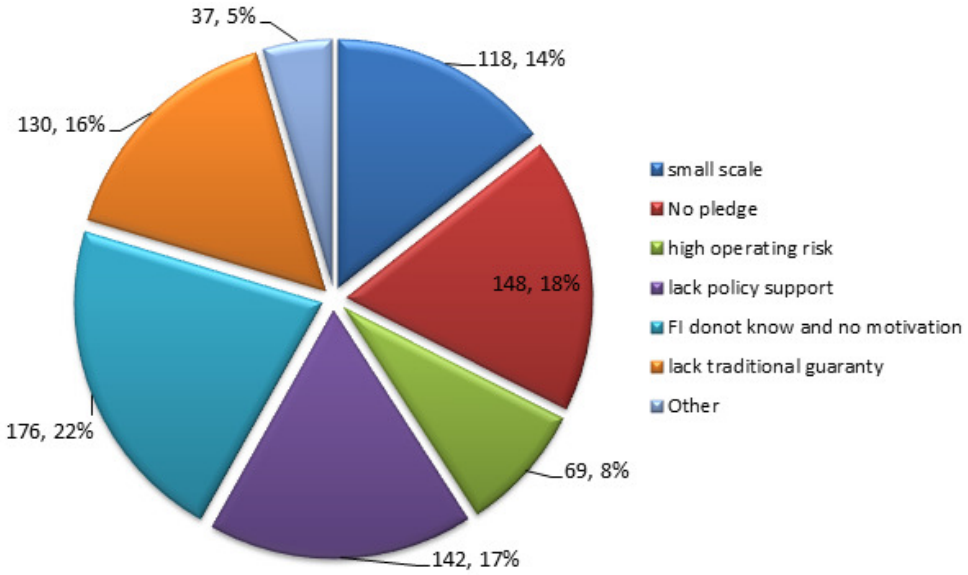


Figure 45 The financing barriers of ESCOs III

Data Source：The Study Questionnaire and Survey

7.1.2 ESCOs' key fund resources

A company can be financed from internal financing, external financing, or both. Internal financing as it is called, refers to a company using its self-owned capital or its retained profits as a source of capital for new investments. In contrast, external financing, refers to a company's capital consisting of money from outside the company brought in for investment. Currently in China, internal financing is the main fund resource of EPC projects. Internal financing is generally thought to be less expensive for the company than external financing, as it does not incur much less transaction costs to obtain, nor does it have to pay taxes associated with paying dividends.[25] However, it could be quite limited in volume due to the limited size of most ESCOs and their shareholders. Especially when a company is growing rapidly and expanding its business, it is hard to imagine that only internal financing can adequately finance ESCO's growth.

Available external financing to ESCOs in the Chinese market includes loans from domestic commercial banks, SME credit-guarantee funds, governmental energy conservation funds or subsidies, loans/ grants/EPC credit guaranteed loans from international financial institutions, and lease financing etc.

Low cost fund resources include Bank loans; medium cost fund resources includes finance leases, trust investments, loans from a parent company, equity investments；high cost funding resources, including: shareholder investments and micro-loans. Usually bank loans are one of the most important and favorite external financing approaches of companies in other matured industries.

[25] http://en.wikipedia.org/wiki/Internal_financing

It also can be seen that ESCOs' external financing channels are not diverse enough. The rate of using many fund sources is still quite low, e.g. trust investment and micro-loans etc.

More than 100 companies (about 29%) have not obtained any external financing at all. This revealed a clear gap between the industry's demand in financing and actual financing obtained.

7.1.3 Analysis of Status of Financial Institutions' Special Finance Products

By means of policy study and interviews, we have also observed that increasingly more banking financial institutions, especially the major commercial banks targeting SMEs, have started to show more attention to the energy saving service industry and hope to develop it into a new key business area. Benefitting from the years support and promotion of international institutions, some of the commercial banks such as Industrial Bank, Bank of Beijing, SPD Bank and Huaxia Bank have become the pioneers designing and applying special financial products to support the ESCO industry. In addition to existing conventional products flexibly applied according to the features of EPC projects, different banks have innovated, to some extent, on how to make proper use of EPC projects account receivables as mortgage to loans.

1) Banking financial institutions

Bank of Beijing (BOB): In 2011 Bank of Beijing officially released its "Energy-conservation Loan Product V2.0" financial service program. The program created an "account receivables" pledge and guarantees models and project "package credit" financing models structured to match ESCO business operations and secured mainly by ESCO project revenues. On the basis of particularly estimation of the investment payback period of ESCO project and its cash flow analysis, the loan volume is able to be defined. The upper limit of loan term can be up to 5 years and the withdrawal period of loan credit shall not be more than 2 years. As for "Energy-conservation Loans", Bank of Beijing has also opened a "green passage" for the financing of energy-conservation projects. In principle, the required loan guarantees include the pledge guarantee with account receivables from the cash flow of EPC projects invested by ESCOs in the past and supplemented by expected cash flow of the current project to be financed by the bank loan, and also one, or a combination of possible pledges of equipment and machinery and buildings and third party guarantees.

As of mid-2012, BOB had approved energy-conservation loans amounted to nearly CNY 1.8 billion. The minimum size of project loan amounted to CNY 1 million, while the maximum was CNY 100 million. The projects financed involve waste heat recovery for power generation, building energy efficiency, energy recovery from flue gas, energy-efficiency retrofits of the power industry and energy-efficient retrofitting of heating systems. As for ESCOs with different scales and at different development

stages: for ESCOs with an annual sales income less than CNY 10 million, Bank of Beijing adopts the pledge for loan security, including a conventional pledge plus account receivables pledge; for ESCOs with a sales income between CNY 10 million to 30 million, third-party assurance and IFC risk sharing, etc.; as for ESCOs with a sales income over CNY 30 million, a different combination of guarantees can be used. Among the projects currently financed by Bank of Beijing, if ESCOs' annual sales income is more than CNY 100 million, the account receivables pledge is generally accepted for loan security.

The Export-Import Bank of China: the major duty of the Export-Import Bank of China is to carry out and implement national industrial policy, foreign economic and trade policy, and financial policy and diplomatic policy. It is a non-profit policy bank. As early as 2005, it started to participate in World Bank projects and provided finance to energy efficiency projects as one of the on lending banks. Now it is executing the on lending Project of WB Phase III, with an amount of US$ 100 million. Types of eligible energy-efficiency loan beneficiaries include: (a) large and medium size energy-consuming industrial enterprises; (b) energy service companies (ESCOs) providing the energy-efficiency retrofits for large and medium enterprises; (c) project companies established for the EPC project with independent corporate qualifications. Eligible energy-efficiency sub-projects should be in the category of energy-efficiency technical retrofit projects in the key energy-consuming industries (in compliance with the range of China's "11th Five-year" ten key energy-efficiency projects), mainly including: (a) use of energy-efficient technologies, such as more efficient industrial boilers, kilns and thermal exchange systems; (b) recycling of residual gas, waste heat and residual pressure; (c) retrofitting of existing machineries and equipment, including fans, pumps, heating and ventilating devices, using such energy-efficient technologies as variable speed drives; (d) optimization of industrial energy systems to increase energy efficiency.

The Export-Import Bank of China has also designed and introduced "Energy-efficiency Project Lending Services of the Export-Import Bank of China for Import and Export Enterprises" with ESCOs as the beneficiary. The borrowers are enterprises registered at Chinese administration for industry and commerce, with independent corporate qualifications and the main business in such energy services as energy-efficiency diagnosis, design, retrofit and operation and included in the registered list by NDRC/MOF or the list recommended by MIIT. The energy consuming enterprises shall engage in import and export business and shall be rated, in principle, as A+ or above in the credit rating by the Export-Import Bank of China. The energy efficiency gain of the project should be increased by over 10%. The single loan amount should not be more than 80% of the total investment of energy service projects or contributions to be paid by ESCOs. In principle, the term can be 1 ~ 10 years. In terms of interest rates, it is generally of particular advantage in comparison with general commercial banks.

SPD Bank: for ESCOs, the banks release a series of financial products, rather than one

product after another, to meet the different demands of enterprises at different stages of development, in different business areas and with different scales. SPD Bank is one of IFC's cooperation banks and also undertakes green credit projects with the FDA and has introduced building energy-efficiency finance products jointly with the Asian Development Bank (ADB). SPD Bank has established a professional team for professional operation, while all its branches have a special team allocated to green credit. According to the financing features of EMC, special financial solutions have been designed.

In 2010, SPD Bank introduced the innovative ESCO receivables pledge financing and IFC loss-sharing financing; in 2011, by integrating its products, it also developed the innovative product called ESCO factoring finance. With three major ESCO innovative finance products and services, SPD Bank primarily achieved an innovative breakthrough in financing modes and guarantee modes. Its Shanghai branch has undertaken pilot work of more than one year for a new financing product with an ESCO receivables pledge, of which more than one hundred contracts have been observed without any bad default. This product has been customized for ESCOs filed at the Shanghai EMC Office. With comprehensive consideration to the attributes of ESCOs, financing is based on the pledge of the receivables of a project without the requirement for a housing property mortgage and guarantee firm, while the loan term can be as long as 5 years. The loan term is determined according to the payment collection period of a project and the receivables of the project are taken as the repayment source of the loan. The product is featured for: repayment is made for the future cash flow of projects, without any mortgage and without any requirement for a guarantee firm.

PingAn Bank (formerly Shenzhen Development Bank): supply chain finance is a prominently advantageous business of PingAn Bank. Based on the features of the EPC business model, PingAn Bank designates its Trade Financing Department, responsible for the supply chain finance, as the matchmaking department. According to PingAn Bank, the core assets or core value of ESCOs should be its capacity of organizing businesses, like the positioning of SMEs and the keynote of risk review in supply chain finance. Therefore, the precondition for designing a special financial product is still based on the trust in the capacity of ESCOs to organize businesses, without showing much concern over asset strength and guarantee mortgage means. In 2012, PingAn Bank also officially introduced the special finance product "ESCO Receivables Loan" for ESCO business. It is a financing model under which, when any ESCO and energy-consuming units undertake any EPC project for sharing energy-saving benefits, ESCOs transfer or pledge its future energy-saving benefit share under the project to Ping An Bank. PingAn Bank will review the energy-consuming unit and ESCO before locking in the fund recovery from the future share of benefits, by tailored design of the financing structure, and issuing a credit line to the ESCO. Such future benefit loans of PingAn Bank are advantageous, as the bank's requirement for ESCOs focus on its capacity in providing the energy service and organizing business, with less

concerns over its asset scale and sale income amount. The bank focuses its business review on the capacity of ESCOs to organize the transaction and implement the energy service project and solvency of the energy-consuming unit.

As for the project, based on the operation model of the EPC project, the bank estimates the loan size by focusing on the cash support to be provided by the energy service projects for repayment of bank loans rather than the cash inflow of the enterprise. The access conditions for ESCOs include: registered with NDRC or MOF or a member of EMCA, having implemented at least 3 EPC projects, compliance of the project with the national relevant policy requirements, with advanced and developed technologies, energy-savings measurable verifiable, and reportable, a contract period of less than 5 years, and ESCO's equity fund being at least 20% of the total cost. Credit subject: ESCO; credit purpose: receivables transferred and funds designated for payment of equipment procurement under EPC projects; operation model: pledge and transfer of ESCO receivables; credit modes: general and structural, as per time point of financing; type of credit: mid and long-term working capital loans; financing proportion: generally no more than 80% of the total future benefit share; financing period: matching with the benefit share period of ESCOs, 2-5 years for one single business. It is required for an external fair third party to issue the relevant technical evaluation comments and the project feasibility study report.

Industrial Bank Co., Ltd.: Industrial Bank Co., Ltd. is the first Equator Principle Bank in China as well as the first bank to cooperate with IFC for energy efficiency finance; it released a standard ESCO financing product in 2012. In 2008, the bank started to cooperate with IFC through the CHUEE Program and in 2009 established the first green financial department tin China, the Sustainable Financial Center, which has been by now the only institution specializing in green finance and set up at the top level among all banking institutions in China. Since 2006, Industrial Bank Co., Ltd. has supported 60 EPC projects, with a total investment amount of about CNY 1 billion, covering about 50 ESCOs. Based on their preliminary experiences, the bank officially standardized the product in 2012 for promotion. In addition to the credit products, the ESCO financial service solution released has also introduced a series of value-added services for ESCOs: (1) ESCO project matching: by taking advantage of its accumulation, information and channels, the bank has established the ESCO project pool, ESCO pool and energy-consumer pool for project matching with its platform. (2) Credit products: the core advantage of Industrial Bank Co., Ltd. is its ability to accept the account receivables of any ESCO project as a pledge. The financing terms include two models: working capital loan and mid and long-term loan. For the mid and long-term loan, its maximum term can be up to 5 years; its repayment term is relatively flexible, with a grace period, and with the repayment mode in installments.

Industrial Bank Co., Ltd. entrusts external professionals to evaluate and assess energy-savings performance of each EE project, the evaluation report is regarded as an important reference for the loan size estimation by considering the project

account receivables under the EPC project as a pledge. The requirements for project access include: project approval for compliance, complete formalities, conditions ready for project execution, ESCOs qualified for filing, with the registered capital of more than CNY 5 million, relevant experience of more than 2 years and the contract amount of over CNY 5 million for the completed project, as well as the evaluation on solvency of the energy-consuming enterprises. The bank has established a team of internal and external experts and all its branches nationwide have a product manager for green financial service and ESCO financing service so that the business can be interlinked at the three levels of headquarters, branch and sub-branch. This allows projects to be measured, reported and reviewed under the energy efficiency evaluation.

2) Non-banking financial institutions

a) Guarantee firms: guaranteed loan is one of the three modes of bank loans. To advance the wide promotion of the EPC mechanism in China, one of the two major parts of "WB/GEF China Energy Conservation Promotion Project" Phase II is to establish, with the donation of US$ 22 million from the World Bank (WB) as the principal, the "ESCO Special Loan Guarantee Foundation", which is operated by China National Investment & Guarantee Co., Ltd (I&G), one of the biggest guarantee companies in China, to provide credit support to the vast small and medium ESCOs with light assets and low bank credit. Upon operation of more than 5 years, the guarantee mode has properly helped some ESCOs in obtaining bank credit. With fund support, these firms have developed rapidly. In addition, more financial institutions comprehend and understand such new mechanisms for energy conservation. Though the project has been successfully completed, I&G has retained the project management office to continue with services for energy conservation projects, the scope of which has been expanded from pure energy saving shared projects, to different types of energy efficiency and emission reduction projects. The project scale is expected to be more than CNY 30 million and the premium is subject to the market-based premium policy. Furthermore, the Government Procurement Guarantee Department recently set up by I&G can also undertake the energy efficiency projects involving governmental procurement, by providing finance support in such areas as tender and performance guarantees and project financing, with a premium rate of about 2.4% and flexible requirements for project scale.

Since 2010, more guarantee firms such as Capital Investment & Guarantee and Zhongguancun Hi-Tech Guaranty have become interested in and also invested in ESCOs. Some firms have also launched special products: e.g., Huazun Investment & Credit Guarantee Co., Ltd, with a registered capital of CNY 1 billion. As the SME guarantee agency designated by NDRC, Huazun targets energy service as one of the areas for key development and has set up an "ESCO Project Management Department" allocated with professionals for project evaluation and review. Meanwhile, the company's decision-making committee set up the "Green Passage of

Evaluation" for ESCO projects and introduced the "Receivables Ledge Loan", a financing service solution formulated as per features of EPC mechanism. With the lawful, true and valid account receivables of an enterprise as the pledge guarantee, the product provides the enterprise different loans, trade financing, acceptance of bills, a letter of guarantee, letter of credit and other on and off-sheet financing services after the account receivables are properly pledged, while the loan limit can be repeatedly disbursed and the premium rate is 2%. The main challenge is lacking of knowledge and experiences of technical evaluation and risks identifying and mitigation.

b) Financial leasing companies: under the current administrative institution of China, as the institutions for procurement, investment and management of leasing assets, financial leasing companies can be financial institutions or non-financial institutions which play a role as a financial service platform. The China Banking Regulatory Commission is the authority for approving and supervising the financial leasing companies, while the Ministry of Commerce is the authority for approving and administrating the financial leasing companies of non-financial institutions. In recent years, more and more financial leasing companies have started to show their active interests over energy efficiency and some of them have started trials. As one of the three demo ESCOs for the WB Project Phase I, Shandong Energy Engineering Co., Ltd was transformed in 2007 to become a financial leasing company, and aroused a tide of activity in the leasing area; by utilizing the advantage of its group, another demo ESCO, Beijing Yuanshen Energy-saving Technology Co., Ltd established its financial leasing company to assist ESCOs in resolving financing problems. Benefiting from cooperation with transnational enterprises with well-known products and technical strength such as Siemens and Schneider, Southern Leasing started to implement several financial-leasing EPC projects in 2005.

Relying on the products and technical strength of Siemens, upon continuous transformation for years, the lease company of Siemens has included the energy efficiency and emission reduction as one of its key directions: for energy efficiency projects, the sale-leaseback is taken as the major mode among numerous alternative modes and the term can match with the share period, but basically within 5-6 years; different projects are designed as per the structure to dissolve the relevant risks, while the return rate is generally about 10-13%. The WB Shandong Energy-efficiency Project now under execution was officially approved by the WB in June 2011, of which the energy-efficiency lease sub-project is jointly executed by Rongshihua Leasing and Guotai Leasing. On one hand, by using the fund from the WB, Rongshihua Leasing can implement these energy-efficiency projects as an ESCO, in the mode of financial leasing; on the other hand, it can also play a role as super ESCO to support small ESCOs undertaking EPC projects in the model of financial leasing within Shandong Province. Such a flexible model of financial leasing is similar to ESCOs in a number of ways, but cooperation has been limited in recent years and the scale small. Hence, leasing companies also encounter the same difficulties and

barriers as the banks do. The failure of leasing companies and ESCOs is their inability to be sure about whether account receivables can be collected, and providing relevant safety assurance. Just like all major manufacturing businesses with exclusive leasing companies, if firms in the energy service business can jointly sponsor the establishment of a leasing company, they will greatly benefit, while technical understanding and risk control will play a greater role.

c) Securities firms: in addition to other functions, securities firms can also assist enterprises to issue different enterprise debts. Prior to the pilot work of SME private bonds, the major debt financing instruments relatively common for non-financial enterprises in the Chinese market included: corporate bonds, enterprise bonds, SME collective bonds and SME collective notes. Due to the relatively high threshold, none of them benefits SMEs much. Since 2007, only 9 collective bonds and 58 collective notes have been issued for SMEs. With the "Measures for Pilot SME Private Bonds" officially published in May 2012, 19 different types of enterprises successfully issued such bonds in June of the same year. The successful issuance of the first batch indicated the official opening of a new channel for the quick financing of SMEs: issuing private bonds. SME Private Bonds are subject to the filing management of the exchange and as a bond financing instrument for SMEs, its threshold is the lowest. As a whole, the average book interest rate is about 9%. As a bond with the highest liberalization, SME Private Bonds have prominent advantages as there are fewer restriction conditions and they encourage a single company to issue them; they endure the shortest issuance procedure and fastest financing; private issuance, direct contact between the issuer and investors, and the most control over cost. Thus they will become the most suitable debt financing instrument in the capital market for SMEs.

At present, many securities firms undertake direct-investment business and the direct investments under some of the securities dealers hold a prospective view over the energy service. For instance, HongyuanHuifu Venture Capital Co., Ltd is a whole-owned professional direct investment company under Hongyuan Securities: for EPC projects, release the credit funds for direct investment in EPC projects, with a term of about 3 years and an annual interest rate around15%.

d) Equity investment: on March 9, 2012, TRCE's which specialized in waste heat recovery power generation- EPC was successful in review and was officially IPOed in SZSE by the end of June, showing the way for more ESCOs to IPO. With a number of enterprises such as Shenwu and SuunPower also in the line of listing, it will attract more funds for investment into the energy conservation service business. During the interview, it was observed that more and more investment companies are fully interested in the energy service business, while all the major securities companies have full-time research staff to study the energy service business. Jiuding invested into Coolead, Beyond Fund into Poweru, Zhonglufund into Kingeta, SoftBank into Ecoso, Tiansu Fund into Sunwise and Aotianqi, SZVC into Jilin Kelong, Yuanwang into

LvzhouDehan, and Beijing Gongfa Group into Lampearl, etc. There are many successful investment cases, but there are still many which are being followed without any action, for the energy service industry is at the initial period of rapid development, a fact is that majority of ESCO companies are still in small size with annual revenue less than CNY 20 million, they are still too small to attract private equity funds to invest in.

In 2011 GFund Management Co., Ltd. officially released the first "ESCO Fund" in China, with CNY 500 million for Phase I. The Fund can be invested in the equities of ESCOs and also participate in the implementation of EPC projects. It is one of the few funds for investing on EPC projects. With respect to the projects, it requires the investment amount to be more than CNY 30 million, with annual ROI of about 20%, which can also be lowered appropriately, in case of any equity investment opportunity into the ESCO. SZVC, CEEPIF and other institutions are also considering the establishment of ESCOs funds or an energy-efficiency and emission reduction fund. One of the feasible modes to promote ESCO industry is to set up a project company, into which ESCOs and Fund Companies, or ESCOs and energy-consuming enterprises and fund companies can jointly invest. It will become easier for the project company to raise adequate funds for project execution by mobilizing the finance from banks.

7.2 Future Financing Demand

The following estimation is made of the future financing demand and size, based on the data of energy-saving potentials forecasts conducted by the Study Team on energy service projects in the sectors of building, industry and transportation during the Twelfth Five-Year Plan period, as well as data relating to average investment size for one tce of energy saving capacity.

Table 4 Energy-saving Potentials Forecast in the Sectors of Building, Industry and Transportation during the Twelfth Five-Year Plan Period

Field	Percentage in Energy Saving portfolio (%)	Energy-saving Potentials (1,000 tce)
Building	16	9,600
Industry	83	49,800
Transportation	1	600
Total	100	60,000

Data Source：The Study Questionnaire and Survey

Based on statistics analysis conducted by EMCA on 874 energy service projects implemented in 2010-2011, investment intensity in these energy service projects are summarized as follows: average investment is CNY 2,116/tce in industry sector, CNY 2,033/tce in building sector and CNY 4,906/tce in transportation.[26]

Table 5 Investment Size Forecast in EPC Projects during the Twelfth Five-Year Plan Period

Field	Percentage in Energy Saving portfolio	Energy-saving Potentials	Investment Intensity	Total Investment Size Forecast
	(%)	(1,000 tce)	(CNY /tce)	(CNY1 billion)
Building	16	9,600	20/33	15.168
Industry	83	49,800	21/16	105.3768
Transportation	1	600	49/06	2.943600
Total	100	60,000	---	126

Data Source：The Study Questionnaire and Survey

Based on the table, the minimum investment demand is estimated to be CNY 126 billion in EPC projects during the Twelfth Five-Year Plan period. According to the analysis by the Study Team on the first round questionnaire, in case 40% of the finance is from banks and other financial institutions, the total financing demand will be more than CNY 50 billion.

Investment intensity to achieve one tce of energy saving capacity will grow with increasing difficulties in technological renovation, as will the total investment size for contract energy management projects and the corresponding financing size. In the meantime, since 2012, more ESCOs have started to pay attention to building energy efficiency, especially in CHP, and with emerging business models such as building energy suppliers, there will be more comprehensive energy-saving retrofit projects than those in previous years in the field of building. In addition, the investment size in the field of building energy efficiency and its proportion in total ESCO project investment will both see an obvious increase.

With regard to finance guarantees, traditional loan guarantee methods can hardly meet the financing to ESCOs which are not able to provide full collateral for loan security. Taking the energy-saving loan product 2.0 of Bank of Beijing as example, the bank has totally approved CNY 1.8 billion of energy saving loans, only 17.8% of the

[26]Date from EMCA.

loans use the pledge of pure future account receivables, and 30% of the loans use the combination of project future account receivables and traditional collateral. Similar financial products have been launched by Industrial Bank and PingAn Bank, and piloted by SPDB. Basically all of those pay more attention to the pledge of project future account receivables of ESCO projects, put more efforts to judge ESCOs' project operation capability and risk-control ability, as well as the operation ability and solvency of energy consuming enterprises, while giving less consideration to ESCOs' size and net assets. As estimated by the StudyTeam, in the future, the pledge of pure future account receivables or the combination of traditional means and future account receivables will break through 50% total finance.

7.3 Development trend of business mode

In the early days when EPC was introduced into China via the World Bank, only one kind of internationally popularized business mode was available, the energy saving sharing Mode. Later after many year practices and the experiences of three demonstration ESCO companies and other ESCOs, other business models have been developed in China. These include the energy saving guaranteed Mode and chauffage Mode, etc.

As the energy saving sharing Mode contract is the only specific mode that can get government financial rewards and tax preferences, it receives more attention and has developed relatively rapidly. It will also become one of the most important business modes in ESCO industry. However, according to our observation, the chauffage (called as outsourcing energy management) Mode will have significant development in the next few years in China.

In outsourcing energy management Mode contract, ESCOs take charge of operation and maintenance of the whole energy system of clients and undertake energy expenditure. During the contract period, energy-consuming enterprises shall periodically pay ESCO energy fees as agreed and entrust ESCOs to conduct energy conservation innovation, energy system operation and management and daily maintenance.

In this mode, the contract period always is more than10 years. ESCOs adopt high quality equipment and services to ensure quantities and benefits of energy savings can be generated. Therefore, energy-consuming enterprises can enjoy more professional and long-term energy management services. Also in this mode, ESCOs always appoint a professional team to work in energy-consuming enterprises, even as a department of the enterprise, which will be engaged in energy management of the enterprise. However, ESCOs will undertake related expenses of this department or directly incorporate related energy department of energy-consuming enterprises into their own force. In this way, related labor costs can be saved for the enterprise. Especially when the related energy department of the enterprise is incorporated into

an ESCO, ESCO will take the leading role for energy management. Relevant workers will do their duty and take responsibility to operate and maintain related energy consumption equipment according to ESCO arrangements and plans. This ensures that conflicts of interest between ESCOs and related departments of energy-consuming enterprises and the poor effects of energy conservation can be avoided. Due to these reasons, the outsourcing energy management Mode is popular with energy-consuming enterprises, particularly building management and public organizations. As an indirect energy supplier, ESCOs can charge regular energy payment, such as “electricity bill”, “heat bill” “water bill” and “gas bill”. In this way, investment is recovered timely and appropriate profits are obtained; meanwhile, investment risks are largely diminished. Therefore, ESCOs engaged in such services also can obtain great development.

As indicated in the investigation results of a group of superior ESCOs conducted by the Study team, it is highly possible that the outsourcing energy management Mode will become a future development trend. For example, the first IPO ESCO in this industry-Top Energy Conservation Engineering Co., Ltd which went public based on EPC business, has successfully in operation relying on this mode. In addition, Shanghai CIBO Co., Ltd. and Beijing Huatong Heating Power Co., Ltd. also operate in this mode or take this mode as the major operation mode. Their development shows great vitality of this business mode. ESCO’s roles change from energy service party, to energy supplier or energy supply station which has higher position than service provider. Due to the role change, it is possible for ESCOs to obtain better profits as a result that more efficient services and better social benefits will be created, which belongs to a win for multiple-parties.

Moreover, looking at the investment scale, the outsourcing energy management Mode involves relatively comprehensive energy efficiency retrofitting and the required investment will be higher than previous energy efficiency projects for buildings. The investment scale is quite suitable and attractive for FIs to participate in. If having a strong capability to control risks, such ESCOs will rapidly develop with relative ease. In addition, the Beijing Municipal Commission of Development and Reform plans to extend the EPC financial reward scope for EE in the building sector by using the outsourcing energy management Mode. This will change the current situation where only the energy saving sharing mode enjoys financial rewards and sufficiently indicates the great development trend of the outsourcing energy management Mode. Therefore, we suggest that IFC and CHUEE partner banks pay more attention and support to these two new business modes: the energy saving guaranteed Mode and the outsourcing energy management Mode (chauffage).

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